Te Ahu a Turanga; Manawatū Tararua Highway

Notices of Requirement for Designations
Volume Three: Technical assessments

NZ TRANSPORT AGENCY
WAKA KOTAHI

New Zealand Government

1. TRANSPORT

IN THE MATTER OF	The Resource Management Act 1991
AND	
IN THE MATTER OF	Notices of requirement for designations under section 168 of the Act, in relation to Te Ahu a Turanga; Manawatū Tararua Highway Project
BY	**NZ TRANSPORT AGENCY** Requiring Authority

TE AHU A TURANGA; MANAWATŪ TARARUA HIGHWAY PROJECT

TECHNICAL ASSESSMENT #1

TRANSPORT

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INTRODUCTION

1. My name is **David James Dunlop**.

2. I am a Principal Transport Planner and Sector Leader - Transport Infrastructure at WSP Opus in Wellington.

3. Sam Thornton, Senior Transportation Engineer and Gabriela Surja, Transport Engineer at WSP Opus assisted me in the preparation of this assessment.

4. In preparing this assessment I have relied on the assessments of **Mr Andrew Whaley** (design), and **Mr Grant Higgins** (construction methodology).

5. In developing this assessment I have worked with **Mr Whaley**, **Mr Higgins**, **Ms Amelia Linzey** (social effects), and **Ms Ainsley McLeod** (planning).

Qualifications and experience

6. I have the following qualifications and experience relevant to this assessment:

   (a) MSc in Planning Studies (focusing on Transportation), Oxford Brookes University in the United Kingdom (1996/97); and

   (b) Bachelor of Resource & Environmental Planning, Massey University in New Zealand (1992/95).

7. I have 21 years of experience in the planning, assessment and design of transportation projects in New Zealand and the United Kingdom, working for a wide range of central government organisations, local and regional authorities, and private developers, both as an employee and a consultant.

8. I have provided advice on transportation matters to the New Zealand Transport Agency ("**NZ Transport Agency**"), a number of local authorities and private developers, in respect of various proposed developments. I have provided expert transportation evidence for the NZ Transport Agency to the Boards of Inquiry for the Peka Peka to Ōtaki Expressway and Basin Reserve Bridge Projects, and have provided evidence in Environment Court proceedings, including for the Kāpiti Coast District Council in relation to the Paraparaumu Airport Plan Change 82.

9. I have also been involved in a number of significant projects within the Wellington and Manawatū-Wanganui Regions, including:

   (a) Manawatū Gorge Detailed Business Case Safety Audit and Project Economic Review, 2016-2018;

   (b) Wellington Resilience Programme Business Case, 2017-2018;

(c) Wellington Network Outcomes Contract, 2014-2018;

(d) Wellington Northern Corridor Roads of National Significance ("**RoNS**") Business Case, 2009 and 2013 update;

(e) Peka Peka to Ōtaki Scheme Assessment, Transport Assessment and evidence for the Board of Inquiry;

(f) Transmission Gully Scheme Assessment, Economic Evaluation and Transport Assessment, 2008-2012;

(g) Basin Reserve Transport Improvements Scheme Assessment, Transport Assessment and evidence for the Board of Inquiry, 2008-2013;

(h) Wellington Transport Strategy Model ("**WTSM**") and Wellington Public Transport Model 2011 update and model build, 2011-2012; and

(i) Ashmore Trust Roberts Line / SH3 Plan Change and Residential Development, 2007-2009.

10. I am a member of a number of relevant associations including:

(a) Chartered Member of the Chartered Institute of Logistics and Transport; and

(b) Affiliate Member of the Engineering NZ, Transportation Group.

Code of conduct

11. I confirm that I have read the Code of Conduct for expert witnesses contained in the Environment Court Practice Note 2014. This assessment has been prepared in compliance with that Code, as if it were evidence being given in Environment Court proceedings. In particular, unless I state otherwise, this assessment is within my area of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

Purpose and scope of assessment

12. My assessment addresses the following matters:

(a) Project description;

(b) the existing transportation environment;

(c) transportation assessment methodology;

(d) Project shaping;

(e) transportation effects of the Project, encompassing:

(i) general traffic effects;

(ii) resilience effects;

(iii) road safety effects;

(iv) effects on public transport users;

(v) effects on vulnerable users (ie pedestrians and cyclists);

(vi) parking effects; and

(vii) effects on private property access;

(f) temporary transportation effects during the construction of the Project, encompassing;

(i) road safety;

(ii) construction and general traffic;

(iii) parking; and

(iv) pedestrians and cyclists;

(g) proposed mitigation and revised effects;

(h) assessment of the Project against relevant transport strategies and policies; and

(i) conclusions.

Assumptions and exclusions in this assessment

13. The Project's transportation-related effects on the environment have been assessed against the 'do-minimum' scenario, which is explained in more detail below (but is largely based on the current transport network, involving use of Saddle Road and Pahīatua Track, with the Manawatū Gorge closed). The NZ Transport Agency has confirmed that the existing Manawatū Gorge route cannot safely be re-opened, and hence it is not a viable alternative to the do-minimum scenario.

14. The following supporting information is attached to the report:

(a) **Appendix 1.A**: Traffic Assumptions;

(b) **Appendix 1.B**: Trip Distribution Summary;

(c) **Appendix 1.C**: Travel Time Summary; and

(d) **Appendix 1.D**: Indicative Construction Site Accesses.

EXECUTIVE SUMMARY

15. This report provides a Transport Impact Assessment ("**TIA**") of the NZ Transport Agency's Te Ahu a Turanga; Manawatū Tararua Highway Project ("**the Project**"). It assesses the transport impacts of the proposed designation corridor alignment for the Project as shown on the Project Drawings included with the Notices of Requirement ("**NoR**").[1]

16. The Project is described in Part C, Volume 2 'Supporting Material', as the construction of a new road, which will form part of SH3. The Project will run from the SH3 western entry to the closed Manawatū Gorge route, across the Ruahine Ranges ("**the Ranges**") north of the Manawatū Gorge and south of Saddle Road, re-joining SH3 near Woodville – a length of approximately 11.5km. The Project replaces the section of SH3 through the Manawatū Gorge that was closed on 24 April 2017 following a large slip and ongoing stability issues in the Gorge. The Manawatū Gorge route was a critical North Island east / west link and the Project seeks to replace it, to deliver a safe, efficient and resilient transport solution that will enable economic development and regional productivity as underlying outcomes.

17. The assessment considers the existing environment of the two alternative routes running east-west over the Ranges: Saddle Road, and the Pahīatua Track (the "**existing routes**"). The closure of the Gorge has had a significant impact on the safety, efficiency and reliability of the existing routes for all modes of travel, attributed to a major consequential increase in the traffic demand. Without the Project, it is expected that the performance of the routes will continue to worsen in future years.

18. The Project will have a significant positive effect on the transport network. The Project will improve resilience, increase capacity within the wider network, and improve safety and efficiency for general traffic and freight, including public transport and emergency services. It will improve route reliability by providing a route built to a higher standard that is more resilient to incidents and events.

19. The Project will significantly reduce travel times between Palmerston North and Woodville by more than 10 minutes for light vehicles ("**LV**"), emergency services, buses and freight (approximately halving the existing time). Travel between Aokautere (SH57 South) to SH2 north of Woodville will gain an even larger travel time saving of more than 24 minutes, if compared to the current

[1] See drawings D-00 and D-01 to D-10 in Volume 4.

travel time via Pahīatua Track and Mangahao Road. Both reductions are approximately half the existing travel time and will have significant benefits to all road users and the wider economy.

20. The Project will redistribute traffic demand from the existing routes, which translates to an overall better environment for residents, pedestrians and cyclists on the local road network, particularly in Ashhurst, on Saddle Road and on the Pahīatua Track.

21. The Project will result in a significant increase in traffic on the existing SH3 Ashhurst Bridge over the Manawatū River, essentially reverting back to a situation similar to before the closure of the Gorge route. A recent survey[2] has confirmed that there is currently little use of the SH3 Ashhurst Bridge by cyclists and almost no use by pedestrians. The Project has the potential to increase adverse safety and amenity effects for any pedestrians or cyclists using this connection. Recently the NZ Transport Agency has installed cycle warning signs near the Ashhurst Bridge, which will help manage the effect for cyclists using this link. The NZ Transport Agency are currently looking at wider access issues and I recommend that the final design safeguards options for the future provision of safe access for active users to and from the Manawatū Gorge recreational area from Ashhurst and the wider Manawatū Region.

22. Irrespective of the project, the predicted traffic growth gives rise to a need to upgrade access to and from Ashhurst, either at Cambridge Avenue and/or York Street, through the implementation of traffic signals or a roundabout.

23. The proposed Project designation bisects a number of private properties, which results in a requirement for several alternative accesses to the existing road network. These properties will have a significant reduction in traffic volumes on Saddle Road, which in turn will significantly improve access. The overall impact to private property is considered neutral, however there is a need for the NZ Transport Agency to work with property owners and constructors to achieve safe access.

24. This assessment has provided an appraisal of the transport impacts that are anticipated to arise from the construction of the Project. The assessment is largely qualitative and provides an appraisal upon which preliminary mitigation measures have been recommended. Construction activities have the potential to exacerbate, temporarily, negative transport effects that have

[2] Video survey of pedestrians and cyclists demand at SH3 Ashhurst Bridge undertaken by WSP Opus between 14 September to 20 September 2018, discussed in Walking and Cycling section of this report.

been experienced on Saddle Road and through Ashhurst and Woodville since the closure of the Gorge. It is expected that construction traffic will result in an increase in overall volumes and in general have moderate negative impacts, due to the potential impacts to safety and efficiency. Construction activities are also likely to impact on users of the Manawatū Gorge walkway, both in terms of access and parking.

25. In general, it is considered that the construction traffic effects outlined in this assessment can be mitigated by developing a Construction Traffic Management Plan ("**CTMP**") and implementing a Construction Management Plan and design solutions in line with good practice. Overall, following the implementation of the CTMP and working with stakeholders and the local community, construction traffic effects are considered minor negative.

26. One relevant consideration, to be seen in the context of the critical nature of the Project (in my view), is that the faster the Project can be constructed, the faster the negative impacts of existing and construction traffic in Ashhurst and on Saddle Road will be eliminated, and the faster the Project's transportation benefits can be realised. Therefore, it will be important for the CTMP to provide a mechanism for the NZ Transport Agency and constructors to work with stakeholders and the local community to make these trade-offs once the final design and construction methodology has been determined.

27. Overall the Project will have a significant positive effect on the transport network and the users of the transport system. In transport terms, I consider the Project should be progressed as a matter of urgency, with appropriate mitigation to manage the effects of construction and operational traffic redistribution.

PROJECT DESCRIPTION

Introduction

28. A full Project description is available in the Assessment of Environmental Effects Report ("**AEE**"). The following section relies on excerpts of the AEE relevant to the assessment of traffic impacts.

29. The Project is 11.5km of new State highway running from the SH3 western entry to the closed Manawatū Gorge route, across the Ruahine Ranges north of the Manawatū Gorge and south of Saddle Road, re-joining SH3 near Woodville as displayed in **Figure 1.1**. Before it was closed, the Manawatū Gorge route (black line) accommodated 7,620 vehicles per day, of which

11.3% were heavy commercial vehicles (“**HCV**”) in 2016. The Project (blue line) is expected to accommodate approximately 9,700 vehicles per day from its anticipated opening date in 2025[3].

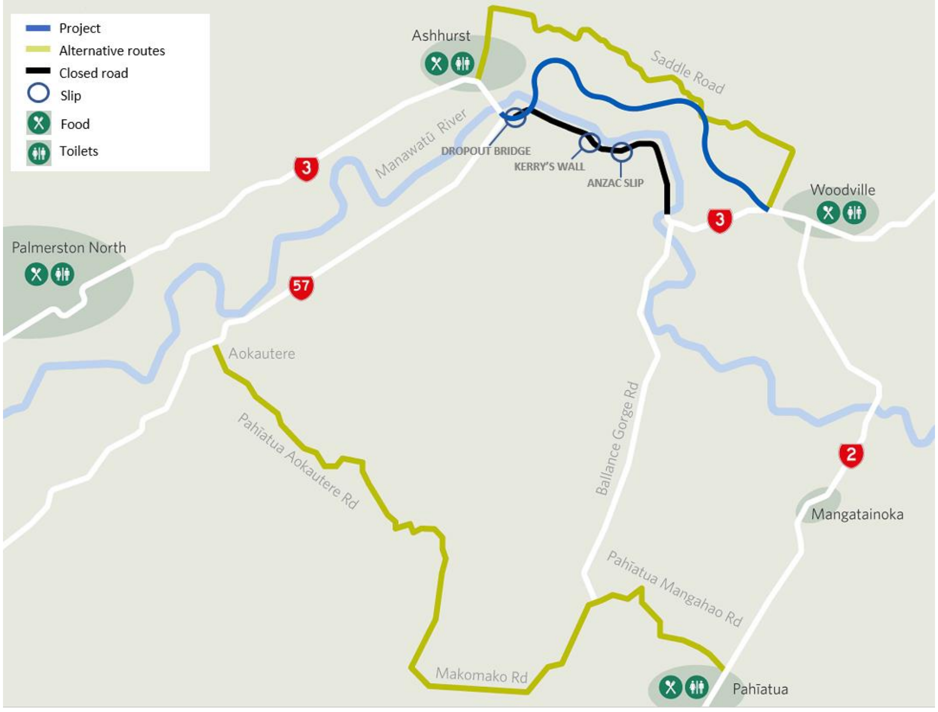

Figure 1.1: Te Ahu a Turanga Project Location and Alternative Routes

Design context

30. The Project is designed to deliver a ‘national route’ classification under the One Network Road Classification ("**ONRC**").[4] The ONRC is a road classification system, which divides New Zealand’s roads into six categories based on how busy they are, whether they connect important destinations, or are the only route available. The importance of the provision of this national route is explained further in the Existing Environment - Transport Infrastructure & Services section below.

31. The Project incorporates design elements that are contained in the NZ Transport Agency’s Action Plans, and that implement a Safe System Approach.[5] The Safe System Approach aims for a more forgiving road system that takes human fallibility and vulnerability into account. Therefore, the transport system in this Project is designed to protect people from death and serious injury.

32. The new route will be SH3, replacing the existing (closed) SH3 route.

[3] Appendix 1.A – Te Ahu a Turanga: Traffic Assumptions Memo, WSP Opus, August 2018
[4] https://www.nzta.govt.nz/roads-and-rail/road-efficiency-group/onrc/
[5] https://www.saferjourneys.govt.nz/about-safer-journeys/the-safe-system-approach/

33. The new route was selected following a multi-criteria analysis of 18 route options. The process involved a consideration of the Project's investment objectives, environmental and social impacts, and feasibility for implementation.

34. The Project's objectives are:

    (a) to reconnect the currently closed Manawatū Gorge State Highway 3 with a more resilient connection;

    (b) to reconnect the currently closed Manawatū Gorge State Highway 3 connection with a safer connection than the Saddle Road and Pahīatua Track; and

    (c) to reconnect the currently closed Manawatū Gorge State Highway 3 with a more efficient connection than the Saddle Road and Pahīatua Track.

35. Further details on the design context are available in the full Project description provided in Volume 2: AEE and supporting material.

Design details

36. The road carriageway layout includes:

    (a) a four-arm two lane roundabout connection with SH57 at Ashhurst;

    (b) a five-arm single lane roundabout connection with existing SH3 at Woodville;

    (c) a two-lane single carriageway highway (1 lane in each direction) where crawler lanes are not provided;

    (d) a four-lane dual carriageway highway (2 lanes in each direction) where crawler lanes are required due to steep grades and where extending the crawler lanes is necessary to provide a consistent corridor and reduce merge and diverge points;

    (e) 3.5-metre-wide traffic lanes;

    (f) 2.5-metre-wide outside shoulders on the single carriageway (to the face of the edge barrier), or 2.0-metre-wide outside shoulders where there is a dual carriageway with crawler lanes (from the outside of the crawler lanes to the face of the edge barrier);

    (g) a central median which will be typically between 4.0 and 6.0 metres wide; and

(h) a wire rope median barrier provided from roundabout to roundabout.

37. A design speed of 110km/h has been adopted for the main alignment. The design speeds for local roads are dependent on the existing speed environment and will be determined during the detailed design phase of the Project on a case-by-case basis.

38. Near continuous wire rope barriers are proposed along the central median to separate oncoming traffic and along the roadside – this results in limited opportunities for vehicles to cross the corridor (e.g. turn right). Higher standard barrier systems may be necessary in some circumstances, where specific hazards exist. For example, across the new Manawatū River Bridge a TL5 barrier (concrete base and steel roll bar) will be provided.

39. Emergency crossover points in the median barrier will be provided at appropriate locations to allow emergency vehicle U-turn movements. Sealed maintenance access areas will be provided behind the barriers to provide safe access and parking for maintenance activities outside of the carriageway.

40. No barriers are proposed on local roads.

41. Separated walking or cycling facilities are not specifically provided for by the Project, although it is proposed that the shoulder width and bridge widths will be sufficient to accommodate cyclists. For the purpose of this assessment it is understood that the primary cycle route between the western and eastern ends of the Manawatū Gorge will continue to be via the Pahīatua Track, which is part of the New Zealand Cycle Trail Touring Route, as detailed in the Existing Environment - Walking and Cycling section of this Transport Assessment. It is also expected that, while there are currently very low levels of usage of Saddle Road by cyclists (due to the volume of traffic and road configuration), Saddle Road will become a more suitable cycling route once the Project is constructed. Similarly, the Manawatū Gorge walking track is expected to remain as the primary walking route between the western and eastern ends of the Gorge.

42. The Project will include rest (or viewing) areas adjacent to both the east and west-bound lanes. The locations will be determined as part of detailed design, and will likely be provided in conjunction with maintenance service areas.

43. Other Project features are detailed in the full project description provided in the AEE report.

EXISTING ENVIRONMENT

Planning and policy context

44. The following national statutory and non-statutory documents apply to this Project:

    (a) Resource Management Act 1991 ("**RMA**");

    (b) Land Transport Management Act 2003 ("**LTMA**");

    (c) Government Policy Statement on Land Transport Funding, 2018/19-2027/28 ("**GPS**"); and

    (d) National Land Transport Programme 2018-2021 ("**NLTP**").

45. The following regional and district level statutory and non-statutory documents apply to this Project:

    (a) Regional Land Transport Plan, Horizons Regional Council, 2015-2025 (2018 Review) ("**RLTP**");

    (b) Regional Public Transport Plan, Horizons Regional Council, 2015-2025 ("**RPTP**"); and

    (c) Relevant district plans, including strategic transport plan and active and public transport plan, prepared by the following local councils:

        (i) Palmerston North City Council ("**PNCC**");

        (ii) Manawatū District Council ("**MDC**"); and

        (iii) Tararua District Council ("**TDC**").

Land-use

46. The proposed designation identified on **Figure 1.2** below shows that the entire proposed designation (purple line) passes through rural zoned land within the jurisdiction of the PNCC, MDC, and TDC.

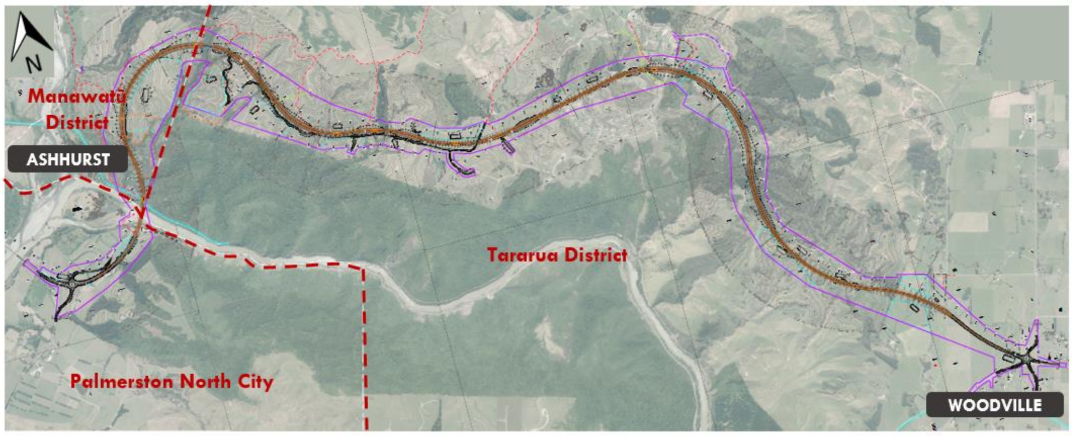

Figure 1.2: Districts Boundaries

47. The land-use along the designation is predominantly farming and power generation (Te Āpiti Windfarm), which are uses that generate a relatively low number of vehicle trips.

Transport infrastructure and services

General

48. **Figure 1.3** below shows the strategic State highway road network in the region. The SH3 connection (old Manawatū Gorge) is the only strategic east-west link between the main north-south National/Regional State highway links (SH1 and SH2) over the length between Wellington (SH58) and Napier-Taupo (SH5).

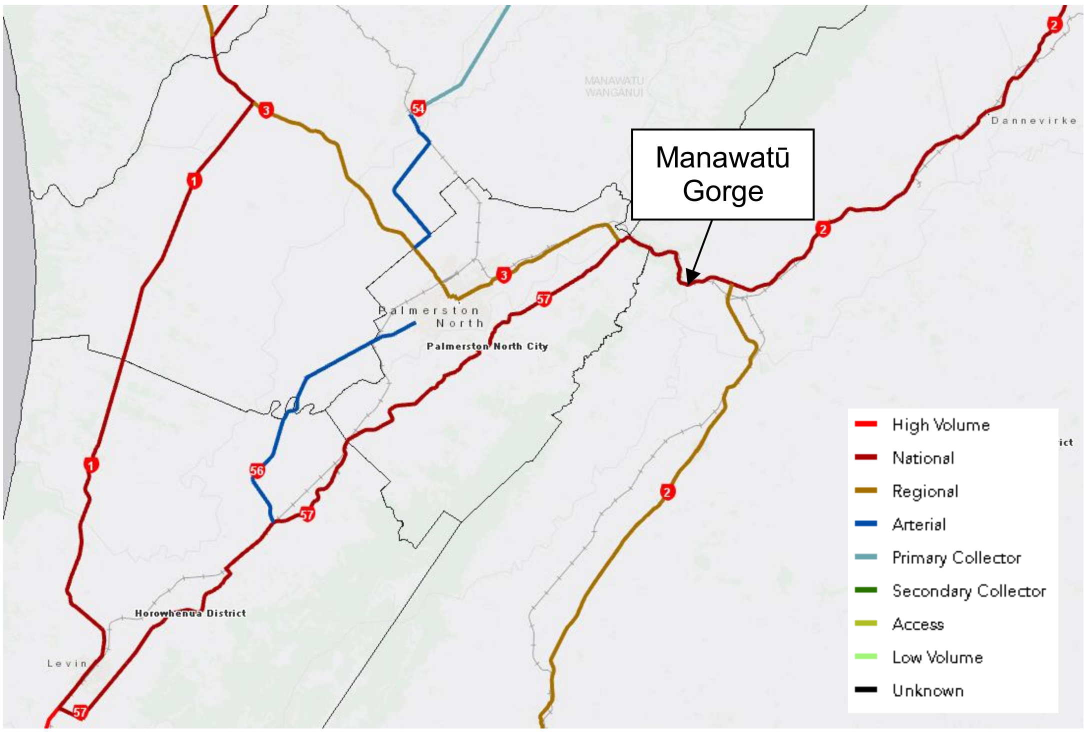

Figure 1.3: Transport Network - Strategic Context (https://nzta.maps.arcgis.com, ONRC)

49. SH57 provides a National State highway connection between SH1 south of Levin and SH3 south of Ashhurst.

50. **Figure 1.4** below shows the road network in the region. There are three east-west connections (including the closed Manawatū Gorge (SH3)). The other two are Saddle Road to the north (Arterial) and the Pahīatua Track to the south (Primary Collector). These are described in more detail below.

51. No regional public transport services are provided on either of the current east-west connections. A bus service does run between Ashhurst and Palmerston North, but is outside the proposed designation.

52. Nation-wide bus provider Intercity[6] operates bus services between the following destinations, which currently use Saddle Road:

(a) Napier – Wellington (7 days, both directions each day);

(b) Gisborne – Wellington (7 days, both directions each day);

(c) Palmerston North – Tauranga (twice a week);

(d) Palmerston North – Napier (twice a week); and

(e) Palmerston North – Masterton (twice a day).

53. The Palmerston North – Gisborne Line railway runs through the Manawatū Gorge and connects Palmerston North with Napier with a station/sidings in Woodville (the railway line provides freight services only).

[6] https://www.intercity.co.nz/.

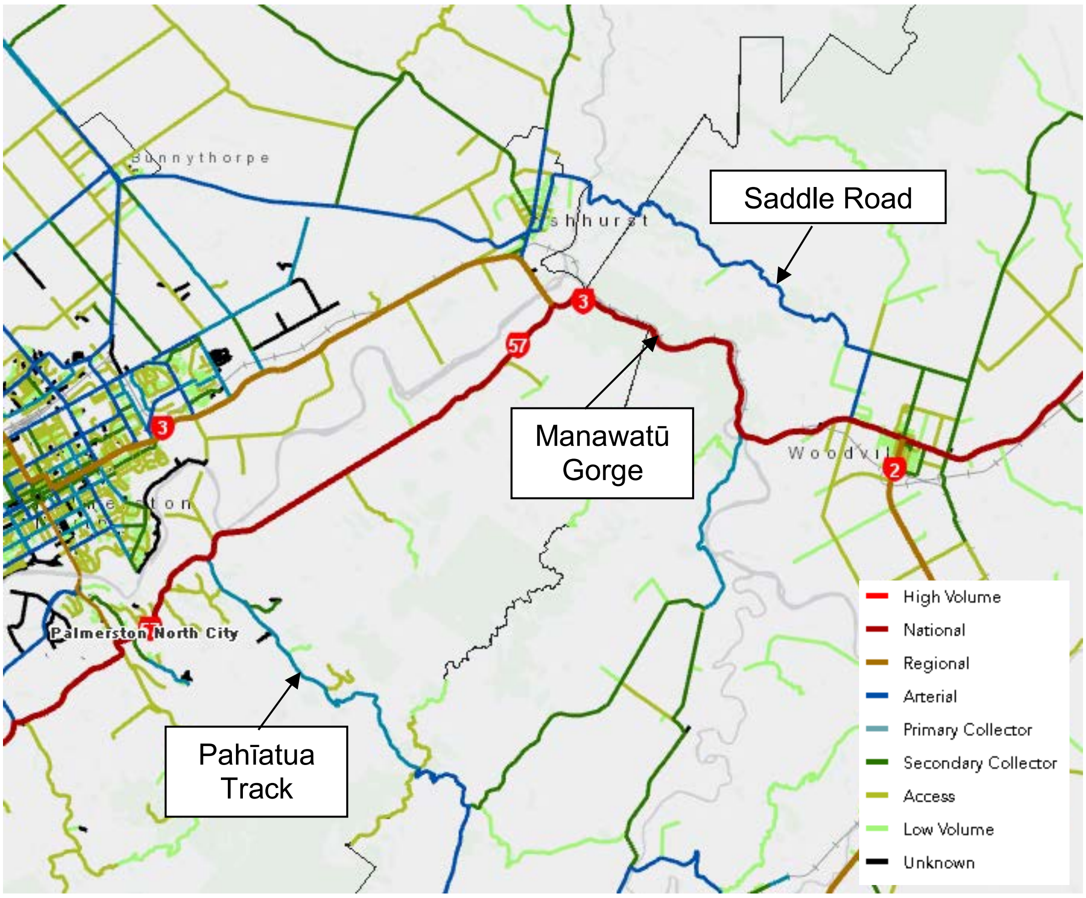

Figure 1.4: Transport Network - Regional Context (https://nzta.maps.arcgis.com, ONRC)

Saddle Road and Pahīatua Track

54. The two remaining alternative routes have been the primary 'alternatives' to the SH3 route since the closure of the Gorge; being Saddle Road and the Pahīatua Track (refer to **Figure 1.5**).

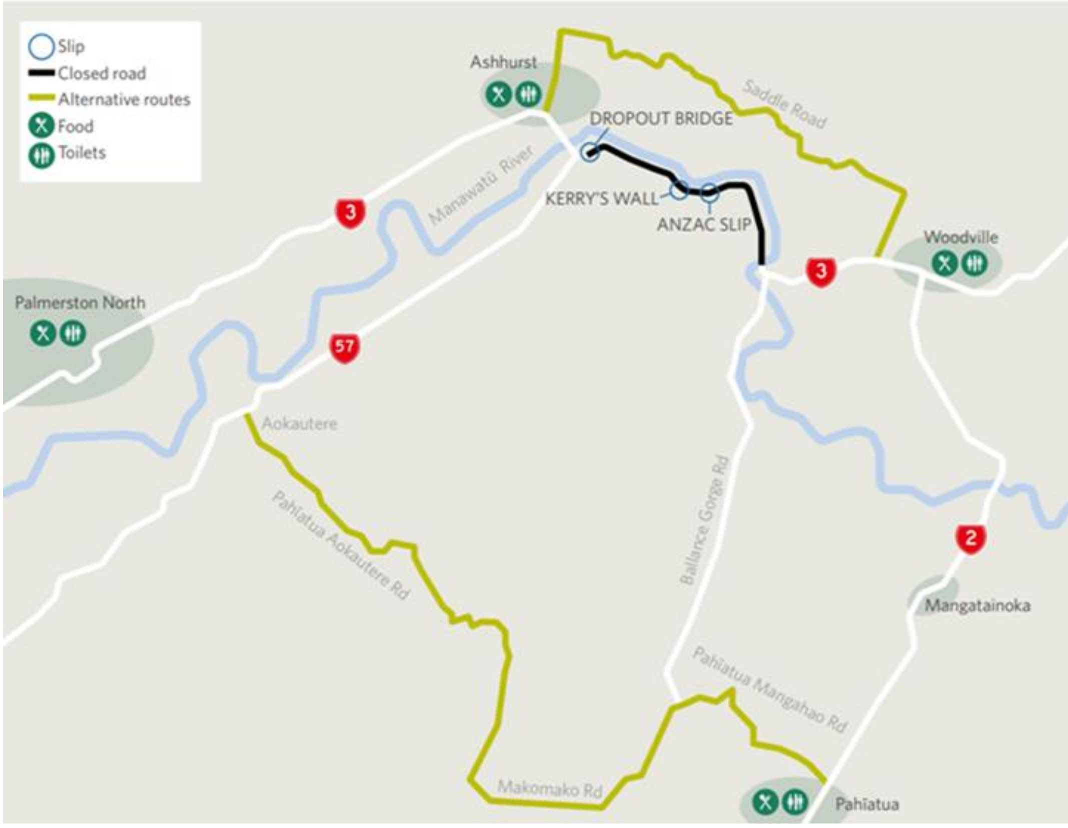

Figure 1.5: SH3 Closure and Alternate Routes. Source: NZ Transport Agency Te Ahu a Turanga Project Map

55. The closure of the Gorge has not resulted in lower traffic volumes traversing the Ranges, signifying the significance of this connection between east and west for the local communities and the region as a whole. **Figure 1.6** sets out the NZ Transport Agency data on the redistribution of traffic volumes soon after the closure, and the change in experience for traffic users.

56. However, travel times are longer since the closure of the Gorge. In general, the travel time between east and west through Saddle Road is 21.6 minutes for light vehicles, which is over 8 minutes slower than the travel time was on the closed Manawatū Gorge.

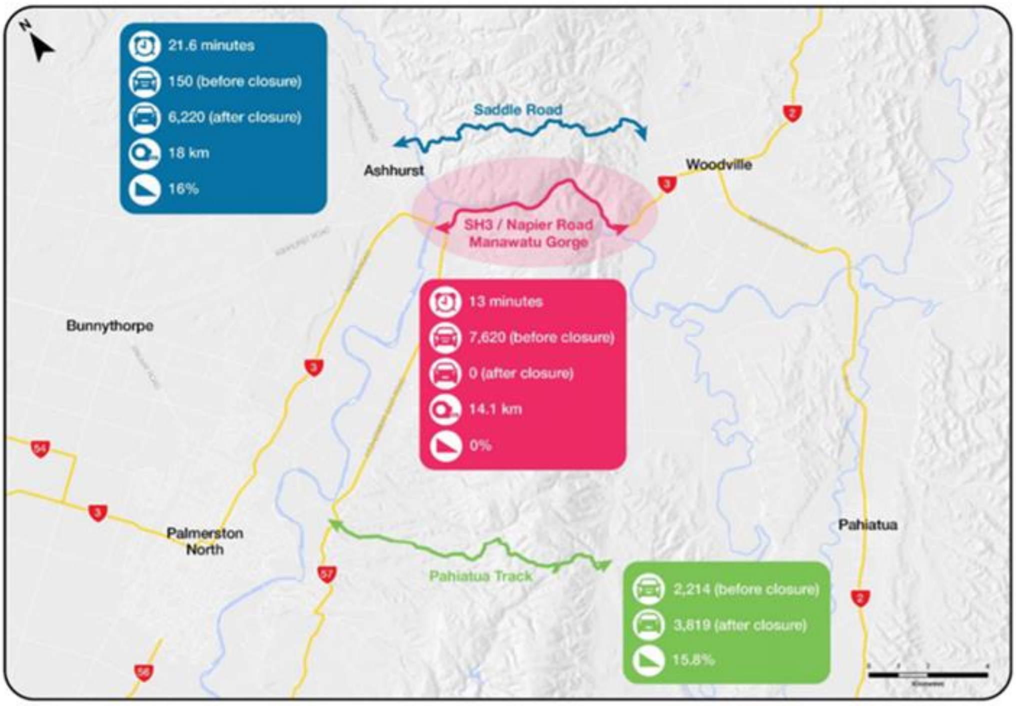

Figure 1.6: Journey experience via SH3, Saddle Road and Pahīatua Track. Source: NZ Transport Agency Business Case for Implementation

57. Saddle Road connects Ashhurst with the northern outskirts of Woodville. At the Ashhurst end, Saddle Road connects to Salisbury Street (refer to Figure 1.7), which travels through the Ashhurst residential area. Along its length, Saddle Road provides rural property access and access to the Te Āpiti wind farm. At the Woodville end of the route, Saddle Road connects to Oxford Road/Woodlands Road, with priority given to vehicles travelling to/from Woodville on Woodlands Road. Various alternative routes exist to bypass Woodville for traffic heading north, east and south (if desired, however these alternative routes are not promoted by the NZ Transport Agency or TDC).

Figure 1.7: Salisbury Street Connection with Saddle Road

58. Saddle Road has a steep curvilinear alignment with one lane in each direction (refer **Figure 1.8** below). Sporadic slow vehicle passing opportunities are provided in the uphill direction. **Figure 1.9** below shows the vertical elevation for the route from SH3 (Ashhurst) to SH3 (Woodville). The route climbs approximately 300m vertically.

Figure 1.8: Saddle Road Alignment (Western Side)

59. The severity of the terrain traversed by Saddle Road results in poor efficiency and safety outcomes. The performance of Saddle Road has been estimated using the Level of Service ("**LOS**") typical curve contained in the Highway

Capacity Manual 2010, Chapter 14 Exhibit 15-5.[7] Given the current demand and peak flow, the high proportion of HCV, and severity of the gradient, the current LOS for Saddle Road is LOS C (acceptable performance), however, the predicted performance in 2041[8] will reduce to LOS E (worst performance).

60. In reality, the current performance of Saddle Road is perceived as lower than LOS C, especially at peak times. This issue is further exacerbated by the frequency of platooning[9] HCV's on the route. This platooning makes it very difficult for LV to overtake, despite the slow speeds of the HCV, which is likely to lead to high levels of driver frustration.

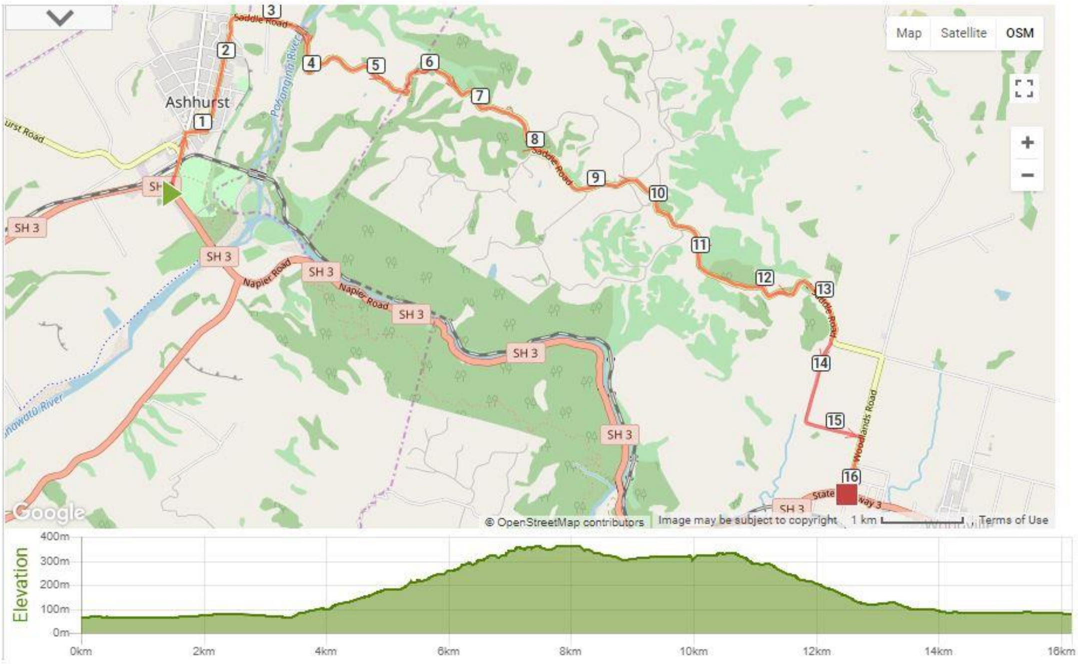

Figure 1.9: Saddle Road Vertical Profile (SH3 to SH3), https://nz.mapometer.com/

61. The Pahīatua Track (Pahīatua Aokautere Road) connects Aokautere (SH57) to Pahīatua (SH2). At the Aokautere end, SH57 provides access to the north (Ashhurst) and south/west (Levin and Palmerston North). Along the length, Pahīatua Aokautere Road provides lifestyle block and rural property access. At the eastern end of Pahīatua Aokautere Road it connects to Makomako Road, which performs a big loop to the south before heading north again,

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[7] Highway Capacity Manual 2010 Chapter 14 Multilane Highways, Transportation Research Board of the National Academies, December 2010.

[8] The year 2041 has been used as the future year for transport assessment in alignment with the noise and vibration assessment. It is also beyond 10 years from the Project opening and is considered a sufficient horizon to ensure that potential network effects are captured.

[9] Grouping of vehicles due to speed or the number of vehicles, often resulting in delays, passing difficulties and potential safety concerns.

and then east to Pahīatua. There are a number of alternative routes north (to SH3) and south / east (to SH2) from the end of Pahīatua Aokautere Road.

62. The Pahīatua Track (and linkages through to Gorge Road) has a narrow curvilinear alignment with one lane in each direction (refer **Figure 1.10** below). Limited passing opportunities are provided. **Figure 1.11** below shows the vertical elevation for the route from SH57 (Aokautere) to SH2 (Pahīatua). The route climbs approximately 350m vertically.

Figure 1.10: Pahīatua Track Alignment

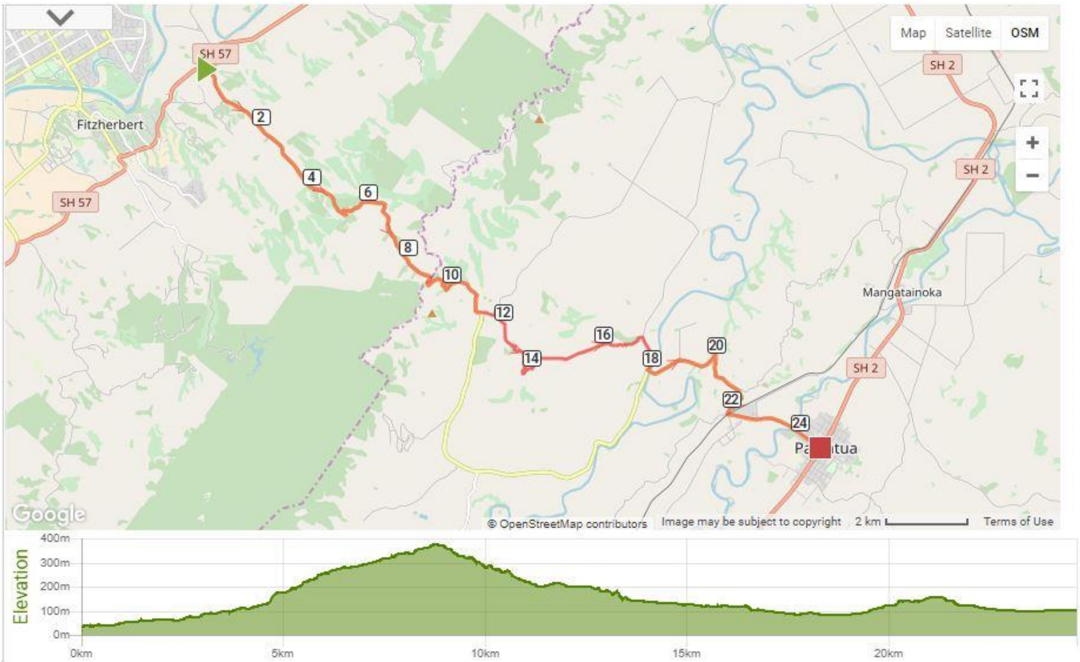


Figure 1.11: Pahīatua Track Vertical Profile (SH57 to SH2), https://nz.mapometer.com/

63. There are fundamental operational issues associated with the terrain, pavement construction and geometry of both Saddle Road and the Pahīatua Track. The extra distance and higher gradients on both routes have led to higher vehicle operating costs, particularly for HCV. This issue is aggravated by increasing traffic volumes (for example, during holidays or harvesting), other incidents or during poor weather which at times result in a total closure of the route.

64. **Figure 1.12** shows an indicative overview of the difference in vertical profile between Saddle Road and the Project.[10]

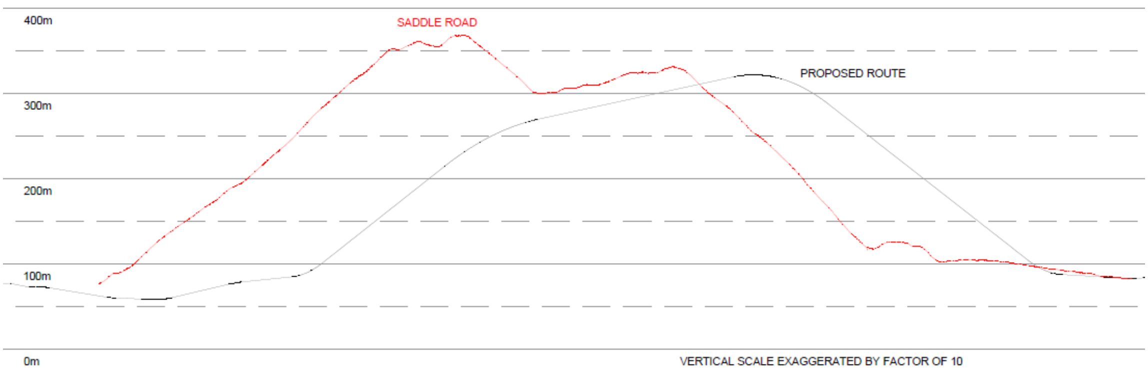


Figure 1.12: Vertical Profile Comparison between the Proposed Route and Saddle Road

[10] Vertical profile data available from the Project DBC stage was provided by GHD to WSP Opus in October 2018 in genio file format, and converted to the Figure 1.12 above by WSP Opus. Data for the Pahīatua Track is not available and therefore it is not shown. No liability is carried by GHD for the use of this data.

65. The additional direct travel costs through the use of Saddle Road (as compared with use of the now closed SH3 through the Gorge), as reported in the Detailed Business Case ("**DBC**") for the Project, have been estimated to be approximately $60,000 a day, or more than $22M per annum, and a significantly increased travel time of approximately 9 minutes for general traffic and 15 minutes for freight per trip. There are many anecdotal examples of impacts to local businesses and access to amenities including additional travel times for ambulances and access to essential services. During situations where both roads are closed, people can no longer traverse the Ranges without taking extensive detours to the north or south. A particular issue relates to the impacts on those who require access to medical services, including hospitals, when one or both routes are closed.

66. There are also significant costs to delaying the Project, with Ernst & Young (EY) having estimated that, in terms of 2016 Net Present Value ("**NPV**")[11], the economy would lose $279M of output over the next 40 years, if nothing were done to restore a State highway connection.[12] This estimate is made up of effects on Gross Domestic Product of lost investment of $82 M (or $7 M per annum), another $130 M (or $9 M per annum) from the impact of increased freight costs on output, and the agglomeration efficiencies forgone (relative to a Gorge-open scenario) of $67 M (or $5 M per annum). These costs are in addition to the direct travel costs outlined in the preceding paragraph above.

67. The Saddle Road route, as the current main route through the Ranges, cuts directly through the centre of Ashhurst along Salisbury Street. Increased traffic through the town centre results in additional noise and vibration, which causes disturbances to the local community and general nuisance. Increased traffic also increases traffic delays and raises safety risk, particularly around Ashhurst School area. A large number of Ashhurst residents have expressed a desire to maintain ‘a quiet village’ character, and the presence of additional general and freight traffic does not support this aspiration.

68. Previous community engagement sessions have revealed that a number of residents living in Ashhurst, Woodville or further north or south east within the Tararua District may consider relocation if the current transport network remained the only option, which would have a further impact on local businesses and the economy.

[11] Net Present Value is a measurement of profit calculated by subtracting the present values of cash outflows from the present values of cash inflows over a period of time.
[12] Assessment of the Wider Economic Benefits of the Shortlisted Options (EY, 2018).

Walking and cycling

69. **Figure 1.13** and **Figure 1.14** below show the walking and cycling routes around the Project area. Particularly relevant routes to the Project include:

   (a) Manawatū River shared path between Ashhurst and Palmerston North;

   (b) walking trails around Ashhurst Domain (west of Manawatū River) and through the Manawatū Gorge (east/south of Manawatū River); and

   (c) the cycle route traversing Pahīatua Track, which forms part of the New Zealand Cycle Trail Touring Route.[13]

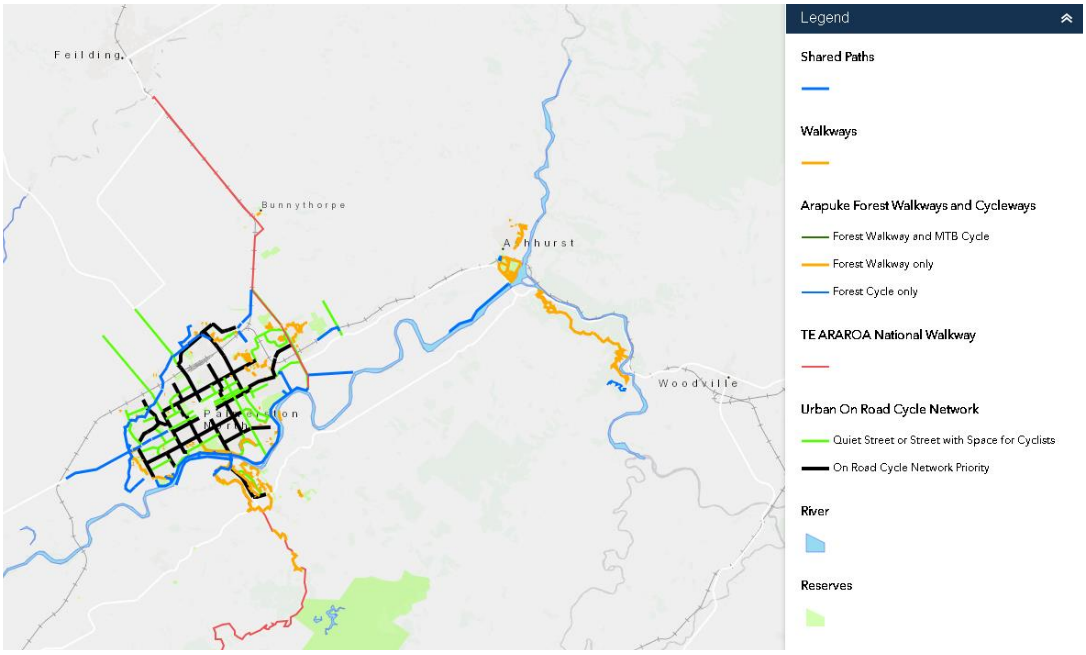


Figure 1.13: PNCC walking and cycling routes (https://geosite.pncc.govt.nz/MapViewer/)

[13] The New Zealand Cycle Trail – Pahīatua Road forms a 10km part of the Tararua Traverse Heartland Ride, which is part of the New Zealand Cycle Trail: https://www.nzcycletrail.com/explore-trails/. Currently the 10km section on Pahīatua Road is closed due to the increased volumes of traffic since the Gorge closure.

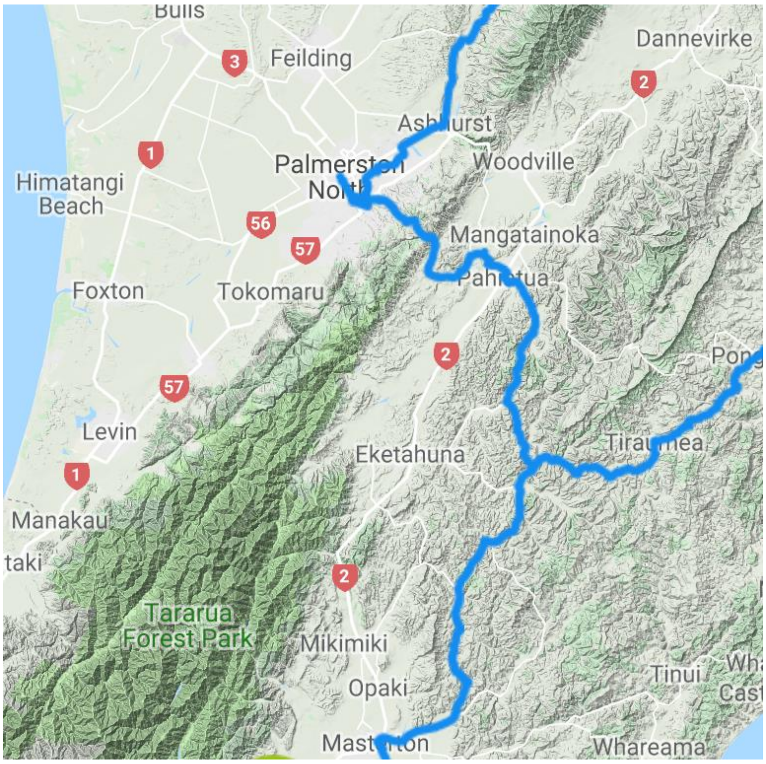


Figure 1.14: National Cycle Routes (https://www.nzcycletrail.com/map/?trail-id=993)

70. A current gap in the cycling/walking network is across the Manawatū River at Ashhurst (the Ashhurst Bridge is shown in **Figure 1.15**), which would otherwise connect the recreational areas in the Manawatū Gorge with the wider walking and cycling network. An Indicative Business Case (**"IBC"**[14]) was prepared in 2016 which considered new facilities adjacent to the existing SH3 road bridge. The IBC estimated the demand (pre-closure of the Manawatū Gorge) to be zero with the potential future demand associated with an improved facility to be 120 pedestrians and 90 cyclists per day. Following the closure of the Manawatū Gorge in 2017 and the associated reduction in traffic on the road bridge, electronic cycle warning signs were installed at the bridge (earlier this year) to improve cycle safety.

[14] Manawatū River Bridge (Ashhurst) Walk/Cycleway Indicative Business Case, Opus, 2016.

Figure 1.15: Ashhurst Bridge

71. A video survey of the use of the SH3 Ashhurst Bridge by pedestrians and cyclists has been undertaken between 14 September and 20 September 2018, between 6am – 8pm, to understand the actual current demand at the location. This survey indicates that currently there is limited use of the bridge by active users. Within this one week period, there was a total of 3 pedestrians and 125 cyclists, with the peak day being Saturday. There is no significant hourly peak flow pattern during the weekdays surveyed which indicates that this is likely a recreational route that is not used by commuter cyclists. The weather during the survey week was largely dry and therefore is not considered influential to the low demand numbers. The daily demand summary obtained from the survey is documented in Table 1-1.

Table 1-1: Pedestrians and Cyclist Demand Survey Summary

Pedestrians and Cyclists Demand Survey at Ashhurst Bridge Survey Period : 1 week, between 6am - 8pm daily Weather : Generally dry throughout the week								
Day	**Fri**	**Sat**	**Sun**	**Mon**	**Tue**	**Wed**	**Thu**	**Week**
Date	**14/09/2018**	**15/09/2018**	**16/09/2018**	**17/09/2018**	**18/09/2018**	**19/09/2018**	**20/09/2018**	**Total**
Pedestrians	0	1	1	1	0	0	0	3
Cyclists	9	41	26	2	15	9	23	125
Total	**9**	**42**	**27**	**3**	**15**	**9**	**23**	**128**

Key traffic routes – existing and proposed

72. The following figures identify the key routes for trips across the Ranges, both in the existing situation and with the proposed Project.

73. Figure 1.16 below shows the primary routes between various origins/destinations on the western side of the Ranges and SH2 north (Woodville and Dannevirke) on the eastern side of the Ranges. Figure 1.17Figure 1.17 below shows the primary routes between the same origins / destinations on the western side of the Ranges and SH2 south (Pahīatua and Eketahuna) on the eastern side of the Ranges. The origins/destinations to the west of the Ranges are:

    (a) North via SH54 / SH1 (red) (assumed to include Pohangina);

    (b) West via SH3 (yellow) (assumed to include Feilding);

    (c) Palmerston North (green); and

    (d) South via SH57/SH1 (blue).

74. There is also a demand to/from Ashhurst itself (not shown due to the scale of the figure).

75. The solid lines show the existing routes with the dashed lines indicating the expected changed routes with the proposed Project. The key changes expected for trips to/from SH2 north (Woodville and Dannevirke) on the eastern side of the Ranges (shown on Figure 1.16) are:

    (a) all Saddle Road trips (north, west and Palmerston North) are expected to transfer to the new road with minor routing changes around Ashhurst; and

    (b) trips to/from the south are expected to transfer from the Pahīatua Track to the new road (via SH57).

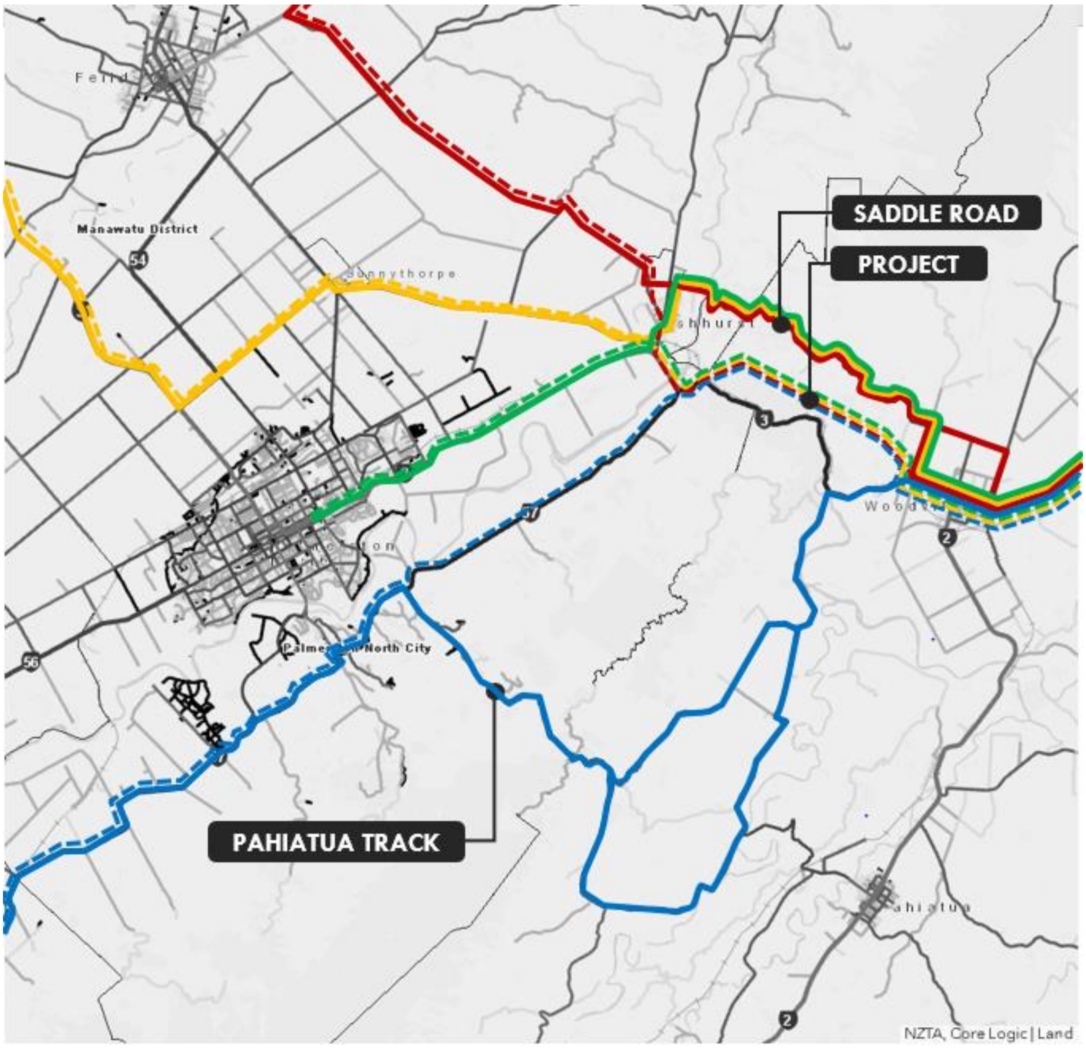


Figure 1.16: Routes to and from SH2 north (Woodville and Dannevirke) (https://nzta.maps.arcgis.com, ONRC)

76. The key changes expected for trips to/from SH2 south (Pahīatua and Eketahuna) on the eastern side of the Ranges (shown on Figure 1.17) are:

    (a) Trips to/from the north and south that currently use Saddle Road are expected to transfer to the new road.

    (b) Some the trips from the south and Palmerston North that currently use the Pahīatua Track are expected to transfer to the new route

    (c) Some of the trips from the west that currently use the Pahīatua Track or Saddle Road are expected to transfer to the new road.

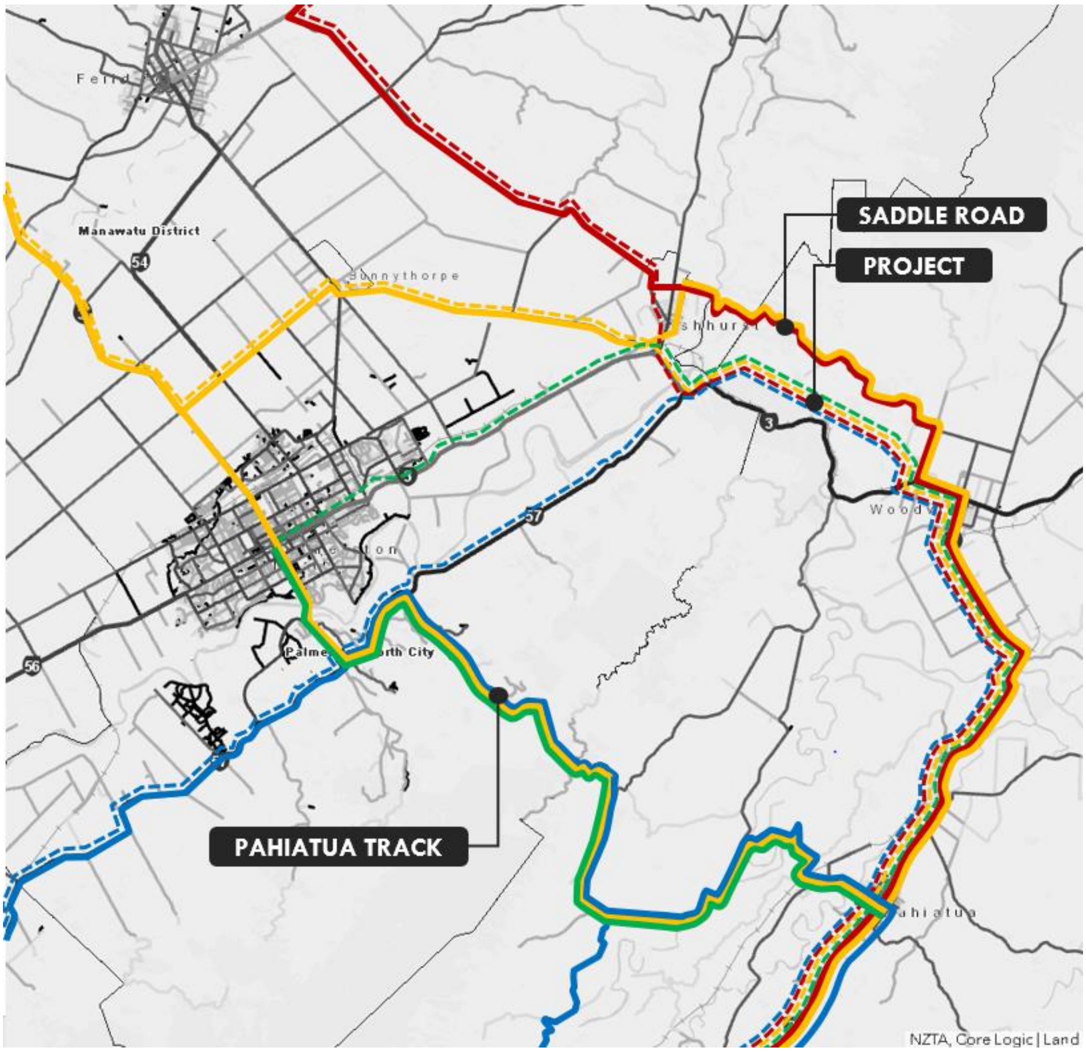


Figure 1.17: Routes to and from SH2 south (Eketahuna and Masterton) (https://nzta.maps.arcgis.com, ONRC)

Travel to work

77. The most recent available travel to work data is from the 2013 census.[15] The demand between east and west has been summarised in **Table 1-2** below. The table focuses on the three key territorial authorities (PNCC, MDC and TDC) but also considers adjacent authorities (Central Hawkes Bay, Whanganui, Rangitikei, Horowhenua, Kāpiti Coast, Masterton and Carterton).

78. Approximately 1,000 people usually work and live on different sides of the Ranges; 65% of those work in the west and live in the east, with the majority commuting to Palmerston North from the Tararua District.

[15] http://archive.stats.govt.nz/Census/2013-census.aspx

Table 1-2: East-west travel to work (2013 census)

	Usual workplace						
	2013 Census	Palmerston North City Council	Manawatū District	Other Territorial Authorities (west)	Tararua District	Other Territorial Authorities (east)	**Total**
Usual residence	Palmerston North City Council	n/a	n/a	n/a	210	36	**246**
	Manawatū District	n/a	n/a	n/a	60	-	**60**
	Other Territorial Authorities (west)	n/a	n/a	n/a	39	9	**48**
	Tararua District	510	54	27	n/a	n/a	**591**
	Other Territorial Authorities (east)	54	6	6	n/a	n/a	**66**
	Total	**564**	**60**	**33**	**309**	**45**	**1011**

Future land-use and growth

79. No significant land-use changes that would affect transportation demands on the proposed route have been identified.

80. The average annual growth rates for the districts that the proposed route traverses have been obtained through an analysis of available census data between 2001 and 2013, as follows:

    (a) Palmerston North City: 0.6%;

    (b) Manawatū District: 0.6%; and

    (c) Tararua District: -0.5% (indicating population decline).

81. It is noted that the net immigration has been at high levels since the 2013 census, and therefore has translated into relatively high levels of population growth throughout the country.

82. A review has also been undertaken of the applicable district plans and proposed growth areas (e.g. Feilding Growth Precinct), which has identified

no potential impact on the demand on the Project area. Changes in Palmerston North residential property prices and supply are anecdotally increasing demand in surrounding areas such as Ashhurst, however these changes are considered to be in line with conservative growth predictions.

83. Assumptions around traffic growth have been documented in the Traffic Assumption Memo in **Appendix 1.A**.

'Do-minimum' transport network

84. The do-minimum transport network is as per the existing transport network described above, with the exception of some changes in and around Ashhurst that have recently been discussed with the community, and are currently being developed for implementation.

85. Safety improvements are being constructed around Ashhurst as shown in **Figure 1.18** below.

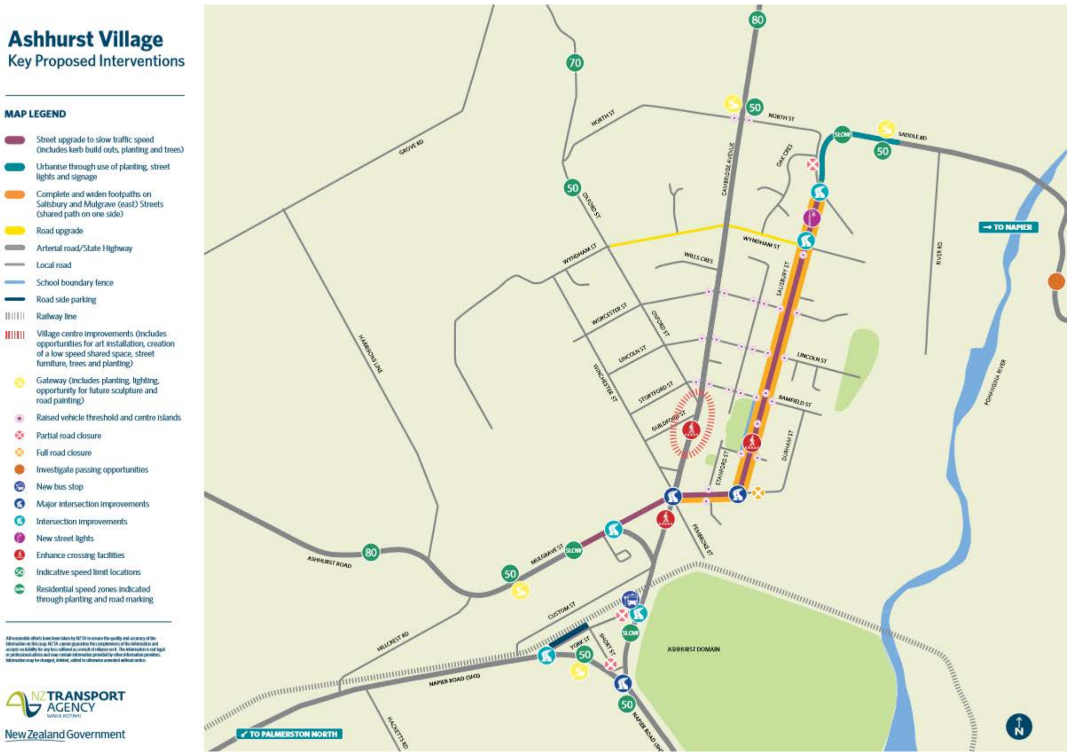


Figure 1.18: Ashhurst Village – Key Proposed Interventions (https://www.nzta.govt.nz/assets/projects/sh3-manawatu-gorge/ashhurst/16-ashhurst-poster-key-proposed-interventions-strategy.pdf, 2018)

86. The Palmerston North Ring Route is currently at the Programme Business Case stage and is expected to include new sections of highway to allow traffic (particularly freight) to bypass Palmerston North. This has not been included in the do-minimum scenario, as details have yet to be confirmed, however any traffic redistribution that occurs as part of a proposed ring route

is unlikely to significantly affect the ability of the Project to accommodate such a change. The outcomes of this investigation may also result in changes to active mode travel patterns accessing the Manawatū Gorge western carpark/access.

Road safety

87. **Figure 1.19** to **Figure 1.22** below (from the NZ Transport Agency's SafetyNet[16]) provide context around the road safety on the State highway network in the area surrounding the Project. Due to the limitation of the system,[17] the following safety ratings are based on the crash data from the period 2013-2017, which included a period of the Manawatū Gorge being open and a period of it being closed. Risk ratings vary from low (green) to high (black) and star ratings vary from 5 (green) to 1 (black).

88. **Figure 1.19** shows that the State highways around Palmerston North (3, 54 and 56) all have high collective risk sections. SH57 and the State highways east of the Ranges generally have lower risk ratings with the exception of the south and east approaches to Woodville.

89. **Figure 1.20** shows that all of the State highways have isolated medium-high/high personal risk sections.

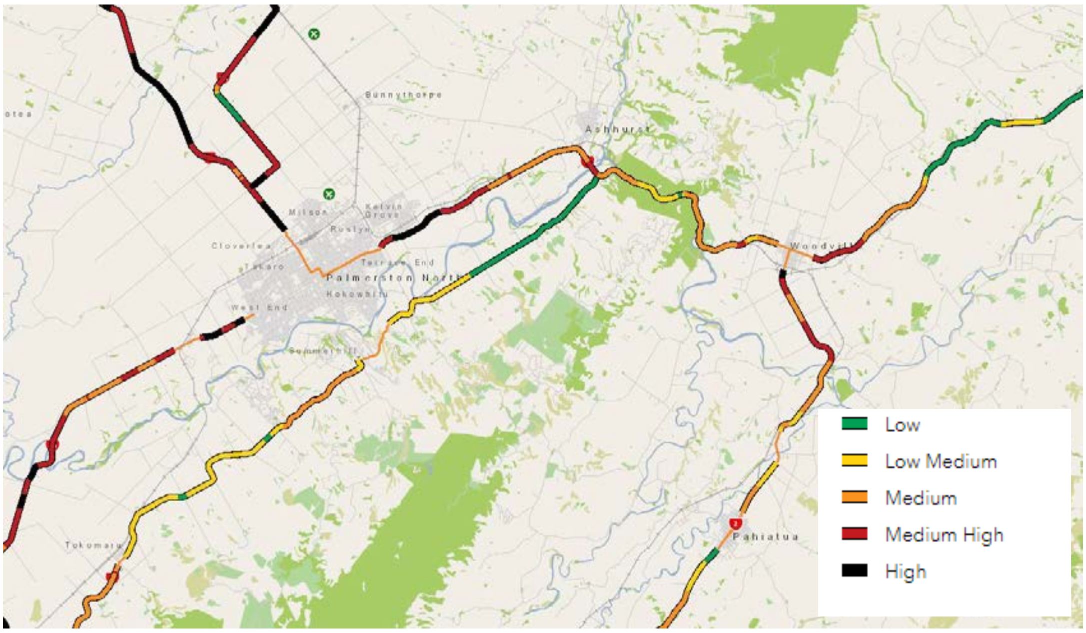


Figure 1.19: Collective Risk Map (https://nzta.maps.arcgis.com/, SafetyNet, 2013-2017)

[16] http://www.safetynet.org.nz/.
[17] The system provides ratings based on 5-year datasets only, meaning we were unable to use this data to compare the periods from before and after the closure of the Gorge.

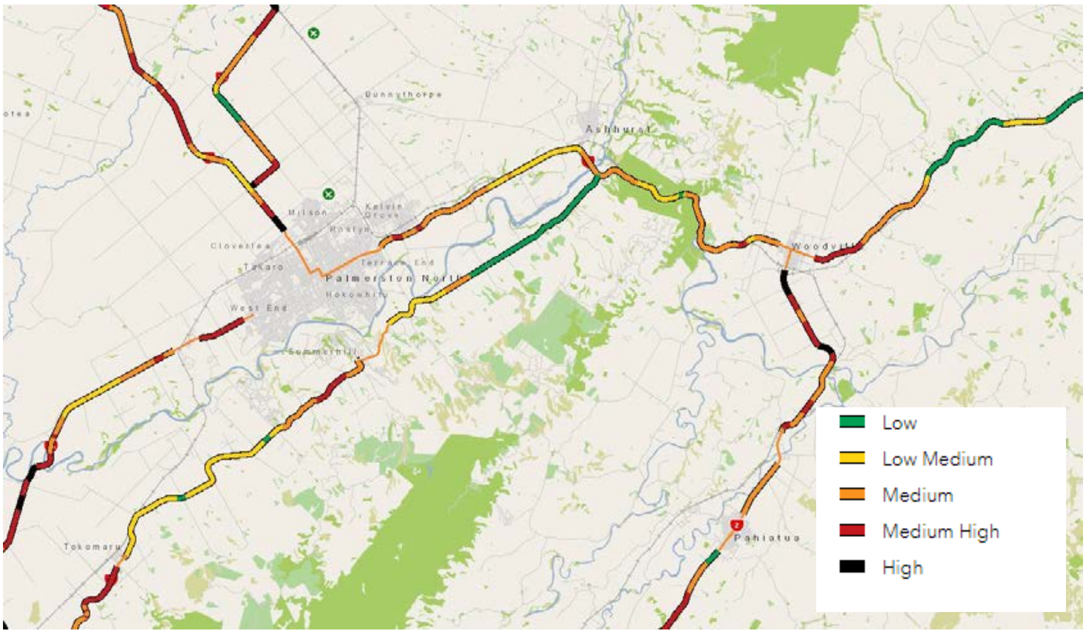
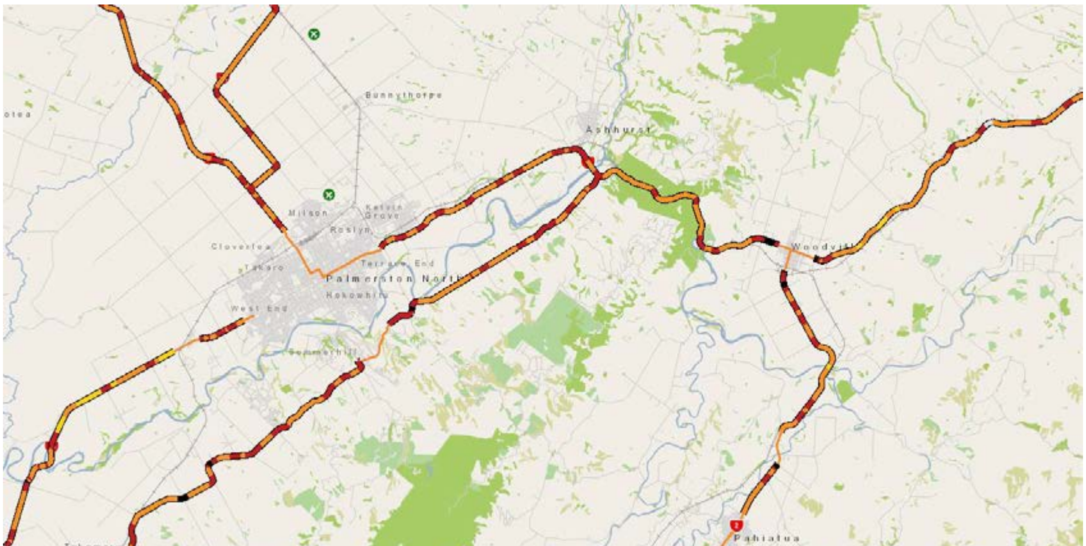


Figure 1.20: Personal Risk Map (https://nzta.maps.arcgis.com/, SafetyNet, 2013-2017)

90. **Figure 1.21** below shows the star rating for the State highway network. The majority of the network is made up of 2-3 star roads, with isolated sections of 1 star road around Woodville, Pahīatua and on SH57.



	1-star	2-stars	3-stars	4-stars	5-stars
Star Ratings	0%	39%	56%	5%	0%

Figure 1.21: Star Rating Map (https://nzta.maps.arcgis.com/, SafetyNet, 2013-2017)

91. **Figure 1.22** shows the collective risk rating for intersections. Generally the risk ratings are low with some high risk intersections around Palmerston North.

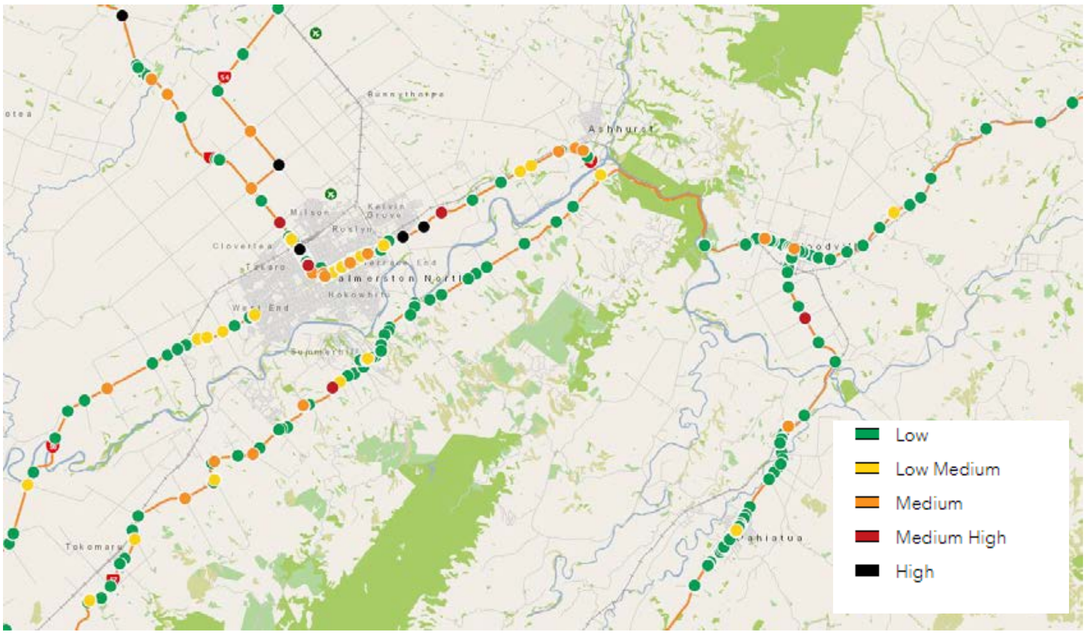


Figure 1.22: Intersection Collective Risk Map (https://nzta.maps.arcgis.com/, SafetyNet, 2013-2017)

92. Crash data has been retrieved from the NZ Transport Agency's crash analysis system for the key alternative routes across the Ranges where traffic volumes are expected to change (as shown in **Figure 1.16** and **Figure 1.17**) as follows:

    (a) Saddle Road from Ashhurst to Woodville;

    (b) Pahīatua Track from Aokautere to Woodville; and

    (c) SH57 from Aokautere to SH3.

93. Crash data has been retrieved[18] for the following periods, as the existing situation has not been operating for a standard five-year period:

    (a) each of the years from 2012 to 2016 inclusive (five one-year periods with Manawatū Gorge open); and

    (b) May 2017 to May 2018 (a one-year period with Manawatū Gorge closed, noting that some non-injury crashes from April – May 2018 may not be processed in time for inclusion into the record for this specific period).

94. The retrieved crash data for Saddle Road, SH57 and Pahīatua Track are summarised in Table 1-3, Table 1-4, and Table 1-5 below.

[18] On 27 June 2018.

Table 1-3: Summary of Crash Data for Saddle Road

SADDLE ROAD					
Year	**Fatal**	**Serious**	**Minor**	**Injury**	**Non-injury**
2012	0	2	7	9	18
2013	0	0	4	4	0
2014	0	0	2	2	0
2015	0	0	0	0	3
2016	0	0	1	1	2
2017-2018	0	2	7	9	18

Table 1-4: Summary of Crash Data for SH57

SH57					
Year	**Fatal**	**Serious**	**Minor**	**Injury**	**Non-injury**
2012	0	2	0	2	2
2013	0	0	1	1	3
2014	0	0	3	3	5
2015	0	0	1	1	5
2016	0	1	0	1	7
2017-2018	0	0	2	2	5

Table 1-5: Summary of Crash Data for Pahīatua Track

PAHIATUA TRACK					
Year	**Fatal**	**Serious**	**Minor**	**Injury**	**Non-injury**
2012	0	1	5	6	11
2013	0	1	4	5	7
2014	0	1	0	1	10
2015	0	1	1	2	14
2016	0	0	3	3	13
2017-2018	0	0	7	7	16

95. **Figure 1.23** shows that crashes on Saddle Road from Ashhurst to Woodville have spiked since the closure of the Manawatū Gorge in April 2017, which is likely to be attributable to the significant increase in traffic using Saddle Road. The historic crash data regarding Saddle Road is not representative of the expected number of crashes in a do-minimum situation. Further, there is insufficient data to confirm whether the recent improvements on Saddle Road[19] are resulting in a reduction in crashes, however the first known fatal

[19] These include measures such as surfacing, speed limits, removal of corners and additional passing/stopping areas for trucks.

crash occurred on the 5th of October 2018, and has not been recorded in the official (above) statistics.

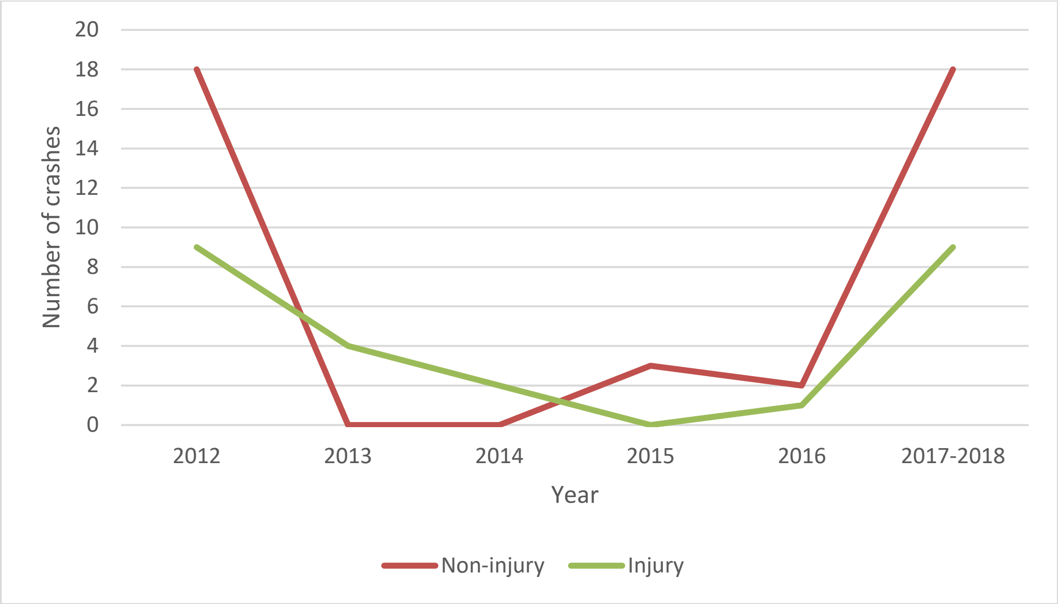


Figure 1.23: Crash trends on Saddle Road

96. **Figure 1.24** below shows no significant change in crash numbers on SH57 from Aokautere to SH3 since the closure of the Manawatū Gorge. The historic trend is expected to be representative of the number of crashes in a do-minimum situation.

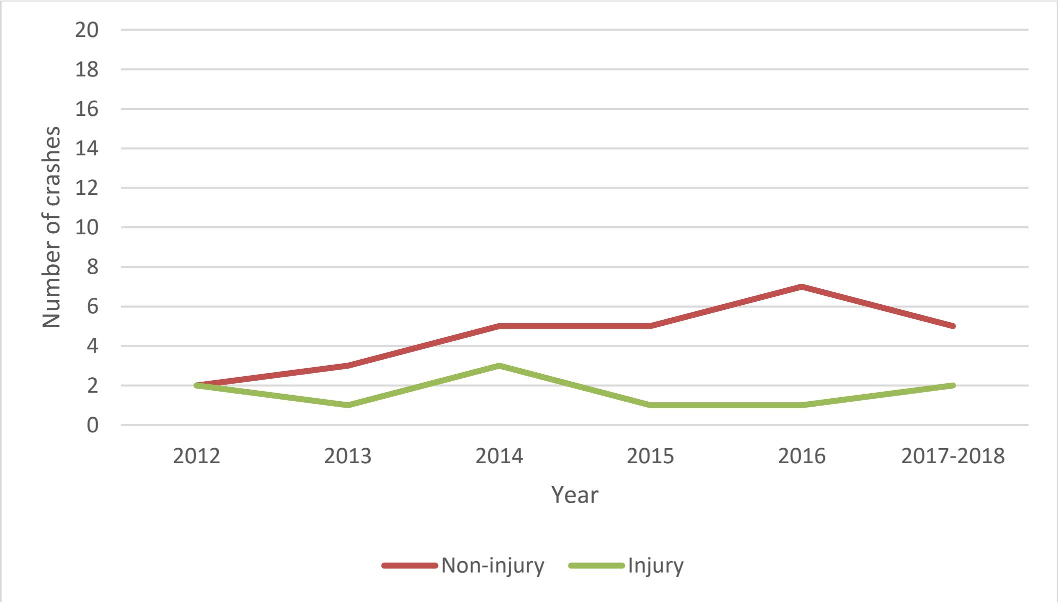


Figure 1.24: Crash trends on SH57

97. **Figure 1.25** below shows a small increase in the number of crashes on Pahīatua Track from Aokautere to Woodville since the closure of the

Manawatū Gorge. Given that the extent of increase in traffic on Pahīatua Track is less than Saddle Road and the Pahīatua Track is designed to a higher standard, this trend indicates that there has been a deterioration in road safety relative to the traffic demand. The historic trend is expected to be broadly representative of the number of crashes in a do-minimum situation. These trend lines are consistent with changes in traffic volume as a result of Gorge closures historically, and more recently with the permanent closure in 2017.

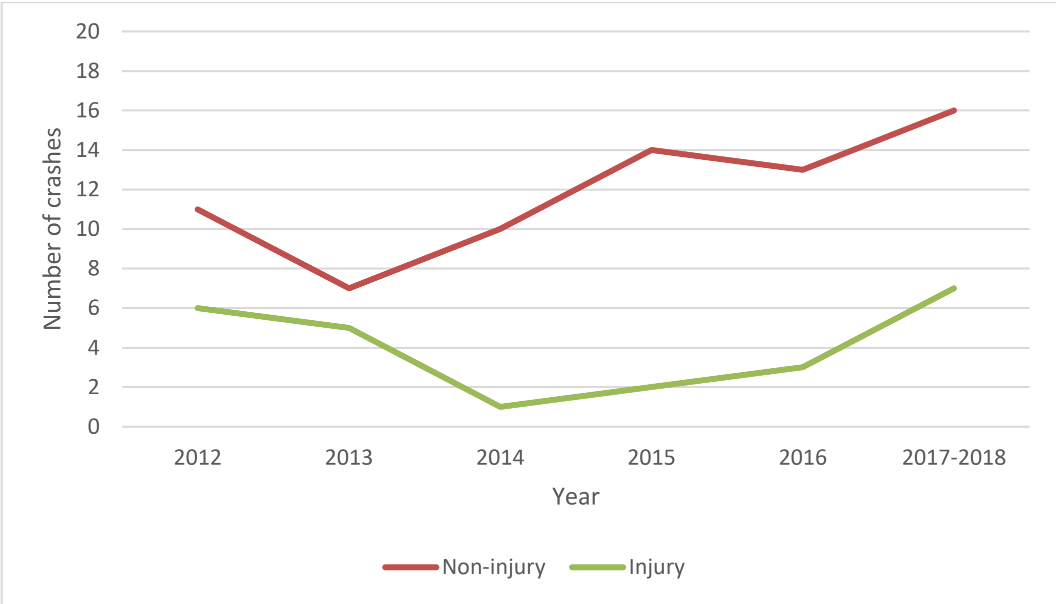


Figure 1.25: Crash trends on Pahīatua Track

98. During the period in which there were no long-term closures of the Manawatū Gorge (2013-2016), there were a total 12 injury crashes and 40 non-injury crashes across all three east / west connections (annual average of 3 injury crashes and 10 non-injury crashes respectively). This is significantly less that the numbers displayed in Figures 1.21 and 1.23 combined during periods in which SH3 Manawatū Gorge has been closured, confirming that safety has been compromised by the volumes using both Pahīatua Track and Saddle Roads.

Current and future transport demands

Current transport demand

99. Prior to its closure, the Manawatū Gorge route carried approximately 7,620 vehicles per day, with HCV making up 11.3% of the traffic. Following the Manawatū Gorge closure, 80% of its total traffic shifted to Saddle Road, while

the rest rerouted along the Pahīatua Track. Consequently, the daily traffic volumes on Saddle Road and the Pahīatua Track have significantly increased from approximately 150 to 6,220 and from approximately 2,214 to 3,819 vehicles respectively.[20]

100. The Pahīatua Track is the preferred alternative route for commuters travelling between Palmerston North, Pahīatua and areas further south. However, in the absence of the Manawatū Gorge connection, Saddle Road bears the vast majority of traffic travelling between Ashhurst, Hawke's Bay and Woodville due its shorter distance and travel time.

101. The 2017 hourly flow on Saddle Road (post-Manawatū Gorge closure) has been obtained from MetroCount.[21] This data has been used to generate a flow profile for the route, as shown in **Figure 1.26**, which also shows the traffic and directional composition of the daily flow.

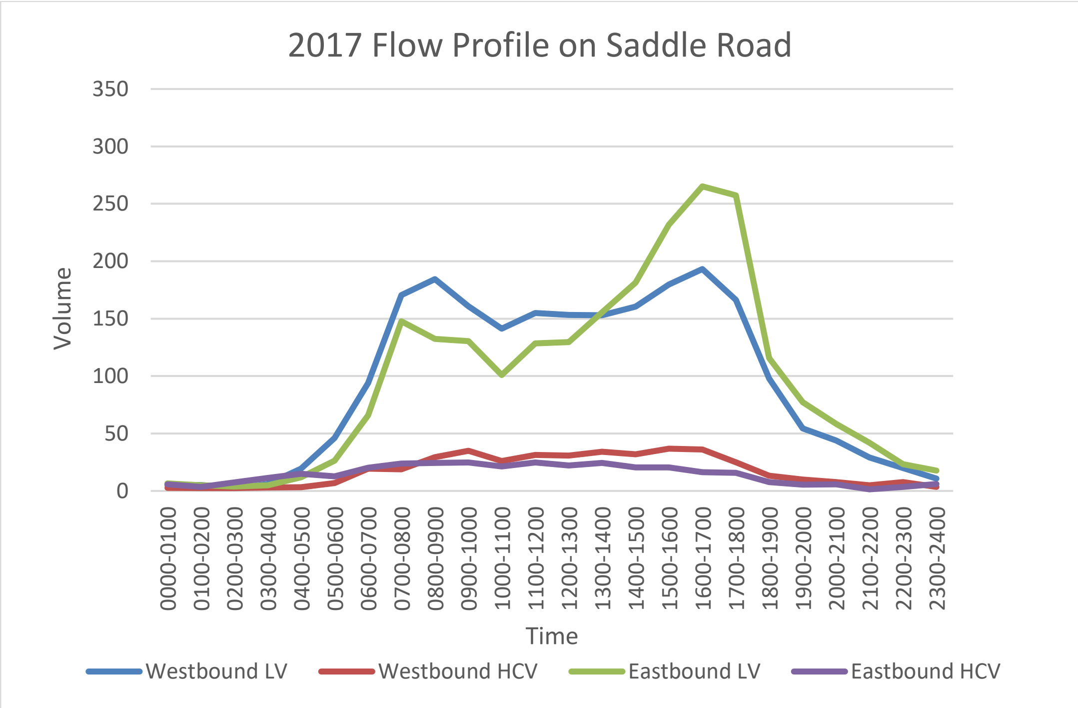


Figure 1.26: 2017 Flow Profile on Saddle Road

102. The flow profile shows that the morning peak flow of 370 vehicles per hour ("**vph**") generally occurs between 8.00-9:00, where the afternoon peak flow of 510vph occurs between 16:00-17:00. The peak directional flow split in the morning peak is approximately 55% westbound and 45% eastbound, and vice versa for the afternoon peak.

[20] Manawatu Gorge Alternative Detailed Business Case, NZ Transport Agency, 2018.
[21] Metrocount Data for July 2017 provided by the Palmerston North City Council to WSP Opus on 7 August 2018.

103. As discussed above, Saddle Road currently forms part of the Intercity bus routes between Napier, Wellington, Gisborne, Palmerston North, Tauranga and Masterton. Several school buses also travel between Dannevirke and Palmerston North daily via Saddle Road.

104. The main fire station and St Johns ambulance service are located in Palmerston North. These services rely on Saddle Road to provide connection to the adjacent eastern districts such as Tararua.

105. As mentioned above, the Pahīatua Track is currently part of the New Zealand Cycle Trail Touring Route, running between the western and eastern ends of the Manawatū Gorge. The closure of the Gorge and associated increased traffic levels on Pahīatua Track have resulted in The NZ Cycle Trail closing this link and advising users to utilise a shuttle as an alternative mode of travel over this link[22]. Saddle Road currently has very low utilisation by cyclists due to the traffic volume and terrain.

106. The Manawatū Gorge walking track is the primary walking route between the western and eastern ends of the Gorge, and has remained open and accessible following the closure of the Gorge. The track is accessible from SH3 and carparks for recreational users are located at the western and eastern ends of the Gorge. Figures from 2016 indicate that the Manawatū Gorge recreational area has over 100,000 visitors annually, with walking track numbers increasing by 350 percent since 2012.[23]

Future transport demand

107. In the do-minimum scenario, the above flow profile on Saddle Road is expected to remain through to the future years. **Figure 1.27** shows the predicted 2022[24] flow profile (volume and time of day) on Saddle Road, based on a medium growth scenario as discussed in the Traffic Assumption Memo (**Appendix 1.A**). The 2022 peak hour flows in the AM and PM peak on Saddle Road (mid-point) are predicted to increase to 430vph and 600vph respectively.

[22] https://www.nzcycletrail.com/trails/tararua-traverse/.
[23] http://www.teapiti.com/updates/2017/11/2/additional-facilities-enhance-te-apiti-manawatu-gorge-visitor-experience.
[24] The year 2022 has been considered as a fair representative of a short-medium future scenario, as well as estimated to be the mid-point of the Project construction period.

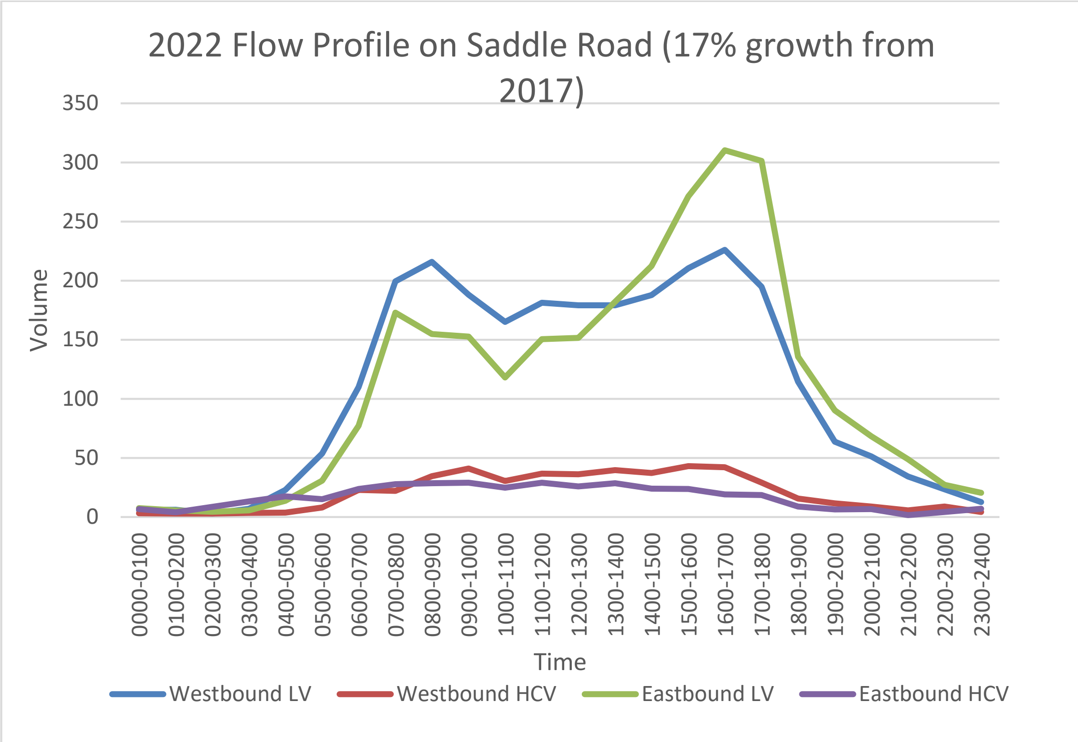


Figure 1.27: 2022 Flow Profile on Saddle Road

108. As discussed above, given the main features of Saddle Road, at this level of peak flow condition the performance of the link will continue to be placed under strain, both in terms of operational efficiency and road safety. Though minor upgrades to Saddle Road form part of the do-minimum scenario, this will not bring the road up to a State highway standard and therefore it is anticipated to provide a progressively lower level of service in the future years.

109. Buses and emergency services will continue to travel on Saddle Road in the do-minimum scenario. There is no available information on the future demand of these services, however, given the low growth rate forecast for the adjacent districts, no significant demand increase is expected.

110. It is expected that cyclists will continue using the Pahīatua Track as the primary east / west route, particularly as the level of traffic on Saddle Road grows further in the future. However, as noted in paragraph 103 earlier, the "*Tararua Traverse Heartland Ride on the Pahīatua Track is temporarily closed because of dangerous traffic conditions*".[25]

111. An increase is also expected in the recreational use of the Manawatū Gorge walking track, as well as the need for parking space.

[25] https://www.nzcycletrail.com/trail-updates/2018/tararua-traverse-section-closure/.

ASSESSMENT METHODOLOGY

112. The following assessment methodology has been used to assess the operational transportation effects of the Project:

    (a) Safety effects have been assessed by comparing actual and predicted crash risks to determine the relative safety risk and effects of the Project.

    (b) Traffic effects have been assessed by considering the future link/intersection performance and combining that with travel time savings to determine the traffic effects associated with the Project.

    (c) Public transport effects have been assessed by considering the potential benefits or dis-benefits to public transport users associated with the Project.

    (d) Effects on vulnerable users (pedestrians and cyclists) have been assessed by considering the provision of facilities and outcomes proposed by the Project compared to the do-minimum scenario.

    (e) Access effects have been assessed by considering the impact of the proposed alignment on the properties surrounding the Project.

113. The following assessment methodology has been used to assess the construction transportation effects of the Project:

    (a) Construction traffic demands have been estimated based on an assumed construction methodology (other methodologies are also available which could adjust the traffic volumes).[26]

    (b) Safety effects have been assessed by considering the number and location of construction vehicle movements associated with constructing the proposed Project and the associated safety.

    (c) Traffic effects have been assessed by considering the number and location of construction vehicle movements associated with constructing the proposed Project and the associated travel times.

    (d) Parking effects have been assessed by considering the potential disruption of the Manawatū Gorge parking facility by construction activity.

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[26] Manawatu Gorge Replacement Project, Construction Traffic Estimate, Higho Consultants, August 2018 (attached to this assessment as part of **Appendix 1.D)**.

(e) Vulnerable user effects have been assessed by considering the movement of construction vehicles in areas where active users activities occur.

PROJECT SHAPING

114. The DBC and the AEE report outline the problems that have been identified with the existing east/west connection, the investment/Project objectives, and the process followed in order to devise the Project.

115. As described in those documents, wide-ranging processes have been undertaken by the NZ Transport Agency to gather information to inform its choice of route for the Project. Those processes included multi-criteria analyses of a long list and short list of options. I was not directly involved in providing transportation-related inputs to those processes, which was a task overseen by specialists at GHD Limited. I was, however, involved in the review of various components of this process, including the Road Safety Audit and Project Economic Assessment of the preferred option.

Designation shaping

116. Although I have not been involved directly in the option assessment for alternative routes and the associated analysis, I have been involved in the processes through which the preferred option has been developed into what is now proposed as a designation corridor. That has involved considering alternatives for the intersections at either end of the Project, and other constraints to ensure good safety and accessibility outcomes for pedestrians, cyclists and vehicles. This process involved:

(a) review of the proposed DBC design;

(b) identification of transport demands and desired outcomes;

(c) development of assessment tools such as Excel Spreadsheets and SIDRA[27] traffic models;

(d) traffic effects being assessed by considering the future link/intersection performance combined with travel time savings to determine the traffic effects associated with the Project;

(e) assessment of options and alternative solutions relating specifically to intersections and safety (road and active travel); and

[27] Intersection Modelling and Assessment Tool.

(f) safety effects being assessed by comparing actual and predicted crash risksto determine the relative safety risk and effects of the Project.

117. In the development of the AEE and the associated Transport Assessment, I have been involved in a number of critical workshops and meetings, including:

(a) initial Project team briefing and Project overview;

(b) design workshop with the technical assessment and design teams;

(c) group and individual site visits;

(d) specialist safety meeting;

(e) stakeholder mitigation workshops (two of these have occurred) where I presented information regarding transport outcomes, effects, and effects management;

(f) Ashhurst improvements interface workshop;

(g) pre-lodgement workshop with the wider stakeholder group and specialists engaged by the local councils;

(h) a transport specific meeting with Harriet Fraser (transport specialist engaged by the councils for the application process) to provide background information relating to the TIA and respond to specific questions raised by Harriet, and

(i) ongoing interaction and communication with the teams involved in the Project design, indicative construction methodology, social impact assessment, and noise assessment.

118. The consideration of alternatives in relation to transport has resulted in refinement of the designation alignment, while also allowing flexibility as the Project design develops and evolves into construction outcomes. Specific areas of focus include the intersections at either end of the Project, and the carpark and Gorge access at the western end.

ASSESSMENT OF OPERATIONAL TRANSPORTATION EFFECTS

119. The following sub-sections outline the assessment of transportation effects with regard to the operational outcomes of the Project. Refer to **Appendix 1.A**, the Traffic Assumptions Memo, for a detailed list of assumptions and methodology relevant to the assessment of traffic effects.

Traffic effects

120. The assessment of traffic effects has been undertaken considering the efficiency Project objective, which is to *“reconnect the currently closed Manawatū Gorge State Highway 3 with a more efficient connection than the Saddle Road and Pahīatua Track”*.

Traffic demands and distribution

121. The introduction of the new Project route will have a significant effect on the traffic demands and distribution within the surrounding areas. It is expected that traffic that previously used the SH3 Manawatū Gorge route will transfer to the new route, which as a result will alleviate traffic demand on the existing travel routes between Ashhurst and Woodville (i.e. Saddle Road and the Pahīatua Track) and the surrounding local roads at both ends. This will return the use of the two existing routes (and associated linkages) back to their original functions as arterial and primary collector routes, respectively.

122. Refer to the trip distribution summary table in **Appendix 1.B** for the summary of the predicted traffic demand between the routes under the do-minimum and Project scenarios.

123. The key traffic demand reductions will be on Saddle Road, primarily between Salisbury Street and Woodlands Road, and the Pahīatua Track between SH57 and Balance Valley Road. In 2041, the Project will result in a demand reduction of up to 97% on Saddle Road and up to 43% on the Pahīatua Track.

124. The Project will also alleviate the demand on key local roads in Ashhurst (notably Cambridge Avenue, and Salisbury Street) and Woodville (notably Woodlands Road and Oxford Road). The corresponding significant increase in traffic demand on the SH3 section around Ashhurst (particularly between Cambridge Avenue and SH57) and Woodville (between Woodlands Road and SH2) will be well-catered for by the new route. The growth in traffic through Woodville will be consistent with growth that would have occurred prior to the Manawatū Gorge closure.

Link performance

125. The link performance of the proposed Project has been evaluated using the HCM 2010 Multilane Highway Chapter 14[28] method for assessing LOS

[28] Highway Capacity Manual 2010 Chapter 14 Multilane Highways, Transportation Research Board of the National Academies, December 2010.

based on the base speed and estimated flow rate (Exhibit 14-5, Equations 14-3 and 14-4).

126. The predicted daily traffic that will be travelling on the Project route in 2041 is 14,000 vehicles.[29] The peak hour flow, based on the current flow profile of Saddle Road, is up to 10% of the average daily flow, and therefore, an upper limit estimate of a one-way peak flow on the Project route in 2041 is 770 vehicle/hour. Considering the high proportion of HCV, the terrain, and the typical peak hour factor, and given there are crawler lanes in addition to the single lane in each direction, the predicted typical flow rate in 2041 is 450 vehicle/hour/lane. According to the LOS Curve in HCM 2010 Chapter 14 Exhibit 14-5, assuming that the base speed on the new route is 80km/h, this flow rate is equivalent to a LOS A, which would be expected for a road of this standard.

127. It is noted that the basis for providing a crawler lane in each direction on the new route is primarily to accommodate the slower travel speed of HCV, given the gradients of the terrain, as well as to allow the provision of a median barrier along the corridor.

128. The new route will offer a higher level of efficiency for emergency service vehicles travelling between Palmerston North and Tararua District.

Intersection performance

129. Five intersections have been identified and assessed to understand their future performance with and without the Project. Refer to **Figure 1.28** and **Figure 1.29** below for the locations of assessed intersections on the western and eastern sides of the Project.

[29] Refer to Appendix A – Te Ahu a Turanga: Traffic Assumptions Memo, WSP Opus, August 2018.

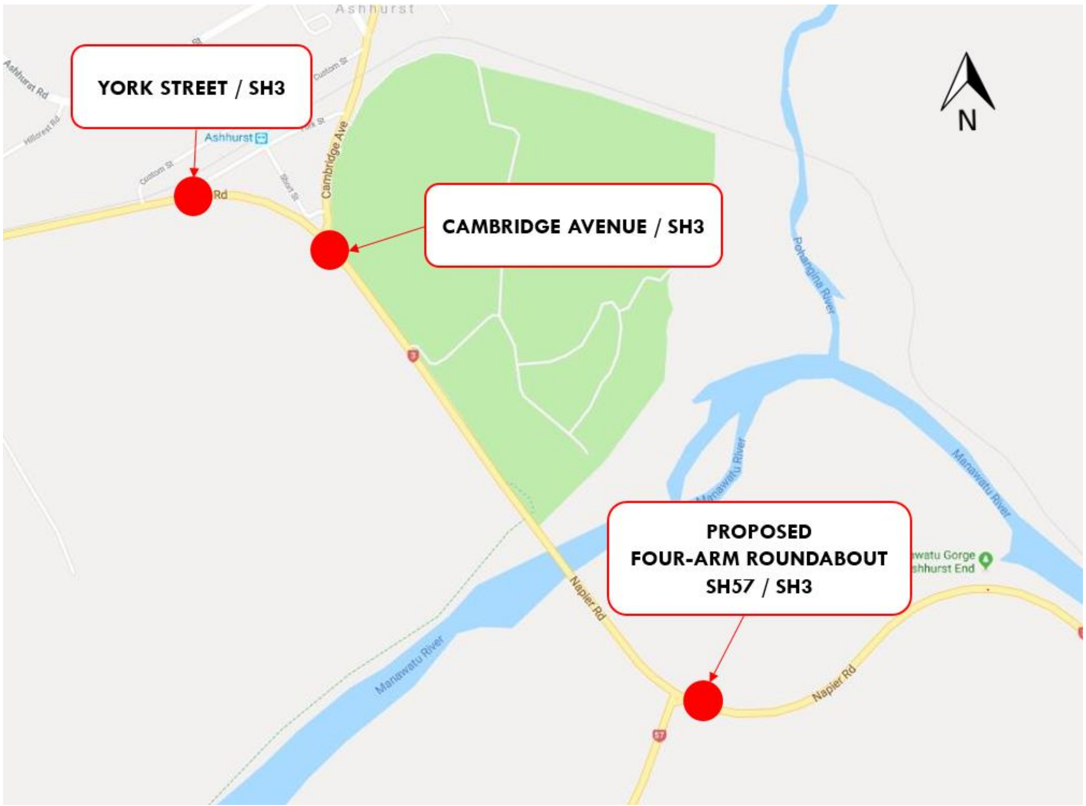

Figure 1.28: Assessed Intersections - Western End (Ashhurst)

Figure 1.29: Assessed Intersections - Eastern End (Woodville)

130. At the western end of the Project, the intersections that connect Ashhurst to SH3 (York Street and Cambridge Avenue) have been assessed. In the current and future do-minimum situation, the majority of traffic uses the York Street intersection (predominantly traffic to/from Palmerston North heading to/from Ashhurst itself and to the east (e.g. Saddle Road)). The Cambridge Avenue intersection has lower traffic demands associated with flows to/from SH57. The NZ Transport Agency is currently looking at options for both of these links prior to construction of the Project.

131. If the current network configuration was retained in Ashhurst, the future performance of the SH3/York Street intersection is expected to be unacceptable both with and without the Project. The SH3/Cambridge Avenue intersection is expected to perform at an acceptable level without the Project, but will perform unacceptably with the Project. Intersection improvements, either carried out at both locations or focused solely around Cambridge Avenue intersection, have been assessed and are able to be accommodated within the existing road reserve to provide an acceptable level of performance. Improvements could take the form of signals or roundabouts at both York Street and Cambridge Avenue, or concentrate all demands into a single set of signals or roundabout at the Cambridge Avenue/SH3 intersection. As the trip distribution analysis shows that the Project will result in a reduction in traffic demand on Cambridge Avenue, it is noted that the need for these improvements arises from the predicted traffic growth around and travel demand to/from Ashhurst (and associated areas such as Feilding), as opposed to being the outcome of the Project. The NZ Transport Agency are currently investigating options for these intersections and traffic flows to and from Ashhurst.

132. The Project proposes to construct a four-arm roundabout at the intersection with SH57. This roundabout has been assessed and has sufficient capacity to cater for the future traffic demands expected with the Project. It will also provide safe access to and from the Manawatū Gorge entrance and parking area.

133. The Project proposes to construct a five-arm roundabout at the intersection with Woodlands Road. This roundabout has been assessed and has sufficient capacity to cater for the future traffic demands expected with the Project, while also improving access and safety for those using Napier Road, Woodlands Road and Troup Road.

134. East of the Project, the current intersection between SH2 and SH3 in Woodville has been assessed. The future performance of this intersection is expected to be unacceptable both with and without the Project. As a result, it will be important for the NZ Transport Agency to ensure the intersection performs safely and efficiently in the future, and this will need to form part of a future State highway improvement programme.

Travel times

135. The introduction of the new route will see a significant reduction in travel times for key trips between SH3 West, Ashhurst, Palmerston North, SH57 South, SH2 North and South, and Woodville. Refer to the travel time summary in **Appendix 1.C** for the improvements between the current and the proposed travel time for the key trips around the Project area.

136. The typical time saving for travel between Palmerston North and Woodville is predicted to be 10.8 minutes. This extent of saving is considered significant, as it essentially reduces the current travel time by nearly half. Travel between Aokautere (SH57 South) to SH2 north of Woodville will see the maximum time saving of up to 24 minutes, if compared to the current travel via Pahīatua Track and Mangahao Road.

137. Travel time savings for HCV travel between Palmerston North and Woodville is predicted to be 10.6 minutes. While HCV travel time savings between Aokautere (SH57 South) to SH2 north of Woodville will see a greater predicted saving, of up to 27.7 minutes, if compared to the current travel via Pahīatua Track and Mangahao Road.

138. Reliability in travel time will also improve significantly, with capacity to ensure there is little or no difference between travel times in peak or off-peak periods.

139. Overall, the significant travel time savings are primarily a result of the improvements in alignment and access efficiency attributed to the Project. The provision of dual carriageway in areas with steeper grade will reduce the delay imposed by slower HCV on the travel time for general traffic.

140. The new route will offer a higher level of efficiency for emergency service vehicles and buses travelling between Palmerston North and Tararua District.

141. Overall the traffic effects are **Significant Positive**.

Resilience effects

142. The assessment of the resilience effects has been undertaken considering the resilience Project objective, which is to *"reconnect the currently closed Manawatū Gorge State Highway 3 connection with a more resilient connection than the Saddle Road and Pahīatua Track."*

143. The Project will provide a high-quality alternative route to the existing non-state highway routes (i.e. Saddle Road and the Pahīatua Track), that customers are currently required to use since the closure of SH3 through Manawatū Gorge.

144. The Project route is a more reliable link, designed to a high standard, and is more resilient to incidents, minimising the risk of road closure and extent of disruptions. This includes meeting the standard for pavement design, which allows the Project route to carry large volumes of HCVs with significantly reduced maintenance activities, compared to the ongoing pavement maintenance required on the existing routes. Most notably, the Project's compliance with the higher seismic design standards for State Highways, compared to that of local roads, means that the new route will be much more resilient to seismic activities.

145. The inclusion of shoulders and crawler lanes for HCVs provides additional resilience, both in terms of incidents (crashes) and natural disasters (e.g. slip/earthquake damage etc.), where traffic can be diverted into the other lane/shoulder or even into a contraflow[30] using the other direction over longer periods.

146. The existing Saddle Road and Pahīatua Track will remain available as alternative routes, in the event that the new route is closed. Altogether, this significantly increases the resilience for the overall road network.

147. Moreover, in the case of emergency that causes a complete blockage along the Project route (for example, in the event of a major slip), there will be opportunities to utilise local roads and Meridian access roads with links to the project for emergency/evacuation access. There are also a number of locations in which the Project designation borders the Saddle Road which could allow for emergency access between the Project and Saddle Road. A number of construction access points could be considered for an upgrade

[30] Running 2-way traffic within the same side of the carriageway using traffic management (e.g. dropping the wire rope barrier / cones etc).

during detail design, if deemed necessary, to be utilised as emergency access.

148. There may be times when wind/snow/ice may cause issues and necessitate partial or full closure of the route. This is a common issue to many passes in New Zealand and can be managed through the use of weather stations and a Variable Messaging System (VMS) as a mean for alerting road users of closures or other forms of Intelligent Traffic System (ITS).

149. Overall the resilience effects are **Significant Positive.**

Safety effects

150. The assessment of the safety effects has been undertaken in consideration of the safety Project objective, which is to *"reconnect the currently closed Manawatū Gorge State Highway 3 connection with a safer connection than the Saddle Road and Pahīatua Track."*

Existing routes

151. As reported in the do-minimum section, it is apparent that there has been an increase in crash risk on Saddle Road and Pahīatua Track, which is primarily associated with the sharp increase in traffic volume travelling through both routes not designed for these traffic volumes following the Manawatū Gorge closure. Traffic demand on these routes is expected to reduce significantly following the opening of the Project. It is anticipated that the crash risks on these routes will then revert to the levels prior to the Manawatū Gorge closure, and indeed safety will improve due to the ongoing upgrades that are occurring.

Proposed route

152. The Project will be constructed to modern highway standards and will have an improved crash performance compared to the existing routes. The key features of the new route include the provision of wider sealed shoulders, a higher number of lanes and passing opportunities, median and edge barriers, and improved design speed and sight distances.

153. An indicative assessment of the proposed route has been undertaken using the KiwiRAP tool, guided by the NZ Transport Agency KiwiRAP Summary Report.[31] This assessment indicates that the proposed Project should achieve a KiwiRAP star rating between 4.1 – 4.5. This compares very favourably to the current 2 and 3-Star rating for the majority of the existing

[31] KiwiRAP Summary Report Final V3, NZ Transport Agency, May 2011.

network, as discussed in the do-minimum section. Therefore, the likely future crash risk along the new route is assessed to be significantly lower than the current crash risks on the network, particularly on Saddle Road and the Pahīatua Track.

154. The increase in traffic volume may impact the crash risk on the western and eastern approaches to the Project. As discussed previously, historically on SH3 between Cambridge Ave and SH57, and between Woodlands Road to SH2 there have been a number of intersection-type and loss of control crashes. The conversion of the SH3/SH57 and SH3/Woodlands Rd intersections to roundabouts as part of the Project will improve the overall safety at the intersections. This is because there will be reduction in crossing conflict points and approach speeds at the roundabouts. According to the High Risk Rural Roads Guide, upgrading a rural sign-controlled intersection to a roundabout should reduce injury crashes by up to 82%.[32] These roundabouts will also act as a threshold treatment for traffic entering existing sections of State highway in Ashhurst and Woodville that have a lower design standard. This will help to reduce the risk of 'crash migration' to areas outside of the Project due to a potential slower operating speed and therefore reduction in loss-of-control crash risk.

155. The increase in traffic demand on the section of SH3 between Woodlands Road to SH2 may have an impact on safety for all road users within the Woodville central area. However, I understand there was a strong community desire for traffic to remain through Woodville and the installation of the proposed roundabout will reduce access conflicts and vehicle speeds through this area, improving the existing situation.

156. Without the Project, the local roads within Ashhurst and Woodville will carry large traffic volumes on links that are not designed for such volumes, and therefore pose a much higher safety risks to road users.

157. Overall the safety effects are **Significant Positive**.

Public transport effects

158. The public transport effects associated with the Project are positive, as the proposed Project will provide a safer, more resilient, more reliable, and faster route. This could attract more users towards public transport in the area and, subject to sufficient demand, potentially lead to new public transport routes and services being introduced.

[32] High-risk Rural Roads Guide, NZ Transport Agency, September 2011.

159. Overall the public transport effects are **Minor Positive**, with the potential for much greater benefit should new services be provided in the future.

Vulnerable user effects

160. Vulnerable user effects can be split into two types of effects:

    (a) Positive effects associated with new facilities on the proposed road; and

    (b) Effects associated with changes in traffic distribution on other routes which enhance or degrade the provision and safety of vulnerable user trips.

161. The new road will provide (as a minimum) 2.0m-wide shoulders[33] on both sides of the road along its entire length, which is a significant enhancement on either of the existing east-west routes. The route will be relatively long and steep, but is expected to attract recreational road cyclists and touring cyclists.

162. For most of the Project route, there will be a crawler lane in each direction to provide a consistent 4-lane corridor without multiple merge and diverge points. There is limited guidance in this area, however according to Austroads Guide to Road Design[34], assuming that the maximum speed of vehicles using the outside crawler lanes is 60km/h, then the minimum width needed for cyclists (comprising of an exclusive bicycle lane width and lateral clearance to the outside of traffic lane) is 2.2m. Therefore, given that the Pahīatua Track and Saddle Road will offer good cycling facilities between Palmerston North/Ashhurst and Woodville, the cyclist numbers using the route are predicted to be low and an exclusive cycle lane is not proposed, the available width of a 2.0m-wide shoulder (as a minimum) is considered sufficient for the Project route, and a significant improvement on the existing situation.

163. The changes in traffic distribution, as detailed in **Appendix 1.B**, result in significant reductions in traffic on most key local road links. These reductions in traffic will make walking/running and cycling along these roads safer and more enjoyable. It is also envisaged that the NZ Cycle Trail, which is routed via Pahīatua Track, will be re-instated (as it is currently closed due to traffic safety concerns, as a result of increased traffic following the closure of the Gorge).

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[33] Te Ahu a Turanga: Project Description (Draft), NZ Transport Agency, August 2018.
[34] Part 3 Figure 4.28 and Table 4.18.

164. It should be noted that overall, the new road does not preclude cycle use and is not intended to substitute the main cycle route between the west end and east end of the project, as discussed above, which will be provided via the well-established Pahīatua Track. This is consistent with the road hierarchy principles, where generally active users are to use an available alternative route that is safer, more convenient, and parallel to the Project route with similar distance.

165. There will be a significant increase in traffic on the existing SH3 bridge over the Manawatū River east of Ashhurst. The recently completed business case[35] estimated a potential moderate demand for improved pedestrian/cycling facilities on the bridge (pre-closure of the Manawatū Gorge). The walking and cycling demand on the bridge following the closure of the Gorge has been surveyed over a period of 1 week, in September 2018.[36] As discussed previously, the walking and cycling demand is already restricted, despite the reduced traffic demand on the bridge. It is noted that the survey was undertaken in a spring month, where numbers may be lower than the annual average and may not be an accurate representation of the actual use of the Bridge.

166. While warning signage has been installed to increase safety for cyclists, the additional traffic demands arising from the Project have the potential to have an effect on the safety of cyclists currently using the bridge (and any pedestrians, especially given that the bridge currently provides no walking facility), and may discourage users to the Gorge recreation and cultural area.

167. The Project will provide a linkage for active modes between the SH57 intersection to the western Gorge entrance which will be away from the State highway, providing improvement for vulnerable users.

168. Overall the vulnerable user effects are **Neutral.**

Parking effects

169. The main access to and from the Manawatū Gorge walking track is currently via the western end, where there is a car park and information area. This area is the location in which the proposed new bridge abutment will be located on the south side of the river. This will result in the relocation this parking area, which is currently still well-used despite the Gorge closure.

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[35] Manawatu Gorge Alternative Detailed Business Case, NZ Transport Agency, May 2018.
[36] Refer to the Walking and Cycling section of this report for details of the Pedestrians and Cyclist Survey carried out by WSP Opus between 14 September to 20 September 2018.

Conversely, the Project provides the opportunity to enhance access to this parking area and create a dedicated facility for Gorge access.

170. Overall the parking effects are **Neutral.**

Access effects

171. The main access effects are associated with properties that that are severed by the proposed Project designation. The following figures identify the scope of the access effects.[37] The overall principle applied has been to limit direct access to and from the new road in order to improve safety. Where access has been removed, alternative access arrangements have been identified, and property may be purchased or an agreement established to ensure an alternative access is provided (e.g. right of way).

[37] Source: Preliminary Drawing No: 51-38113-C-951 to 959 from Te Ahu a Turanga Indicative Construction Access/Areas, NZ Transport Agency/GHD, July 2018.

Figure 1.30 (shows the properties affected at the western end of the proposed alignment.

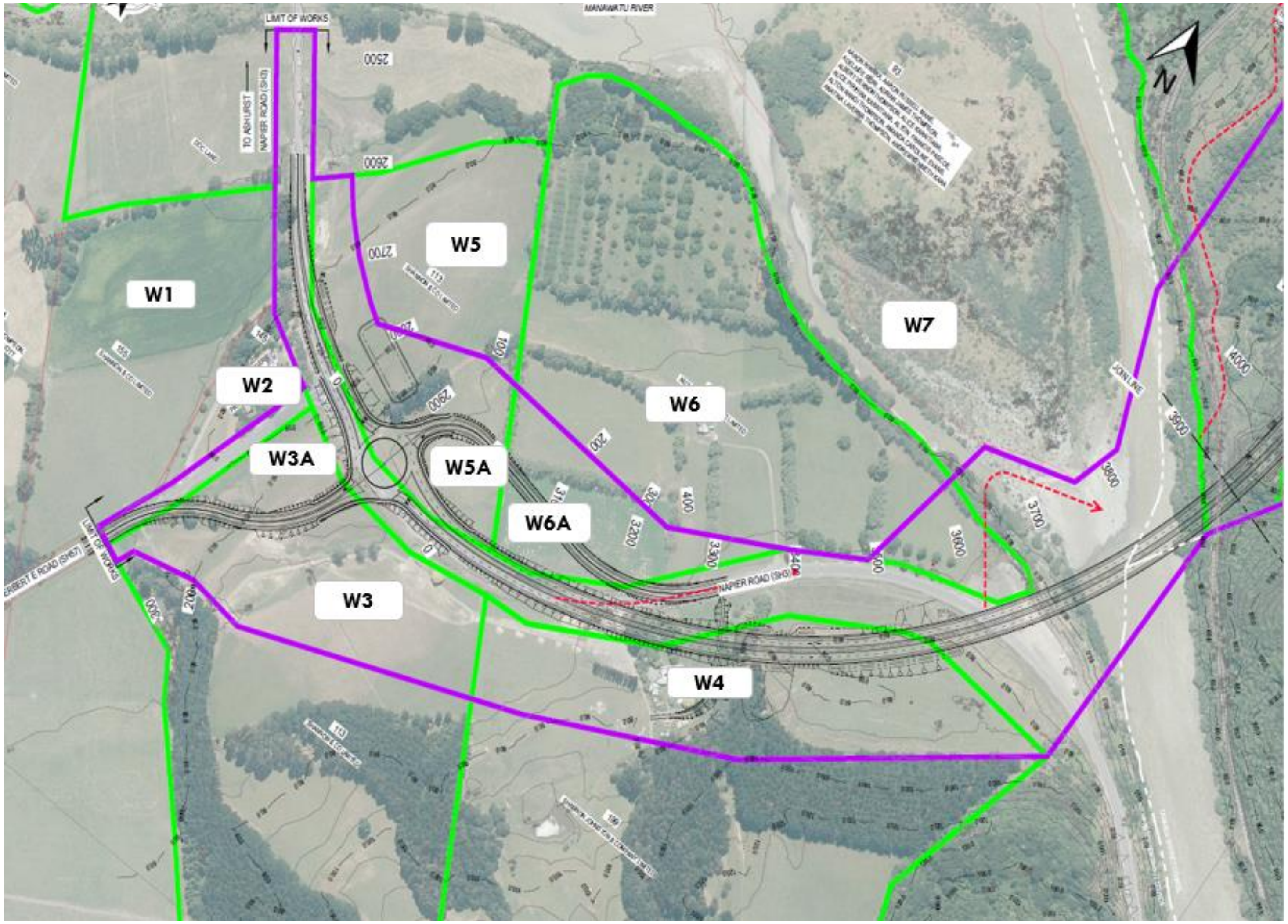


Figure 1.30: Properties at western end of proposed alignment

172. The following Table 1-6 contains information on the existing access for each adjacent property and the impact of the proposed designation on that access, as understood at the time this transport assessment is undertaken.

Property	**Existing Access**	**Impact of Proposed Designation**
W1	Existing access off SH57	No change other than formed entrance to required standard off SH57 where it is realigned as it approaches proposed roundabout.
W2	Existing access off SH57 (primarily used)	No change other than formed entrance to required standard off SH57 where it is realigned as it approaches proposed roundabout.
W2	Entrance off SH3	It is proposed that the entrance is closed as it is within the merging area east of the proposed roundabout.
W3	Existing access off SH57	No change other than formed entrance to required standard off SH57 where it is realigned as it approaches proposed roundabout.
W3	Entrance off SH3 adjacent to stock yards	Intention is to close this entrance as it is within the dual carriageway length and very close to the likely roundabout location.
W3A	Severed parcel within designation	No access currently required – subject to property disposal strategy.
W4	Access off old SH3. Severed without further works	Proposed access off old SH3 via roundabout. New overpass (SH over) to be constructed off old SH3. Design vehicle (height) to be agreed with landowner. Larger vehicles would require access via property W3, or via rural entrance off area by gorge carpark.
W5	Existing off SH3	Replacement of access off old SH3.
W5A	Severed parcel within designation	No access currently required– subject to property disposal strategy.
W6	Existing off SH3	Existing access off old SH3 to remain.
W6A	Severed parcel within designation	No access currently required – subject to property disposal strategy.
W7	Existing from SH3	Proposed access off old SH3 via roundabout.

Table 1-6: Impact to properties through the western section of the Project

173. **Figure 1.31:** shows the properties affected through the middle section of the proposed alignment.

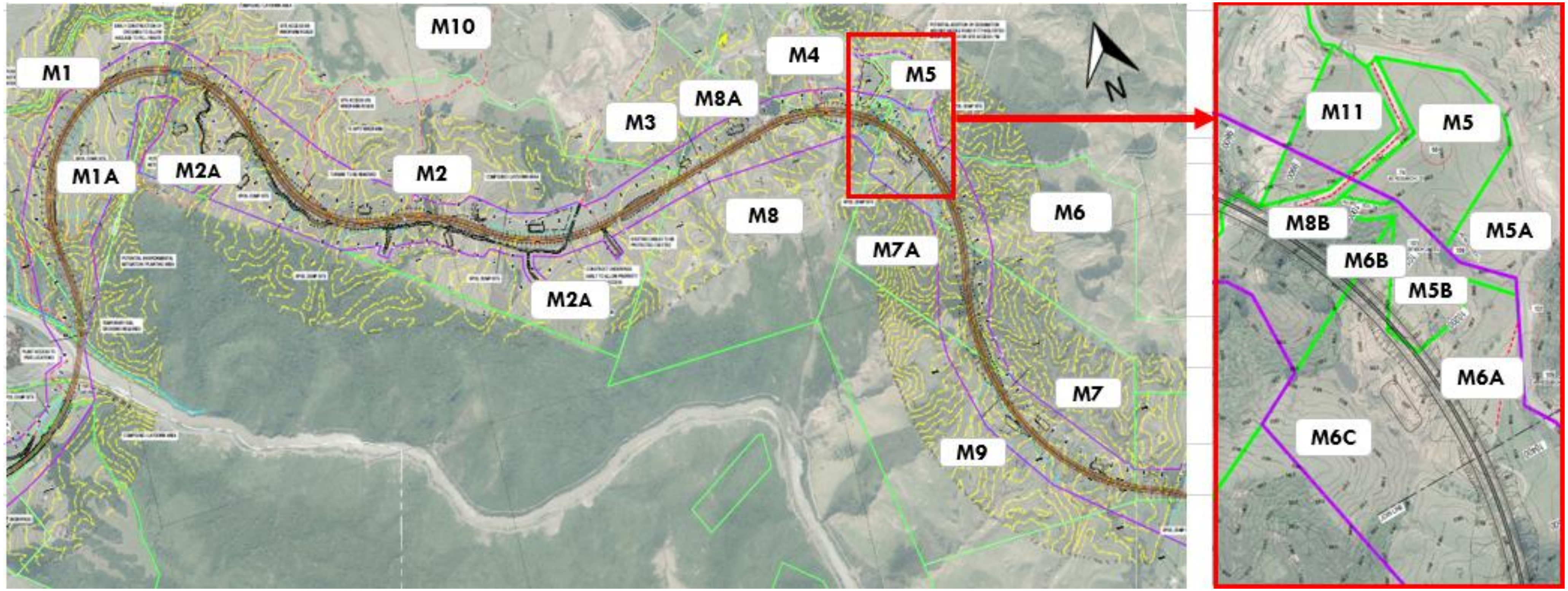


Figure 1.31: Properties through middle section of proposed alignment

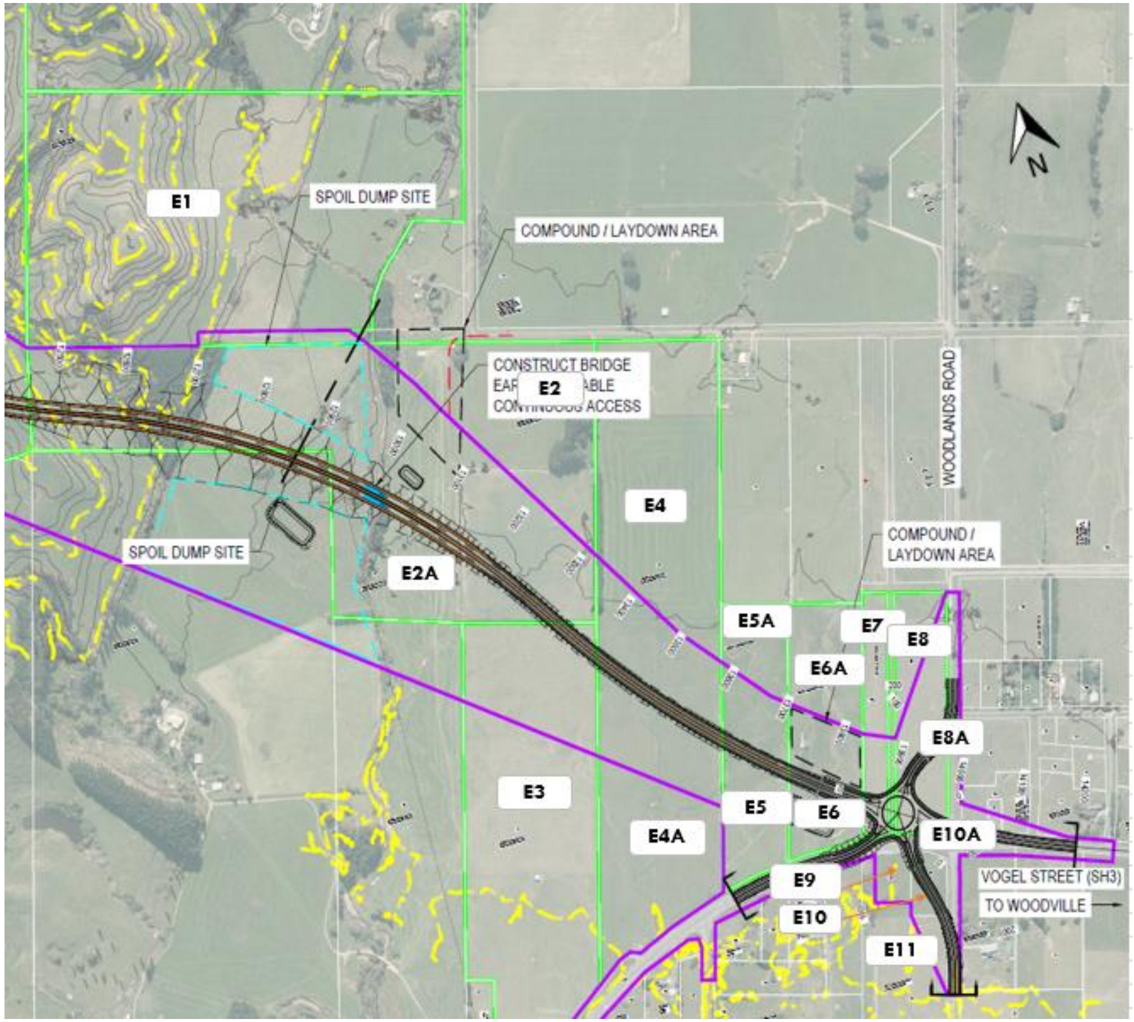
174. The following Table 1-7 contains information on the existing access for each adjacent property and the impact of the proposed designation on that access, as understood at the time this transport assessment is undertaken.

Property	Existing Access	Impact of Proposed Designation
M1	Existing access off Saddle Road	No change.
M1A	Severed parcel	Used as disposal site. No access is planned, however the Transport Agency will investigate as part of disposal strategy, noting that may be used for ecological mitigation planting.
M2	Existing access off Saddle Road via Cook road plus easement (right of way) over M10 (need to confirm legal status)	No change
M2A	Existing access off Saddle Road via Cook road plus easement over M10 (need to confirm legal status)	Primary access to be off Saddle Road and M2 via overpass adjacent to Cooks Road. Height of underpass to be agreed with property owner/easement holder. Over-dimension/Large vehicle access provided by left in/left out access of SH. Note: Primary and routine access of Saddle road. Non-routine off SH.
M3	Existing access of Cook Road	No change.
M4	Existing access off Saddle Road Access also off Morgan Road via M8 (Need to confirm legal status) Morgan Road may be part of M8 title)	Access off Saddle Road retained.
M5	Existing access off Saddle Road	No change.
M5A	Existing access off Saddle Road	No change.
M5B	Existing access off Saddle Road and Morgan Road	No change.
M6A	Existing access off Saddle Road and off Ag Research internal track which extends east as far as Hope Road	Access of Saddle Road retained. Internal access track potentially severed. Opportunity exists to potentially reconnect through accommodation works.
M6B	Currently access from adjacent rural/pasture areas from M5B and M6C	Severed parcel within designation. Land purchase/disposal discussion required.

M6C	Existing access off Saddle Road and off Ag Research internal track which extends east as far as Hope Road	Access will be provided via underpass-from parcel M6A.
M7	Landlocked parcel	Land purchase/disposal discussion required.
M7A	Landlocked parcel	Land purchase/disposal discussion required
M8	Existing access off Saddle Road via Morgan Road and via Cook Road and internal road network within M2 and M4 (Don't know if these are legalised)	Access from Morgan Road and M4 severed. Internal road access from M2A retained, however not legalised.
M8A	Existing access off Saddle Road via Morgan Road and via Cook Road and internal road network within M2 and M4 (Don't know if these are legalised)	Severed. Potential access via M4s internal access road to northern corner. Not legalised.
M9	Landlocked parcel however farmed as unit by owner with access from adjacent titles	No change. No access proposed from SH.
M10	Access off Saddle Road	No change.
M11	Access off Saddle Road at intersection with Morgan Road	No change.

Table 1-7 : Impact to properties through the middle section of the Project

175.



176. Figure 1.32 shows the properties affected at the eastern end of the proposed alignment.

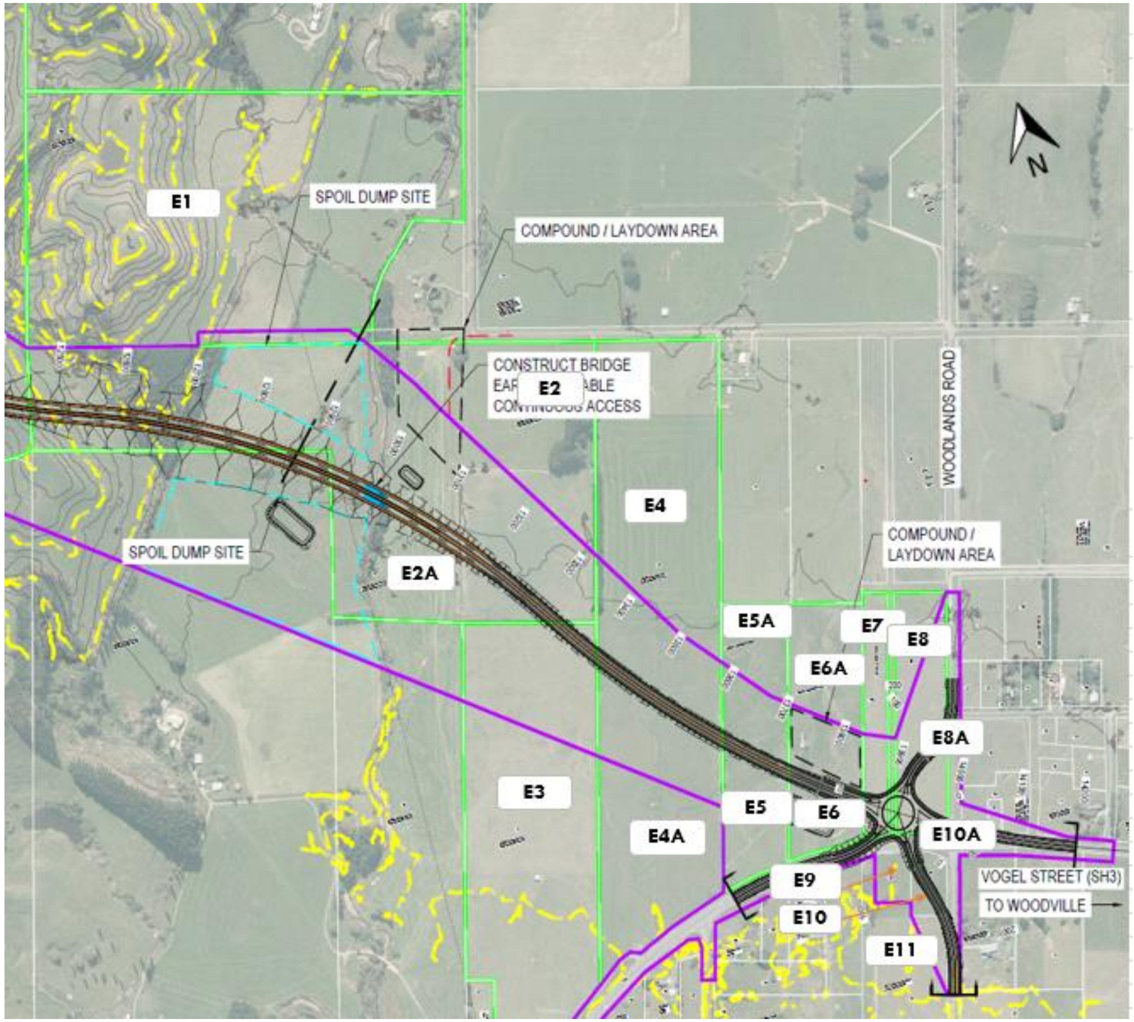


Figure 1.32 : Properties at eastern end of proposed alignment

177. The following Table 1-8 contains information on the existing access for each adjacent property and the impact of the proposed designation on that access, as understood at the time this transport assessment is undertaken.

Property	Existing Access	Impact of Proposed Designation
E1	Existing access off Hope Road Design development no longer requires land form E1	No change.
E2	Existing access off Hope Road	No change. Potential to maintain access between E2 and E2A under bridge that crosses stream providing access for farming activities either side of highway.
E3	Existing access off Napier Road SH3.	No change.
E4	Existing access off Hope Road.	Property split. Northern operation will retain access off Hope Road.
E4A	Property split	Access proposed via Napier Road (old SH3)
E5	Existing access of Napier Road SH3	No change.
E5A	Severed parcel	New access from Woodlands Road to be provided. Land purchase/disposal discussion required.
E6	Existing access of Napier Road SH3 via E5. No formed access to E6 frontage.	Property split. Northern section severed. Southern section (within designation) access off Napier Road SH3.
E6A	Severed parcel	New access from Woodlands Road to be provided. Land purchase/disposal discussion required.
E7	Current access via paper road not fenced. Farmed with E8.	No change. Access of new SH3 frontage will not be possible if roundabout is located as per NoR base option.
E8	Existing access from Woodlands Road	No change.
E8A	Existing access from Woodlands Road	Likely severed parcel within designation, no current access requirements, although could retain access. Land purchase/disposal discussion.
E9	Frontage on Napier Road SH3, but no formed access.	Currently fenced and farmed as single paddock with E10, with access to E10 being from Troup Road Access not possible from new SH corridor.

E10	Access from Troup Road. Frontage on SH3 Napier Road, but no formed access.	Likely severed parcel within designation. Currently fenced and farmed as single paddock with E9, with access being from Troup Road Access not possible from new SH corridor. Land purchase/disposal discussion
E10A	Existing access from Woodlands Road	Likely severed parcel within designation, no current access requirements, although could retain access via Woodlands Road. Land purchase/disposal discussion
E11	Existing access from Troup Road	New access from realigned Troup Road to be provided.

Table 1-8 : Impact to properties through the eastern section of the Project

178. It is noted that all severed properties will either be purchased by the NZ Transport Agency, have alternative access to the existing road network provided, or be subject to agreements to provide alternative access via existing links to Saddle Road or other local roads. Negotiation and further considerations will be undertaken during the detailed design stage of the Project.

179. Overall the access effects are largely **Neutral** due to the significant improvements to access that will be experienced on Saddle Road following completion of the Project.

ASSESSMENT OF CONSTRUCTION TRANSPORTATION EFFECTS

180. The following sub-sections outline the assessment of transportation effects with regard to construction of the Project. A suite of proposed mitigation measures corresponding to the adverse effects of construction traffic below is outlined in the subsequent section of the assessment.

181. Given the context of the critical nature of the Project (in my view), the faster the Project can be constructed, the faster the negative impacts of general and construction traffic in Ashhurst and on Saddle Road will be eliminated, and the faster the Project's transportation benefits can be realised.

Construction methodology

182. The indicative Project construction sections have been identified as the following: Bridge to Bridge, New Manawatū River/Gorge Bridge, Western Slope, Te Apiti Wind Farm and Ridge, Eastern Slope, and Woodville Gateway. Access to the construction sites will be primarily via Saddle Road. The indicative potential site accesses are included in **Appendix 1.D**.

183. The approach taken to assessing effects of construction traffic movements and suggested mitigation was to assess the proposed construction access locations for safety and efficiency, considering the typical construction traffic volumes given the scope of the Project.

184. Given the stage of the Project development, there is uncertainty regarding the construction duration and methodology. The assessment was undertaken with a reasonable degree of conservatism to consider the Project uncertainties identified earlier.

185. A detailed programme and methodology will be finalised in the CTMP. Construction traffic will need to be managed as appropriate to ensure that safety and efficiency of the affected roads and intersections are maintained.

Construction traffic demands

186. It is acknowledged that the construction traffic will have a high level of interaction with the general through traffic on Saddle Road, as well as the local roads leading to Saddle Road on the Ashhurst and Woodville sides. This translates to a significant increase in the overall traffic demand in these areas, particularly if the construction traffic movements occur during the general peak periods.

187. Construction traffic demands have been estimated based on an assumed construction methodology,[38] it is predicted that up to 224 construction vehicles per day (with 40% of these being HCV) would travel between Ashhurst and Saddle Road at one phase[39] during construction, before entering or exiting the site through various construction access points along Saddle Road. Up to 224 construction vehicles per day (50% being HCVs) would travel on the other end of Saddle Road/Woodlands Road, to/from Woodville.

188. **Figure 1.33** shows an indicative scenario of peak construction traffic demand on Saddle Road between the indicative construction access points, based on the construction traffic estimate and methodology referred to above.

[38] Manawatu Gorge Replacement Project, Construction Traffic Estimate, Higho Consultants, August 2018 (at **Appendix 1.D**).

[39] The busiest phase during construction being the Pavement Construction and Sealing phase according to the Construction Traffic Estimate provided. It has also been assumed that the pavement construction and sealing stage is undertaken simultaneously across all Project sections, for an indicative scenario with fair degree of conservatism.

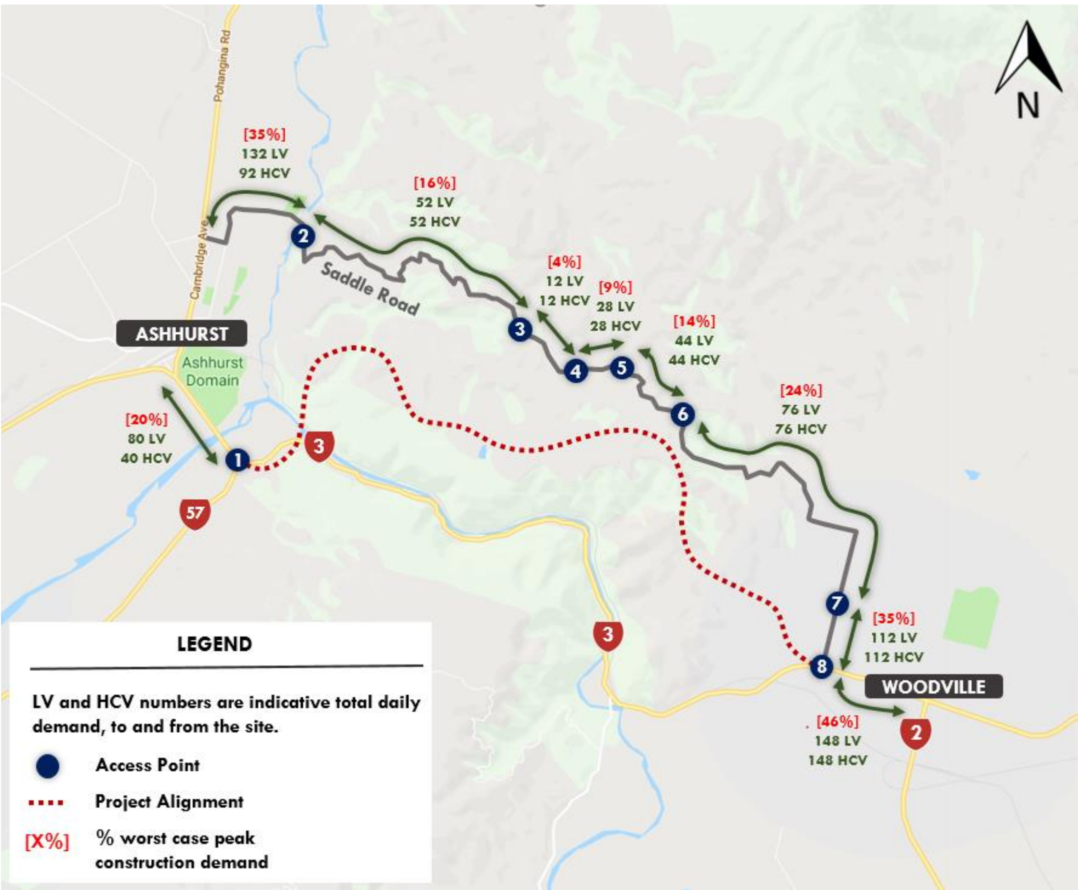


Figure 1.33: Indicative construction demand on Saddle Road

189. There may be some impact to the operation of the railway line east of the Manawatū River during the construction of the new Manawatū River bridge, due to the access requirements of the construction traffic. It has been assumed that a temporary bridge could be constructed, however other access options may be achieved and agreed with KiwiRail once there is more certainty around the bridge and the construction methodology.

Safety effects

190. Construction traffic will primarily be travelling along and accessing the Project site off Saddle Road. Given the steep grade and curved alignment, there are potential safety issues around limited sight distances and insufficient space for larger construction vehicles to manoeuvre into and out of site accesses in some locations. These effects will need to be managed by the contractor in conjunction with the road controlling authorities. Refer to later section discussing the mitigation of the adverse safety effects on site accesses as required by the NZ Transport Agency and local authorities.

Traffic effects

191. An efficiency analysis of a typical construction access and Saddle Road has been undertaken using SIDRA Intersection Software, including an assessment of the likely delay to through traffic travelling along Saddle Road.

192. For the purposes of the efficiency analysis, a worst case peak scenario has been created by assuming that 25% of the daily construction traffic will travel to site within one peak hour period in the morning, and an equal 25% will travel away from site within one peak hour period in the afternoon. The assessment assumes that the peak hour flow of general traffic consists of 10% of the daily flow, with an even split between each direction.

193. The results of our delay assessment show that access into and out of the sites onto Saddle Road is expected to operate at an acceptable level of service. However, the delay experienced by construction vehicles (particularly the larger sized trucks) turning into the site may have a significant impact on through traffic, particularly if no mitigation measures are put in place. Appropriate mitigation measures would be to install right turn bays or shoulder widening at the construction accesses (which is likely to require widening of Saddle Road) to ensure left turning construction traffic can enter and exit the site without crossing the centreline.

194. Given the current operating condition on Saddle Road, as discussed in the Existing Environment section of this assessment, it is considered that the presence of construction traffic will reduce the overall traffic performance on Saddle Road, particularly if the peak travel periods of general traffic and construction traffic coincide with each other.

195. Construction traffic effects on the travel efficiency within Ashhurst has been considered. A performance assessment on the intersection of Mulgrave Street and Cambridge Avenue has been undertaken using SIDRA Intersection Software to gauge the potential impact of the construction traffic on the intersection efficiency. This test has considered the proposed traffic signal arrangement, as part of the Ashhurst Improvements,[40] using the intersection model provided by Beca[41] as a base. The assessment shows that the construction traffic impact on the intersection is minor. This impact should be assessed further and managed accordingly as part of the CTMP.

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[40] Ashhurst Improvements, include the conversion of the existing roundabout to signals, which includes turning lanes and pedestrian facilities - NZ Transport Agency file: https://www.nzta.govt.nz/assets/projects/sh3-manawatu-gorge/ashhurst/21-ashhurst-poster-mulgrave-cambridge.pdf
[41] SIDRA file name 'Mulgrave Cambridge_20180724', Beca, July 2018.

196. Construction traffic movements to and from the site will have an adverse impact on the operation of local roads, particularly at the western end of the Project in Ashhurst and at the eastern end in central Woodville, including the potential for the use of inadequate bypass routes. To improve access efficiency and accommodate increased traffic demand in the area, some improvements to the SH3/Cambridge Avenue intersection should be implemented prior to the start of Project construction, and appropriate mitigation strategies be included in the CTMP. This is discussed further in the mitigation section.

197. In general, construction traffic on the local road network (particularly Saddle Road) will result in a reduced efficiency for users of these roads during construction, however I consider this to be manageable as explained further in the mitigation section. The potential trade-off between reduction in efficiency during construction and the earlier realisation of the operational benefits of the Project is recognised as a critical consideration.

198. Overall the construction traffic effects are **Moderate Negative**.

Parking effects

199. The construction of the new Manawatū Gorge bridge and southern abutment will take place within the existing Manawatū Gorge car park by the entrance to the walkway.[42] This will have the potential to disrupt the current provision of parking. I consider it vital to maintain the provision of parking at this area for recreational users during the construction period. Given the land around this location, and the fact that the Gorge is closed to general traffic, there should be plenty of space to maintain current levels of parking.

200. Overall the parking effects are **Minor Negative**.

Vulnerable user effects

201. There will be some impact to the access to the Manawatū Gorge walking track during construction. This will have an impact on recreation opportunities in this area, which are currently in high demand.

202. Construction traffic will also contribute to the increase in traffic volume in the Saddle Road and the surrounding areas, with the most notable impact to the active users in Ashhurst. Construction traffic movements may also have an adverse impact on the central Woodville area, particularly the Woodville School immediately east of SH2/SH3 intersection. Provision for safe facilities

[42] Te Ahu a Turanga: Project Description (Draft), NZ Transport Agency, August 2018.

for vulnerable users at these locations will need to be managed by the CTMP.

203. Overall the vulnerable user effects are **Minor Negative**.

Summary rating of effects

204. The following table summarises the operational transportation assessment of the Project, as discussed in previous sections. Where negative effects are recognised, mitigation strategies are recommended to remedy and mitigate the effects. These mitigation measures are discussed in more detail in the subsequent section of the report.

Table 1-9: Summary of Operational Transportation Assessment

Area	Summary of Effect	Rating of Effect	Recommended Mitigations
Safety	<u>Existing Routes</u> Reduction in traffic demand contributing to a decrease in crash risks on Saddle Road and Pahīatua Track <u>Proposed Route</u> High quality of the new route and intersection upgrades resulting in the low predicted crash risk	Significant Positive	n/a
Traffic	The Project increases the overall transport network reliability and efficiency. The Project will, however, impose higher traffic demand particularly on the SH3/Cambridge Avenue intersection and therefore affect its future performance.	Significant Positive	Improvements to the adversely impacted intersections prior to the completion of the Project (specifically SH3/SH57, Ashhurst/SH3 access, and SH3/Woodlands Road)
Resilience	The Project provides a more resilient route that is less susceptible to incident. However, extreme events may necessitate a partial or full closure of the route.	Significant Positive	Maintain emergency access via Saddle Road should it be required. The use of ITS, such as VMS, to inform road users of roading issues including closures.
Public transport	Safer, more resilient and faster route for Public Transport.	Minor Positive	n/a

Vulnerable users	Existing Links Reduction in traffic demand on existing links results in better environment for cyclists and pedestrians. However, it will also result in higher traffic across the existing Ashhurst bridge, which will adversely impact active user safety and usage at this location. The Project The new road features a wide shoulder which will cater for cyclists.	Neutral	Not foreclose future provision of safe walking and cycling facilities on existing network.
Access	A number of properties are severed by the proposed Project, but all severed properties will have alternative access provided to the existing road network, be purchased by the NZ Transport Agency or agreements established to provide alternative access via existing links to Saddle Road. Improvements to property accesses on Saddle Road due to the overall reduction of traffic demand on the road.	Neutral	Construction of new access roads and links as soon as practicable in accordance with NZ Transport Agency and TLA standards.

205. The following table summarises the Project's construction traffic effects on the transport network. Where negative effects are recognised, mitigation strategies are recommended to remedy and mitigate the effects. These mitigation measures are discussed in more detail in the subsequent section of the report.

Table 1-10: Summary of Construction Transportation Assessment

Area	Summary of Effect	Rating of Effect	Recommended Mitigations
Safety	Safety issues with regard to construction vehicles' access on the curved and steep alignment of Saddle Road.	Minor negative	A comprehensive construction traffic management plan (CTMP) is proposed to enable the NZ Transport Agency and the Contractors to programme and manage the construction activities to maximise the efficiency of operations and minimise the effects of activities on the existing road network, active users, parking and the community. Associated with the CTMP should be an aspiration to get the bridges at either end of the Project completed as soon as practicably possible, and ideally useable prior to the pavement construction phase of the Project.
Traffic	Construction traffic will impact the operation of Saddle Road, local roads and intersections in Ashhurst, and the rail corridor.	Moderate Negative	
Parking	Accesses to the site and construction lay-down area at the entrance to the Manawatū Gorge recreational area will impact the carparks at this location.	Minor Negative	
Vulnerable users	Potential issues around the safety of vulnerable users in major centres in Ashhurst and Woodville, and Saddle Road, during the peak construction traffic period, as well as the impact to the access to the Manawatū Gorge walking track, during the peak construction traffic period.	Minor Negative	

MEASURES TO AVOID, REMEDY OR MITIGATE ACTUAL OR POTENTIAL ADVERSE TRANSPORT EFFECTS

Proposed mitigation measures

Operational

206. The following outlines the recommended mitigation strategy for the potential adverse effects resulting from the operational aspects of the Project.

207. Further to the recommended provision of alternative parking and walkway access during the construction period (discussed above), in my view a Reinstatement Plan should be prepared for a permanent replication of the original Manawatū Gorge parking provision. This would ideally be sized to meet future access demand to the walkway once the Project is completed with a like-for-like replacement consistent with the existing parking provision as a minimum.

208. The Project will result in a significant increase in traffic on the existing SH3 Ashhurst Bridge over the Manawatū River, essentially reverting back to a situation similar to before the closure of the Gorge route. This will in turn potentially increase adverse safety and amenity effects for pedestrians and cyclists using this connection, although it is noted that according to the survey undertaken in September 2018 as reported earlier, the use of the SH3 Ashhurst Bridge by pedestrians and cyclists is already limited. Recently the NZ Transport Agency has installed cycle warning signs which will help manage this effect for the small number of cyclists using this link. I also recommend that the final design does not hinder opportunities for the future provision of safe access for active users to and from the Manawatū Gorge recreational area from Ashhurst and the wider Manawatū Region. The NZ Transport Agency should continue to work with PNCC and other stakeholders to look at options for access, including consideration of active modes as part of the Palmerston North ring investigation which is currently ongoing.

209. I also recommend that the final design of the intersection at the Woodlands Road/SH3 on the Woodville side of the Project includes provision for pedestrians and cyclists to gain access between Woodville and the eastern end of the Gorge and local amenities.

210. Assessment of the future performance of the Cambridge Avenue/SH3 intersection shows that the Project will negatively impact its performance, particularly those exiting Cambridge Avenue once the priority shifts back to

SH3. It is crucial that an improvement is made to the Cambridge Avenue/SH3 intersection (either as part of the Project or prior) to ensure its safe and acceptable performance following the completion of the Project. Assessment undertaken has confirmed that either a signal intersection or roundabout could be accommodated and provide a safe and efficient facility in the future.

211. As identified above, the severance of accesses for existing private property will need to be addressed by establishing new access roads and underpass structure(s) as soon as practicable (unless the NZ Transport Agency purchases the severed property). Property agreements will need to be established where purchases occur with landowners and all access arrangements should be agreed and documented.

212. Once the project is opened, any disruptions to the journey via the Project route will need to be communicated to the road users as early and effectively as practicable to minimise impact on travel time and safety. On site, this will be primarily through the use of VMS or other forms of ITS accommodated within existing or proposed road reserve.

Construction

213. The Project construction traffic effects on the transport network are in general **moderately negative**, as explained above. To address those potential adverse effects, the mitigation measures set out below are recommended.

214. The following construction traffic mitigation strategy is proposed for consideration and inclusion in the CTMP, subject to liaison with key stakeholders:

    (a) Considering hours for construction traffic movement and bulk earthworks transportation through Ashhurst during peak traffic periods to minimise construction traffic impact on Ashhurst, while balancing the benefit of having the Project completed as quickly as possible. Consideration should also be given to implementing restrictions around the Woodville central area to ensure that any traffic and safety impact to the area is minimised. Consideration should be also given to a faster delivery of the new Manawatū Gorge bridge to allow alternative access from the western end of the Project (Ashhurst) as well as the smaller Hope Road Bridge to allow access to the eastern of the Project (Woodville).

(b) Minimising impact on Saddle Road by utilising site access roads on either side of the Ranges wherever possible and by limiting construction HCV during peak flow periods.

(c) The early construction of access roads to private land prior to the main alignment to minimise access restrictions during the construction period.

(d) The use of KiwiRail's infrastructure to transport large bridge components into the Manawatū River site, if possible.

Overall the CTMP will allow the construction traffic movements to be managed to minimise the impact on the network and maximise the efficiency of the construction operations.

215. To mitigate adverse effects on safety at construction site accesses, all construction site accesses are to be designed and maintained in accordance with the Accessway Standards and Guidelines attached as Appendix 5B to the NZ Transport Agency's Planning and Policy Manual.[43] Mitigation measures to address any adverse safety impacts as required by the Manual must be put in place, where appropriate. Under the Manual this includes, but is not limited to, the provision of localised road widening, safe sight distances, acceleration and deceleration lanes, and turning bays. This also includes the upgrade of any local roads (for example, Hope Road in Woodville) to accommodate construction traffic.

216. It is recommended that an agreement with KiwiRail is sought to co-ordinate the new bridge construction work with other rail closures or periods of low demand. This agreement will minimise the effect of construction activities on the railway operation.

217. It is acknowledged that construction traffic movements to and from the site will have adverse effects on the operation of local roads, particularly at the western end of the Project in Ashhurst and on Saddle Road. To improve access efficiency and accommodate increased traffic demand in the area, some improvements to the SH3/Cambridge Avenue intersection should be implemented prior to the start of Project construction.

218. The potential adverse impact of construction activities to the Manawatū Gorge Cark Park and entrance to the walkway at times is acknowledged. To mitigate this adverse effect, it is recommended that an alternative parking

[43] https://www.nzta.govt.nz/assets/resources/planning-policy-manual/docs/planning-policy-manual-appendix-5B.pdf See in particular Diagram and Perspective E.

provision and access to the walkway are provided at all times, or as specified under the CTMP.

ALIGNMENT WITH POLICIES, STRATEGIES AND OBJECTIVES

219. This section considers the alignment of the project with the following Statutory documents:

 (a) the GPS;

 (b) the NLTP;

 (c) the RLTP;

 (d) Horizons Regional Council, One Plan;

 (e) Horizons Regional Council, Regional Public Transport Plan;

 (f) PNCC, District Plan, Section 20 (Transportation);

 (g) PNCC Strategic Transport Plan;

 (h) PNCC Active and Public Transport Plan;

 (i) MDC, District Plan, Section 3B (Transportation); and

 (j) TDC, District Plan.

Government Policy Statement on Land Transport, 2018/19-2027/28

220. The GPS outlines the Government's strategy to guide land transport investment over the next 10 years. It also provides guidance to decision-makers about where the Government will focus resources. The GPS operates under the LTMA, which sets out the scope and requirements for the GPS.

221. The GPS has four strategic priorities, with the first two being the stated key strategic priorities for the Government:

 (a) Safety;

 (b) Access;

 (c) Environment; and

 (d) Value for Money.

222. The safety objective is to have a land transport system that is a safe system, free of death and serious injury. As specified in the Preliminary Design Philosophy Statement[44], the detailed design of this Project is to consider all

[44] Te Ahu a Turanga; Manawatū Gorge Replacement Route Preliminary Design Philosophy Report, GHD, October 2018.

the relevant Transport Agency Action Plans (2011-2012, 2013-2015, and 2016-2020) which address the safety concerns recognised within the State highway network. The Transport Agency Technical Memorandum TM-2503 Guidelines for Edge protection and Medians on Dual Carriageway Roads (March 2013) will also be adopted into the design of the Project.

223. As discussed earlier in this report, to date alignment with the Safe System approach has been achieved primarily through the provision of following features:

(a) Roundabouts: The project route ties in to the existing roads at both ends by an at-grade roundabout. These roundabouts will act as a threshold treatment for traffic in the immediate area, reduce conflict points and approach speeds and improve safety at the intersections.

(b) A central median and wire rope median barrier from roundabout to roundabout: This physically separates opposing traffic streams and helps to prevent vehicles from travelling into opposing traffic lanes. Therefore, this feature will reduce head-on crashes, and shift turning movements to safer locations.

(c) Crawler lanes on sections with steep grades: This is provided to allow for safe opportunity for overtaking.

(d) Shoulders: Provides clearance from the traffic lanes and space for cyclists using the route.

224. There are three objectives under the access strategic priority:

(a) A land transport system that provides increased access to economic and social opportunities;

(b) A land transport system that enables transport choice and access; and

(c) A land transport system that is resilient.

225. The environment objective is to have a land transport system that reduces greenhouse gas emissions, as well as adverse effects on the local environment and public health.

226. The value for money objective is to have a land transport system that delivers the right infrastructure and services to the right level at the best cost.

227. The Project has good alignment with the key strategic priorities of safety and access, particularly the access objectives of increased access for economic opportunities and resilience.

National Land Transport Plan, 2018-2021

228. The NLTP was released in August 2018. This release includes specific mention of SH3 Te Ahu a Turanga: Manawatū Gorge highway, being of highest priority both regionally and nationally. This includes a funding allocation of $122m for the 2018-21 period.

229. The Manawatū/Whanganui section of the Plan states:

> *"As a key freight and transport hub for the central North Island, the Manawatū/Whanganui region has enormous strategic value for the whole of New Zealand. This is highlighted by the fact that a key priority for the Transport Agency in this NLTP is the development of the SH3 project highway Te Ahu a Turanga: Manawatū Gorge to connect the Manawatū, Tararua district, Hawke's Bay and northern Wairarapa. It replaces the highway through the Manawatū Gorge, now indefinitely closed by a mass land movement".*

Regional Land Transport Plan, 2015-2025 (2018 Review)

230. Horizons' RLTP sets out the strategic direction for land transport in the Manawatū-Whanganui Region over the next 10 years. It describes what the region is seeking to achieve in land transport in order to contribute to an effective, efficient and safe land transport system in the public interest as required under the LTMA.

231. The RLTP also incorporates the programme of land transport activities the region wishes to prioritise for inclusion in the NLTP for subsequent funding investment.

232. The RLTP notes the following with regard to an alternative to the Manawatū Gorge (Section 3 – Regional Issues):

> *"It is critical for regional economic growth that the focus remains on the development of an alternative to the Manawatū Gorge as the principal east-west link between Manawatū and Hawke's Bay. Completion of a new route must ensure an improvement to the resilience and availability of the route as well as realising opportunities for connectivity to land use development, freight hubs and efficiency, and tourism".*
>
> *"Freight flows from the Hawke's Bay Region to the Horizons Region, of which a large proportion will come directly from the Port, are expected to increase from 0.68 million tonnes (2012) to 1.48 million tonnes in 2042. Freight going in the reverse direction is also anticipated to*

increase. Therefore the links between the two regions needs to be secure for the passage of High Productivity Motor Vehicles (HPMV)."

233. The RLTP has the following strategic priorities:

(a) Effective and efficient road maintenance and delivery;

(b) Improve connectivity, resilience and the safety of strategic routes to and from key destinations linking north-south and east-west, while factoring in demographic changes and impacts on land use;

(c) An appropriate network of tourism routes;

(d) An integrated walking and cycling network; and

(e) Effective, efficient, accessible and affordable multi-modal transport networks.

234. An alternative to the Manawatū Gorge is the number one priority activity in the RLTP.

235. Based on the information provided above, the Project has a very strong alignment with the RLTP.

Horizons Regional Council, Regional Public Transport Plan, 2015-2025

236. The purpose of the RPTP is to set out the framework for the provision and development of services and infrastructure integral to public transport in the Manawatū-Wanganui Region.

237. The statutory purpose of the RPTP is to provide:

(a) A means for Horizons and public transport operators to work together in developing services and infrastructure for public transport in the Manawatū-Wanganui Region;

(b) An instrument for engaging with the public in the Manawatū-Wanganui Region about how the public transport network is designed and operated; and

(c) A statement of the services that are integral to the public transport network, the policies and procedures that will apply to those service, and the information and infrastructure that support them.

238. The following objectives apply to all public transport services units that Horizons provides financial assistance to:

(a) A reliable, integrated, accessible and sustainable public transport system;

(b) An effective procurement system that delivers the desired public transport services;

(c) A safe and accessible network of supporting infrastructure; and

(d) Increasing patronage.

239. The following services in Tararua District, as specified in the RPTP Appendix 1, will benefit from the provision of the Project:

(a) Order of St John Dannevirke Health Shuttle

This on-demand service serves areas around Dannevirke, as well as travels between Dannevirke and district to Palmerston North.

(b) Dannervirke to Palmerston North school service

The route of this service is from Dannevirke to Palmerston North, via Woodville. It operates Monday – Friday from 7am to 4pm.

240. Therefore, the Project provides alignment and opportunity for greater alignment with the RPTP objectives above in the future.

Horizons Regional Council, One Plan

241. The One Plan combines the Regional Policy Statement, Regional Plan and Coastal Plan for the Horizons Region. The One Plan defines how the natural and physical resources of the Region, including fresh water, air, productive land and natural ecosystems, will be cared for and managed by the Regional Council in partnership with territorial authorities and the community.

242. Objective 3-1: Infrastructure and other physical resources of regional or national importance requires that decision-makers under the RMA:

> *"Have regard to the benefits of infrastructure^ and other physical resources of regional or national importance by recognising and providing for their establishment, operation, maintenance and upgrading."*

243. A number of policies under this objective have relevance to the Project:

(a) Policy 3-1: Benefits of infrastructure and other physical resources of regional or national importance;

(b) Policy 3-2: Adverse effects of other activities on infrastructure and other physical resources of regional or national importance;

(c) Policy 3-3: Adverse effects of infrastructure and other physical resources of regional or national importance on the environment; and

(d) Policy 3-4: The strategic integration of infrastructure with land use.

244. In summary, the above policies:

(a) ensure that infrastructure of regional or national importance, such as the proposed Project, are recognised as a physical resource of regional or national importance;

(b) ensure that adverse effects on infrastructure of regional or national importance, such as the proposed Project, from other activities are avoided as far as reasonably practicable;

(c) recognise and provide for the establishment, maintenance and operation of infrastructure of regional or national importance, such as the proposed Project, and allow for minor effects that may result from these activities; and

(d) ensure that Territorial Authorities develop and implement appropriate land use strategies to manage urban growth and infrastructure asset management to ensure the efficient and effective provision of associated infrastructure.

PNCC District Plan, Section 20 (Transportation)

245. The PNCC District Plan contains the following Transportation Objectives:

(a) to maintain and enhance the safe and efficient functioning of the roading network;

(b) to protect the roading network, as identified in the roading hierarchy, from the potential adverse effects of all land use activities;

(c) to avoid, remedy or mitigate the effects of roads and vehicles on the amenity values of the City; and

(d) to maintain and enhance the use of public transport, walking and cycling as alternative modes to the private motor vehicle.

246. The Project has good alignment with all those objectives, for the reasons explained in this report.

PNCC Strategic Transport Plan

247. The Strategic Transport Plan shows how the PNCC will contribute to achieving their goals to achieve ‘An innovative and growing city’.

248. The purpose of the Strategic Transport Plan is to provide infrastructure to enable growth and a transport system that links people and opportunities,

and provides amenity, safety, interconnectivity, accessibility, resilience and reliability.

249. The Project contributes to the fulfilment of the following desired outcomes listed in the Plan:

(a) Provision of resilient and reliable travel routes to key destinations that meet the specific constraints for time, mode and travel purpose of users

(b) Reliable city and regional routes/connections, including alternative routes, will be accessible to all main ports of new Zealand for heavy vehicles

(c) A State Highway Network that goes around dthe urban area and interconnects with the regional ring road.

PNCC Active and Public Transport Plan

250. The Active and Public Transport Plan shows how the PNCC will contribute to achieving their goals to achieve ‘A creative and exciting city’,

251. The purpose of the Active and Public Transport Plan is to have a safe, efficient, and effective active and public transport system and the most active community in New Zealand.

252. The Project contributes to the fulfilment of the above desire as it provides improved access to all modes of transport, including the Project effect of lowering the traffic volumes through the Pahīatua Track, the primary route for cyclists between Palmerston North and Woodville.

MDC District Plan (Section 3B Transport)

253. The MDC District Plan contains the following Transportation Objective:

(a) To maintain and enhance the safe, efficient and integrated operation of the transport network within the District

254. For the reasons set out in this report, the Project has good alignment with this objective.

TDC District Plan

255. The TDC District Plan contains the following Transportation Objective:

(a) To ensure the safe, efficient and effective operation of the District's transportation networks while avoiding, remedying or mitigating adverse environmental effects.

256. The Project likewise has good alignment with this objective.

CONCLUSION AND RECOMMENDATIONS

257. The Project forms a critical piece of infrastructure in New Zealand's transport system. The closure of the Manawatū Gorge has had a significant impact on the surrounding transport network, the communities it serves, and the wider economy. In transport terms, the Project should be progressed as matter of urgency to address the impact on the existing transport network and provide long-term resilience, access and improved safety between the Manawatū and Tararua Regions of the North Island.

258. The following conclusions can be drawn from the transportation assessment with regard to the operational outcomes of the Project:

    (a) the significant reduction in traffic on the local road network (particularly Saddle Road, through Ashhurst and the Pahīatua Track) associated with the Project will result in a significant positive safety, efficiency, access, and resilience effect for all users of these local roads;

    (b) the new alignment will be designed to a high standard to provide a significantly safer, more efficient and resilient route for general traffic and freight when compared with the current local road alternatives;

    (c) the improved intersections at SH3/SH57 and Woodlands Road/SH3 will provide significantly improved safety and accessibility;

    (d) the changes in traffic distribution at the intersection of SH3 and Cambridge Avenue (Ashhurst) associated with the Project will result in the intersection being over capacity following completion of the Project, however various improvement options have been identified for the intersection to mitigate this effect;

    (e) the new alignment will provide a significantly improved (reliable and safe) route for the buses and critical emergency services that currently use the local road alternatives and could support future public transport routes;

    (f) the significant reduction in traffic on the local road network (particularly Saddle Road, through Ashhurst, and the Pahīatua Track) associated with the Project will result in positive safety and amenity effects for pedestrians and cyclists using these local roads;

    (g) the new alignment will also provide a wide shoulder which can be used by cyclists;

(h) the significant increase in traffic on the SH3 Ashhurst Bridge over the Manawatū River associated with the Project has the potential to reduce safety and amenity for cyclists (current pedestrian usage identified is next to nothing) using this connection (particularly those accessing the Manawatū Gorge recreational area). Recent improvements have been implemented for cyclists and is it recommended the Project does not preclude NZ Transport Agency and PNCC continuing to work together to consider options in order to improve the existing facilities for both cyclists and pedestrians;

(i) mitigation is proposed to ensure there is provision for parking and safe pedestrian and cycle access to the Manawatū Gorge recreational area from the proposed SH3/SH57 intersection. A similar provision for pedestrians and cyclists is also proposed at the SH3/Woodlands Road/Napier Road intersection;

(j) access to a number of properties is severed by the proposed Project, but all severed properties will either have alternative access provided to the existing road network, be purchased by the NZ Transport Agency, or be subject to agreements to provide alternative access via existing links to Saddle Road or alternate local road linkages;

(k) the reduction in traffic on Saddle Road associated with the Project (once operational) will result in positive safety and efficiency effects for access to properties on Saddle Road and in part other local roads due to the redistribution of traffic and freight; and

(l) the overall effect on the operational outcomes of the Project is significantly positive.

259. The following conclusions can be drawn from the transportation assessment with regard to construction:

(a) construction vehicles using the local road network (particularly Saddle Road) will result in a reduced safety, efficiency and amenity effect for users of these roads during construction, however this is deemed to be manageable, and must be considered alongside the conclusion that the faster the Project is constructed the sooner the wider operational benefits of the Project will be realised;

(b) accesses to the site and construction lay-down areas on Saddle Road and at the entrance to the Manawatū Gorge recreational area have the potential to result in a reduced safety and amenity effects for users of these roads, access points, and carparks in these areas during construction;

(c) a comprehensive CTMP is proposed to enable the NZ Transport Agency and the contractors to programme and manage the construction activities to maximise the efficiency of operations, and minimise the effects of activities on the existing road network, active users, and parking; and

(d) the overall effect of construction is a moderate negative that will be mitigated through the construction programme and CTMP.

260. Overall it is my opinion that the Project provides a critical transport linkage with significant positive effects, with a relatively small amount of mitigation required in order to complete construction as a matter of urgency.

David Dunlop

1.A
TRAFFIC ASSUMPTION MEMO

Memorandum

To	David Dunlop
Copy	Craig Nicholson
From	Sam Thornton
Office	Wellington Civil
Date	5 October 2018
File	5-C3688.00
Subject	Te Ahu a Turanga: Traffic Assumptions

The purpose of this memo is to document the assumptions used to determine the traffic distribution, growth and travel time for the Te Ahu a Turanga project.

The traffic assessment is based on the available data prior to and post closure of the Manawatū Gorge (the Gorge). It is to be noted that as the Gorge closure occurred in April 2017, there is limited amount of traffic data in terms of distribution, growth, travel time and demand post the closure of the Gorge.

The following sections have documented the use of available data, limitations and assumptions associated with the transport assessment of the Te Ahu a Turanga project.

1 Traffic Distribution

The following bullets outline the process used to determine the current / proposed distribution of traffic, each bullet is expanded upon in the following sections.

- Estimate pre-Gorge closure traffic distribution;
- Estimate post closure traffic distribution;
- Estimate do-minimum traffic distribution; and
- Estimate traffic distribution with project.

The following bullets outline the high level assumptions used to determine the current / proposed distribution of traffic.

- The data collected by others is representative; and
- The proposed distribution is the same as the pre-Gorge closure traffic distribution.

1.1 Estimate pre-Gorge closure traffic distribution

The pre-Gorge closure traffic distribution has been estimated from the following data sources:

- Mobileroad.org.nz (RAMM) traffic counts / estimates from the various road controlling authorities (NZ Transport Agency, Tararua District Council, Palmerston North City Council) estimates are from 2014-2016;
- Traffic volumes from the Detailed Business Case (DBC prepared by GHD, original source and dates unknown);
- Estimates based on professional judgement (where no data exists); and
- Origin and destination information from BlipTrak and adjustments made based on the Cube model (information provided by GHD, date of source information unknown).

The original origin and destination data provided by GHD are illustrated in Figure 1.A.1 and Figure 1.A.2 below.

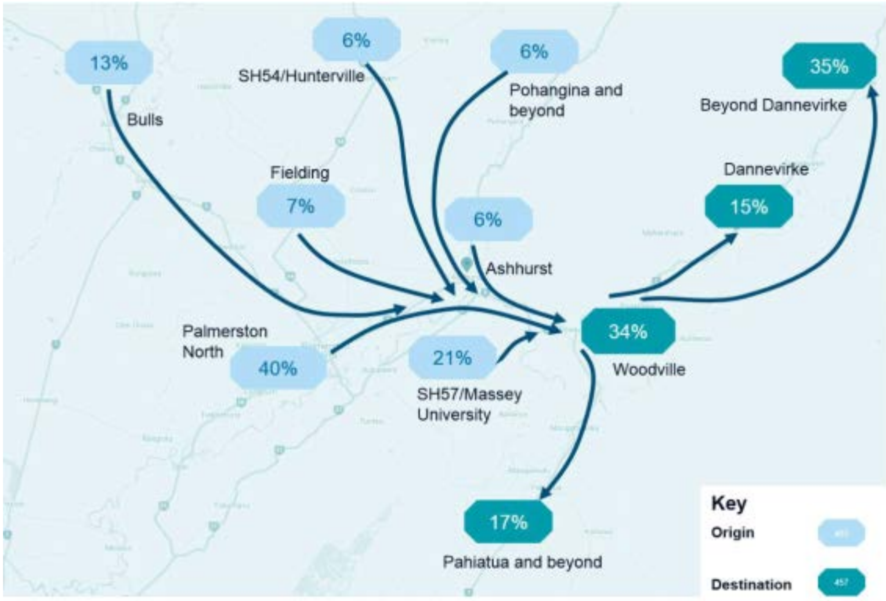


Figure 1.A.1: Origin Destination Map (Westbound), GHD

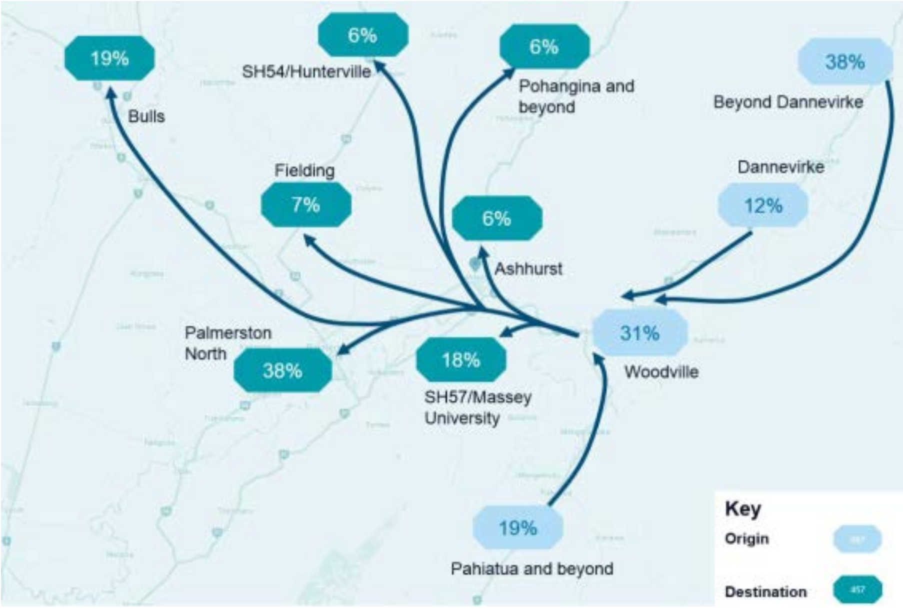


Figure 1.A.2: Origin Destination Map (Eastbound), GHD

The above origin and destination data provided by GHD was simplified down to the following two-way origin–destination matrix.

	SH2 North	Woodville	SH2 South	Total
SH54 North / Pohangina	3.3%	3.7%	4.9%	**11.9%**
Ashhurst	2.7%	2.3%	1.0%	**6.0%**
SH3 West / Fielding	10.4%	5.5%	3.9%	**19.8%**
Palmerston North	19.6%	17.8%	5.6%	**42.9%**
SH57 South	13.4%	3.0%	2.9%	**19.3%**
Total	**49.4%**	**32.3%**	**18.3%**	

The following origin and destination data shows the assumed HCV proportions for each origin and destination pair. The overall average HCV proportion of redistributed traffic is 12% which is close to the 11% in the Manawatū Gorge (pre-closure (2016)).

Higher proportions have been assumed between non-urban origin and destination pairs with lower proportions where one or both of the origin or destination was an urban area.

	SH2 North	Woodville	SH2 South
SH54 North / Pohangina	20%	5%	20%
Ashhurst	5%	5%	5%
SH3 West / Fielding	20%	5%	20%
Palmerston North	10%	5%	10%
SH57 South	20%	5%	20%

1.2 Estimate post closure traffic distribution

The post closure traffic distribution has been estimated from the following data sources:

- Traffic counts undertaken on Saddle Road and Paihiatua Track (and connecting roads) by Tararua District Council between May 2017 and November 2017;
- Traffic counts undertaken around Ashhurst by Palmerston North City Council in 2017;
- Traffic counts undertaken on the State Highway network in 2017 / 2018;
- Traffic volumes from the Detailed Business Case (DBC prepared by GHD, original source and dates unknown); and
- The simplified matrix above.

The first step was to estimate the change in the distribution of traffic assuming all pre-closure east-west trips used either Saddle Road or Paihiatua Track.

Based on the proportions of the traffic count information the following matrix shows the trips assumed to use the two different routes (blue via Saddle Road, green via Paihiatua Track).

	SH2 North		Woodville		SH2 South	
SH54 North / Pohangina	95%	5%	95%	5%	75%	25%
Ashhurst	95%	5%	95%	5%	75%	25%
SH3 West / Fielding	95%	5%	95%	5%	25%	75%
Palmerston North	95%	5%	95%	5%	25%	75%
SH57 South	50%	50%	50%	50%	25%	75%

There are various feeder routes which connect into these two key routes, the flows on these various routes have been balanced to align with available traffic count proportions.

The traffic count information provided by Tararua District Council between May 2017 and November 2017 indicated that there were fewer total trips on Saddle Road and Paihiatua Track compared with pre-closure. This implies some trip suppression and / or rerouting outside the project area. This has been ignore for the purpose of this assessment.

1.3 Estimate do-minimum traffic distribution

The do-minimum traffic distribution is the same as the post closure traffic distribution.

1.4 Estimated traffic distribution with project

The estimated traffic distribution with the project is as per the estimated pre-Gorge closure traffic distribution with the exception of the revoked sections of SH3 which become access roads.

2 Traffic Growth

Historic traffic growth has been analysed on the state highway network to determine historic growth trends.

2.1 SH3 Manawatū Gorge

Historic traffic volumes for 1975-2016 have been analysed for the SH3 telemetry site in the Manawatū Gorge. Analysis has been undertaken looking at different time periods and with and without the outlier values between 2011 and 2014 (corresponding to the last major Gorge closure).

The trend-line is relatively linear (fixed average increase in AADT per year) so the percentage growth reduces year on year. Growth rates for 40, 20, 10 and 5 years have been plotted with and without the data from 2011-2014.

- With the 2011-14 values excluded, the growth rate for each period (40, 20, 10 and 5 years) is between 1-2% (over the past 5 years).
- With the 2011-14 values included the growth rates for the 20 and 10 periods is less than 1% (over the past 5 years). The 40 year period is between 1-2% (over the past 5 years) and the 5 years is between 4-6% (over the past 5 years).

2.2 Wider Network

Historic traffic volumes for 2001-2017 (no outliers excluded) have been analysed at the following locations around the project area:

- SH2 north of Woodville.
- SH2 south of Woodville.
- SH3 east of Palmerston North.
- SH3 east of Ashhurst.
- SH57 north of Palmerston North.

As per the Gorge, the trends have been relatively linear (consistent average AADT increase per year) so the growth rate proportion reduces year on year.

The growth rate at all sites based on the time period analysed (2001-2017) is relatively low (less than 0.5% per annum) at all locations except SH57 which is closer to 1%.

2.3 Assumed rates

The historic growth tends lines have been used to predict the total growth between 2016 and 2041. Three scenarios have been assessed:

- The base scenario uses historic data from 1975-2010 and predicts approximately 50% growth (7,620 increases to 11,520).
- The high growth scenario uses historic data from 2011-2016 and predicts approximately 100% growth (7,620 increases to 15,210).
- A medium growth scenario has been assumed which is part way between the base and high growth scenarios (75%) (7620 increases to 13365). Based on this assumption, the predicted daily traffic at the time of Project opening (2025) is 9,700.

The do-minimum and project scenarios are assumed to have the same growth rate.

3 Travel Times

3.1 Routes

Based on the traffic distribution calculated, there are up to five different routes for each of the 15 origin and destination pairs (up to 75 possible unique trips).

To simplify the assessment the busiest routes have been identified as below:

Five routes carry more than 5% of trips, these are highlighted below:

- Between SH3 / West Fielding and SH2 North via Saddle Road and Oxford Road (5.8%)
- Between SH3 / West Fielding and Woodville via Saddle Road and Woodlands Road (5.2%)
- Between Palmerston North and SH2 North via Saddle Road and Oxford Road (11.0%)
- Between Palmerston North and SH2 North via Saddle Road and Woodlands Road (7.7%)
- Between Palmerston North and Woodville via Saddle Road and Woodlands Road (16.9%)

The five busiest routes are all via Saddle Road, the three busiest routes via Paihiatua Track are:

- Between Palmerston North and SH2 South via Paihiatua Track and Mangahao Road (3.7%)
- Between SH57 South and SH2 North via Paihiatua Track and Balance Valley Road (3.0%)
- Between SH57 South and SH2 North via Paihiatua Track and Mangahao Road (3.7%)

3.2 Travel distances

Travel distances have been identified from:

- DBC drawings (for proposed route); and
- Google maps / TomTom data (existing routes).

3.3 Travel speeds and times

Travel times have been calculated from the travel distance and the estimated average vehicle speed.

Estimated HCV average travel speeds on the proposed project have been calculated from the longitudinal profile of the proposed route and the speed / grade curves provided in Austroads Guide to Road Design Part 3: Geometric Design (2016) and assume that HCV speeds downhill are the same as the equivalent uphill grade. Car speeds are assumed to be 90km/h.

Travel speeds on existing routes are based on professional judgement informed by:

- The road form;
- Predicted travel times from Google maps; and
- Proportions of urban and rural road.

All estimates are rounded to the nearest 5km/h.

4 Intersection Modelling

4.1 Turning Demands

The following process has been used to calculate the turning demands:

- Average Daily Traffic (ADT) Car and HCV combined.
- Combined ADT on each approach converted to overall average vehicles per hour (VPH) by multiplying the combined ADT by 10%.
- Origin-destination (OD) matrix created from the overall average VPH assuming OD proportions to balance flows.
- OD matrix converted to overall average VPH turning flow diagrams.
- Overall average VPH turning flow diagrams converted to peak hours by:
    - multiplying the peak direction by 150%
    - multiplying the off-peak direction by 50%
- 15% HCV assumed for modelling.

4.2 Modelling Assumptions

The following assumptions have been used for the modelling:

- SIDRA 7 modelling software used.
- 85% peak flow factor (PFF) assumed.
- Default settings used.

1.B
TRIP DISTRIBUTION SUMMARY

Appendix 1.B Trip Distribution

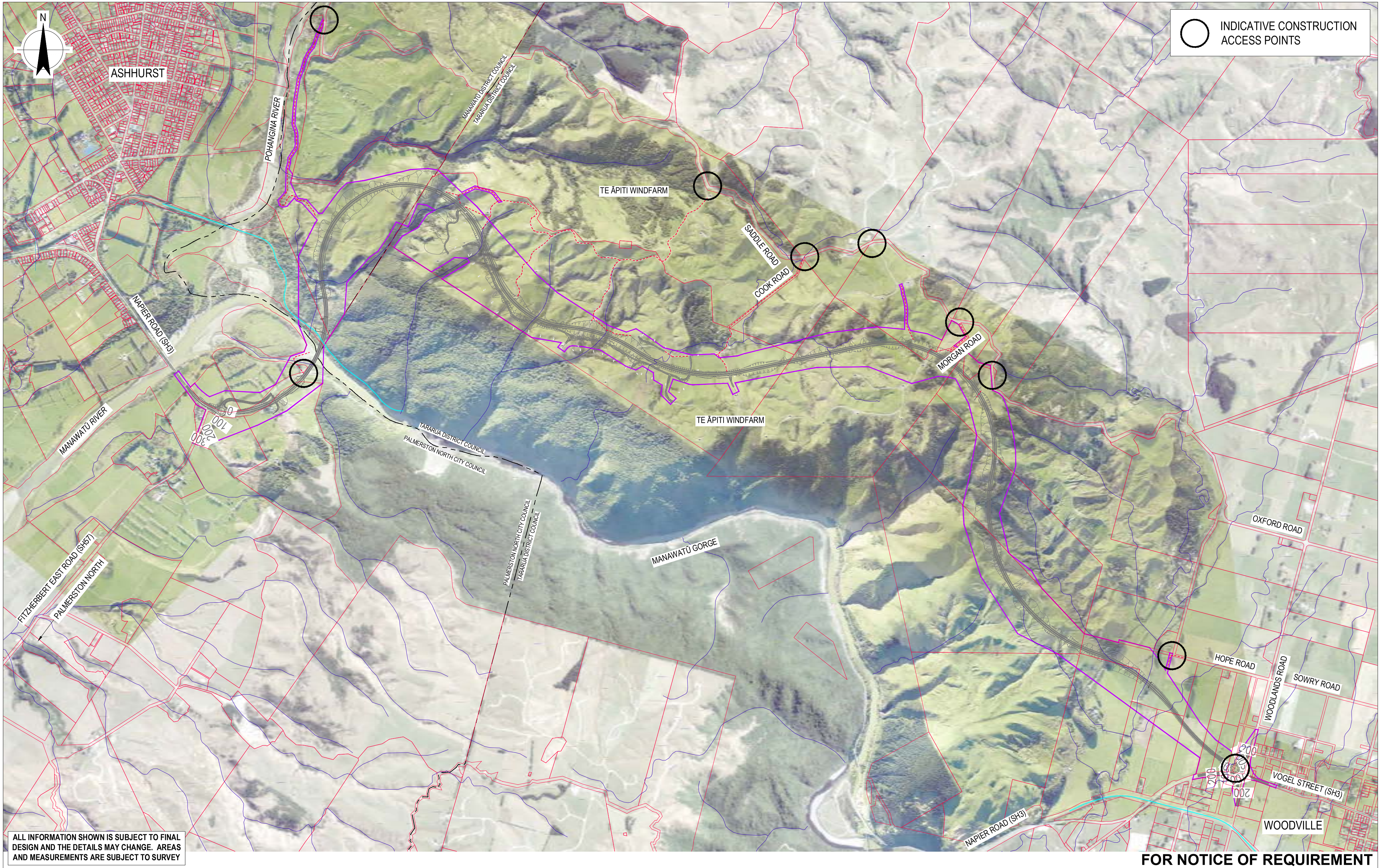
Route Data			Car				HCV			
			2016	2041 (75% growth from 2016)			2016	2041 (75% growth from 2016)		
Route	Start	End	Current	Do Minimum	Proposed	Difference	Current	Do Minimum	Proposed	Difference
Pahiatua - Aokautere Road	SH57	Balance Valley Road	3429	6001	3497	-2505	483	845	389	-456
Balance Valley Road	Pahiatua - Aokautere Road	Gorge Road	649	1136	551	-584	94	165	61	-104
Mangahao Road	Nikau Road	SH2	1834	3209	1433	-1776	277	485	159	-325
Saddle Road	Sailsbury Street	Woodlands Road	5403	9456	236	-9220	675	1181	26	-1154
Woodlands Road	Saddle Road	SH3	3875	6780	315	-6465	413	722	35	-687
Oxford Road	Saddle Road	SH2	1778	3111	357	-2754	303	530	63	-467
Cambridge Avenue	York Street	Mulgrave Street	8169	14296	12856	-1440	903	1580	1651	71
Wyndham Street	Oxford Street	Sailsbury Street	782	1369	193	-1175	167	292	87	-205
Sailsbury Street	Mulgrave Street	Wyndham Street	5677	9934	1890	-8044	662	1159	210	-949
SH3 (New Route)	SH57	Woodlands Road	0	0	11724	11724	0	0	1611	1611
SH3	Cambridge Avenue	SH57	1757	3075	11463	8388	292	510	1417	906
SH3	Woodlands Road	SH2	4028	7050	11724	4675	452	791	1611	820
SH2	Station Street	Mangahao Road	3628	6349	6841	492	744	1302	1401	99
SH57	Aokautere	SH3	1515	2650	3552	901	213	373	578	205

1.C
TRAVEL TIME SUMMARY

Appendix 1.C Travel Time Summary

Route Data			Car Travel Times (minutes)			HCV Travel Times (minutes)		
Start	End	Route	Current	Proposed	Difference	Current	Proposed	Difference
SH3 West / Fielding (Intersection of Mulgrave Street and Hillary Crescent)	SH2 North (Intersection of SH2 and Pinfold Street)	Saddle Road and Oxford Road	21.2	12.3	-8.9	25.2	16.8	-8.4
	Woodville (Intersection of SH3 and SH2)	Saddle Road and Woodlands Road	20.2	10.8	-9.4	24.1	15.0	-9.1
Palmerston North (Intersection of SH3 and York Street)	SH2 North (Intersection of SH2 and Pinfold Street)	Saddle Road and Oxford Road	22.1	11.8	-10.3	26.1	16.3	-9.8
		Saddle Road and Woodlands Road	22.6	11.8	-10.8	26.9	16.3	-10.6
	Woodville (Intersection of SH3 and SH2)	Saddle Road and Woodlands Road	21.1	10.3	-10.8	25.1	14.5	-10.6
Palmerston North (The Square)	SH2 South (Intersection of SH2 and Mangahao Road)	Paihiatua Track and Mangahao Road	38.3	34.8	-3.6	44.0	40.8	-3.2
SH57 South (Intersection of SH57 and Pahiatua Track)	SH2 North (Intersection of SH3 and Woodlands Road)	Paihiatua Track and Balance Valley Road	28.5	14.9	-13.6	34.2	18.6	-15.6
	SH2 North (Intersection of SH3 and SH2)	Paihiatua Track and Mangahao Road	40.8	16.5	-24.3	48.4	20.7	-27.7

1.D
INDICATIVE CONSTRUCTION SITE ACCESSES



FOR NOTICE OF REQUIREMENT

No	Revision	Drawn	Checked	Approved	Date
A	FOR SUBMISSION	ST	DD*	AW*	10/18

Note: * indicates signatures on original issue of drawing or last revision of drawing

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Drafting Check	D DUNLOP*	Design Check	D DUNLOP*
Approved	A WHALEY*		
Date	OCTOBER 2018		
Scale	N.T.S.		This Drawing must not be used for Construction unless signed as Approved

Client: NZ TRANSPORT AGENCY
Project: TE AHU A TURANGA; MANAWATŪ TARARUA HIGHWAY
Title: INDICATIVE CONSTRUCTION ACCESS - SHEET 1 OF 1

Original Size: A1 | Project Number: 51-38113 | Drawing Number: A-11 | Rev: A

Plot Date: 29 October 2018 - 10:11 a.m. Cad File No: G:\Transport\NZTA\Proj\5-C3688.00 Manawatu Gorge Transport Assessment\Report - Evidence\Appendices\Drawing\51-38113-A-00 - Standard\51-38113-A-11.dwg

Higho Consultants

MANAWATU GORGE REPLACEMENT PROJECT

CONSTRUCTION TRAFFIC ESTIMATE

August 2018

Revision No.	Revision	Revision Date	Prepared By	Checked By
01	Draft for Internal Review	02/08/18	JS	GH

NOTES/ASSUMPTIONS:

- 1 movement is a single journey to / from site (a return journey is two movements).
- Estimated construction traffic movements occur between 7am and 6pm, Monday to Saturday.
- Construction traffic estimates assume that some plant, equipment, materials etc will not be readily avialable in Woodville (and surrounding areas) and the Contractor will choose to transport these to the Woodville side of the route from Palmerston North. For example it may be more cost effective to mobilise cranage, site facilities, heavy eathrworks plant etc to the eastern side of the route from Palmertson North rather than Hawkes Bay or The Wairarapa.

BRIDGE TO BRIDGE SECTOR & MANAWATU RIVER BRIDGE				
ACTIVITY	**ASSUMED ROUTE**	**ESTIMATED DURATION**	**VEHICLE TYPE**	**FREQUENCY**
Site Establishment including services diversions, forming laydowns, setting up compounds, accesses, fencing, initial erosion & sediment control etc	PN – Site	3-4 weeks	Transporters, Low Loaders, Flat Decks, Hiabs etc	20 movements per day
		1-2 weeks	6/8 Wheeler Tipper Truck & Trailers	20 movements per day
		3-4 weeks	Light Vehicles	40 movements per day
Site Clearance, Demolition & Vegetation Removal	PN – Site	2-3 weeks	6/8 Wheeler Tipper Trucks, Logging Trucks	40 movements per day
		2-3 weeks	Light Vehicles	30 movements per day
Strip Topsoil, Bulk Earthworks, Engineered Fill & Drainage (Seasonal)	PN – Site	20-24 weeks	Transporters, Low Loaders, Flat Decks, Hiabs etc	10 movements per day
		20-24 weeks	6/8 Wheeler Tipper Truck & Trailers	10 movements per day
		20-24 weeks	Light Vehicles	60 movements per day
Pavement Construction & Sealing (Seasonal)	PN – Site	12-16 weeks	Transporters, Low Loaders, Flat Decks, Hiabs etc	10 movements per day
		12-16 weeks	6/8 Wheeler Tipper Truck & Trailers	30 movements per day
		12-16 weeks	Light Vehicles	80 movements per day
Manawatu River Bridge South Abutment & Superstructure Construction	PN – Site	70-80 weeks	Transporters, Low Loaders, Flat Decks, Hiabs etc	20 movements per day
		18-20 weeks	Concrete Trucks	40 movements per day (max)
		70-80 weeks	Light Vehicles	40 movements per day
Installation of signage/barriers/road markings, landscaping, planting etc	PN – Site	8-10 weeks	Transporters, Low Loaders, Flat Decks, Hiabs etc	20 movements per day
		2-3 weeks	Concrete Trucks	10 movements per day (max)
		8-10 weeks	6/8 Wheeler Tipper Truck & Trailers	10 movements per day
		8-10 weeks	Light Vehicles	30 movements per day

WESTERN SLOPE SECTOR & MANAWATU RIVER BRIDGE NORTH ABUTMENT				
ACTIVITY	**ASSUMED ROUTE**	**ESTIMATED DURATION**	**VEHICLE TYPE**	**FREQUENCY**
Site Establishment including forming laydowns, setting up compounds, accesses, fencing, initial erosion & sediment control etc	PN/Ashurst – via 985 Saddle Road - Site	3-4 weeks	Transporters, Low Loaders, Flat Decks, Hiabs etc	20 movements per day
		1-2 weeks	6/8 Wheeler Tipper Truck & Trailers	20 movements per day
		3-4 weeks	Light Vehicles	40 movements per day
Establish Temporary Rail Crossing & Access/Haul Routes to Site	PN/Ashurst – via 985 Saddle Road - Site	5-6 weeks	Transporters, Low Loaders, Flat Decks, Hiabs etc	6 movements per day
		5-6 weeks	6/8 Wheeler Tipper Trucks	20 movements per day
		5-6 weeks	Light Vehicles	20 movements per day
Site Clearance, Demolition & Vegetation Removal	PN/Ashurst – via 985 Saddle Road - Site	3-4 weeks	6/8 Wheeler Tipper Trucks, Logging Trucks	10 movements per day
		3-4 weeks	Light Vehicles	30 movements per day
Form crossing over QEII covenant area (bridge assumed)	PN/Ashurst – via 985 Saddle Road - Site	12-16 weeks	Transporters, Low Loaders, Flat Decks, Hiabs etc	10 movements per day
		3-4 weeks	6/8 Wheeler Tipper Trucks / Concrete Trucks	10 movements per day
		12-16 weeks	Light Vehicles	30 movements per day
Manawatu River Bridge North Abutment Construction	PN/Ashurst – via 985 Saddle Road - Site	10-12 weeks	Transporters, Low Loaders, Flat Decks, Hiabs etc	10 movements per day
		8-10 weeks	Concrete Trucks	30 movements per day (max)
		10-12 weeks	Light Vehicles	20 movements per day
Build viaduct over existing high value forest area (steel or precast superstructure assumed - scope to be confirmed)	PN/Ashurst – via 985 Saddle Road - Site (including north river bridge abutment)	60-70 weeks	Transporters, Low Loaders, Flat Decks, Hiabs etc	20 movements per day
		18-20 weeks	Concrete Trucks	40 movements per day (max)
		60-70 weeks	Light Vehicles	40 movements per day
Strip Topsoil, Bulk Earthworks, Engineered Fill & Drainage (Seasonal)	PN/Ashurst – via 985 Saddle Road - Site (including north river bridge abutment)	20-24 weeks	Transporters, Low Loaders, Flat Decks, Hiabs etc	10 movements per day
		20-24 weeks	6/8 Wheeler Tipper Truck & Trailers	10 movements per day
		20-24 weeks	Light Vehicles	60 movements per day

Pavement Construction & Sealing (Seasonal)	PN/Ashurst – via 985 Saddle Road - Site (including north river bridge abutment)	12-16 weeks	Transporters, Low Loaders, Flat Decks, Hiabs etc	10 movements per day
		12-16 weeks	6/8 Wheeler Tipper Truck & Trailers	30 movements per day
		12-16 weeks	Light Vehicles	80 movements per day
Installation of signage/barriers/road markings, landscaping, planting etc	PN/Ashurst – Saddle Road - Site (including north river bridge abutment)	8-10 weeks	Transporters, Low Loaders, Flat Decks, Hiabs etc	20 movements per day
		2-3 weeks	Concrete Trucks	10 movements per day (max)
		8-10 weeks	6/8 Wheeler Tipper Truck & Trailers	10 movements per day
		8-10 weeks	Light Vehicles	30 movements per day

TE APITI WIND FARM & RIDGE SECTOR				
ACTIVITY	**ASSUMED ROUTE**	**ESTIMATED DURATION**	**VEHICLE TYPE**	**FREQUENCY**
Upgrade/Extend/Divert Existing Wind Farm Access Roads & Fencing etc	PN/Ashurst – via Saddle Road & Wind Farm - Site (50%) Woodville - via Saddle Road & Wind Farm – Site (50%)	2-3 weeks	Transporters, Low Loaders, Flat Decks, Hiabs etc	6 movements per day
		6-8 weeks	6/8 Wheeler Tipper Trucks	20 movements per day
		6-8 weeks	Light Vehicles	20 movements per day
Site Establishment including forming laydowns, setting up compounds, accesses, fencing, initial erosion & sediment control etc	PN/Ashurst – via Saddle Road & Wind Farm - Site (60%) Woodville - via Saddle Road & Wind Farm – Site (40%)	3-4 weeks	Transporters, Low Loaders, Flat Decks, Hiabs etc	20 movements per day
		1-2 weeks	6/8 Wheeler Tipper Truck & Trailers	20 movements per day
		3-4 weeks	Light Vehicles	40 movements per day
Existing Wind Turbine Decommissioining & HV Cable Diversions	PN/Ashurst – via Saddle Road & Wind Farm - Site (80%) Woodville - via Saddle Road & Wind Farm – Site (20%)	3-4 weeks	Transporters, Low Loaders, Flat Decks, Hiabs etc	6 movements per day
		3-4 weeks	6/8 Wheeler Tipper Truck & Trailers	10 movements per day
		3-4 weeks	Light Vehicles	20 movements per day
Site Clearance, Demolition & Vegetation Removal	PN/Ashurst – via Saddle Road & Wind Farm - Site (30%) Woodville - via Saddle Road & Wind Farm – Site (70%)	3-4 weeks	6/8 Wheeler Tipper Trucks, Logging Trucks etc	10 movements per day
		3-4 weeks	Light Vehicles	30 movements per day
Construct Box Culvert Underpass	PN/Ashurst – via Saddle Road & Wind Farm - Site (60%) Woodville - via Saddle Road & Wind Farm – Site (40%)	6-8 weeks	Transporters, Low Loaders, Flat Decks, Hiabs etc	10 movements per day
		1-2 weeks	6/8 Wheeler Tipper Trucks	10 movements per day
		6-8 weeks	Light Vehicles	20 movements per day
		60-70 weeks	Light Vehicles	40 movements per day
Strip Topsoil, Bulk Earthworks, Engineered Fill & Drainage (Seasonal)	PN/Ashurst – via Saddle Road & Wind Farm - Site (50%) Woodville - via Saddle Road & Wind Farm – Site (50%)	28-30 weeks	Transporters, Low Loaders, Flat Decks, Hiabs etc	10 movements per day
		28-30 weeks	6/8 Wheeler Tipper Truck & Trailers	10 movements per day
		28-30 weeks	Light Vehicles	60 movements per day

Pavement Construction & Sealing (Seasonal)	PN/Ashurst – via Saddle Road & Wind Farm - Site (50%) Woodville - via Saddle Road & Wind Farm – Site (50%)	38-40 weeks	Transporters, Low Loaders, Flat Decks, Hiabs etc	10 movements per day
		38-40 weeks	6/8 Wheeler Tipper Truck & Trailers	70 movements per day
		38-40 weeks	Light Vehicles	80 movements per day
Installation of signage/barriers/road markings, landscaping, planting etc	PN/Ashurst – via Saddle Road & Wind Farm - Site (70%) Woodville - via Saddle Road & Wind Farm – Site (30%)	12-14 weeks	Transporters, Low Loaders, Flat Decks, Hiabs etc	20 movements per day
		3-4 weeks	Concrete Trucks	10 movements per day (max)
		12-14 weeks	6/8 Wheeler Tipper Truck & Trailers	10 movements per day
		12-14 weeks	Light Vehicles	30 movements per day

EASTERN SLOPE SECTOR				
ACTIVITY	**ASSUMED ROUTE**	**ESTIMATED DURATION**	**VEHICLE TYPE**	**FREQUENCY**
Site Establishment including forming laydowns, setting up compounds, accesses, fencing, initial erosion & sediment control etc	PN/Ashurst – via Saddle Road - Site (40%) Woodville - via Saddle Road - Site (10%) Woodville – Eastern End of Site (50%)	3-4 weeks	Transporters, Low Loaders, Flat Decks, Hiabs etc	20 movements per day
		1-2 weeks	6/8 Wheeler Tipper Truck & Trailers	20 movements per day
		3-4 weeks	Light Vehicles	40 movements per day
Establish Access/Haul Routes Along Route	PN/Ashurst – via Saddle Road - Site (20%) Woodville - via Saddle Road - Site (30%) Woodville – Eastern End of Site (50%)	3-4 weeks	Transporters, Low Loaders, Flat Decks, Hiabs etc	10 movements per day
		3-4 weeks	6/8 Wheeler Tipper Trucks	30 movements per day
		3-4 weeks	Light Vehicles	30 movements per day
Site Clearance, Demolition & Vegetation Removal	PN/Ashurst – via Saddle Road - Site (20%) Woodville - via Saddle Road - Site (30%) Woodville – Eastern End of Site (50%)	4-5 weeks	6/8 Wheeler Tipper Trucks, Logging Trucks etc	20 movements per day
		4-5 weeks	Light Vehicles	30 movements per day
Construct Bridge at CH 13000	Woodville – Eastern End of Site (100%)	12-16 weeks	Transporters, Low Loaders, Flat Decks, Hiabs etc	10 movements per day
		3-4 weeks	6/8 Wheeler Tipper Trucks / Concrete Trucks	10 movements per day
		12-16 weeks	Light Vehicles	30 movements per day
Strip Topsoil, Bulk Earthworks, Engineered Fill & Drainage (Seasonal)	PN/Ashurst – via Saddle Road - Site (10%) Woodville - via Saddle Road - Site (40%) Woodville – Eastern End of Site (50%)	28-30 weeks	Transporters, Low Loaders, Flat Decks, Hiabs etc	10 movements per day
		28-30 weeks	6/8 Wheeler Tipper Truck & Trailers	10 movements per day
		28-30 weeks	Light Vehicles	60 movements per day
Pavement Construction & Sealing (Seasonal)	PN/Ashurst – via Saddle Road - Site (10%) Woodville - via Saddle Road - Site (40%) Woodville – Eastern End of Site (50%)	38-40 weeks	Transporters, Low Loaders, Flat Decks, Hiabs etc	10 movements per day
		38-40 weeks	6/8 Wheeler Tipper Truck & Trailers	70 movements per day
		38-40 weeks	Light Vehicles	80 movements per day

Installation of signage/barriers/road markings, landscaping, planting etc	PN/Ashurst – via Saddle Road - Site (30%) Woodville - via Saddle Road - Site (20%) Woodville – Eastern End of Site (50%) ite (50%)	12-14 weeks	Transporters, Low Loaders, Flat Decks, Hiabs etc	20 movements per day
		3-4 weeks	Concrete Trucks	10 movements per day (max)
		12-14 weeks	6/8 Wheeler Tipper Truck & Trailers	10 movements per day
		12-14 weeks	Light Vehicles	30 movements per day

WOODVILLE GATEWAY SECTOR				
ACTIVITY	**ASSUMED ROUTE**	**ESTIMATED DURATION**	**VEHICLE TYPE**	**FREQUENCY**
Site Establishment including services diversions, forming laydowns, setting up compounds, accesses, fencing, initial erosion & sediment control etc	PN – via Saddle Rd - Site (20%) Woodville – Site (80)%	3-4 weeks	Transporters, Low Loaders, Flat Decks, Hiabs etc	20 movements per day
		1-2 weeks	6/8 Wheeler Tipper Truck & Trailers	20 movements per day
		3-4 weeks	Light Vehicles	40 movements per day
Site Clearance, Demolition & Vegetation Removal	Woodville – Site	2-3 weeks	6/8 Wheeler Tipper Trucks	10 movements per day
		2-3 weeks	Light Vehicles	30 movements per day
Strip Topsoil, Bulk Earthworks, Engineered Fill & Drainage (Seasonal)	PN – via Saddle Rd - Site (5%) Woodville – Site (95)%	10-12 weeks	Transporters, Low Loaders, Flat Decks, Hiabs etc	10 movements per day
		10-12 weeks	6/8 Wheeler Tipper Truck & Trailers	10 movements per day
		10-12 weeks	Light Vehicles	40 movements per day
Pavement Construction & Sealing (Seasonal)	PN – via Saddle Rd - Site (10%) Woodville – Site (90)%	8-10 weeks	Transporters, Low Loaders, Flat Decks, Hiabs etc	10 movements per day
		8-10 weeks	6/8 Wheeler Tipper Truck & Trailers	30 movements per day
		8-10 weeks	Light Vehicles	40 movements per day
Installation of signage/barriers/road markings, landscaping, planting etc	PN – via Saddle Rd - Site (30%) Woodville – Site (70)%	4-5 weeks	Transporters, Low Loaders, Flat Decks, Hiabs etc	20 movements per day
		1-2 weeks	Concrete Trucks	10 movements per day (max)
		4-5 weeks	6/8 Wheeler Tipper Truck & Trailers	10 movements per day
		4-5 weeks	Light Vehicles	30 movements per day

2. NOISE & VIBRATION

IN THE MATTER OF	The Resource Management Act 1991
AND	
IN THE MATTER OF	Notices of requirement for designations under section 168 of the Act, in relation to Te Ahu a Turanga; Manawatū Tararua Highway Project
BY	**NZ TRANSPORT AGENCY** Requiring Authority

TE AHU A TURANGA; MANAWATŪ TARARUA HIGHWAY PROJECT

TECHNICAL ASSESSMENT #2

NOISE AND VIBRATION

TABLE OF CONTENTS

INTRODUCTION

1. My full name is **Dr Stephen Gordon Chiles**.

2. I am self-employed as an acoustician through my company Chiles Ltd. I have been employed in acoustics since 1996, as a research officer at the University of Bath, a principal environmental specialist for the NZ Transport Agency, and as a consultant for the international firms Arup, WSP, and URS, and for the specialist firms Marshall Day Acoustics and Fleming & Barron.

3. I am responsible for the assessment of operational and construction noise and vibration effects for the Te Ahu a Turanga; Manawatū Tararua Highway Project ("**the Project**").

4. I have been assisted in my assessment by John Bull and Michael Smith of Altissimo Consulting, who have conducted acoustics computer modelling and measurements under my supervision.

Qualifications and experience

5. I have the following qualifications and experience relevant to this assessment:

   (a) I have degrees of Doctor of Philosophy in Acoustics from the University of Bath, and Bachelor of Engineering in Electroacoustics from the University of Salford. I am a Chartered Professional Engineer in acoustics and a Fellow of the UK Institute of Acoustics.

   (b) Over the last decade I have worked extensively on matters relating to road operational and construction noise and vibration. I am an independent professional advisor to the NZ Transport Agency, and in that capacity I have:

      (i) reviewed acoustics assessments and advised on most major NZ Transport Agency projects;

      (ii) investigated numerous noise and vibration issues and liaised with stakeholders;

      (iii) developed a noise mitigation specification, guidance (noise assessment, construction noise and vibration, noise barriers, surface noise, building treatment and land-use planning), case studies, technical memoranda, templates, and web tools;

(iv) procured and managed engine braking and road surface noise measurement systems; and

(v) advised and given evidence on land-use planning controls near State highways.

(c) In addition to work at a national level I have been the acoustics lead in project teams for State highway projects, including for stages of: Warkworth to Wellsford, Transmission Gully, Peka Peka to Ōtaki, Tauranga Eastern Link, Christchurch Southern Motorway 2, Waikato Expressway Cambridge/Tamahere Sections, Arras Tunnel and Mt Victoria Tunnel.

(d) In addition to road projects I consult to a range of other clients including: KiwiRail, Transpower, central and local government, developers and residents. I am contracted to provide the Environmental Noise Analysis and Advice Service to the Ministry of Health and regional public health services.

(e) I am convenor of the New Zealand industry reference group for the committee responsible for approximately 200 published "ISO" acoustics standards. I was Chair of the 2012 New Zealand acoustics standards review, Chair for the development of the 2010 wind farm noise standard,[1] and a member for the 2008 general environmental noise standards.[2]

Code of conduct

6. I confirm that I have read the Code of Conduct for expert witnesses contained in the Environment Court Practice Note 2014. This assessment has been prepared in compliance with that Code, as if it were evidence being given in Environment Court proceedings. In particular, unless I state otherwise, this assessment is within my area of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

[1] NZS 6808:2010 Acoustics – Wind farm noise.
[2] NZS 6801:2008 Acoustics – Measurement of Environmental Sound, and NZS 6802:2008 Acoustics – Environmental noise.

Purpose and scope of assessment

7. I have been engaged to assess effects of operational and construction noise and vibration that would be caused by the Project, and to recommend any measures necessary to avoid, remedy or mitigate those effects.

8. Adverse effects from noise and vibration can include:

   (a) reduced amenity;

   (b) annoyance;

   (c) sleep disturbance;

   (d) health impacts; and

   (e) building cosmetic damage.

9. The scope of my assessment has involved:

   (a) investigating the existing noise environment;

   (b) calculating future road-traffic sound levels associated with the Project;

   (c) determining areas that may be adversely affected by road-traffic noise;

   (d) identifying and recommending mitigation to reduce these effects;

   (e) considering road-traffic vibration effects;

   (f) identifying houses where construction noise and vibration may be at risk of exceeding criteria; and

   (g) examining those areas to determine required construction mitigation measures and strategies.

10. In the course of this work I have visited the area around the Project on several occasions in 2017 and 2018 and inspected locations of nearby houses, including in Ashhurst and Woodville.

11. I was previously engaged in 2017 to assess potential noise and vibration effects of long-list and short-list route options and sub-options for the Project. This current assessment relates solely to the designation now proposed for the selected route.

12. I have also been separately engaged by the NZ Transport Agency in 2018 to advise on mitigation to ameliorate adverse noise effects from diverted State

Highway 3 (“**SH3**”) road-traffic currently passing through Ashhurst to access Saddle Road. That work is not part of this current assessment, other than forming part of the existing environment within which the Project is assessed.

13. I have set out acoustics terms and abbreviations that I use in my assessment in **Appendix 2.A**.

Assumptions and exclusions in this assessment

14. In my assessment I have liaised with other members of the Project team. In particular, I have relied on:

    (a) indicative road and earthwork locations and design constraints from Andrew Whaley;

    (b) current and future traffic volumes, compositions and speeds from David Dunlop;

    (c) an indicative construction methodology from Grant Higgins;

    (d) an Environmental and Cultural Design Framework (“**ECDF**”) from Chris Bentley; and

    (e) identification of visual issues by Boyden Evans.

15. My assessment relates to noise and vibration effects on people and buildings. I do not address potential effects on fauna.

16. My assessment of the existing environment assumes that proposed road upgrades in Ashhurst are complete because these are currently being implemented and should be fully in place by the end of 2019. This includes reduced speeds, low-noise road surfacing in some areas and reconfiguration of intersections. I have assumed that traffic will access Ashhurst from SH3 using Cambridge Avenue rather than York Street. For simplicity, in the acoustics model for the pre-existing (2016) scenario I have maintained the same road network.

EXECUTIVE SUMMARY

Project description

17. The Project is described in Part C, Volume 2 ‘Supporting Material’, as the construction of a new road, which will form part of SH3. As a result of the construction of this new section of SH3 there will be changes in traffic

volumes on other existing roads. I have assessed noise effects both for the new section of road and over a wider area including in Ashhurst and Woodville, beyond the proposed designation.

Existing environment

18. I have assessed the existing environment based on site observations, acoustics modelling of existing road-traffic and measurements. The existing environment includes State highway traffic passing through the wider area, mainly on Saddle Road. Currently there are relatively high road-traffic noise levels in parts of Ashhurst and Woodville near roads that connect to the route over Saddle Road.

19. The proposed designation is near a few houses at the western roundabout, where there are currently moderate road-traffic noise levels from existing roads in the vicinity. There are no houses near the designation on the main western or eastern slopes, or through the wind farm area. On the lower eastern slope there are two houses near the designation where existing sound levels are relatively low, reflecting the rural environment. In the vicinity of the proposed eastern roundabout there are numerous houses which are currently exposed to road-traffic noise from existing roads.

Methodology

20. I have assessed effects of operational road-traffic noise both with reference to criteria from the relevant New Zealand Standard (NZS 6806), and also through broader consideration of changes in sound levels and potential sound characteristics. I have considered effects at 20 houses near the proposed designation, and at a further 518 locations by the wider road network.

21. For operational road-traffic vibration I have made a screening assessment to check whether any houses could be close enough to a new section of road to be at risk of exceeding guideline criteria.

22. I have used criteria from New Zealand Standard NZS 6803 to assess the effects of construction noise, and for construction vibration I have used criteria published by the NZ Transport Agency based on international standards. For both noise and vibration, I have identified locations where there is risk of exceeding criteria and then investigated the practicality of management measures for construction activity.

Model forecast

23. I have predicted road-traffic sound levels at all receivers for five scenarios, addressing the pre-existing (2016) and existing (2018) situations, as well as future scenarios in a design year of 2041 without the Project, with the Project without any mitigation, and with the Project including mitigation.

24. I have used data from previous projects to determine distances at which there may be risk of exceeding operational vibration and construction noise and vibration criteria.

Project shaping

25. I provided advice on potential noise and vibration issues during the route selection process in 2017 and during the shaping of the designation for the selected route in 2018. During the route selection I identified that one of the short-list options, Option 4, would have substantial adverse noise effects from traffic using local roads outside the Project area. I did not identify any significant issues with the selected option, Option 3. For the selected route, I did not identify any areas where noise and vibration were critical in terms of the Project shaping, and they have not been a major factor in the process.

Assessment of effects

26. In my opinion the Project will have a significant positive effect, reducing road-traffic noise levels through Ashhurst and around the outskirts of Woodville.

27. Without mitigation, the Project could have significant adverse noise effects due to increased traffic on Napier Road in Ashhurst and Vogel Street in Woodville. There could also be significant adverse effects due to sound characteristics of individual vehicles braking and accelerating at the two roundabouts and on the lower eastern slope.

28. Operational road-traffic should have minor vibration effects due to the separation of the new road from houses.

29. With normal good practice management, construction noise and vibration effects should be minor due to the separation of works from most houses. Noise from construction traffic should generally have a minor adverse effect but could potentially be significant if bulk imported fill/aggregate passes through Ashhurst, particularly at night.

Measures to avoid, remedy or mitigate actual or potential adverse noise and vibration effects

30. I have recommended use of asphaltic road surfaces on Napier Road in Ashhurst, Vogel Street in Woodville and on the lower eastern slope, to mitigate operational road-traffic noise effects in those locations.

31. To moderate vehicle sounds at roundabouts I recommend bold landscape treatments in those locations, and separation from houses of at least 100 metres for roundabouts and 200 metres for the alignment on the lower eastern slope.

32. I consider that construction noise and vibration effects should be managed in accordance with standard practice. I recommend that construction traffic passing through Ashhurst is minimised, particularly at night.

Conditions

33. To give effect to my recommendations and to maintain the assumptions of my assessment I have recommended prescriptive designation conditions that require specific control measures. In the case of landscape and traffic controls I recommend that these matters should be addressed through the ECDF and Construction Traffic Management Plan ("**CTMP**") respectively.

Conclusions

34. With the mitigation and conditions I have recommended, the residual adverse noise and vibration effects of the Project are all likely to be minor. There will be significant positive noise effects associated with reductions in traffic volumes through Ashhurst and around the outskirts of Woodville. The construction and operational activity will be clearly audible over a wide area, but at reasonable levels that should be compatible with the environment. In my opinion the noise and vibration effects of the Project are likely to be acceptable.

PROJECT DESCRIPTION

35. Part C of Volume 2 of the Assessment of Environmental Effects ("**AEE**"), 'Supporting Material', includes a Project Description. This includes the Project being described in six sectors (shown in Volume 4, drawing C2). My assessment assesses the existing environment and effects of the Project with reference these six sectors:

(a) bridge to bridge;

(b) new Manawatū River/Gorge bridge;

(c) western slope;

(d) Te Āpiti Wind Farm and ridge;

(e) eastern slope; and

(f) Woodville gateway.

36. Since SH3 through the Manawatū Gorge was closed, traffic on the State highway network has been redistributed to alternative routes. The locations at which the Project ties into the existing designated State highway network do not correlate exactly to the locations at which traffic is currently diverted to alternative routes:

(a) At the west, the Project ties into the State highway network at the intersection of SH3 and State Highway 57 ("**SH57**"), with the proposed designation extending to the existing Manawatū River bridge. Currently, a significant proportion of SH3 traffic leaves or joins the State highway network at the intersection of SH3 with Cambridge Avenue in Ashhurst, to connect to Saddle Road. The Project will result in that traffic moving back to SH3 such that there will be a significant increase in current road-traffic volumes on the existing SH3 between Cambridge Avenue and the Manawatū River bridge, outside the proposed designation.

(b) At the east, the Project ties into the State highway network at the intersection of SH3 and Woodlands Road. Currently, a significant proportion of light vehicles passing over Saddle Road by-pass Woodville to leave or join the State highway network at the intersection of State Highway 2 ("**SH2**") and Pinfold Road to the east of Woodville. The Project will result in most of that light traffic re-routing to pass through Woodville on Vogel Street (SH3/SH2) from Woodlands Road to Pinfold Road, outside the proposed designation.

37. Due to the changes in traffic that are caused by the Project, for my operational road-traffic noise assessment I have considered effects along the future route beyond the proposed designation, through Ashhurst and extending from the intersection of SH3 with Cambridge Avenue in Ashhurst

to the intersection of SH2 with Pinfold Road in Woodville. My assessment of these areas is headed Ashhurst, Ashhurst (Napier Road), and Woodville.

EXISTING ENVIRONMENT

Measurements and predictions

38. I have assessed the existing environment on the basis of my site observations, acoustics modelling, and sound level measurements at two key locations. In this instance I consider that reliance primarily on modelling to be a robust approach given that the existing noise environment at most sensitive locations is controlled by road-traffic, which is accurately represented by the modelling. Use of modelling also allows me to account for road improvements about to occur in Ashhurst that are specifically designed to reduce road-traffic noise in the existing environment.

39. The details of the acoustics modelling undertaken to predict existing road-traffic sound levels are set out in **Appendix 2.B** and details of the sound level measurements and results are set out in **Appendix 2.C**.

Ashhurst

40. When SH3 through the Manawatū Gorge closed, significant volumes of traffic were rerouted through Ashhurst to access Saddle Road. This situation, with SH3 traffic through Ashhurst, forms the existing environment. Residents in Ashhurst have reported significant disturbance from noise and vibration caused by this traffic, particularly from heavy vehicles.

41. While traffic uses several routes through Ashhurst to reach Saddle Road, for the purposes of this assessment, I have looked at the main route along Cambridge Avenue, Mulgrave Street and Salisbury Street. On this route modelling shows that in the order of 100 houses are currently exposed to over 57 dB $L_{Aeq(24h)}$.

42. This is not an unusual statistic for traffic passing through an urban area, but adverse effects are likely to have been accentuated in Ashhurst by the sudden onset of the traffic, use of minor roads not designed for such traffic flows, and houses that have not been designed or adapted for the noise environment.

43. In addition to noise effects from traffic within Ashhurst, sound from traffic on Saddle Road can be audible over a wide area. In particular, poorly silenced

engine brakes on heavy vehicles descending Saddle Road can be clearly audible in Ashhurst.

Ashhurst (Napier Road)

44. The section of SH3 Napier Road between Cambridge Avenue and the Manawatū River, has had reduced traffic volumes since the closure of the Manawatū Gorge. In the existing environment there are modest traffic flows on this section of SH3 and predicted sound levels range from 49 to 62 dB $L_{Aeq(24h)}$ at nearby houses. Road-traffic noise remains part of the character of the existing environment.

Bridge to bridge

45. There are modest traffic flows on SH57 and SH3 in this area. There is one house at the intersection of SH3 and SH57 that is currently predicted to be exposed to around 56 dB $L_{Aeq(24h)}$, accounting for screening by an existing earth bund around the house. This prediction is consistent with a level of 54 dB $L_{Aeq(24h)}$ measured at this house in September 2018. Most traffic has to brake and accelerate by the house to negotiate a sharp 90 degree turn linking SH57 and SH3, resulting in some vehicle sound characteristics likely to cause disturbance.

46. From the intersection of SH57 and SH3 to the Manawatū Gorge car parking area there is one house near the road that will be removed as a result of the Project, and another set-back on a hill above the road. At that location existing road-traffic noise will still be audible, but at a relatively low level.

New Manawatū River/Gorge bridge

47. Around the Manawatū Gorge car park and visitor area, road-traffic from the wider area is still audible in the distance, along with natural sounds from the river and vegetation. There are sporadic local sounds from visitors and their vehicles. It is likely this area is generally perceived as being relatively quiet. In the pre-existing environment (when the section of SH3 through the Manawatū Gorge was open) there was regular road-traffic adjacent to this area and associated noise.

Western slope

48. The Western slope passes through vegetated areas and farmland. There will be occasional vehicles and activity on the farm and occasional train

movements audible. Sound from road traffic in the wider area may also be audible in places. Much of this area is physically exposed and sounds caused by the wind will often be dominant. The wind farm will be audible in many places when it is operating.

Te Āpiti wind farm and ridge

49. As for the western slope, this area comprises vegetated areas and farmland. The sound from the wind farm will often be audible, along with other wind generated sound in the environment. However, when there are calm wind conditions the area is likely to be relatively quiet due to the separation from other anthropogenic sources. While Saddle Road is in the area, existing road-traffic is generally screened by the terrain.

Eastern slope

50. The top of the eastern slope will have a similar existing noise environment to the wind farm area and western slope. The lower slope passes through farm land, with isolated houses to each side of the proposed designation. This area is subject to noise from road-traffic on Saddle Road joining to Oxford Road and Woodlands Road. As such, the background environment includes this general road-traffic noise in the area. However, in some sheltered areas it is likely that natural sounds will dominate. At 75 Hope Road an ambient sound level of 50 dB $L_{Aeq(24h)}$ was measured in September 2018, with sound from wind and vegetation controlling the aural environment at that time.

Woodville gateway

51. The Woodville gateway is in the vicinity of Woodlands Road and the existing SH3, which both have moderate traffic flows from vehicles using Saddle Road. There is currently a sharp 90 degree turn at the intersection of these roads, resulting in some vehicle sound characteristics likely to cause disturbance. It is understood that this turn is to be realigned, which may reduce some of these characteristics.

52. In this area existing predicted road-traffic sound levels range from 52 to 66 dB $L_{Aeq(24h)}$ at nearby houses.

Woodville

53. There are moderate traffic volumes passing through the centre of Woodville on SH3/2 Vogel Street, including regular heavy vehicles, that control the

existing environment. Many of the buildings in this area are commercial, but there are also:

(a) in the order of 45 houses that are currently exposed to over 57 dB $L_{Aeq(24h)}$; and

(b) in the order of 7 houses exposed to over 64 dB $L_{Aeq(24h)}$.

54. The existing route on Vogel Street through Woodville has various road surface and pavement irregularities and vibration from heavy vehicles is perceptible adjacent to the road in places.

55. There are houses on the outskirts of Woodville on Woodlands Road, Oxford Road and Pinfold Road that are currently exposed to noise from traffic accessing Saddle Road. Of these there are:

(a) in the order of 15 houses that are currently exposed to over 57 dB $L_{Aeq(24h)}$; and

(b) in the order of 7 houses exposed to over 64 dB $L_{Aeq(24h)}$.

METHODOLOGY

Introduction

56. My assessment covers three distinct issues, which each require different approaches:

(a) operational road-traffic noise;

(b) operational road-traffic vibration; and

(c) construction noise and vibration.

57. For a State highway project, operational road-traffic noise usually has widespread effects that often require mitigation. I have therefore made a detailed study of potential operational road-traffic noise effects, including computer modelling to allow consideration of noise levels from the existing and pre-existing scenarios, as well as the future scenarios with and without the Project. I have compared predicted noise levels to criteria from the relevant New Zealand Standard and made a broad consideration of potential noise effects including the likely character of traffic sounds and changes to the aural environment. I have then made recommendations for mitigation,

and used the computer model to confirm the effectiveness of those measures.

58. Operational road-traffic vibration can cause disturbance for people living adjacent to existing roads with pavement or surface irregularities or defects. However, for new State highways with pavements and surfaces constructed in accordance with specifications, operational road-traffic vibration should not cause disturbance, even at houses close to the road. For this Project, I have considered operational vibration through a screening assessment based on the proximity of houses to the new road corridor and likely locations of surface irregularities such as bridge movement joints.

59. Large infrastructure works, such as this Project, involve a range of construction equipment that can generate significant temporary noise and vibration. I have considered typical set-back distances needed to comply with construction noise and vibration criteria and identified “hot spot” locations where there may be risk of exceedance. There are standard site practices routinely applied to minimise construction noise and vibration levels and to manage adverse effects arising from any exceedances of criteria. I have considered the identified hot spots to determine whether adverse effects can be controlled with these standard measures or whether enhanced mitigation is required.

Operational noise

60. There is no National Environmental Standard for operational road-traffic noise, and most district plans including the Palmerston North City and Manawatū District Plans explicitly exclude sound of vehicles on roads from general noise limits.[3] The Tararua District Plan[4] also adopts the same position through a reference to NZS 6802,[5] which excludes road-traffic sound. There is an unusual provision in the Manawatu District Plan that omits airbrakes from the exclusion of vehicles from noise limits.[3]

61. In the absence of other standardised criteria, most major roading projects since 2010 have been subject to noise assessment in accordance with NZS

[3] Palmerston North City District Plan, Rule R6.2.6.2.1.b; Manawatu District Plan, Plan Change 55 (operative in part), Rule 3C.4.2.d.ii.
[4] Tararua District Plan, Rule 5.4.1.2.a.
[5] Standards New Zealand (2008) NZS 6802:2008 *Acoustics - Environmental noise*.

6806[6], which was written for this specific application. The NZ Transport Agency requires use of NZS 6806 for State highway projects.[7]

62. NZS 6806 sets absolute rather than relative criteria to protect people living near roads from sleep disturbance and to provide a reasonable level of residential amenity. The method in NZS 6806 provides performance targets and requires assessment of a number of different options for noise mitigation (often including barriers and low-noise road surfaces). The criteria from NZS 6806 are set out in the following table for new and altered roads:

Table 2.1: NZS 6806 road-traffic noise criteria

Category	*New road criteria*	*Altered road criteria*
A (Primary)	57 dB $L_{Aeq(24h)}$	64 dB $L_{Aeq(24h)}$
B (Secondary)	64 dB $L_{Aeq(24h)}$	67 dB $L_{Aeq(24h)}$
C (Internal)	40 dB $L_{Aeq(24h)}$	40 dB $L_{Aeq(24h)}$

63. The majority of the Project is defined as a new road under NZS 6806, other than at the two roundabouts where it is defined as an altered road. Road-traffic noise from other existing parts of the network outside the proposed designation are not within the scope of NZS 6806. However, due to the consequential changes in traffic volumes caused by the Project, I have considered SH3 from Cambridge Avenue to the Manawatū River and SH3/SH2 Vogel Street through Woodville to Pinfold Road as altered roads under NZS 6806.

64. Under NZS 6806, noise mitigation options are to be assessed and, if practicable, the Category A (primary) criterion should be achieved. If this is not practicable, then mitigation should be assessed against Category B. However, if it is still not practicable to comply with categories A or B, then mitigation should be implemented to ensure the internal criterion in Category C is achieved. Depending on the specific building, mitigation in Category C could include ventilation and/or sound insulation improvements ranging from

[6] Standards New Zealand (2010) NZS 6806:2010 *Acoustics - Road-traffic noise - New and altered roads*.
[7] NZ Transport Agency (2016) *Guide to assessing road-traffic noise using NZS 6806 for State highway asset improvement projects*; and NZ Transport Agency (2013) *Technical memorandum NV3 State highway noise and vibration management*.

upgraded glazing through to new wall and ceiling linings. In Category C there is no protection of outdoor amenity.

65. Since NZS 6806 was first published in 2010, a number of Boards of Inquiry[8] have considered assessments where it has been used for State highway projects. The Boards determined that broader assessment of noise effects is required additional to application of NZS 6806, and in some instances additional mitigation is necessary beyond that determined by NZS 6806. In undertaking my assessment, I have applied the methodology in NZS 6806 and I have also made a broader assessment, seeking to address the issues raised by the Board of Inquiry decisions.

66. In my assessment I have considered effects at noise sensitive locations near the Project. In accordance with NZS 6806 these are known as Protected Premises and Facilities ("**PPFs**") and include existing houses, schools, visitor accommodation and various other locations defined in the Standard. NZS 6806 requires consideration of road-traffic sound at all PPFs within 100 metres of a road in an urban area defined by Statistics New Zealand, or within 200 metres of a road in a rural area. For the Project, the area is defined by Statistics New Zealand as rural, other than in Woodville and Ashhurst.

67. I have identified the 20 PPFs listed in **Table 2.4** below, as receiver locations for my assessment. In some cases I have included houses beyond the distances specified by NZS 6806 to ensure all relevant potential noise effects are captured by my assessment. In accordance with NZS 6806, I have not considered noise effects on future (unbuilt) PPFs, unless they have building consent. I understand that all three district councils have confirmed to the NZ Transport Agency that as of 10 September 2018 there were no unimplemented building consents for new houses within 200 metres of the proposed designation. I have not had further regard to possible future houses.

68. I have not included houses in Ashhurst, Ashhurst (Napier Road) and Woodville in **Table 2.4** as PPFs, but there are an additional 518 receivers included in the acoustics modelling and shown on the drawings that I have considered in my assessment.

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[8] Waterview Connection, Transmission Gully, MacKays to Peka Peka, Christchurch Southern Motorway, Peka Peka to North Ōtaki, Basin Bridge, Northern Corridor Improvements, East West Link.

69. Road-traffic sound levels have been predicted for five scenarios:

(a) Pre-existing (2016) – this is not a standard scenario required to be considered under NZS 6806, but I have included this to show the situation before the permanent closure of SH3 through the Manawatū Gorge.

(b) Existing (2018) - the current road layout and traffic volume, including re-routed traffic passing through Ashhurst to use Saddle Road.

(c) Future without the Project (2041) – the current road layout but with increased traffic volumes to represent a future year.

(d) Future with the Project (2041) – the new road layout with the Project built without any specific noise mitigation and with increased traffic volumes corresponding to a future year.

(e) Project with mitigation (2041) – the new road layout with the Project and future traffic volumes, with my recommended noise mitigation measures (low noise surfaces) added.

70. For the last three scenarios with future traffic volumes, NZS 6806 requires use of traffic forecasts for a year 10 to 20 years after opening of the road. I understand the road is intended to open in 2025 and I have therefore used traffic data for 2041, which is a standard year for traffic modelling within this 10 to 20 year period after opening. Use of 2041 provides some flexibility in case the opening year is delayed.

71. Mr Dunlop has provided three traffic forecasts for 2041 based on different growth assumptions. I understand from Mr Dunlop that he considers the lowest growth assumption to be the most realistic. However, for the purposes of my noise assessment I have used the highest growth assumption, resulting in higher traffic volumes and correspondingly higher road-traffic sound level predictions. This makes my assessment and recommendations for mitigation conservative, as potentially there will be lesser noise effects than I have considered.

72. To consider noise effects I have compared predicted sound levels under the first four modelled scenarios listed above with each other and with reference to NZS 6806 criteria. I have also qualitatively considered specific areas where the new road may give rise to distinct vehicle sound characteristics. NZS 6806 sets out a process for a formal evaluation of potential noise

mitigation options. As set out later in my assessment, in this case there are only limited areas where mitigation is required and only limited mitigation options. I have therefore been able to recommend specific noise mitigation measures without further evaluation. These recommended mitigation measures are included in the fifth scenario modelled. Prior to finalising my recommendations for noise mitigation, I discussed potential measures at two mitigation workshops for the Project (on 27 July 2018 and 14 August 2018), to establish whether there were any conflicts or synergies with other disciplines.

73. To provide a realistic assessment of operational noise effects, the acoustics modelling is based on the indicative alignment described by Mr Whaley and shown on the drawings. The final horizontal and vertical alignment to be constructed will inevitably move within the proposed designation as the design is refined, including in the development of the detailed design. I have therefore conducted sensitivity analysis to determine whether movement of the alignment would alter my findings.

Operational vibration

74. For operational road-traffic vibration there is again no relevant National Environmental Standard and no relevant district plan rules. The Tararua District Plan does include a rule for general vibration,[9] but the standard referenced in that rule is out-of-date and has been withdrawn by Standards New Zealand. There are no relevant New Zealand Standards. For previous assessments of road (and rail) vibration in New Zealand a Norwegian Standard, NS 8176[10], has often been applied as it has criteria and methods designed specifically for this application. NS 8176 recommends a criterion of 0.3 mm/s $v_{w,95}$ for operational road-traffic vibration from new roads, and this is the guideline recommended by the NZ Transport Agency.[7]

75. Previous measurements of vibration at numerous different sites have demonstrated that the 0.3 mm/s $v_{w,95}$ criterion is readily achieved near to a well-constructed State highway. To make a screening assessment, I have reviewed the location of the proposed designation and indicative alignment to confirm whether any new traffic lanes could be close enough to houses for there to be a risk of exceeding the criterion.

[9] Tararua District Plan, Rule 5.4.1.2.h.

[10] Norwegian Standard NS 8176E:2005 Vibration and shock – Measurement of vibration in buildings from land based transport and guidance to evaluation of its effects on human beings.

Construction noise and vibration

76. With respect to construction noise and vibration there are no relevant National Environmental Standards, but all three district plans[11] require use of the New Zealand Standard NZS 6803[12] for construction noise. This also forms the basis of guidance by the NZ Transport Agency.[13]

77. NZS 6803 sets out guideline criteria and management methods for construction noise. For the Project, the long-term criteria from NZS 6803 are applicable as set out in the following table:

Table 2.2: NZS 6803 construction noise criteria

Time of week	*Time period*	$L_{Aeq(15\ min)}$	L_{AFmax}
Weekdays	0630-0730	55 dB	75 dB
	0730-1800	70 dB	85 dB
	1800-2000	65 dB	80 dB
	2000-0630	45 dB	75 dB
Saturdays	0730-1800	70 dB	85 dB
	1800-0730	45 dB	75 dB
Sundays and Public Holidays	0730-1800	55 dB	85 dB
	1800-0730	45 dB	75 dB

78. For most large infrastructure projects near existing houses, it is sometimes impracticable for certain construction processes to fully comply with these criteria. Construction noise effects can usually still be managed to a reasonable degree through good practice, such as detailed in the NZ Transport Agency guide,[13] including greater emphasis on effective stakeholder engagement.

79. For general construction vibration, there are no relevant provisions in the three district plans, although the Tararua District Plan does refer to a standard specifically for noise and vibration from blasting.[14] Any blasting for the Project would be in areas of cut that are all remote from houses.

80. In the absence of any national standards, the NZ Transport Agency has developed construction vibration criteria based on standards from other

[11] Palmerston North City District Plan, Rule R6.2.6.2.1.f; Manawatu District Plan, Plan Change 55 (operative in part), Rule 3C.4.2.c; and Tararua District Plan, Rule 5.4.1.2.f.
[12] Standards New Zealand (1999) NZS 6803:1999 *Acoustics - Construction noise.*
[13] NZ Transport Agency (2013) *State highway construction and maintenance noise and vibration guide*, August 2013, Version 1.0.
[14] Tararua District Plan, Rule 5.4.1.2.e.

countries, as set out in the following table. The criteria relate both to perception of vibration resulting in disturbance for people, and also to potential cosmetic damage to buildings.

Table 2.3: NZ Transport Agency construction vibration criteria

Receiver	*Location*	*Details*	*Category A ppv*	*Category B ppv*
Occupied PPFs	Inside the building	Night 2000h to 0630h	0.3 mm/s	1 mm/s
		Day 0630h to 2000h	1 mm/s	5 mm/s
Other occupied buildings	Inside the building	Day 0630h to 2000h	2 mm/s	5 mm/s
Unoccupied buildings	Building foundation	Vibration transient	5 mm/s	BS 5228-2[15] Table B.2
		Vibration continuous		50% of BS 5228-2 Table B.2

81. These vibration criteria provide a tiered approach to allow the substantial variabilities in vibration sensitivities of people and buildings to be considered. The inclusion of higher "Category B" criteria allows a graduated response whereby more intense assessment and monitoring is required above the Category B criteria than between the Category A and B criteria.

82. I have used the same PPFs identified as receivers for operational noise effects in my assessment of construction noise and vibration.

83. Based on construction noise and vibration levels for similar infrastructure projects, I have identified PPFs within a 200 metre buffer distance from the proposed designation whereby they are likely to be affected to some extent but where compliance with noise and vibration criteria will generally be achieved using standard practices. I have then identified PPFs within a 50 metre buffer distance whereby enhanced mitigation might be required to maintain compliance with noise and vibration criteria. I have considered construction activities in each of these "hot spot" areas and potential mitigation.

[15] British Standard BS 5228-2:2009 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration.

MODEL FORECAST

84. Details of the acoustics model for operational road-traffic noise are set out in **Appendix 2.B**. Predicted road-traffic sound levels at each PPF under each of the five scenarios modelled are shown in the following table.

Table 2.4: PPFs and predicted sound levels

PPF / Address	*NZS 6806 type*	*Predicted $L_{Aeq(24h)}$ sound levels, dB*				
		Without Project			*With Project*	
		Pre-existing (2016)	*Existing (2018)*	*Future (2041)*	*Without mitigation (2041)*	*With mitigation (2041)*
1213 Fitzherbert East Road	altered	58	56	59	58	58
1158 Fitzherbert East Road*	altered	49	46	49	51	51
1171 Fitzherbert East Road*	altered	50	44	47	52	52
1630 Napier Road	altered	54	44	47	55	55
5 Adele Street	altered	70	66	69	71	66
9 Adele Street	altered	59	55	58	60	55
4 Franklin Road	altered	66	57	60	59	57
5 Franklin Road	altered	62	52	55	57	54
9 Hampson Street	altered	58	54	57	60	55
75 Hope Road	new	39	42	45	57	52
29 Hope Road	new	45	49	52	53	48
3 Mabel Street	altered	65	60	63	66	61
5 Stanley Street	altered	55	57	60	57	53
9 Stanley Street	altered	55	54	57	57	52
49899 State Highway 3	altered	69	65	68	70	65
49901 State Highway 3	altered	67	63	66	68	63
49846 State Highway 3	altered	66	57	60	58	56
49807 State Highway 3	new	48	34	37	56	51
49807A State Highway 3	altered	58	45	48	53	49
15 Troup Road	altered	57	53	56	57	52

*Only the altered section of SH57 Fitzherbert Road near SH3 is included in the model

85. An overview of the modelled noise contours over the wider area for each scenario is shown in Volume 4, drawings N1 to N5. More detailed contours for the final scenario of the Project with mitigation are shown in Volume 4, drawings N6 to N11.

86. The computer model has predicted sound levels across a grid and also at specific PPFs. The grid is interpolated to generate the noise contours giving a visual representation of noise exposure over a wide area. However, I have made my assessment on the basis of the predictions at individual PPFs which are more accurate. Predicted sound levels at PPFs in **Table 2.4** and on the drawings are colour coded according to NZS 6806 categories:

Category A – green, Category B – orange, Category C – red. As set out above, the thresholds for these categories vary between PPFs by new and altered sections or road. In most instances the altered road criteria are applicable other than at three PPFs as listed in **Table 2.4** where new road criteria apply.

87. Previous measurements of engine braking indicate that levels can be in the order of 75 dB L_{AFmax} at a distance of approximately 50 metres from a truck.

88. Road-traffic vibration should comply with the 0.3 mm/s $v_{w,95}$ criterion beyond 15 metres of a new road[16] and some previous measurements by new roads have shown compliance at much shorter distances. All PPFs are further than this distance from the new road. Some PPFs are closer to existing roads but this Project should not result in increased vibration levels at those locations.

89. Construction of the Project will require a range of standard equipment. The majority of the Project involves extensive earthworks, paving and compaction, but there are also structures requiring piling, and there will be general construction activities including construction traffic. On the basis of sound levels predicted and measured for these same activities on previous projects, it is straight-forward to comply with the 70 dB $L_{Aeq(15\ min)}$ daytime construction noise limit and 1 mm/s daytime vibration limit for occupied buildings at a distance of 200 metres. Increased noise screening and management can be required to maintain compliance at shorter distances, and for construction activities closer than 50 metres to PPFs it might not be practicable to comply with the daytime noise limit or the 5 mm/s unoccupied building vibration limit at all times, or might require enhanced mitigation. From my experience with constrained urban sites it still remains feasible to manage construction noise and vibration effects in these instances, but more detailed investigation can be required.

PROJECT SHAPING

Route options

90. In 2017 I advised the NZ Transport Agency on potential noise and vibration effects from long-list and short-list options and sub-options for a new route for SH3 to replace the Manawatū Gorge. At the long-list stage there were options with cuts, viaducts and tunnels that would limit the gradient of the

[16] NZ Transport Agency (2015) Guide to the management of effects on noise sensitive land use near to the State highway network, September 2015, Version 1.0.

new road and would be preferable in terms of operational noise as it would reduce vehicle engine and braking sounds. However, for other reasons, all options that progressed to the short-list were for routes passing over the hills with similar adverse noise effects associated with road gradients. I advised that gradients were not a fatal flaw with these options.

91. Of the short-list options and sub-options, I identified increased effects where the routes connected into different parts of the existing State highway network to the pre-existing Manawatū Gorge route or passed near houses previously unaffected by State highway road-traffic noise. One of the options in particular (Option 4) connected to SH3 closer to Palmerston North at Stoney Creek Road. That option would have resulted in significantly increased traffic using Stoney Creek Road and other minor roads outside the Project area, causing substantial adverse noise effects. In this respect the selected route is preferable to other short-list options and sub-options as it does not affect many additional houses to the pre-existing scenario.

92. In terms of construction noise and vibration, some of the long-list options such as the large cut option would have caused substantially greater adverse effects due to activity associated with disposal of extreme quantities of cut material off-site. However, for the short-list options I identified that all routes would have similar construction noise and vibration effects to a degree that should be manageable with conventional methods.

93. The proposed designation for the selected route is near to a small number of PPFs. The larger number of receivers by the modelled roads shown on Volume 4, drawings N1 to N5, is due to my extension of the noise assessment area beyond the designation, but those are not affected by the Project shaping for the selected route which relates only to the designation. The PPFs near the designation are only in the bridge to bridge area and on the lower eastern slope and Woodville gateway.

94. Noise and vibration considerations have not needed to influence the Project shaping with respect to the central part of the Project in the wind farm area and upper slopes where it is remote from PPFs.

95. At both east and west ends of the Project, roundabouts are proposed in the vicinity of PPFs. Roundabouts cause all traffic to brake and accelerate to some extent, resulting in disturbing sound characteristics from some vehicles. During the Project shaping the Project team considered whether

alternative intersection forms could be used to allow the main traffic flow to move freely to avoid or reduce braking and acceleration sounds.

96. Roundabouts have been maintained in the indicative design for road safety and intersection efficiency reasons. With forecast traffic movements I understand from Mr Dunlop that the intersection of SH3 and SH57 will give a substandard level of service without a roundabout (or signalisation/grade separation). From a safety perspective, I understand the roundabouts at both ends are required to signal a change in road environment as vehicles come to the end of the long descents on separated carriageways. The potential noise effects of maintaining roundabouts are set out later in my assessment.

97. Through the Project shaping the designation has been extended so the locations of the two roundabouts can been moved away from PPFs as far as practicable.

98. The road gradients of the indicative alignment will give rise to engine braking noise effects. In the Project shaping there were no practical options that would avoid the need for relatively steep gradients at both ends of the Project. This is an inherent feature of the Project and minor changes to the gradients would not materially alter engine braking issues.

ASSESSMENT OF EFFECTS

Positive effects

Ashhurst

99. The Project results in a substantial reduction in traffic volumes through Ashhurst. Compared to the scenario without the Project in 2041, with the Project, road-traffic noise is reduced by approximately 7 dB at in the order of 250 houses in Ashhurst. With the Project, the majority of these houses have a noise exposure of less than 57 dB $L_{Aeq(24h)}$, which is the most stringent new road criteria in NZS 6806. This represents a significant positive effect of the Project, although for residents this might be perceived simply as a return to the pre-existing (2016) situation.

100. Road-traffic vibration has not been quantified in Ashhurst, but there are numerous PPFs close to the road and there has been reported vibration disturbance. The frequency of heavy vehicles causing vibration disturbance in Ashhurst will significantly reduce with the Project. As the vibration levels

have not been quantified the extent of this positive effect is not certain, but it will be at least a minor positive effect of the Project.

Woodville

101. The Project results in a substantial reduction in traffic volumes on Woodlands, Oxford and Pinfold Roads around Woodville. Compared to the scenario without the Project in 2041, with the Project, road-traffic noise is reduced by 10 dB or more at in the order of 25 houses on the outskirts of Woodville. Again, while this represents a significant positive effect of the Project, for residents this might be perceived simply as a return to the pre-existing (2016) situation.

Adverse effects

Operational

Ashhurst (Napier Road)

102. Numerous PPFs will be exposed to increased road-traffic noise as a result of the Project, which is an adverse effect.

103. The following two figures show future (2041) predicted road-traffic sound levels on SH3 Napier Road in Ashhurst between Cambridge Avenue (left) and the Manawatū River (right), with and without the Project. The figures show overall noise contours in 1 dB increments, coloured in 5 dB bands, and also label the predicted sound level at each PPF. PPFs are colour coded according to NZS 6806 categories. The cut batters by the road to the right of the figures have not been accurately modelled due to limited digital terrain data, but the overall trends shown are realistic.

Figure 2.1: Ashhurst (Napier Road) noise contours without the Project

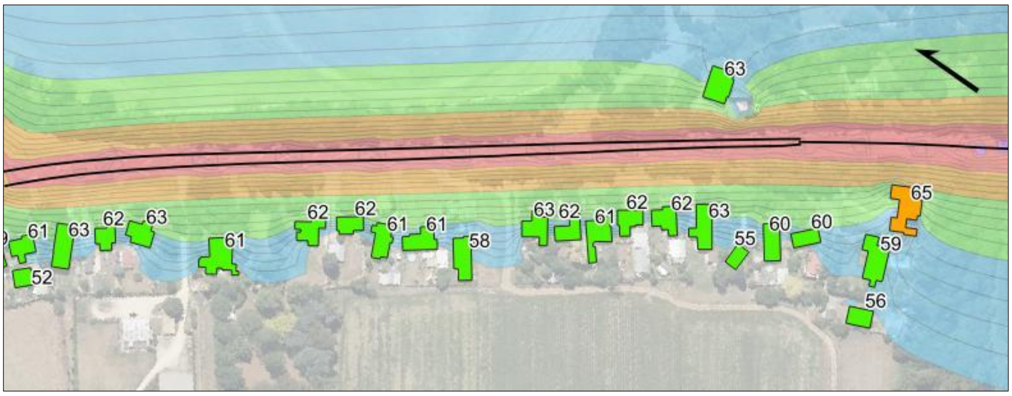
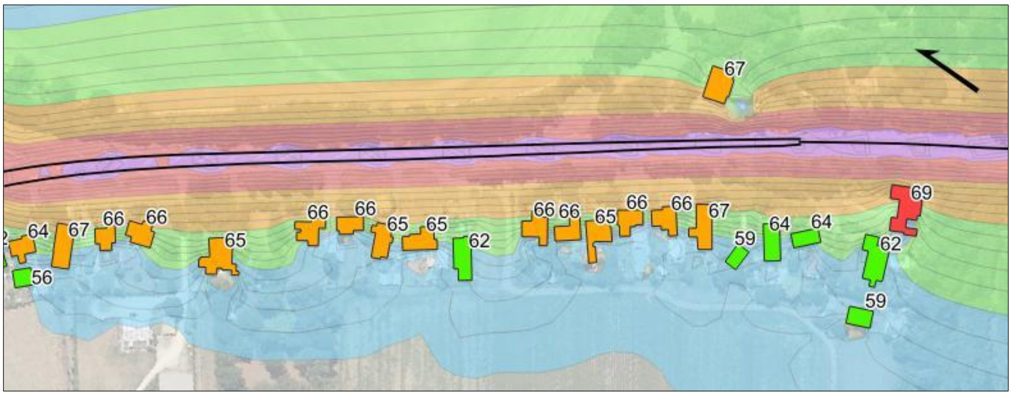


Figure 2.2: Ashhurst (Napier Road) noise contours with the Project

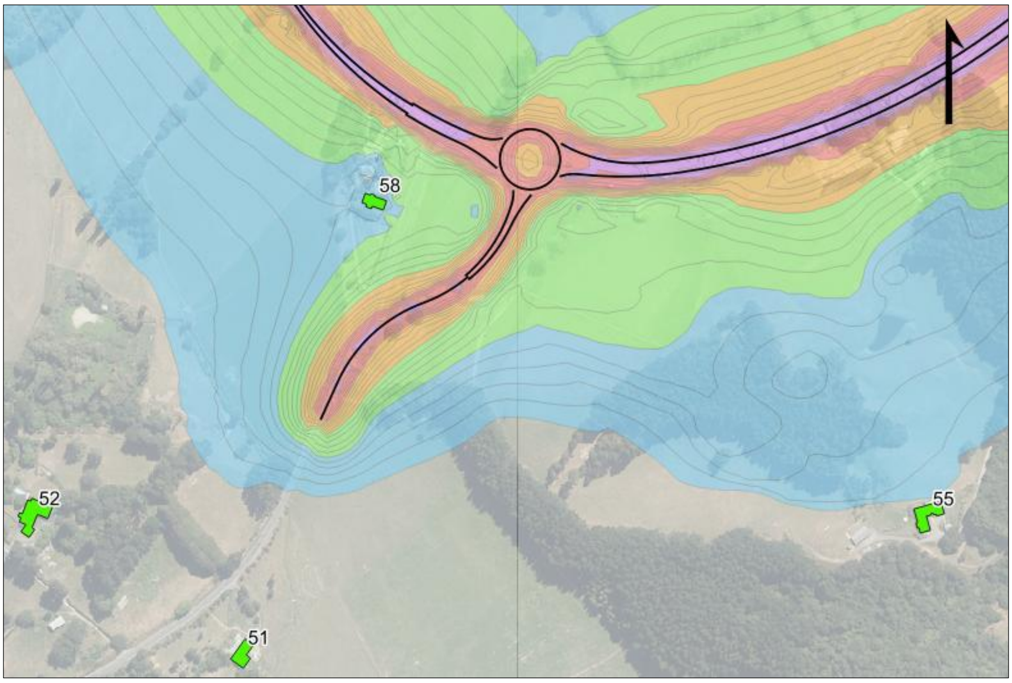


104. There are in the order of 24 PPFs in this area that without the Project will be exposed to future road-traffic noise levels mainly below NZS 6806 Category A, 64 dB $L_{Aeq(24h)}$. With the Project, 16 of these PPFs move into Category B and 1 is exposed to more than 67 dB $L_{Aeq(24h)}$ so moves into Category C. The noise levels increase by approximately 4 dB which is a modest amount, but the resulting noise exposures are high, as can be seen from the NZS 6806 categories. On this basis I consider this increased exposure to represent a significant adverse noise effect.

Bridge to bridge

105. In the bridge to bridge area there are four PPFs that will receive road-traffic noise within NZS 6806 Category A for the future scenario with the Project, as shown in the following figure. As these PPFs already experience road-traffic noise in the environment the noise effect should generally be minor.

Figure 2.3: Bridge to bridge noise contours with the Project



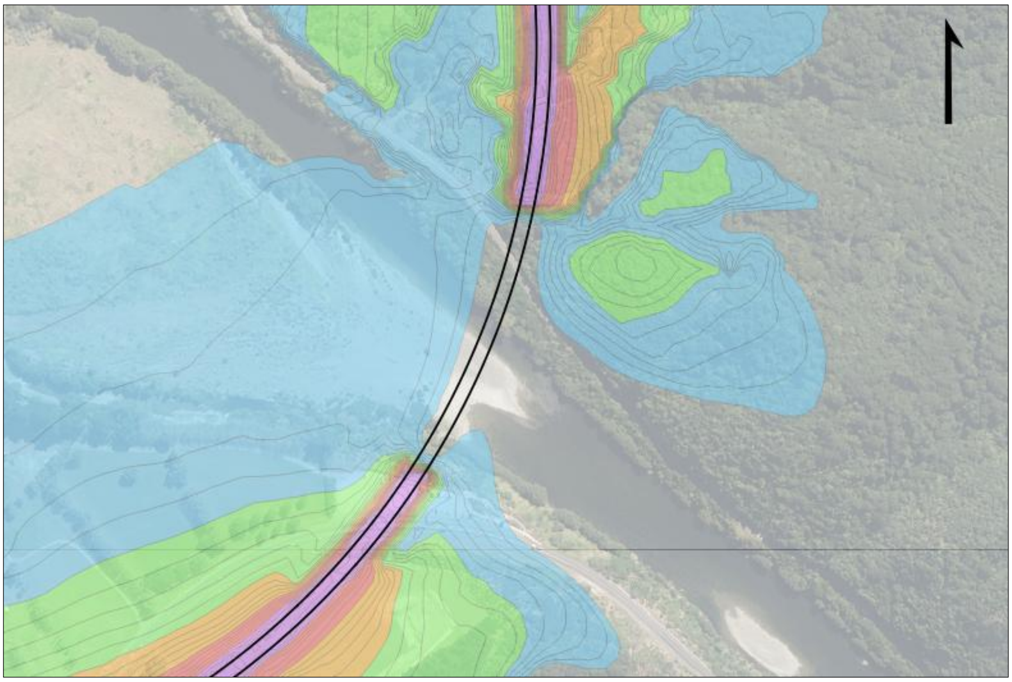
106. The acoustics modelling for the PPF adjacent to the SH3 and SH57 intersection includes noise screening by an existing earth bund beside the property. I will discuss the durability of that bund later with respect to mitigation measures.

107. Sound characteristics from vehicles traversing the roundabout could cause significant disturbance at nearby PPFs. If there were no controls to moderate driver behaviour at this roundabout this could result in a significant adverse noise effect.

New Manawatū River/Gorge bridge

108. The following figure shows future noise contours at the Manawatū Gorge car park and visitor area with the Project. The model includes a 0.8 m high concrete safety barrier on the sides of the bridge and approach embankment.

Figure 2.4: New Manawatū bridge noise contours with the Project



109. Road-traffic noise will control the aural environment at the car park and visitor area. There are no standardised criteria for this situation. In the context of an area that is dependent on vehicle access, and has historically been adjacent to a State highway, the adverse effect of road-traffic noise in this area is considered minor.

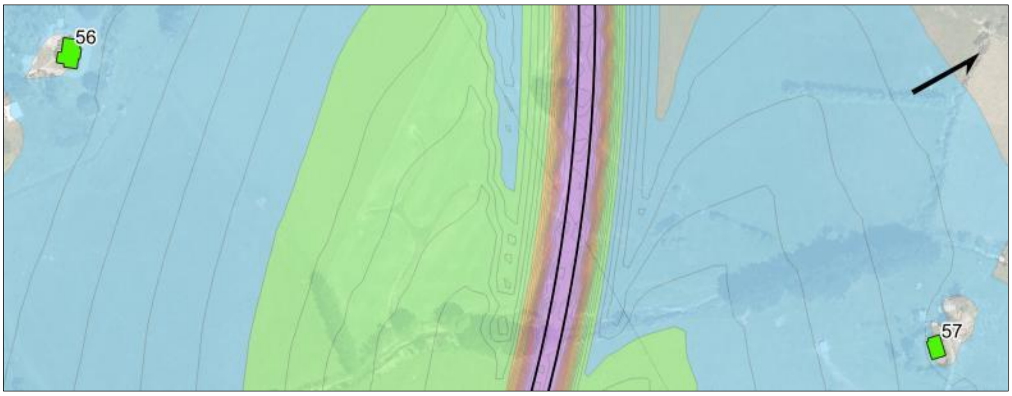
Western slope and Te Āpiti wind farm and ridge

110. There are no PPFs near the western slope or upper eastern slope. However, sound from trucks engine braking will be audible over a wide area, albeit at modest levels. This sound will be similar to trucks engine braking on the existing Saddle Road. As such, while there will be some variation in where the sound is heard, the noise effect should be minor.

Eastern slope

111. There are two PPFs near the lower eastern slope that are both predicted to receive road-traffic noise within NZS 6806 Category A, as shown in the following figure.

Figure 2.5: Lower eastern slope noise contours with the Project

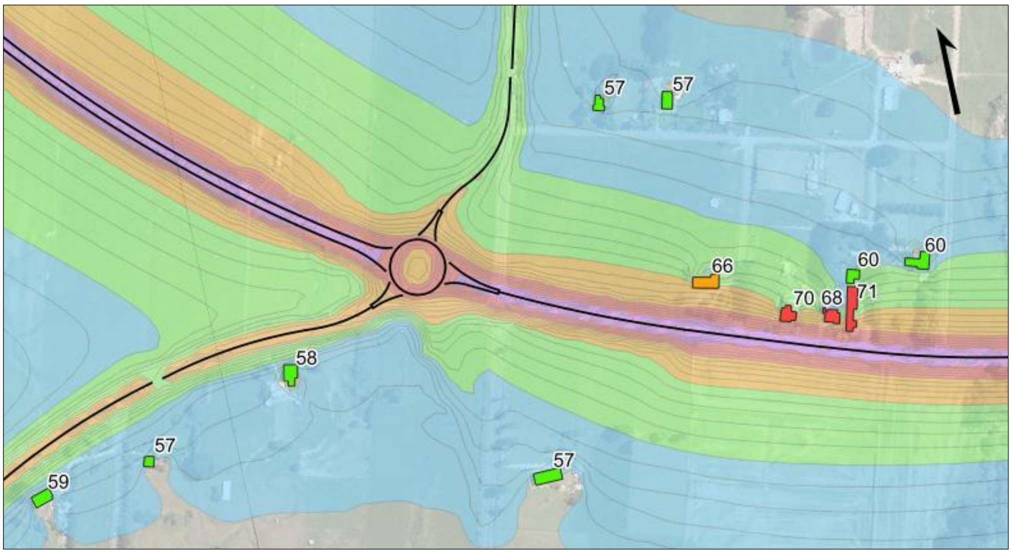


112. These PPFs currently experience relatively low levels of road-traffic noise from the wider environment and with the Project there will be a marked change. However, the resulting road-traffic sound levels are in compliance with NZS 6806 Category A, and the noise effect should generally be minor. However, adverse effects of engine braking noise at these PPFs are potentially significant.

Woodville gateway

113. At the Woodville gateway there are numerous PPFs in the vicinity of the roundabout. The noise levels at most of these PPFs are predicted to be in NZS 6806 Category A as shown on the following figure. There is one PPF by Vogel Street in Category B and three in Category C. I have addressed these four PPFs in my consideration of effects along all of Vogel Street through Woodville below.

Figure 2.6: Woodville gateway noise contours with the Project



114. All PPFs in this area are already affected by road-traffic noise and the predicted future increase should only have a minor adverse noise effect. However, as for the western roundabout, sound characteristics from vehicles traversing the eastern roundabout could cause significant disturbance at these PPFs. If there were no controls to moderate driver behaviour at this roundabout this could result in a significant adverse noise effect.

Woodville

115. The Project results in a substantial increase in future traffic volumes using SH3/2 Vogel Street through Woodville. The following two figures show future (2041) predicted road-traffic sound levels in Woodville with and without the Project.

Figure 2.7: Woodville (Vogel Street) noise contours without the Project

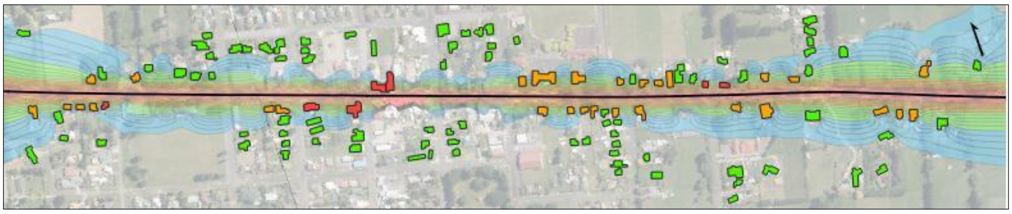
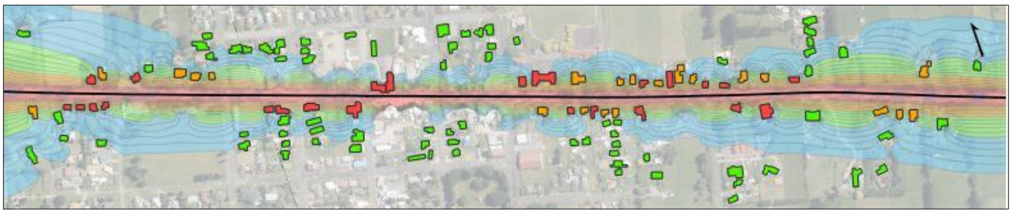


Figure 2.8: Woodville (Vogel Street) noise contours with the Project



116. Without the Project, 39 PPFs in Woodville are predicted to be in Categories B or C, and this number would increase to 50 PPFs with the Project. While the Project is only a contributing factor to existing high noise exposures, it does materially worsen an unsatisfactory situation whereby residents are subject to road-traffic noise levels above recommended criteria. In my opinion this would be a significant adverse effect.

117. I understand that in response to community feedback based on economic considerations, the Project has been constrained so State highway traffic remains travelling through the centre of Woodville. To some extent the adverse noise effect is an unavoidable consequence of that decision.

Sensitivity to road alignment changes

118. I have reviewed road-traffic noise effects with respect to the sensitivity of acoustics modelling to changes in the alignment within the designation. Generally, I have found that my assessment is not sensitive to changes to the alignment within the designation, but I have identified three areas where changes in the alignment could potentially alter my assessment:

(a) at the SH3/SH57 intersection I have assumed the traffic lanes around the roundabout are at least 100 metres from the nearest PPF;

(b) at the lower eastern slope I have assumed that traffic lanes are at least 200 metres from the nearest PPFs; and

(c) at the Woodville gateway I have assumed the traffic lanes around the roundabout are at least 100 metres from the nearest PPFs.

119. If the alignment moved within these distances, the noise exposure categories of PPFs are likely to increase and the degree of noise effects would worsen. I have discussed appropriate conditions to avoid that occurring later in my assessment.

Operational vibration

120. Throughout the Project, no PPFs are closer than 15 metres to new roads, even allowing for the alignment to move within the designation. There are no PPFs near potential bridge joints. Therefore, operational vibration should comply with the criteria and while it may be felt by people the adverse vibration effects should be minor.

Construction

121. Volume 4, drawing N12 shows PPFs within a 200 metre and 50 metre buffer of the designation where construction works may occur.

122. There are two areas where works in the proposed designation may be closer than 50 metres to PPFs:

(a) SH3 and SH57 intersection; and

(b) Woodville gateway.

123. In these areas there are no structures to be constructed near PPFs and only standard earthworks are required. As such, there are a range of options that

are available to maintain compliance with the noise limits in these areas, including temporary screening if necessary. There is scope in these areas to avoid site access points, yards, laydown areas and fixed plant close to PPFs.

124. On the basis that normal good practice is followed,[13] works should generally comply with the construction noise and vibration criteria in all areas. The works will cause temporary daytime disturbance to residents, but most people should be able to continue normal domestic activities with only minor adjustments, particularly if there is effective advanced communication about when construction activities are due to occur. There should not be significant night works near PPFs, other than potentially short-term activity that may be required to connect to the existing road network (and other activities noted in the Project description in Part C of the AEE), without causing daytime traffic disruption. Therefore, any potential sleep disturbance effects should be limited. On this basis I consider that adverse noise and vibration effects from construction within the designation should be minor.

125. Construction traffic passing through Ashhurst may exacerbate existing operational road-traffic noise disturbance. For occasional heavy vehicles during the daytime and light vehicles, construction traffic should not be distinct from general traffic in Ashhurst and should only have a minor adverse noise effect. However, if bulk imported fill/aggregate were to pass through Ashhurst it could materially increase existing noise disturbance. Potentially there could be in the order of 100 heavy construction vehicles a day passing through Ashhurst at peak times. The extent of the effect would depend on the number of trucks, timing and duration, but could be significant.

126. Construction traffic passing through Woodville would use the existing State highways (SH2 and SH3). While a temporary increase in heavy vehicle traffic may be noticeable, the noise effects should be minor in this environment.

SUMMARY RATING OF EFFECTS

127. The Project will result in a significant positive effect from reduced road-traffic noise in Ashhurst and around the outskirts of Woodville.

128. Without mitigation the Project will result in significant adverse noise effects from increased traffic on SH3 Napier Road in Ashhurst between Cambridge Avenue and the Manawatū River, and on SH3/2 Vogel Street through Woodville.

129. Without mitigation the Project might result in significant adverse effects from sound of individual vehicles braking and accelerating at the two roundabouts, and from vehicles engine braking near PPFs on the lower eastern slope.

130. Without mitigation other operational road-traffic noise and vibration effects should be minor.

131. With standard good practice management, adverse noise and vibration effects from construction in the designation should be minor.

132. Noise from transporting bulk imported fill/aggregate is potentially a significant adverse effect if large numbers of trucks pass through Ashhurst for an extended period and/or at night.

MEASURES TO AVOID, REMEDY OR MITIGATE ACTUAL OR POTENTIAL ADVERSE NOISE AND VIBRATION EFFECTS

Proposed mitigation measures

Operational

Ashhurst (Napier Road) and Woodville

133. I have identified a significant adverse noise effect that could arise from increased traffic on SH3 Napier Road in Ashhurst between Cambridge Avenue and the Manawatū River, and on SH3/2 Vogel Street through Woodville. In both areas the scope for noise barriers is limited by gaps that would be needed for driveways from the road. In both areas there is currently a chip seal road surface, other than a short section of asphaltic surface at the SH3/SH2 intersection in Woodville.

134. Chip seal is a relatively noisy road surface type and a noticeable reduction in noise in the order of 4 dB could be achieved in both areas by using an asphaltic surface. The exact type of surface would depend on engineering requirements, but a significant noise reduction could be achieved in these locations by use of either porous asphalt or stone mastic asphalt. Based on a porous asphalt surface the predicted sound levels would be reduced as shown in the following figures:

Figure 2.9: Ashhurst (Napier Road) noise contours with the Project and an asphaltic road surface

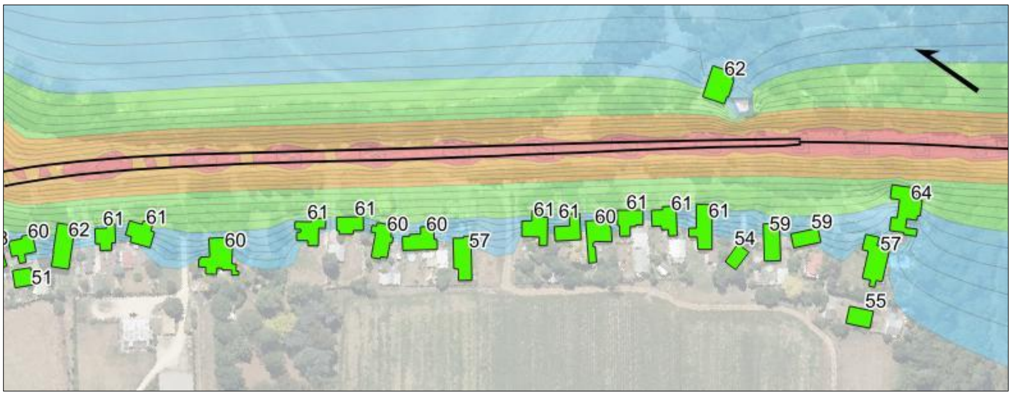


Figure 2.10: Woodville (Vogel Street) noise contours with the Project and an asphaltic road surface

135. It can be seen that with an asphaltic surface all PPFs by this section of SH3 Napier Road in Ashhurst and most PPFs by Vogel Street in Woodville are in NZS 6806 Category A. On this basis, with an asphaltic road surface, the residual adverse noise effect in these areas would be minor.

Bridge to bridge and Woodville gateway

136. I have identified a potentially significant adverse noise effect at each of the roundabouts due to individual vehicles braking and accelerating. To mitigate this effect, the road environment needs to encourage gradual speed changes. I have liaised with Mr Bentley who has confirmed it is practical to clearly signal the presence of the roundabouts and the changing environment through bold landscape treatment of the areas. He is including principles for these treatments in the ECDF, which would be further developed in due course and shown as part of the Outline Plan for these works.

137. On the basis that the road design minimises disturbance from individual vehicles at roundabouts, and roundabout traffic lanes are at least 100 metres from PPFs, I consider that the residual adverse noise effect should be minor.

138. The acoustics modelling relies on the presence of an existing earth bund around the PPF at the intersection of SH3 and SH57. The bund has steep sides that might not be durable to provide a long-term barrier. There is space within the designation to either enhance or replace this existing bund. I recommend that, subject to landowner approval, the upgrading of this bund to maintain the current noise reduction be addressed through the ECDF, with details included in the Outline Plan.

Eastern slope

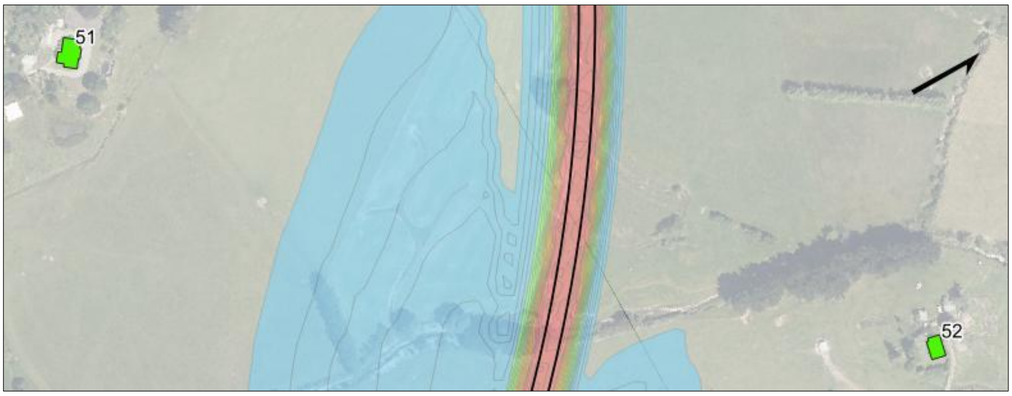
139. For the two PPFs nearest the lower eastern slope I have identified engine braking as a potentially significant adverse effect. I am not aware of a method to address this effect other than fitting individual trucks with effective exhaust silencers, which is beyond the powers of the road controlling authority. In other areas engine braking can be prohibited or other methods applied to identify trucks and minimise engine braking use. However, in this location at the end of a long steep downhill gradient it would conflict with safety to restrict or discourage use of engine brakes.

140. Engine braking noise will reduce with distance from the road, so maintaining separation from PPFs will assist in minimising the effect. However, it will still be clearly audible and potentially disturbing at several hundred metres.

141. At the lower eastern slope I previously set out that I consider general road-traffic noise levels to have a minor adverse noise effect, although it does alter the existing environment. Considering the effects of road-traffic noise holistically in this location, while engine braking noise cannot be mitigated directly, it is possible to reduce general traffic noise through barriers or a low noise road surface.

142. On the elevated section of the lower eastern slope a road-side concrete safety barrier could form a noise barrier. However, Mr Bentley has advised that any solid road-side barriers in this location are not preferred from a visual and landscape perspective, although could be used if necessary for noise mitigation. A low noise asphaltic road surface extending for 1.5 km from the roundabout up the eastern slope would reduce road-traffic noise by approximately 4 dB resulting in the predicted sound levels shown in the following figure:

Figure 2.11: Lower eastern slope noise contours with the Project and an asphaltic road surface



143. With this general reduction in road-traffic noise from an asphalt surface, or alternative reduction by a solid barrier, and if traffic lanes are kept at least 200 metres from PPFs, while engine braking noise will still be clearly audible, I consider that the overall noise effects in this area should be minor.

Construction

144. As described previously, if construction activities are managed in accordance with normal good practice then noise and vibration effects should be minor. A standard approach adopted for most major State highway projects is to use a Construction Noise and Vibration Management Plan ("**CNVMP**") to provide a structure through which issues can be identified and actioned. I consider that such a control is appropriate to give effect to my assumption of normal good practice being applied.

145. I have highlighted a potential significant effect if high volumes of heavy construction vehicles pass through Ashhurst, particularly at night. I recommend this issue should be addressed through a CTMP, noting that the draft conditions relating to the CTMP state that, as a minimum, the CTMP must describe methods to limit the movement of heavy vehicles through Ashhurst at night. Heavy construction vehicles should not travel through Ashhurst at night other than oversized loads and essential movements such as if concrete trucks are needed for continuous pours. With controls in a CTMP minimising bulk imported fill/aggregate movements in particular, the residual noise effects should be minor.

Conditions

146. Designation conditions for road-traffic noise are often performance based at least in part, allowing flexibility for alternative mitigation solutions as the road design is developed. However, in this instance the available options are limited, and greater certainty is provided by requiring specific treatments. These specified treatments exceed the requirements of NZS 6806, although confirmation of compliance with NZS 6806 should be provided in the Outline Plan for the works.

147. To give effect to my recommendations for noise mitigation set out above, I recommend that conditions should be imposed on the designation requiring the following:

(a) Prior to opening of the new road an asphaltic surface must be laid on SH3 Napier Road in Ashhurst between Cambridge Avenue and the Manawatū River and for the extent of SH3/2 Vogel Street in Woodville.

(b) Within 12 months of the new road opening to traffic either an asphaltic surface must be laid on the main alignment, or concrete safety edge barriers must be used, from the eastern roundabout extending at least 1.5 km to the west of the roundabout.

(c) The ECDF must include road environment design principles to encourage vehicles to make gradual speed changes approaching and departing from the two roundabouts.

(d) The ECDF must address upgrading of the existing bund, subject to landowner approval, at the SH3/SH57 intersection to provide enduring noise mitigation.

(e) Traffic lanes of roundabouts must not be closer than 100 metres to PPFs.

(f) Traffic lanes must not be closer than 200 metres to the houses at 49807 State Highway 3 and 75 Hope Road, Woodville.

(g) Construction noise and vibration must be controlled through a CNVMP.

(h) The CTMP must include methods to minimise heavy construction traffic passing through Ashhurst, including avoidance of heavy construction traffic passing through Ashhurst at night other than oversized loads and essential deliveries.

CONCLUSION AND RECOMMENDATIONS

148. I have assessed operational and construction noise and vibration from the Project. I have found that due to the small number of PPFs near the designation, potential noise and vibration effects are generally minor. However, there are potentially significant adverse effects arising from individual vehicles negotiating roundabouts at each end of the Project and from heavy vehicles using engine brakes on long steep descents.

149. I have recommended design of the road environment to moderate vehicles at roundabouts and minimum separation distances between roundabouts and houses. With these measures the adverse effect should be minor.

150. While the effects of engine braking noise cannot practically be fully mitigated, I have recommended an asphaltic road surface on the lower eastern slope and minimum separation distances to minimise the overall road-traffic noise effect. With these measures I consider there will be a minor adverse noise effect in this area.

151. In the wider area I have found the Project will have significant positive effects through a reduction in road-traffic noise in Ashhurst, but without mitigation there could be significant adverse effects through increased road-traffic noise on SH3/2 Vogel Street in Woodville and on SH3 Napier Road in Ashhurst. I have recommended an asphaltic road surface in these areas that would reduce noise levels and result in a minor adverse effect.

152. Construction will use standard processes, and I have found that noise and vibration effects should be minor if normal good practice controls are applied. Bulk construction traffic passing through Ashhurst could have potentially significant adverse noise effects, but this could be controlled through a CTMP.

153. In summary, while there are various potential noise and vibration effects, with the mitigation and conditions I have recommended the residual noise and vibration effects are all likely to be minor. The construction and operational activity will be clearly audible over a wide area, but at reasonable levels that should be compatible with the environment. In my opinion the noise and vibration effects of the Project are likely to be acceptable.

Dr Stephen Chiles

2.A
GLOSSARY OF ABBREVIATIONS & TERMS

APPENDIX 2.A: Glossary of abbreviations and terms

Table 2.A.1: Glossary of abbreviations

Abbreviation	*Description*
AADT	Annual average daily traffic
BS	British Standard
CNVMP	Construction noise and vibration management plan
CTMP	Construction traffic management plan
dB	Decibels
DIN	German Standard (Deutsches Institut für Normung)
ECDF	Environmental and cultural design framework
HV	Heavy vehicle
km	Kilometre
km/h	Kilometres per hour
$L_{Aeq(24h)}$	Time-average sound level over a twenty-four hour period, measured in dB
$L_{Aeq(15min)}$	Time-average sound level over a 15 minute hour period, measured in dB
L_{AFmax}	Maximum sound level, measured in dB
mm/s	Millimetres per second
NS	Norwegian Standard
NZS	New Zealand Standard
PPF	Protected premises and facilities
ppv	Peak particle velocity
SH2	State Highway 2
SH3	State Highway 3
SH57	State Highway 57
$v_{w,95}$	Statistical maximum weighted velocity with 95% probability
vpd	Vehicles per day

Table 2.A.2: Glossary of terms

Term	*Definition*
Annual average daily traffic	The total volume of traffic passing a roadside observation point over the period of a calendar year, divided by the number of days in that year (365 or 366 days). Measured in vehicles per day.
Free-field (Noise)	Description of a location which is at least 3.5 metres from any significant sound reflecting surface other than the ground.
Vehicles per day	The number of vehicles observed passing a point on a road in both directions for 24 hours.
Traffic volume	The number of vehicles flowing in both directions past a particular point in a given time (e.g. vehicles per hour, vehicles per day).

2.B
ACOUSTICS MODELLING DETAILS

APPENDIX 2.B: Acoustics modelling details

Road-traffic sound levels have been predicted using an acoustics computer model with the following parameters.

Table 2.B.1: Acoustics modelling details

Parameter	*Setting/source*
Operator	John Bull (detail checking – Stephen Chiles)
Software	CadnaA 2018 (build 161.4801)
Algorithm	CRTN (Calculation of Road Traffic Noise. UK Department of Transport and the Welsh Office. ISBN 0115508473. 1988) Low traffic flow cut-offs and adjustments have not been applied.
Parameter	$L_{Aeq(24h)}$ (taken as $L_{10(18h)}$ - 3dB)
Receivers	Free-field, 1.5 m high at ground floor, all buildings approximated as single-storey (height relative to the ground at one corner of the building estimated to be representative)
Sound contour grid	Free-field, 1.5 m high
Ground absorption	0.5
Road surface	Corrections in accordance with NZTA Guide to State highway road surface noise, v1, January 2014, p37.
Terrain	Base terrain: Palmerston North DEM, LINZ Data Service (15 metre resolution). This data is relatively coarse and has resulted in modelling artefacts occurring in some areas. While these issues affect the shape of noise contours in places such as at existing bridges and where there are steep gradients, they do not affect the modelling of the new alignment and are not material to the conclusions of the assessment. Within 200m of earthworks: Study_Area_LiDAR_Merged.las, GHD (resampled to 5 metre resolution) Existing bund at 1213 Fitzherbert East Road: manually added with an assumed height of 2 metres relative to the surrounding terrain.
New roads	51_38113_XC_NOR_BASE_OPTION_V3_WGS84_20180827.shp (received from GHD 28/08/18)
Building footprints	NZ Building Outlines, LINZ Data Service (retrieved 13/08/18)
PPF addresses	NZ street addresses, LINZ Data Service (retrieved 09/08/18)

Five scenarios have been modelled with the road and traffic characteristics set out in the following table.

Table 2.B.2: Road and traffic characteristics

Scenario	*Road*	*From*	*To*	*AADT*	*%HV*	*Speed*	*Surface*
2016 – Pre-existing	SH3	Cambridge	80km/h sign	7360	11	80	Chipseal
		80km/h sign	SH57			100	
2018 – Existing	SH3	Cambridge	80km/h sign	2903	14	80	Chipseal
		80km/h sign	SH57			100	
2041 – Without Project	SH3	Cambridge	80km/h sign	5805	14	80	Chipseal
		80km/h sign	SH57			100	
2041 – With Project	SH3	Cambridge	SH57	14720	11	80	Chipseal
2041 – Project with mitigation	SH3	Cambridge	Manawatu River	14720	11	80	PA10
		Manawatu River	SH57				Chipseal
2016 – Pre-existing	SH3 (Gorge)	SH57	Gorge	7620	12	100	Chipseal
2041 – With Project	SH3 (New)	SH57	100m east of SH57	15240	12	80	Chipseal
		100m east of SH57	100m west of Woodlands			100	
		100m west of Woodlands	Woodlands			80	
2041 – Project with mitigation	SH3 (New)	SH57	100m east of SH57	15240	12	80	Chipseal
		100m east of SH57	1.5km west of Woodlands			100	
		1.5km west of Woodlands	100m west of Woodlands			100	PA10
		100m west of Woodlands	Woodlands			80	
2016 – Pre-existing	SH3	Gorge	Woodlands	8058	12	100	Chipseal
2018 – Existing	SH3	Gorge	Woodlands	831	14	100	Chipseal
2041 – Without Project	SH3	Gorge	Woodlands	1662	14	100	Chipseal
2041 – With Project	SH3 (Old)	Gorge	Woodlands	900	10	100	Chipseal
2041 – Project with mitigation	SH3 (Old)	Gorge	Woodlands	900	10	100	Chipseal

Scenario	*Road*	*From*	*To*	*AADT*	*%HV*	*Speed*	*Surface*
2016 – Pre-existing	SH3	Woodlands	50km/h sign	7620	12	100	Chipseal
		50km/h sign	SH2			50	
2018 – Existing	SH3	Woodlands	50km/h sign	4480	10	80	Chipseal
		50km/h sign	SH2			50	
2041 – Without Project	SH3	Woodlands	50km/h sign	8960	10	80	Chipseal
		50km/h sign	SH2			50	
2041 – With Project	SH3	Woodlands	50km/h sign	15240	12	80	Chipseal
		50km/h sign	SH2			50	
2041 – Project with mitigation	SH3	Woodlands	50km/h sign	15240	12	80	PA10
		50km/h sign	SH2			50	
2016 – Pre-existing	SH2	SH3	50km/h sign	5880	13	50	Chipseal
		50km/h sign	Pinfold			70	
2018 – Existing	SH2	SH3	50km/h sign	4039	12	50	Chipseal
		50km/h sign	Pinfold			70	
2041 – Without Project	SH2	SH3	50km/h sign	8078	12	50	Chipseal
		50km/h sign	Pinfold			70	
2041 – With Project	SH2	SH3	50km/h sign	11760	13	50	Chipseal
		50km/h sign	Pinfold			70	
2041 – Project with mitigation	SH2	SH3	50km/h sign	11760	13	50	PA10
		50km/h sign	Pinfold			70	
2016 – Pre-existing	Cambridge	SH3	Mulgrave	8290	11	50	Chipseal
2018 – Existing	Cambridge	SH3	Mulgrave	9072	10	50	PA10
2041 – Without Project	Cambridge	SH3	Mulgrave	18144	10	50	PA10
2041 – With Project	Cambridge	SH3	Mulgrave	16580	11	50	PA10
2041 – Project with mitigation	Cambridge	SH3	Mulgrave	16580	11	50	PA10
2016 – Pre-existing	Salisbury	Mulgrave	Wyndham	1200	10	50	Chipseal
2018 – Existing	Salisbury	Mulgrave	Wyndham	6339	10	50	PA10
2041 – Without Project	Salisbury	Mulgrave	Wyndham	12678	10	50	PA10
2041 – With Project	Salisbury	Mulgrave	Wyndham	2400	10	50	PA10
2041 – Project with mitigation	Salisbury	Mulgrave	Wyndham	2400	10	50	PA10

Scenario	Road	From	To	AADT	%HV	Speed	Surface
2016 – Pre-existing	Saddle	Salisbury	Woodlands	150	10	100	Chipseal
2018 – Existing	Saddle	Salisbury	Woodlands	6078	11	80	Chipseal
2041 – Without Project	Saddle	Salisbury	Woodlands	12156	11	80	Chipseal
2041 – With Project	Saddle	Salisbury	Woodlands	300	10	80	Chipseal
2041 – Project with mitigation	Saddle	Salisbury	Woodlands	300	10	80	Chipseal
2016 – Pre-existing	Woodlands	Saddle	SH3	200	10	100	Chipseal
2018 – Existing	Woodlands	Saddle	SH3	4287	10	80	Chipseal
2041 – Without Project	Woodlands	Saddle	SH3	8574	10	80	Chipseal
2041 – With Project	Woodlands	Saddle	SH3	400	10	80	Chipseal
2041 – Project with mitigation	Woodlands	Saddle	SH3	400	10	80	Chipseal
2016 – Pre-existing	Oxford	Saddle	SH2	240	15	100	Chipseal
2018 – Existing	Oxford	Saddle	SH2	2081	15	80	Chipseal
2041 – Without Project	Oxford	Saddle	SH2	4162	15	80	Chipseal
2041 – With Project	Oxford	Saddle	SH2	480	15	80	Chipseal
2041 – Project with mitigation	Oxford	Saddle	SH2	480	15	80	Chipseal
2016 – Pre-existing	SH57	Aokautere	SH3	2360	14	100	Chipseal
2018 – Existing	SH57	Aokautere	SH3	1728	12	100	Chipseal
2041 – Without Project	SH57	Aokautere	SH3	3455	12	100	Chipseal
2041 – With Project	SH57	Aokautere	SH3	4720	14	100	Chipseal
2041 – Project with mitigation	SH57	Aokautere	SH3	4720	14	100	Chipseal

After the acoustics modelling Mr Dunlop updated his traffic forecast. The updates relate to Cambridge Avenue and SH3 from Cambridge Avenue to SH57 in the scenarios without the Project. The acoustics modelling has not been updated with those latest traffic forecasts but the changes would slightly lessen the noise effects assessed due to the Project.

2.C
SOUND LEVEL SURVEY

APPENDIX 2.C: Sound level survey

1213 Fitzherbert East Road

Table 2.C.1: 1213 Fitzherbert East Road - survey details

Parameter	*Setting/source*
Operator	Michael Smith
Address	1213 Fitzherbert East Road (corner SH3/SH57) NZTM 1834637E 5534202S
Equipment	ARL Ngara Type 1 SLM Serial 878106 calibrated 31/7/18 Pulsar 105 Type 1 calibrator, calibrated 31/7/18
Parameter	$L_{Aeq(24h)}$
Observations	Traffic sound on SH57 audible behind bund. Significant vegetation sound from large trees to the north-west of the property
Average level	54 dB $L_{Aeq(24h)}$
6/9/18	50 dB $L_{Aeq(24h)}$
7/9/18	53 dB $L_{Aeq(24h)}$
8/9/18	58 dB $L_{Aeq(24h)}$
9/9/18	49 dB $L_{Aeq(24h)}$
10/9/18	51 dB $L_{Aeq(24h)}$

Figure 2.C.1: 1213 Fitzherbert East Road – graphs of measured sound levels and meteorological conditions

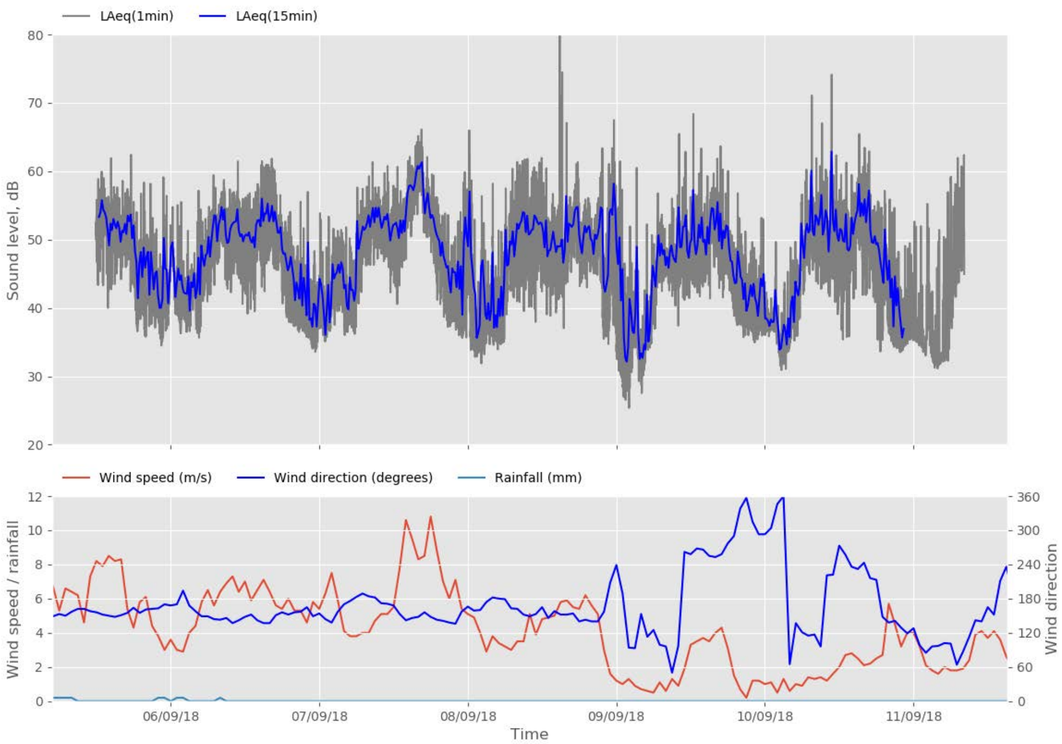


Figure 2.C.2: 1213 Fitzherbert East Road - aerial photograph showing monitoring location

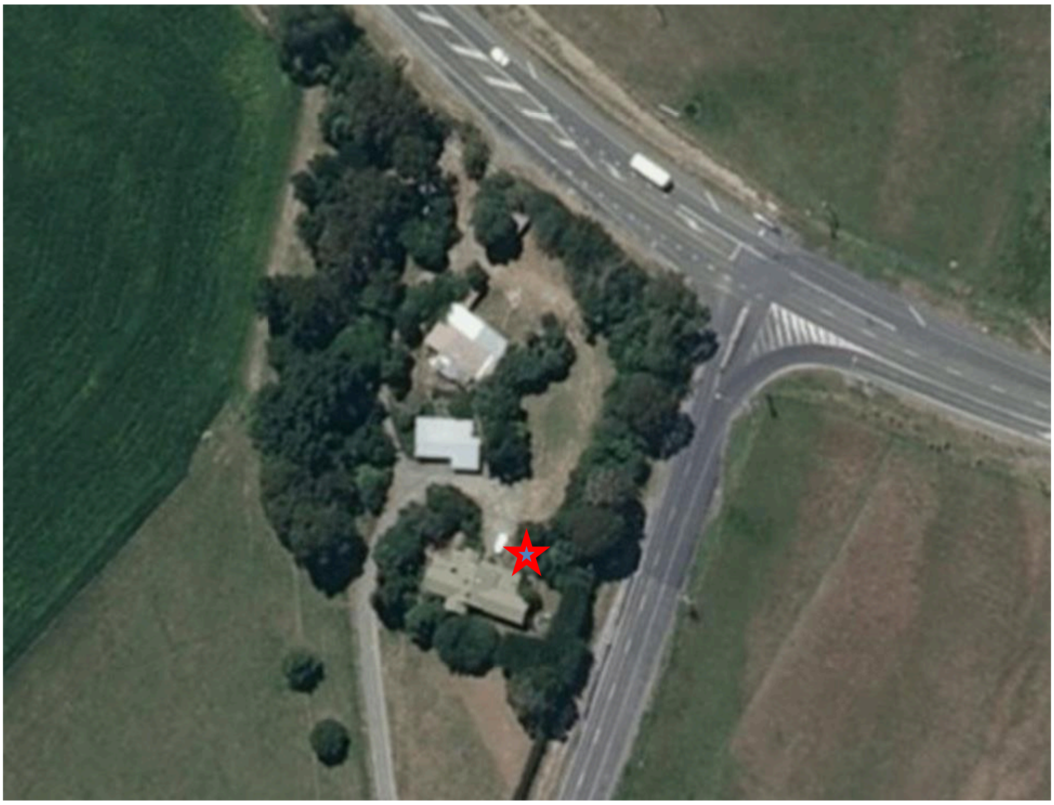


Figure 2.C.3: 1213 Fitzherbert East Road - photographs of sound level monitoring position

North view

East view

South view

West view

75 Hope Road

Table 2.C.2: 75 Hope Road - survey details

Parameter	*Setting/source*
Operator	Michael Smith / Tim Dreadon
Address	75 Hope Road
Equipment	ARL Ngara Type 1 SLM Serial 878106 calibrated 31/7/18
	Pulsar 105 Type 1 calibrator, calibrated 31/7/18
Parameter	$L_{Aeq(24h)}$
Observations	Distant traffic noise was audible, but acoustic environment dominated by natural sounds, particularly wind in trees
Average level	50 dB $L_{Aeq(24h)}$
15/9/18	49 dB $L_{Aeq(24h)}$
16/9/18	50 dB $L_{Aeq(24h)}$
17/9/18	49 dB $L_{Aeq(24h)}$
18/9/18	50 dB $L_{Aeq(24h)}$

Figure 2.C.4: 75 Hope Road – graphs of measured sound levels and meteorological conditions

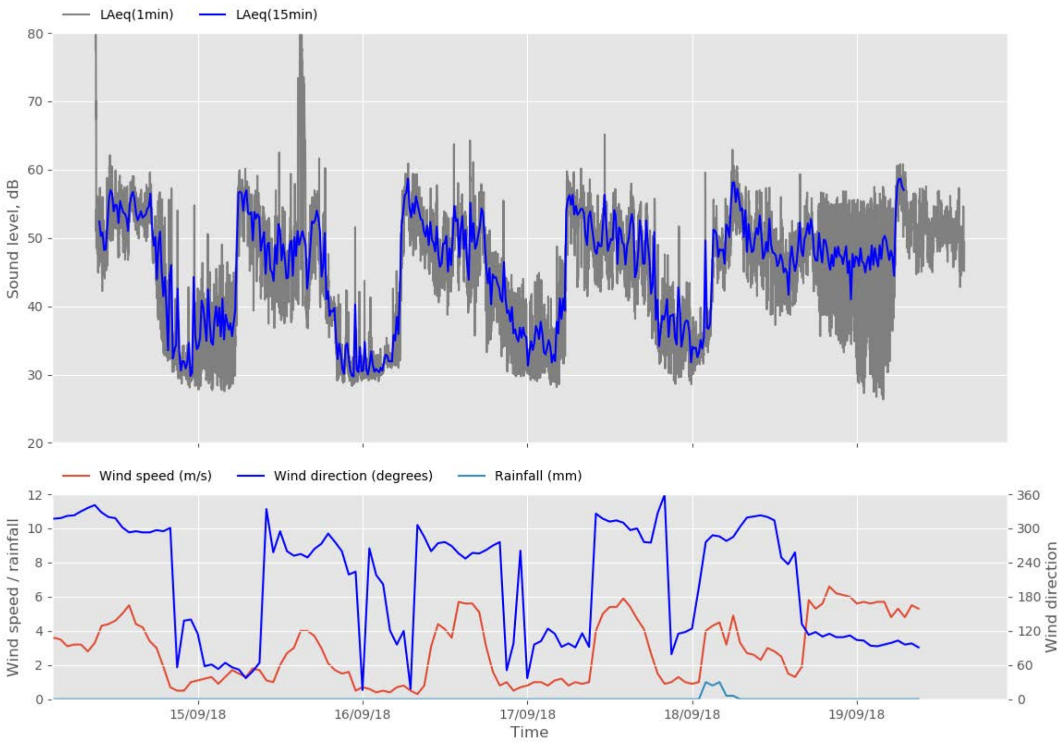


Figure 2.C.5: 75 Hope Road - aerial photograph showing monitoring location

Figure 2.C.6: 75 Hope Road - photographs of sound level monitoring position

North view

East view

South view

West view

3. SOCIAL

IN THE MATTER OF	The Resource Management Act 1991
AND	
IN THE MATTER OF	Notices of requirement for designations under section 168 of the Act, in relation to Te Ahu a Turanga; Manawatū Tararua Highway Project
BY	**NZ TRANSPORT AGENCY** Requiring Authority

TE AHU A TURANGA; MANAWATŪ TARARUA HIGHWAY PROJECT

TECHNICAL ASSESSMENT #3

SOCIAL IMPACT ASSESSMENT

TABLE OF CONTENTS

INTRODUCTION

1. I, **Amelia Linzey** of Beca Limited, am the primary author responsible for the preparation of this Social Impact Assessment ("**SIA**"). With my oversight, Jo Healy of Beca Limited has also contributed to the preparation of this assessment.

Qualifications and experience

2. I have the following qualifications and experience relevant to this assessment:

   (a) over 20 years' professional experience in environmental impact assessment and consultation;

   (b) Master of Science in Geography (First Class Honours) from the University of Auckland and Bachelor of Science; and

   (c) full member of the New Zealand Planning Institute ("**NZPI**") and a member of the International Association of Public Participation (IAP2) and I have undertaken the IAP2 Certificate Programme in Public Participation (2003).

3. I prepared or was otherwise involved in undertaking SIAs for the following projects or matters:

   (a) Ōtaki to North of Levin Transport Corridor, Short List Options, NZ Transport Agency;

   (b) peer review of the Social Impact Monitoring Report for Wiri Prison, Auckland, for the Department of Corrections;

   (c) options for the proposed Huia Water Treatment Plant, Auckland, for Watercare;

   (d) advice to Western Bay of Plenty District Council regarding the social impacts of potential changes to its District Plan, responding to debris flow hazards;

   (e) East West Project (involving preparation of an SIA and presentation of evidence to a Board of Inquiry), for NZ Transport Agency;

   (f) peer review of the SIA for the Redoubt Road-Mill Road Corridor Project, for Auckland Transport;

   (g) the designations for the City Rail Link for Auckland Transport;

   (h) the resource consent applications to abandon the wreck of the MV Rena on the Astrolabe Reef (including presentation of hearing evidence);

(i) the Drury South Plan Change, a private plan change initiated by Stevenson Ltd to extend the Metropolitan Urban Limit and change the zoning of rural land in Auckland (Drury) to a mix of urban land uses (including industrial and business park land);

(j) the Ruakura Inland Port Proposed Plan Change (2013-2014) including presentation of hearing evidence;

(k) the Waterview Connection Proposed Plan Change for the NZ Transport Agency (2010-2011) including presentation of evidence; and

(l) peer review of the MacKays to Peka Peka SIA (2012), for the M2PP Alliance.

4. Jo Healy of Beca Limited has the following qualifications and experience relevant to this assessment:

(a) professional experience in environmental impact assessment and consultation;

(b) Bachelor of Science in Geography and Environmental Science (First Class Honours) from the University of Auckland and Bachelor of Science; and

(c) associate member of the NZPI.

5. She has assisted in undertaking SIAs for the following projects or matters:

(a) Ōtaki to North of Levin Transport Corridor, Short List Options, NZ Transport Agency;

(b) peer review of the Social Impact Monitoring Report for Wiri Prison, Auckland, for the Department of Corrections;

(c) options for the proposed Huia Water Treatment Plant, Auckland, for Watercare; and

(d) input on assessment of social impacts for multi criteria analysis of short list options for a number of safety improvement projects for the NZ Transport Agency (Safe Roads Alliance) including SH16 Safety Improvements, SH22 Safety Improvements, and SH1 to SH15 Safety Improvements.

Code of conduct

6. I confirm that both Jo Healy and I have read the Code of Conduct for expert witnesses contained in the Environment Court Practice Note 2014. This

assessment has been prepared in compliance with that Code, as if it were evidence being given in Environment Court proceedings. In particular, unless I state otherwise, this assessment is within my area of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

Purpose and scope of assessment

7. This SIA forms part of a suite of technical assessments prepared for the NZ Transport Agency's Te Ahu a Turanga; Manawatū Tararua Highway Project (the "**Project**"). Its purpose is to inform the assessment of effects on the environment included in Part G, Volume 2 'Supporting Material' that accompanies the Notices of Requirement application for designations under the Resource Management Act 1991 ("**RMA**").

8. This assessment analyses the social impacts of the Project (by reference to the proposed designation corridor shown on the Project drawings).

9. The purpose of this report is to:

   (a) identify and describe the existing social environment;

   (b) describe my assessment of the potential general (Project-wide) and specific local social impacts of the Project;

   (c) recommend measures as appropriate to avoid, remedy or mitigate potential adverse social impacts (including any conditions and management plans required); and

   (d) present an overall conclusion of the level of potential adverse social impacts of the Project after recommended measures are implemented.

Assumptions and exclusions in this assessment

10. The assessment of the Project is based on the anticipated and potential social consequences of the construction and operation of a new strategic (State highway) corridor that will bypass the existing use of Saddle Road and/or Pahīatua Track between the Ashhurst and Woodville areas.

11. In particular, the Project reinstates State Highway 3 ("**SH3**"), which was closed in April 2017 as a result of slips and stability issues through the Manawatū Gorge. As the area is still a significant health and safety risk, there are currently no plans to re-open the road for any activities including winning material, cycling or pedestrians. As such, the 'existing environment' against which the effects of the Project are assessed includes the road network that

is operational at the present time. This SIA does not analyse the social effects that arose from the closure of SH3 in April 2017 (and since then), except insomuch as these impacts have been considered as an input to the potential social consequences of the re-establishment of the SH3 corridor.

12. The Project will become the new SH3 and will replace the existing route. The details associated with the revocation and/or termination of the existing (albeit closed) SH3 route through the Gorge are not part of this Project and will be subject to separate procedures and consultations with stakeholders. Until such time as the future of the existing route is confirmed the existing designation will remain in place. Any potential uses of the ‘old Manawatū Gorge’ are thus to be seen as opportunities.

13. In all sections the assessment considers potential social impacts at the regional, local community, and 'Project extent' scales. While I acknowledge that there will be impacts experienced at an individual/household level, specific property impacts (and in particular socio-economic impacts associated with property purchase) have not been the focus of this social impact assessment. I understand that individual consultation with owners and occupiers within the Project footprint, specifically in respect of property and site-specific issues is being addressed by the NZ Transport Agency, as part of the wider Public Works Act 1981 process for the acquisition/lease of directly impacted properties.

14. In my assessment I have relied on the following data to assess the social impacts of the construction and operation of the Project:

    (a) Project drawings indicating road and earthwork locations;

    (b) current and future traffic volumes and journey times from Transport Assessment by David Dunlop;

    (c) the indicative construction methodology and design details provided in the AEE; and

    (d) the current noise environment and future noise effects evaluated in the Noise and Vibration Assessment by Dr Stephen Chiles.

15. Measures are recommended to address potential social impacts of the Project. Depending on the implementation of these measures, the degree to which the assessed impacts of the Project may change is commented on in my overall assessment.

16. As discussed in subsequent mitigation recommendations, I am of the opinion that it will be important in the detailed design phase of the Project, to develop more specific management measures, particularly in respect of design and implementation details. This will provide greater clarity on how the community may experience the Project; for example traffic movements/access to facilities such as the Gorge walkway etc., as a result of construction works. This will also provide an opportunity to demonstrate how the Project will address specific matters identified in this SIA (for example, community liaison).

17. In addition, there are currently a number of uncertainties of detail on construction and design, which have different potential social consequences. In my opinion, involving the community in consideration of these options may allow some 'trade-offs' to be balanced. For example, the opportunity to accelerate construction by night works may result in some potential adverse effects (such as disruption to people's quality of environment and way of life) but the community may consider this preferable to longer construction periods overall. In my experience, involving the community in the development and consideration of these construction and design details can, in itself, provide valuable social mitigation (by enabling the community to assist in informing option consideration, rather than having such decisions 'imposed' on them). I have seen a number of projects where working with a community in the consideration of options results in the consequential impacts being more readily accepted (and less adverse) than if such changes take people by surprise.

18. This SIA does not cover regional or local economic impacts, except where it may potentially impact on employment and, as such, people's way of life and/or ability to provide for themselves.

19. This SIA also does not seek to assess the cultural effects of the Project, or potential impacts on tangata whenua/mana whenua values. I have been advised by the NZ Transport Agency that these are to be assessed by mana whenua.

EXECUTIVE SUMMARY

20. The Project is to construct and operate 11.5km of new State highway running from the SH3 western entry to the closed Manawatū Gorge route, across the Ruahine Ranges ("**the Ranges**") north of the Manawatū Gorge and south of Saddle Road, and emerging near Woodville. The Project replaces section of

SH3 through the Manawatū Gorge that was closed on 24 April 2017 following a large slip, and has been closed since due to ongoing stability issues in the Gorge.

21. This assessment is based on the existing environment which includes a transport network featuring the use of two alternate routes over the Ranges; Saddle Road and the Pahīatua Track. It assesses social impacts at the regional scale (people within the Tararua, Manawatū, and Palmerston North Districts and surrounding areas are dependent on this section of SH3 to traverse east and west of the Ranges), local scale (Ashhurst and Woodville) and within the Project extent (local landowners and neighbours).

22. The construction of the Project has the potential to exacerbate negative social impacts that have been experienced by Woodville, Ashhurst and the wider region since the closure of the Gorge and the use of the alternate route. That said, construction traffic will result in a relatively small increase in overall volumes and in general have low negative impacts. Potential changes will add to issues regarding the safety and the integrity of the road, slowing traffic, increased congestion and noise.

23. At a regional and local (for the Woodville community) scale, additional construction traffic using Saddle Road may impact on the way people carry out their daily activities such as commuting to work or education, accessing health services, and may increase time spent away from home (or potentially time spent away from work, albeit work hours are more often for specified or contractual amounts) due to increased journey times.

24. Overall, communities to the east of the Ranges may be further isolated from Ashhurst, Palmerston North and other western communities, due to accessibility issues on Saddle Road (such as reliability of travel time, disruptions to trips and perceptions of poorer safety or road quality).

25. Over construction, the existing constraints on the use of Pahīatua Track as a cycle route over the Ranges may also be exacerbated, further reducing connectivity; while this route is primarily a recreation and tourism movement for cyclists, there was at least one person in consultation who identified using it to commute by cycle to work.

26. The Ashhurst community is less reliant on traversing the Ranges, but construction traffic may exacerbate impacts already experienced from the higher traffic volumes currently travelling through the centre of residential Ashhurst. Social impacts associated with this activity include potential

changes to the way people carry out daily activities, come together as a community, and otherwise move within Ashhurst, and further potential disruption to the quiet lifestyle residents once enjoyed. While this is a relatively low change (compared to the existing traffic volumes using the route), high volumes of construction traffic at night could increase the severity of this impact, as people are often more sensitive to changes in the quality of environment (particularly noise and light disturbance) over-night periods. Notwithstanding this general comment, it is also acknowledged that there may be some social benefits associated with reducing overall construction periods (for example, communities may be tolerant of increased disruption for a shorter period of time).

27. In contrast to the shorter-term construction impacts (albeit still in the order of 5 years), at a regional and local scale the Project, once operational, will have longer-term or permanent positive social impacts that range in scale from moderate to high. These social benefits will arise from relieving the issues associated with the existing environment and reverting to an environment that is similar to prior to the Gorge closure, namely reinstating a SH3 connection between the east and west across the Ranges in this area (and in many respects improving the connection, in terms of safety and reliability).

28. The social benefits from providing a safer, more reliable and more resilient journey include improving social cohesion, enabling people to improve their way of life and opportunities to provide for their social and economic wellbeing (including by improving opportunity for economic activity). In addition, as a consequence of the new route, it is anticipated that the regional cycle route (via the Pahīatua Track) will be reinstated, improving both recreation activity/connectivity and the associated tourism activity that is identified as important for the community.

29. I consider that providing mitigation via relevant management plans (such as in relation to the management of construction traffic), targeted communication, and further engagement and consultation with the community, will enable the potential negative impacts to be appropriately remedied and mitigated. However, it is acknowledged that construction is likely to be a disruptive impact for communities (albeit a necessary process to achieve the longer term positive social outcomes of the Project).

PROJECT CONTEXT AND EXISTING ENVIRONMENT

Project context

30. A detailed business case for implementation has been prepared by the NZ Transport Agency[1], and the following details about the Project context and existing environment are largely derived from that document.

31. Prior to closure, SH3 through the Manawatū Gorge provided an important and strategic transport connection between the west and east of the North Island. As well as providing a physical connection between the Manawatū-Whanganui and Hawke’s Bay regions, it connected communities such as Woodville and Dannevirke with Ashhurst and Palmerston North. The route was classified as a National Road and carried general traffic and freight traffic (the latter at a level qualifying it as an important national freight link).

32. The road was first built in 1872 and had undergone significant construction and widening since the 1940s. It provided two lanes and no shoulder, and the 8km winding route through the Gorge did not allow for overtaking. Vehicle volumes were approximately 7,620 a day, approximately 11% of which were heavy commercial vehicles ("**HCVs**"). However, the route was not designed for over-weight or over-dimension loads (which instead use Saddle Road). The Pahīatua Track is another connection across the Ranges, and is identified as the relevant national cycle route connection.

33. In combination, these three routes – the Gorge, Saddle Road, and the Pahīatua Track – provided for accessibility and connectivity between the west and east across this lower central band of the North Island. The topography through this area means the other ‘east-west’ connections are either significantly to the north (e.g. at Rangipo on SH1/SH46) or to the south (e.g. Wairarapa to Wellington on SH2).

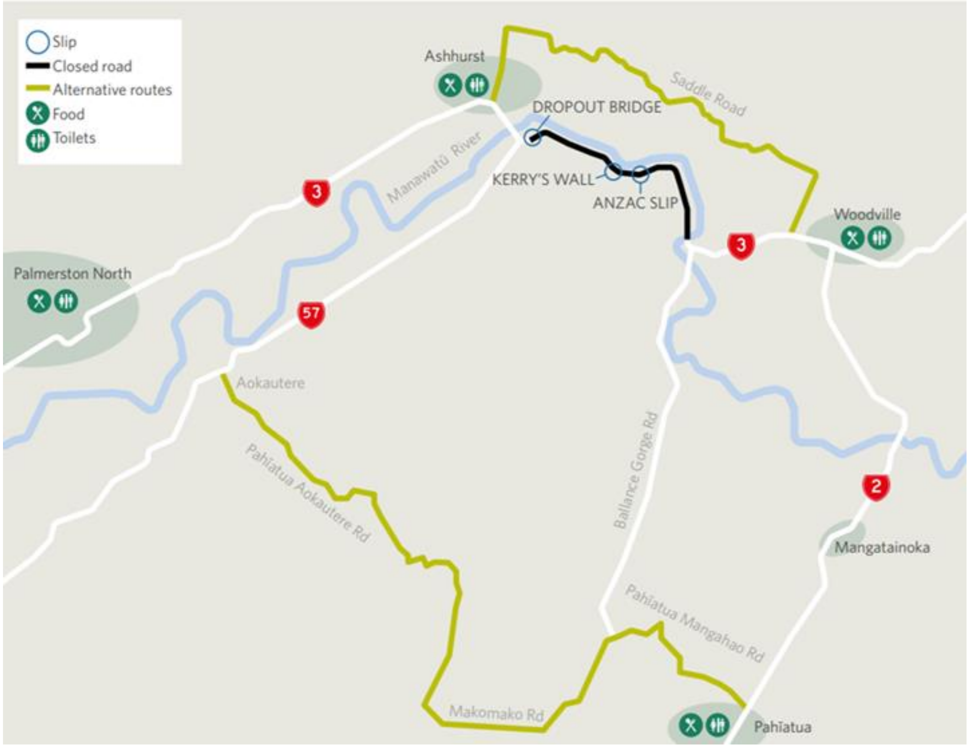
34. This section of SH3 is positioned to connect into SH57 east of Ashhurst (providing a link to SH1). Additionally, at the eastern side of the Gorge, it connects to the SH2/3 intersection in Woodville which accommodates traffic movements to and from the Wairarapa and Hawke’s Bay regions. It was used both by local road users, to connect the nearby urban and rural areas, and by business operators and inter-regional travellers.

[1] It is understood that potential social effects of a long list of 18 and short list of 4 options were considered as part of the Business Case process. I was not involved in that process but, as noted below, have reviewed that evaluation in undertaking this assessment.

35. Landslides within the Gorge have caused intermittent road closures since its opening and there has been a high probability this would be an ongoing occurrence. The road was closed indefinitely on 24 April 2017 following a large slip and ongoing stability issues in the Gorge.

36. The two remaining alternative routes have been the primary 'alternatives' to the SH3 route since the closure; being Saddle Road and Pahīatua Track (see Figure 1 below).

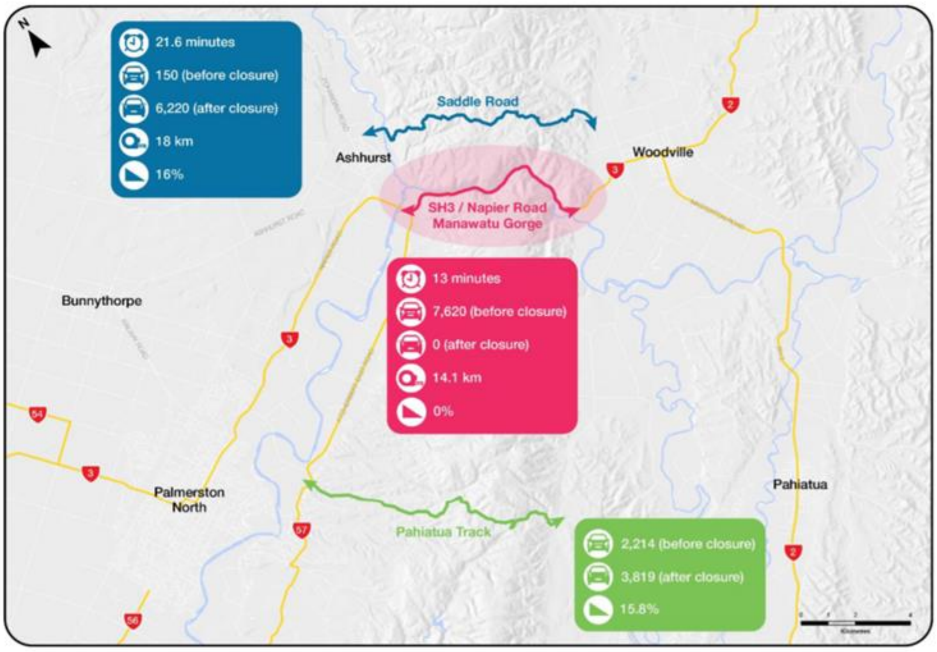
Figure 1: SH3 Closure and Alternate Routes. Source: NZ Transport Agency Te Ahu a Turanga Project Maps



37. The closure of the Gorge has not resulted in lower traffic volumes traversing the Ranges, signifying the significance of this connection between east and west for the local communities and the region as a whole. Figure 2 sets out the NZ Transport Agency data on the redistribution of traffic volumes soon after the closure and the change in experience for traffic users.

Figure 2: Journey experience via SH3, Saddle Road and Pahīatua Track. Source: NZ Transport Agency Business Case for Implementation

(31 May 2018)



38. Even with the improvement works that have been undertaken on Saddle Road since the closure of the Gorge, both Pahīatua Track and Saddle Road are steep, narrow and winding resulting in poor safety, resilience and efficiency outcomes. These routes are not considered to provide an appropriate level of service for the SH3 link. Given the traffic volumes on the routes, both have been subject to a number of road closures as road maintenance and repairs have been undertaken. Given this, a replacement route for SH3 is being sought.

Existing environment

39. As noted above, SH3 through the Manawatū Gorge has been closed since 24 April 2017 due to major damage and ongoing risks associated with landslides. The 'environment' against which the Project's effects have been assessed is the current environment, as it has been since the closure of the Gorge route; this is the use of Saddle Road or Pahīatua Track to travel east to west or west to east between SH2 and SH57 and/or SH3.

40. Currently approximately 6,220 vehicles a day (820 being HCVs) use Saddle Road (for context, the volumes using this route were closer to 150 vehicles prior to the Gorge closure) and 3,820 use the Pahīatua Track (as compared to 2,214 prior to the closure). Saddle Road was originally designed to service the local farms along it but has had upgrades in recent years to enable

construction of the Te Āpiti wind farm and, more recently, to improve the level of service for detoured State highway traffic. The NZ Transport Agency considers that Saddle Road, while sufficient as a short-term alternative route, does not offer an appropriate level of service for an interregional State highway connection catering for the current volume of traffic and HCVs.

41. A demonstration of the accessibility and connectivity impacts of the Gorge closure is provided in assessed details of travel times. The NZ Transport Agency indicates that the average travel times for general traffic between Woodville and Ashhurst have now increased from approximately 13 minutes for all traffic to 22 minutes for general traffic and 28 minutes for HCVs. In addition to this, anecdotally in the consultation process, a number of residents raised issues that many trips were even longer than these cited figures.

42. While not a specific consideration in the context of this SIA, the changes to the transport network that took place on closure of the Gorge have had considerable economic and social consequences, including in relation to operating/commuter costs and time costs resulting from the new ways in which businesses and commuters have had to carry out their daily activities and connect to other communities and regions. Concerns over travel time reliability have also had impacts for residents, as explained during consultation (some of whom, for example, have chosen not to travel in the fear or expectation of potential significant delays or safety concerns). One resident advised that family had left Woodville and moved into Palmerston North as a consequence of travel delays and safety concerns they had that were impacting both their way of life and health and wellbeing. A further impact raised was for those who require access to medical services, including hospitals, in Palmerston North.

43. Furthermore, the main alternative route currently being used through the range is via Saddle Road which results in traffic traversing directly through the centre of Ashhurst along Salisbury Street. Ashhurst School is also located on Salisbury Street. It is also acknowledged that increased traffic has resulted in additional noise and vibration, causing potential disturbance to locals and general nuisance, for example, sleep disturbance. Increased traffic also raises safety risk, particularly around the school. These concerns have been identified through community engagement feedback in the preparation of this SIA report.

PROJECT DESCRIPTION

Introduction

44. The Project is described in Part C, Volume 2 'Supporting Material',[2] and the following points are particularly relevant to this SIA.

45. The Project is 11.5km of new State highway running from the SH3 western entry to the closed Manawatū Gorge route, across the Ruahine Ranges north of the Manawatū Gorge and south of Saddle Road, emerging near Woodville. The Manawatū Gorge route accommodated 7,620 vehicles per day, including 11.3% of HCVs in 2016, prior to being closed. The Project is expected to accommodate approximately 9,370 vehicles per day when it opens in 2025. The Project includes:

    (a) two lanes (one in each direction with additional crawler lanes where the highway grades require and where extension of the crawler lane provides a consistent corridor);

    (b) new bridge or culvert structures (crossing Manawatū River and some unnamed streams, and providing property access underpasses);

    (c) new roundabout connections at SH57 and SH3; and

    (d) the reconfiguration of a portion of the Te Āpiti wind farm, albeit that both access to and around the wind farm and the majority of wind turbines will be maintained.[3]

Design context

46. The Project is designed to deliver a 'national route' under the One Network Road Classification. It incorporates design elements that are contained in the NZ Transport Agency's Action Plans, particularly in respect of safety standards (as detailed in its guidance for a Safe System Approach). The new route will be SH3, replacing the existing (closed) SH3 route.

47. The new route was selected following a multi-criteria analysis of 18 route options. The process involved a consideration of the Project's investment objectives, environmental and social impacts, and feasibility for implementation.

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[2] The design of the Project will be developed once the designations have been confirmed. This detailed design will be undertaken within the scope of the final designations' boundaries and delivery to the standards and requirements set in the conditions and will be set out in outline plans and other documents that will be provided to the Councils prior to construction.

[3] Those works are relevant to this SIA insomuch as they relate to the scale of construction activity proposed.

Design details

48. The road carriageway layout includes:

    (a) a four-arm two-lane roundabout connection with SH57 at Ashhurst;

    (b) a five-arm single-lane roundabout connection with existing SH3 at Woodville;

    (c) a two-lane single-carriageway highway (1 lane in each direction) where crawler lanes are not provided;

    (d) a four-lane dual-carriageway highway (2 lanes in each direction) where crawler lanes are required due to steep grades and where extending the crawler lanes is necessary to provide a consistent corridor and reduce merge and diverge points;

    (e) 3.5m-wide traffic lanes;

    (f) 2.5m-wide outside shoulders on single carriageway (to the face of the edge barrier), or 2m-wide outside shoulders where there is a single carriageway with crawler lanes (from the outside of the crawler lanes to the face of the edge barrier);

    (g) a central median which will be typically between 4m and 6m wide; and

    (h) a central median and wire rope barrier provided from 'roundabout to roundabout', i.e. for the length of the Project from SH57 near Ashhurst to the outskirts of Woodville.

49. A design speed of 110km/h has been adopted for the main alignment. The design speeds for local roads are dependent on the existing speed environment and will be determined during the detailed design phase of the Project on a case-by-case basis.

50. Near-continuous wire rope barriers are proposed along the central median to separate oncoming traffic and along the roadside – this results in limited opportunities for people to cross the corridor (e.g. turn right), which is reduced by the emergency crossover points discussed below. More rigid roadside barrier systems may be necessary in some circumstances, such as across the new Manawatū River Bridge where a TL5 barrier (concrete base and steel roll bar) will be provided.

51. Emergency crossover points in the median barrier will be provided at appropriate locations to allow emergency vehicle U-turn movements. Sealed maintenance access areas will be provided behind the barriers to provide

safe access and parking for maintenance activities outside of the carriageway.

52. No barriers are proposed on local roads.

53. Separated walking or cycling facilities are not specifically provided for by the Project, although it is anticipated that the shoulder width and bridge widths will be sufficient to accommodate cyclists. For the purpose of this SIA it is understood that the primary cycle route between the western and eastern ends of the Manawatū Gorge will continue to be via the Pahīatua Track, which is the currently identified as part of the New Zealand Cycle Trail Touring Route.[4] It is also expected that, while there are currently very low levels of usage of Saddle Road, due to the volume of traffic and road configuration, Saddle Road will revert to a suitable cycling route once the new road is constructed.[5] Similarly, the Manawatū Gorge walking track is expected to remain as the primary walking route between the western and eastern ends of the Gorge.

54. The Project will include rest (or viewing) areas adjacent to the east and west bound lanes. The locations will be determined as part of detailed design and will likely be provided in conjunction with maintenance service areas.

METHODOLOGY

Preparation of the SIA

55. The preparation of the SIA has sourced information from:

    (a) documents describing the business case process and associated specialist reports;[6]

    (b) plans showing the Project corridor and descriptions of an indicative construction methodology;

    (c) district and local plans, strategies and legislation which explain the particular characteristics of Manawatu-Wanganui Regional Council ("**Horizons**") and the three territorial authorities within whose districts the Project is located;

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[4] The New Zealand Cycle Trail – Pahiatua Road forms a 10km part of the Tararua Traverse Heartland Ride which is part of the New Zealand Cycle Trail: https://www.nzcycletrail.com/explore-trails/. Currently the 10km section on Pahiatua Road is closed due to the increased volumes of traffic since the Gorge closure.

[5] 'Revert' in this sense refers to the effect of the Project restoring Saddle Road to a similar environment (pre-Gorge closure).

[6] Manawatū Gorge Alternative Detailed Business Case including the Multi-Criteria Analysis ("**MCA**") assessment and social and environmental assessment, Appendix F Transport Assessment, Appendix H Manawatū Gorge Alternative Consultation Summary Report and Appendix 0 Draft Manawatū Gorge Property Acquisition Strategy.

(d) Statistics New Zealand data for the region and local communities;

(e) public feedback provided during the consultation process carried out by the NZ Transport Agency during the 'long list to preferred option' phase;

(f) observations during a site visit of the proposed corridor and local communities;

(g) discussion with community members and other attendees at the consultation events run by the NZ Transport Agency (all attended by either Jo Healy or Amelia Linzey) on 19, 20, and 21 July 2018 (in Ashhurst), 25 July 2018 (in Woodville), 26 July 2018 (in Palmerston North), 31 July 2018 (in Dannevirke), and 1 August 2018 (in Pahiatua)[7];

(h) feedback forms provided by members of the public during the above consultation process and consultation material as summarised in Part F of Volume 2 'Supporting Material'[8]; and

(i) the transport and noise assessments for the Project, as referred to above.

56. The bibliography contains a more detailed list of the documents that were reviewed and used to assist in the development of community profiles and evaluation of this SIA.

Social Impact Assessment Framework

57. SIA is the most common framework used in New Zealand and internationally to analyse, monitor and manage the potential social consequences of development. The methodology used for this SIA is based on the matters provided for in the International Association of Impact Assessment Guidelines, and also considers the NZ Transport Agency's Social Impact Guide 2016.[9] It then draws these frameworks together and identifies the specific social context matters I consider relevant to this Project (being the four headings identified in paragraph 61 below).

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[7] We consider attendance at the various open days was good to high (particularly in Woodville and Ashhurst). These events provided an open discussion on the scale of the project, delivery timeframes and potential construction issues (with noise and transport specialists also available at some events). I consider issues were well canvassed and a range of views were presented, including potential social impacts and consequences of the Project. I acknowledge that attendance at the consultation events was disproportionate to older residents in the community and under-represented in youth. In my experience this is common in engagement processes.

[8] It is noted that we provided input to the questions asked in the feedback and response forms.

[9] Social impact guide. NZ Transport Agency, September 2016. Retrieved from file:///C:/Users/keg1/Desktop/16-243-People-and-place-state-highway-social-impact-guide-2017-FINAL.pdf.

58. This SIA draws from the social impact matters described in the International Association of Impact Assessment Guidelines. The International Association of Impact Assessment Guidelines describe social impacts as an impact arising on one or more of the following functions and processes of a community or social system:[10]

(a) People's way of life – how they live, work, play and interact with one another on a day-to-day basis.

(b) Their culture – their shared beliefs, customs, values and language or dialect.

(c) Their community – its cohesion, stability, character, services and facilities.

(d) Their political systems – the extent of which people are able to participate in decisions that affect their lives, the level of democratisation that is taking place, and the resources provided for this purpose.

(e) Their environment – the quality of the air and water people use, the availability and quality of the food that they eat, the level of hazard of risk, dust and noise to which they are exposed, the adequacy of sanitation, their physical safety, and their access to and control over resources.[11]

(f) Their health and wellbeing – health is a state of complete physical, mental, social and spiritual wellbeing and not merely the absence of disease or infirmity.

(g) Their person and property rights – particularly whether people are economically affected, or experience personal disadvantage which may include a violation of their civil liberties.

(h) Their fears and aspirations[12] – their perceptions about their safety, their fears about the future of their community, and their aspirations for their future and the future of their children.

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[10] International Principles for Social Impact Assessment 2003 – SIA principles – Frank Vanclay.
[11] It is acknowledged that other reports provide assessment of the potential impacts and effects on this physical environment and this SIA considers how these potential changes may impact on people's relationship with or association to this environment.
[12] In accordance with the NZ Transport Agency Social Impact Guidelines 2016, note that Resource Management Act 1991 case law indicates that community perceptions, including fear, should only be given weight to if they are reasonably based on a real risk (*Shirley Primary School v Telecom*, 1998). Where communities are expressing fear of an effect that is not based on a real risk, the NZ Transport Agency's preferred approach is to report on this, acknowledging the concern but also the limitations of this as an impact. It is acknowledged that in many instances such fears are based on misunderstanding of potential effects and therefore the NZ Transport Agency also recognises the importance of community engagement tools to address such issues.

59. In addition, this report has taken into consideration the NZ Transport Agency's Social Impact Guide 2016, which specifically notes the following potential social consequences associated with changes to transport networks:

(a) Access and accessibility – changes to transport patterns and movements, including how people move about and connect by active transport, public transport and private vehicle;

(b) Social connectedness;

(c) Community severance;

(d) Changes to facilities; and

(e) Changes to local movement patterns.

Potential social impacts

60. Acknowledging the guidelines and consequence frameworks set out above, a number of potential social impacts from the Project have been identified in undertaking this SIA. Following an analysis of the Project and the community context, the potential impacts from this Project this SIA considers are as follows:

(a) **impacts on way of life** – how people carry out and get to their daily activities such as work, leisure and domestic activities including consideration of access to and between communities and places/centres where people live, work and play;

(b) **impacts on community cohesion** – connectivity between people including potential impacts relating to severance of communities and loss of communities (through the physical impact/land take of the Project);

(c) **impacts on sustaining oneself** – how people sustain themselves both financially (such as business operations from land) and by providing for themselves in other ways (such as growing food), including the viability and feasibility of economic production/activity in areas where people live and work; and

(d) **impacts on the quality of the environment** – this includes people's well-being (related to changes to the environment), sense of place and identity and changes to the character and amenity of living environments and character of communities.

61. The SIA process has used these matters to consider the potential social impacts of the transport corridor options, in the context of:

(a) the existing community;

(b) the nature of the proposed works; and

(c) the potential consequential social changes anticipated from the construction and operation of the Project.

Methodology overview

Introduction

62. The methodology undertaken for this SIA is summarised as follows:

(a) **Step 1** – Scoping and contextualisation – obtaining an understanding of what is proposed, geographical areas and the demographic context, including review of material collected and collated in earlier phases of the Project (acknowledging this information was not collected by the authors of this report);

(b) **Step 2** – Information gathering – community open days, site visits and confirming community profile understanding through review of demographic and community vision/plan processes (e.g. what the community looks like now and the changes and plans community members have for the future);

(c) **Step 3** – Assessment of potential social impacts – using the information obtained in steps 1 and 2, the assessment of potential impacts is undertaken to determine the scale, extent, distribution and duration of potential social impacts; and

(d) **Step 4** – Recommendations for mitigation – using the assessment in step 3, consider the requirements to avoid or mitigate the identified impacts and make recommendations.

63. While this SIA has focused on an assessment of the Project (the subject of the designations being sought), in preparing this SIA, I have undertaken a review of the documentation prepared in the options assessment process, which is summarised in the Detailed Business Case and in Part E of the AEE. While I was not specifically involved in the long-list or short-list option evaluation, I make the following observations, insomuch as they demonstrate

how consideration of social impacts has assisted in defining the Project:

(a) A risk-based assessment of social and environmental effects has been reported in the Detailed Business Case, which included specific consideration of potential social impacts and outcomes of the options, concluding that there was an overall minor positive effect identified for Option 3, which is the subject of the designation;

(b) There was a long-list options assessment process, which assessed 18 options against an MCA (multi-criteria assessment) that included social impacts; and

(c) There was a short-list options assessment process, which documented assessment of the four short-list options against 16 environmental and social criteria. All four options were identified as having the potential to create substantial adverse effects, including potential adverse social effects. With specific reference to the potential social effects, Option 3 was considered to have similar potential adverse effects to Options 1 and 2, but lesser scale of adverse effects than Option 4.

64. I was not involved in this phase of assessment of potential social impacts. Notwithstanding this, I consider the above demonstrates that there has been an evaluation of social impacts in various stages in the Project, and that such information has informed decision-making processes.

Geographical extent

65. Following analysis of the proposed designations for the Project and the surrounding area, three geographical extents are considered relevant to the assessment:

(a) **regional scale**: the greater region dependent on SH3 for traversing over the Ruahine Ranges;

(b) **local scale**: the local communities impacted by the proposed corridor, namely Ashhurst and Woodville; and

(c) **Project extent**: properties within or adjacent to the proposed corridor (e.g. affected landowners and neighbours).

Rating

66. The assessment of potential social impacts is considered as either positive or negative, depending on whether the Project will either enhance or detract from the community values, social processes, or social infrastructure. It is

noted that understanding community values and social processes has included considering the plans and outcomes described in the Long Term Plans of Horizons and the Manawatū District, Tararua District, and Palmerston North City Councils, and specifically their visions on how the districts will grow or other development plans.

67. In cases where potential adverse impacts have been identified, the opportunities for these impacts to be mitigated by Project design and implementation of management and/or mitigation strategies have been considered; these are discussed below.

68. The scale of impact is identified as either very low (negligible), low, moderate, high or very high. This assessment is made in consideration of both the assessed duration and the scale of the impact relative to the existing environment (in other words the degree of change from the existing condition). The following provides an overview description of the assessment scale:

(a) **Very low (negligible):**

(i) Short/temporary duration (temporary e.g. weeks/months);

(ii) Small extent of impact on the community being considered (e.g. less than 10% of community extent); and

(iii) Very low or negligible level or severity of impact (the degree of change anticipated to the community system, process or value identified in the community profile assessed at a community level[13]);

(b) **Low:**

(i) Transitional duration (e.g. months or for periods of construction activity);

(ii) Small to medium extent of impact on a community (e.g. between 10% and up to 50% of a community impacted – factoring severity); and

(iii) Low level of severity of impact (there is low degree to which it will affect the community systems, processes and values identified in the profile);

[13] It is important to note that the SIA does not attempt to account for all 'individual' impacts. As such, it is acknowledged that different people within a community will experience a project and the impacts of a project in different ways. These individual issues are an important consideration for any project and are most appropriately considered through individual submissions from those parties.

(c) **Moderate:**

(i) Transitional to long-term duration (e.g. months to years; impacts that will extend over and throughout a construction period or beyond);

(ii) Medium scale or extent of impact for community (e.g. likely to impact half or more of an identified community extent); and

(iii) Low to moderate level of severity of impact;

(d) **High:**

(i) Long-term duration (e.g. years to permanent impact);

(ii) Medium to large scale extent of impact for community (e.g. likely to impact more than half of an identified community extent); and

(iii) Moderate to high level of severity of impact (the degree to which it will affect the community systems, processes and values identified in the profile);

(e) **Very High:**

(i) Long-term duration (e.g. more likely to be a permanent impact);

(ii) Large extent or scale of impact for community (e.g. most of a community is likely to experience the impact); and

(iii) Significant severity (e.g. is likely to result in major change to the community system, process or value identified in the community profile).

69. It is important to set out clearly, particularly in the context of this Project, that the SIA report evaluates the potential social effects of construction and operation of the Project in the context of the social effects being experienced in the existing environment. Social outcomes and processes are naturally dynamic, and there can be a number of social effects being experienced by a community in an 'existing environment' (e.g. population growth resulting in housing demand and pressure on vulnerable communities, or conversely population decline resulting in weakening community cohesion or detracting from sense of place). In respect of this Project, it is acknowledged that the closure of the Manawatū Gorge route and resulting alternate use of Saddle Road has had adverse social impacts that are still being experienced by the community (locally and regionally). This SIA report considers the incremental changes to these social conditions arising from the Project.

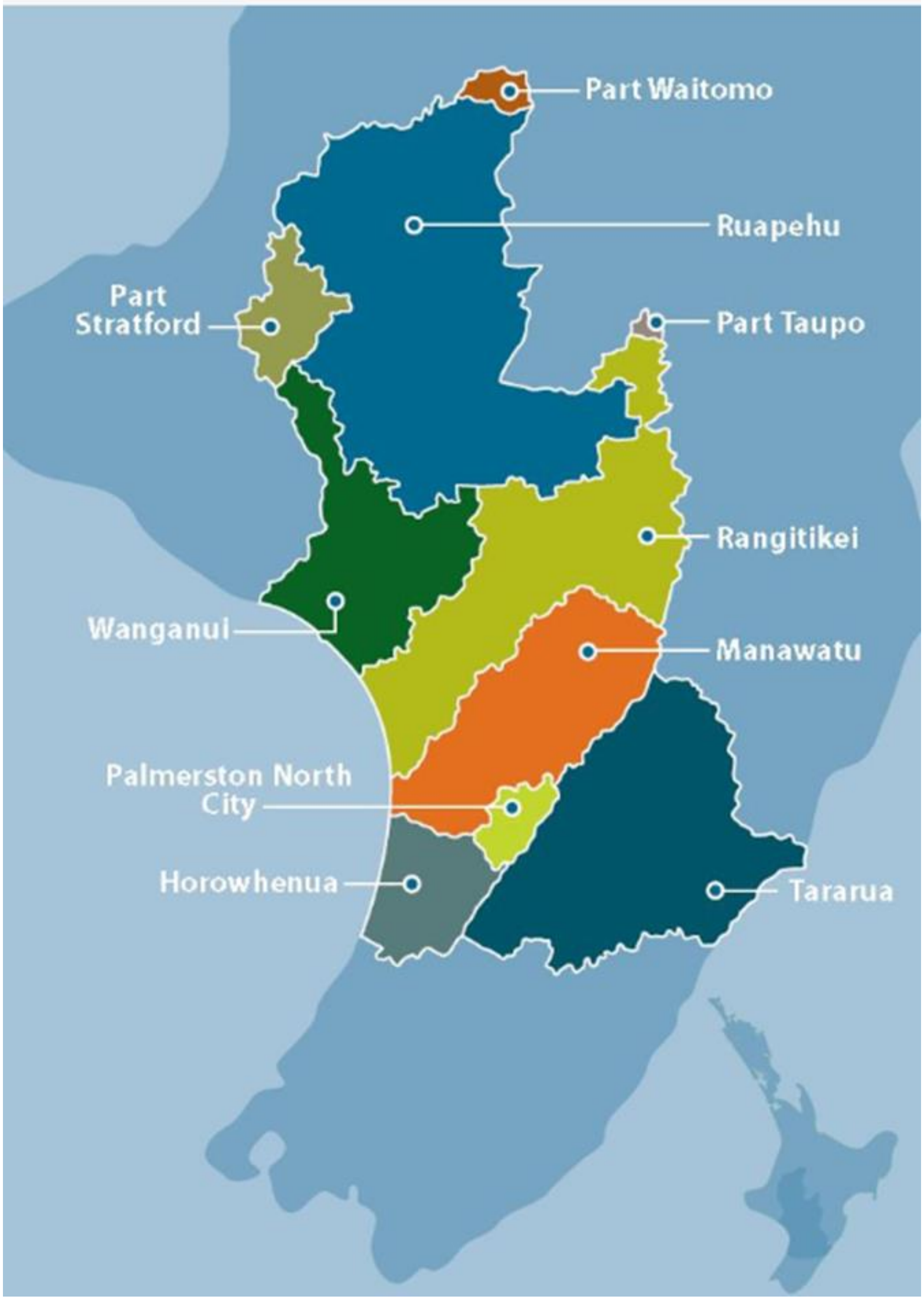
COMMUNITY PROFILES

Regional

70. The Project traverses and connects three districts: Palmerston North, Manawatū and Tararua. Each of these is represented by a district council, and Horizons has functions in respect of the region as a whole. At a larger scale the Project provides connections east to west and west to east for the lower North Island.

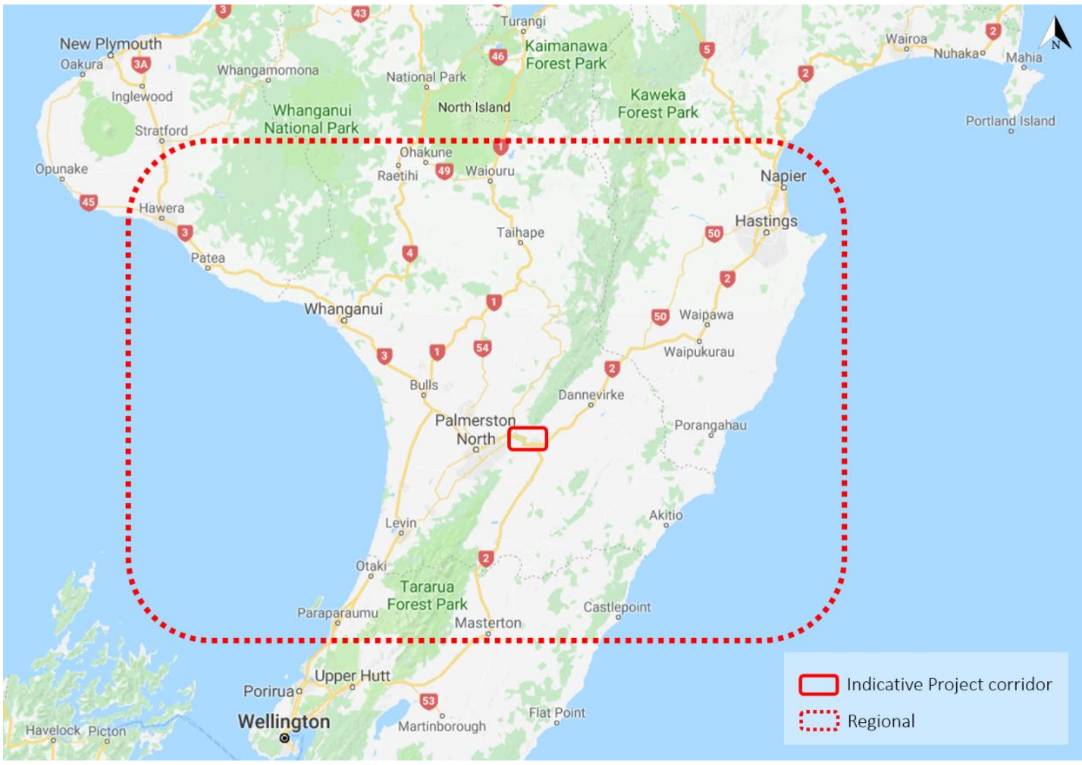
71. The Horizons Region covers an area of over 22,200km^2 (see Figure 3 below) with over 240,000 people residing in the region.

Figure 3 Horizons Region. Source: Horizons Regional Council



72. Due to the large extent of the Horizons Region and the location of the Project, the regional assessment and description of existing environment will focus on the three districts (Palmerston North, Manawatū and Tararua), and the surrounding areas that are dependent on SH3 (including current alternate routes) to reach the east or western section of the lower North Island (see Figure 4). These districts stretch across the North Island from the west to east coast and are distinguished by the Tararua and Ruahine Ranges which traverse the centre of the region.

Figure 4: Regional Geographic Extent. Source: Modified from Google Maps



73. Of particular note within this region are the communities located around the alternate Pahīatua Track, including Ballance. Currently these communities have experienced an increase in traffic due to the Gorge closure, and safety issues are occurring particularly when short-cuts are taken by heavy vehicles on Ballance Valley Road and Post Office Road past the Ballance Primary School.

74. As of the 2013 Census, this combined area of Palmerston North, Manawatū District and Tararua District had a population of 124,340 residents, of which 64% live in Palmerston North city itself. Outside of Palmerston North the areas are predominantly rural with smaller cottage industries and local town services. Palmerston North serves as an employment, education (secondary and tertiary), retail, and specialist health services hub for the region.

75. Feedback from open days indicates that traversing the Ranges (both historically via the Gorge, now using the existing alternate routes of Saddle Road and Pahīatua Track, and in future with the Project) is a daily occurrence for many in relation to employment, business operations and education. In addition, the corridor was identified as a key route for social connections (family and friends), recreation (recreational areas and sporting competitions), food and other retail shopping and accessing health services. The route connects the towns on either side of the Ranges, creating a wider interdependent community network.

76. Te Āpiti – Manawatū Gorge is a landmark for the area and a location of many tourism and recreational opportunities, including walks, mountain bike trails (Te Ara o Mahurangi and Windfarm Ride), horse trekking and jet boating. Reserves at both ends of the Gorge offer camping and safe swimming spots.

77. Visitors can explore this unique and dynamic example of geomorphology that forms the western entrance to Woodville, by jet boat, kayak (a grade 2-3 river), or vintage steam train, or by experiencing the 4 hour Manawatū Gorge walking track along the ridges high above the road level.

78. Palmerston North City Council adopted a 10 year Plan 2018-28 on 25 June 2018. The Manawatū Gorge replacement route is recognised in the Plan as one of two high-priority government transport projects on which the district is reliant that will *“enable freight to move through the region, ease congestion and make the city more liveable”*.

79. The vision stated in the Plan is *“Palmerston North: Small city benefits, big city ambition”*. Goal 1 in the Plan aims at fostering an innovative and growing city which identifies taking advantage of opportunities in new and developing areas to foster innovation and entrepreneurship and fuel sustainable growth, prosperity and wellbeing. The Council has a target of 12,000 more jobs in Palmerston North by 2028, which will contribute to achieving an innovative and growing city that has sustainable growth, prosperity and wellbeing. This vision and planned growth is relevant to the SIA as it assists in understanding community aspirations and future plans.

80. At the time of writing the SIA a review of available rental accommodation websites showed on average approximately 80 rentals were available in Palmerston North, 10 in Manawatū and 10 in Tararua. QV Rental Analysis (2018) shows that Manawatū District has 126 rentals, Palmerston North has 688 rentals and Tararua has 55 rentals (rental numbers are based on bonds lodged). Lettings from 2017 to 2018 in Palmerston North have a monthly range in the order of around 80 and 200 properties (not all areas of Palmerston North are captured in these statistics)[14]. This demonstrates relatively high rental turnover.

81. The Statistics New Zealand Commercial Accommodation Monitor (May 2018) reported that there were approximately 88 accommodation facilities (78

[14] Data is sourced from Landlord – For Kiwi Property Investors (https://www.landlords.co.nz/housing-statistics/rental-graphs.php) a commercial website providing rental market graphing in particular tracking the number of letting per month.

motels and hotels) available in the region with a capacity of approximately 70,000 (48,880 for motels and hotels) and an occupancy rate of 40%.

Local

Ashhurst community

82. Ashhurst is a small satellite community located 14km northeast of Palmerston North. The town is located at the base of the Ruahine Ranges, beneath Wharite Peak. The town had a population of approximately 2,800 at the 2013 Census, which was an 8.2% increase since the 2006 Census. It makes up 3.5% of the population of the wider Palmerston North district.

83. Consultation feedback reported that many moved to Ashhurst for a quiet lifestyle and community feel with ease of access to Palmerston North City for all major services and amenities. Prior to the closure of the Gorge, travelling through Ashhurst to reach Saddle Road was an alternate route traversed by approximately 6% of daily east-west trips over the Ranges. Currently approximately 80% (6,080) of east-west trips use Saddle Road and traverse through Ashhurst.

Census information

84. At the time of the 2013 Census,[15] the following key demographic characteristics of the resident population of Ashhurst are noted (for context these are reported relative to Palmerston North city (i.e. the wider district) and/or New Zealand population overall):

    (a) The median age was 36.8 years (compared with 33.8 years for Palmerston North city). In the overall age structure, approximately 13% of people were aged over 65 years, which is the same as the overall total for Palmerston North. However, the community does have a greater percentage of youth with around 25% of people aged under 15 years, compared with 20% for all of Palmerston North city.

    (b) The most common ethnic groups in Ashhurst were European (90%) and New Zealand Māori (14%) (percentages do not add up to 100% as people identify with more than one ethnic group). The percentage of European is significantly greater than Palmerston North city (79%, which reflects that increased ethnic diversity in urban Palmerston North).

[15] At the time of preparing this report data for the 2018 Census was unavailable.

(c) 76% of people aged 15 years and over in Ashhurst had a formal qualification (slightly lower than the district), and 14% of people aged 15 years and over held a bachelor's degree or higher as their highest qualification.

(d) The unemployment rate was 5% for people aged 15 years and over (slightly lower than Palmerston North city). The most common occupational group was ‘professionals’.

(e) For people aged 15 years and over, the median income was $29,000. 23% of people aged 15 years and over have an annual income of more than $50,000, with 36% having an annual income of less than $20,000. Annual individual incomes in Ashhurst are slightly higher than for the district overall, with fewer people (as a percentage) earning less than $20,000 per annum.

(f) Couples with children make up 44% percent of all families, while couples without children make up 38% of all families. One-family households make up 73% percent of all households (higher than the district overall). One-person households make up 23% of all households (slightly lower than the district overall). The average household size is approximately 3 people.

(g) Home ownership rates are higher for Ashhurst and rentals are equal, relative to the district. For example, 77% of dwellings were owned (or held in trust) by residents in Ashhurst, compared to 62% for the district (which may reflect Palmerston North city's higher student population). For households renting the dwelling in which they lived, the median weekly rent paid was $250 for both areas.

(h) There were 202 business locations (geographic units) in Ashhurst, which was a decrease of 7% from the year ended February 2006. There were approximately 340 paid employees in Ashhurst, mainly working in education, agriculture, construction, manufacturing and accommodation and food services. This a 6% increase from 2006.

Amenities

85. Horizons provides a bus service between Ashhurst to Palmerston North which runs four trips (both ways) on weekdays and once on Saturday. Ashhurst has a local primary school, kindergarten and play centre. Secondary and tertiary education is available in Palmerston North city.

Residents are required to travel outside of Ashhurst to places such as Palmerston North to access primary and specialist health services.

86. Community facilities include a library, churches, aquatic centre, sports grounds, Ashhurst Domain and community centre. Ashhurst is an active community with a variety of community organisations and resources. It has an annual music festival and community markets. It has limited retail and commercial services, with the main employment opportunities and retail services (including supermarkets) being accessed outside Ashhurst.

87. According to the Palmerston North City Council Long Term Plan 2018-2028, sustainable growth (industrial and residential) is planned for the area. The residents of Ashhurst have expressed a desire to remain a separate satellite suburb of Palmerston North that retains a peaceful village-like environment.

Woodville community

88. Woodville is a small rural village within the Tararua District. The population of Woodville was approximately 1400, as at the 2013 Census, with less than a 1% increase since 2006 Census. Woodville has approximately 8% of Tararua District's population. Currently it is approximately 31km (via Saddle Road) to 38km (via Pahīatua Track) from Palmerston North. Woodville is located at the intersection of SH2 and SH3. The main street is a thoroughfare for many travellers within the region, and commercial and retail opportunities are focused around this street. Beyond the main street is a peaceful rural environment with the 'city amenities' nearby.

89. The Woodville community is a more rural land use community than that of Ashhurst (which has a higher proportion of residents commuting in a more dormitory suburb of Palmerston North) and this is (at least in part) attributable to the travel distances between this community and Palmerston North. During consultation, a number of residents identified the Manawatū Gorge as an important environmental and social 'separation' from Palmerston North and their commute or travel through this as an important 'gateway home'. Others (fewer in number) expressed a contrary view, and identified that the Gorge had always been 'unstable' and considered it more as an ongoing risk or potential threat to their safety and wellbeing.

90. The Tararua District Council Long Term Plan 2018-2028 anticipates a modest growth in households over the next 30 year period (driven by some initial population growth over next 10-15 years and then as population growth declines a levelling of housing demand). A town centre upgrade is noted in

the Long Term Plan, as an initiative to attract more visitors to Woodville, adding to its vibrancy and sustainability. A desire was also expressed to attract more residents by becoming a desirable residential location for people working in Palmerston North.

Census information

91. At the time of the 2013 Census, the following key demographic characteristics of the resident population of Woodville are noted (for context these are reported relative to the Tararua District and/or New Zealand population overall):

    (a) The median age was 46 years (comparative to 41 years for Tararua District), potentially reflective of the older rural population in the district retiring to the local rural towns. This is also reflected in the overall age structure, with 20% of people aged over 65 years, compared with 17% of the total Tararua District population. The community has 20% of people aged under 15 years, compared with 22% for all of Tararua District.

    (b) The most common ethnic groups in Woodville were European (82%) and New Zealand Māori (25%) (again, percentages do not add up to 100% as people identify with more than one ethnic group). The percentage of European is slightly less than the district (82% compared with 85% for the district) and the Māori population was slightly higher (25% compared with 21% for the district).

    (c) 59.4% of people aged 15 years and over in Woodville had a formal qualification (slightly lower than the district), and 7% of people aged 15 years and over held a bachelor's degree or higher as their highest qualification.

    (d) The unemployment rate was 11% for people aged 15 years and over (over 4% greater than the district rate of 6%). The most common occupational group was ‘labourers’.

    (e) For people aged 15 years and over, the median income was $20,500. 14% of people aged 15 years and over have an annual income of more than $50,000, with 49% having an annual income of less than $20,000. Annual individual incomes in Woodville are lower than for the district overall, with fewer people (as a percentage) earning more than $50,000 per annum.

(f) Couples with children make up 29% percent of all families, while couples without children make up 45% of all families. One-family households make up 63% percent of all households (slightly lower than the district overall). One-person households make up 31% of all households (slightly higher than the district overall). The average household size is two people.

(g) Home ownership rates and rentals are slightly higher for Woodville relative to the district. For example, 72% of dwellings were owned (or held in trust) by residents in Woodville, compared to 67% for the district. For households who rented the dwelling that they lived in, the median weekly rent paid was $160 (compared to $150 for the district overall). This higher rental is noted against the lower annual median incomes.

(h) There were 109 business locations (geographic units) in Woodville, compared with 2,940 for all of Tararua district. This is a decrease of 6% from the year ended February 2006 for Woodville. There were 220 paid employees in Woodville compared with 6,130 for all of Tararua district. This is an increase of 5% from the year ended February 2006 for Woodville.

Amenities

92. Woodville provides many support services such as doctors, plumbers, electricians, builders, contractors and automotive repairs. Retail includes cafes, speciality retail outlets, and a local grocery store. A supermarket and larger commercial and retail services are available in Dannevirke and Palmerston North. Woodville Primary Health Services has limited hours; outside these hours residents are required travel to other local towns and, for any specialist care, to Palmerston North. Within Woodville there is a primary school (Woodville School), play centre, and Kōhanga Reo, and there are two other primary schools in the vicinity of Woodville (Kumeroa/Hopelands and Papatawa). Secondary education is available at Tararua College in Pahīatua, or alternatively in Palmerston North. Community facilities include a library, local marae, churches, council offices, recreation and sports grounds and a community centre. It is an active community with a variety of community organisations and resources.

Project extent

93. The proposed designation corridor for the Project traverses through rural land, primarily farming land. Other activities in this area include Meridian's Te Āpiti wind farm and AgResearch's fertiliser trial site at the Ballantrae research farm. All land requirements reflect only a portion of any total property impacted (e.g. they are partial land takes). One residence is within the proposed corridor and a small number (fewer than ten) are adjacent to it.

94. Both ends of the Project reconnect with SH3. Two residences at the western end (on Napier Road near the SH57 intersection) are currently on SH3 (a strategic route); these people currently experience relatively low levels of traffic due to the closure of the Gorge (as this section of SH3 is not experiencing its traditional traffic volumes due to traffic diversion onto Saddle Road).

REGIONAL SOCIAL IMPACT ASSESSMENT

95. Against that background, the assessed social impacts of the Project are set out below for each geographical scale (Regional, Local Community and Project Extent). This assessment considers social impacts during both the construction and operational phase.

Construction period

96. Many people in the region have already undergone significant change in the way they carry out their daily activities, arising from the closure of the Manawatū Gorge section of SH3. During construction of the Project there is potential for further disruption to traffic movements on Saddle Road, due to its use by HCVs and other Project-related vehicles. Any further delays on Saddle Road have potential to exacerbate the existing impacts under the SIA heads of:

    (a) Way of life;

    (b) Sustaining oneself; and

    (c) Social connectedness.

97. For example, increased journey times on Saddle Road would impact on daily commutes for work and education, business operations dependent on this route, and the ability for social connections across the region. In addition, it has potential to have further impacts on people’s general access to health services operating out of Palmerston North (e.g. day-to-day medical needs,

not emergency needs). People in communities spending longer times in travel would either have consequential reduced time at home with family, and increased fuel and business costs, or may reduce travel/trips (e.g. choosing not to engage in community or social activities due to the actual or perceived connectivity issues) and thus increased isolation.

98. Overall, it is considered that the potential adverse effects will be experienced by some parts of the region, with reductions in accessibility over the construction period. However, when considered in the context of the existing environment (with the Manawatū Gorge route closed), this is not considered a significant impact; it will result in some additional delays and disruption to travel, rather than a 'severance' or loss of access[16]. I note that there are approximately 7,600 people traversing the Ruahine Ranges per day (and the adverse social impacts identified above will only be experienced by some of these users). Given the relatively small scale of this impact, no further specific assessment has been made to further quantify those that may experience reduced accessibility or connectivity as an adverse social impact over the construction period.

99. The construction of the new bridge across the Manawatū River will take place within the area of the Manawatū Gorge Car Park and entrance to the Gorge walk. There is the potential for temporary closures (I am advised by the NZ Transport Agency that this would be in the order of days only) or other disruption of the parking area (and potentially for access to this walkway) to occur at times during construction. Any limitations in access to this facility will have an impact on people's way of life, particularly in respect of recreation opportunities. However, on the basis that the design parameters include a commitment to maintain access at nearly all times, I consider this potential impact only minor.

100. The region has experienced uncertainties over the Manawatū Gorge for decades and many participants in the open days expressed to us the views and opinion that action has been delayed and information on future plans has been limited to this point. While views about the Project overall were generally highly positive, participants expressed concern about potential adverse effects caused by the length of time taken to construct it (and the potential for further delays), and how the region will manage the current

[16] This impact acknowledges but does not include the socio-economic impacts being experienced by the regional community as a result of the Manawatū Gorge closure.

inconveniences (and consequential social impacts being experienced from these) for that length of time.

101. Conversely, the construction phase is also viewed as a potential avenue to meet business and employment aspirations for some in the region. For example, workers and business owners saw opportunities to provide for socio-economic wellbeing through both direct employment opportunities and opportunities in associated areas such as accommodation, retail, and other service industries. The type of jobs infrastructure generates can be described as direct jobs (those employed on the job), indirect jobs (those employed in areas related to materials supplying the job) and induced jobs (jobs or economic gain from increased spending of the employees and firms associated with the job).[17]

102. Drawing from other project experience, a report by Market Economics Limited (2017) for the NZ Transport Agency on the Ōtaki to North of Levin project indicated that the socio-economic effects for the region during construction can be realised, but this is dependent on the total budget, spatial distribution of expenditure and timing of spend. Levels of local employment, local company involvement, sources of materials, and location and travel patterns of employees will also influence the socio-economic benefits.

103. Factoring the above, I make the following observations:

(a) There are a number of major construction projects recently at, or nearing completion, which are likely to result in increased capacity of employment (people) in the construction industry (e.g. Papatawa Realignment and Peka Peka to North Ōtaki , and Whirokino Trestle and Manawatū River Bridge (both due for completion in 2020));

(b) Notwithstanding the above projects, there has been an overall decline in construction employment (number of employees and percentage of employees) over the wider Horizons South East region between 2012 and 2017, as cited in the EY report prepared for the NZTA in respect of the short-list of options assessment.[18] From this, I consider that activity which may increase construction employment activity will meet emerging and growing 'gaps' between employment and workforce.

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[17] Chapter 3 Estimating Economy-Wide Job Creation Effects – International Finance Coorporation - https://www.ifc.org/wps/wcm/connect/f0be83804f7cdf68b7deff0098cb14b9/chapter3.pdf?MOD=AJPERES

[18] See Figures 7, 8 and 9 of the EY Report Manawatu Gorge Alternatives –Assessment of Wider Economic Benefits of the Shortlisted Options, prepared by NZ Transport Agency, 16 March 2018.

104. It is my view that the Project will have positive socio-economic outcomes for the Region. Although many of the specific employment and labour force outcomes are unknown for the Project at this stage, positive outcomes will predominantly be generated from the significant size of the Project, the anticipated duration of construction (more than 5 years), and the level of human resources required and location (not within easy commute of many other major cities). As a result of this activity, potential social benefits will include an improved ability for residents of the region to sustain themselves through employment opportunities and/or increased business activity. Also, there are potential way of life benefits as employment opportunities may allow residences to stay within the area for economic opportunities, rather than feeling it is necessary to seek opportunities outside the region.

105. While it is acknowledged that the quantum of these potential benefits are speculative at this stage, in my experience it is reasonable to conclude that these positive social outcomes will arise. I have been personally involved in construction projects where I have witnessed positive socio-economic outcomes for communities where construction projects are being undertaken. For example, for the Māngere Bridge community in construction of the Manukau Harbour Crossing (Auckland) and similarly for the MacKays to Peka Peka Project (albeit my personal involvement was more peripheral). In respect of Māngere Bridge, the construction activity provided local employment activity, but also more tangibly increased economic activity and vibrancy in the local Māngere Bridge town centre (particularly for food, service retail and similar business activities).

106. Given wider national concerns on availability and affordability of housing, I have given specific consideration to the potential impacts of the Project's construction activity on this. It is acknowledged that provision of accommodation for workers during the construction phase will increase demand for housing and other accommodation options in the region. A review of the rental availability undertaken at the time of our report preparation (looking at rental listings and turnover), projected employment growth, and amount and level of occupancy of hotels and motels indicates that the region has the capacity to absorb the influx of workers (on the assumption of the workforce numbers provided in the construction description for the Project). Furthermore, Palmerston North City Council has assumed high forecast population growth, and has planned sufficient zoning

capacity to accommodate this.[19] In addition, capacity and the ability for mid- and longer-term use of motel accommodation may further ease potential pressure on the rental market if required.

107. While only anecdotal information, discussions with some attendees at the open days indicated that local business owners are already considering opportunities for provision of alternative accommodation options for workers associated with the Project (this is noted solely on the basis that there is a receptiveness and capacity to accommodate the growth, not as a necessary mitigation to address the potential demand for such growth). On this basis, I do not consider that the influx of workers over construction will result in any significant impact on housing/housing affordability across the region.

108. There are some areas, such as Ballance and residences adjacent to the Pahīatua Track, which may experience more traffic if users choose this route as an alternative to Saddle Road (which potentially will experience more delays due to construction traffic). While this is not a direct impact of the Project works, this consequential impact has the potential to result in some physical degradation to the condition of the road (increasing wear damage), increase congestion, and decrease the safety environment (particularly around the Ballance School and Ballance Valley Road). This has potential social impacts, such as reduction in the quality of the environment and changes to the way people live (such as driving rather than walking to school and potentially reducing trips outside the home for some people).

Operational phase

109. The Project will provide a transport route with improved safety performance over the existing Saddle Road and Pahīatua Track. The Project's safety rating is an average of 4 Star KiwiRAP standard, and it will also lead to reduced traffic volumes on Saddle Road and Pahīatua Track, which are less safe. It is forecasted that the Project will lead to a reduction of 108 deaths and serious injuries over a 30-year period[20]. In addition to the important direct physical health and safety outcomes for the regional community this is also considered to have positive social impacts arising from the reduced social consequences from such events (e.g. wider community and socio-economic impacts).[21]

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[19] Palmerston North City Council Financial Strategy 2018 -2028.

[20] The forecasts given are based on the work done by the NZ Transport Agency for the Manawatū Gorge Alternatives Detailed Business Case.

[21] The evidence base for this is well established. One example includes the Ministry of Transport paper from 2011: The Social Cost of Road Crashes and Injuries, June 2011 Update (ISSN 1173-1370).

110. The Project will also improve the resilience of the local and regional road network. The closed SH3 section (Manawatū Gorge) was vulnerable due to geotechnical/geological conditions resulting in frequent disruptions and eventual closure. The current alternate routes (Saddle Road and Pahīatua Track) are not designed for the current volumes of traffic and are experiencing road surface issues which require maintenance works. The re-establishment of a new corridor for SH3 will improve resilience, both in terms of the resilience of accessibility and the capacity of transport corridors for the anticipated volume of traffic, including slow crawler lanes to allow for breakdowns and management of accidents without the requirement of diversions.

111. From a social perspective, this increased resilience provides an opportunity for improved cohesion and connectivity (arising from the increased surety that such connections are available) and ability to plan daily activities involving this route with increased certainty.

112. A safe and resilient route, with the capacity to accommodate the type of vehicles traversing it, will improve daily commutes and the ease with which users traverse the Ranges. This will facilitate better access to social services and facilities, such as: education, employment and healthcare, and reconnection of the community (socially and recreationally). Again, this is a positive impact both in terms of social cohesion (at a regional scale) and improvements to people's way of life including less time spent commuting and more at home or on other chosen activities. It will also result in an improved environment in terms of the experience driving SH3 (versus Saddle Road and Pahīatua Track) resulting in decreased anxiety and improved wellbeing.

113. A report by Marketview for Kāpiti Coast District Council (2017) on the MacKays to Peka Peka Expressway has demonstrated that, once the project is operational, benefits continue in terms of increases in spending for towns within proximity of the road. I note that this report identifies benefits to Ōtaki Township and Raumati are reflective of the expressway joining back to existing roads in these areas. Within the Kāpiti district, spending is up across a range of store types including for bars, cafes, restaurants and takeaways, fuel and automotive, and durable goods.

114. While acknowledging the project-specific characteristics of the expressway in that review, it is my opinion that socio-economic benefits could be anticipated for the regional area of this Project resulting from improved connectivity to

Palmerston North, as the city provides many of these types of stores for the region. As such, the reliable journey times will have positive socio-economic consequences, both in terms of efficiency and reliability for businesses frequenting this route and savings in fuel costs. While not further quantified, on the basis of my discussions with residents (particularly regarding the negative social consequences of the loss of the Gorge Route) it is reasonable to conclude that the Project will improve the ability to plan for and operate businesses either side of the Ranges as a result of the improved reliability and resilience of the connection.

LOCAL SOCIAL IMPACT ASSESSMENT

Ashhurst

Way of life

Construction

115. Construction traffic using Saddle Road as a means to access the construction site is expected to traverse through Ashhurst (in a manner similar to existing traffic using the route). The anticipated increase in traffic through Ashhurst, particularly HCVs, has the potential to exacerbate current effects experienced by the community from the closure of the Gorge and use of Saddle Road.

116. Effects include disrupting the way community members move within the community (both by foot and vehicle) due to increased traffic volumes and changes in the road safety environment. Other activities will potentially be disrupted, such as recreating, travelling to school, and getting to and from work.

117. Increased traffic noise generated from the HCVs, in particular, has the potential to disrupt how people live within their homes, such as sleeping patterns and their ability to undertake other activities such as working from home. I rely on the assessment of Dr Chiles in respect of physical noise effects during construction.

118. In terms of the social consequences of construction activities, I consider these to be low negative potential impacts. This assessment considers:

   (a) the medium-term duration of construction (some 5 years or more);

   (b) the scale (I consider the impacts will be experienced by around half of Ashhurst's population, acknowledging the school and that community); and

(c) the overall severity of the change, relative to the existing environment.

119. I conclude that the severity of impact on people's way of life will be low (noting however, that the effect on any one resident will depend on their specific location and circumstances). I make this assessment on the basis that the impact represents an incremental increase in disruption arising from construction activity, rather than a loss of connectivity, and in light of the impacts already experienced by this community with the traffic volumes using Saddle Road (the condition of the existing environment). I consider this adverse impact can be mitigated to reduce the impact of construction traffic; see below for further details.

120. Examples of the opportunities to mitigate such effects are the works already planned for existing road and centre improvements in Ashhurst. While these are not mitigating construction activities, they demonstrate the ability for local road works to address the adverse impacts on residents (safety, noise and accessibility issues). On this basis, to mitigate adverse impacts (discussed further in later sections of this report), I recommend management approaches for ongoing communication and processes to ensure response to issues as they arise.

Operational

121. Conversely, once operational, the Project will divert traffic out of Ashhurst. This will result in a 'reinstatement' of the patterns and way of life for the community to a condition similar to when the SH3 Gorge route was operational. Given the issues and concerns expressed by the community regarding the impacts of the diversion of traffic on this community, the potential social impact of this is considered to be high positive (again, noting this assessment is relevant to the existing environment, experienced since closure of the Manawatū Gorge route).

122. Some attendees at the consultation open days for the Project described this as living in a quiet community where it was safe and easy to travel by foot (to locations such as school and the Ashhurst Domain) and by car. In addition, in terms of living conditions within people's homes, the change in traffic volumes will facilitate better sleep and ability to carry out activities such as working from home.

123. I acknowledge that, between now and the time of operation (a period of over five years), there will be a number of changes to the community of Ashhurst. In particular, construction activity (and the increased workforce in the area)

has the potential to increase economic activity in Ashhurst. This activity is likely to be more reliant on the through-traffic currently diverted through Ashhurst (onto and from Saddle Road). While these elements are not part of the existing social environment, it is anticipated that there will likely be some 're-calibration' for those activities as construction ceases and the new operational movements are established. In my view, this is properly categorised as a period of social change (rather than either a positive or negative social impact).

Community cohesion

Construction

124. Connectivity within the community will potentially be further disrupted by increased construction traffic traversing through Ashhurst, particularly those living east of Salisbury Street. It provides a potential separation or some effective 'severance' resulting from increased difficulty traversing across this road, due to construction traffic. However, this needs to be factored in terms of the actual construction traffic volumes relative to the high volumes of existing traffic (over 7,600 per day) already using the route. In addition, Ashhurst residents' ability to connect to other communities east of the Ranges is potentially impacted by increased congestion on Saddle Road, which may include impacting community cohesion, for example as demonstrated by activities such as people coming together for weekend sports and visiting friends and family.

125. Although the duration of construction impact is recognised as medium (in other words it is not a short term effect), the severity (for the reasons set out above) and scale are considered to be at a lower level and therefore assessed as a potential low to very low negative impact.

Operational

126. The Project, once operational, will have a low positive impact on community cohesion (separating this from the higher positive impacts associated with way of life, which have been discussed above). These benefits are also identified as a result of the removal of a large proportion of traffic (including HCVs) from Salisbury Street and Cambridge Avenue through the centre of Ashhurst. While such traffic is considered a 'disruption' to accessibility and connectivity it has been considered less significant in respect of a severance to overall community cohesion.

127. Another positive outcome of the Project once operational is that it will facilitate a safe and reliable journey to the east of the Ranges to aid the ability to connect with other communities in the area. This may have some improved cohesion outcomes, improving connectivity for those with family and friends to the east of the Ranges (such as Woodville).

Sustaining oneself

Construction

128. Acknowledging the existing and potential disruptions to businesses that use Saddle Road, for the reasons explained above, activity generated from construction workers is likely to result in increased retail activity and use of services within Ashhurst, due to its proximity to much of the construction site. This benefit would be experienced predominantly by businesses within Ashhurst providing relevant services to construction workers, such as food and accommodation. Applying a 'balance' of impacts approach (with businesses relying on accessibility and connectivity potentially being disrupted), I consider this to be a potential low positive impact. Further, currently the community has a low current reliance on local socio-economic activity within Ashhurst, and relies instead on services and retail facilities in Palmerston North city which is a short commute distance. In my experience, it is reasonable to assume there may also be new businesses and opportunities for people to sustain themselves, arising from the increased economic activity associated with Project construction and particularly the influx of construction workers. While this opportunity is recognised, these new businesses are not part of the existing environment and as such specific impacts on these activities have not been further assessed.

Operational

129. Overall, this is assessed to be a potential low positive impact. This assessment considers the following factors:

(a) That people in Ashhurst use private vehicle to travel to work, and the <u>majority</u> are commuting to Palmerston North, rather than to the east across the Ranges, and therefore will not experience the scale of positive effect relative to those east of the Ranges.

(b) The transition back to traffic diverted around Ashhurst and the loss of construction workers frequenting services within Ashhurst (following construction activity) will result in a transition back to a quieter retail environment, which may be negative for some (particularly those businesses and employees of those businesses).

(c) There is an improved ability for other existing service and supply businesses to have a wider commute area (e.g. east of the Ranges) that is safer and more resilient, which is assessed as a positive impact for these business owners.[22]

Quality of environment

Construction

130. The current environment in Ashhurst incorporates impacts, since the Gorge closure, on the character and amenity value and health of residents (due to increase in traffic and, in particular, traffic noise). This includes the character of Ashhurst as a quiet, safe and peaceful village. This SIA focusses on assessing the existing environment (post-closure); in this respect, increased traffic volumes as a result of construction traffic will potentially exacerbate those elements of concern to residents at present. However, the Project is likely to generate minimal night traffic and changes will not be significant, compared to the existing disruptions. On this basis, it is assessed that these impacts are a low negative impact.

Operational

131. Diversion of traffic around Ashhurst due to the operation of the Project will have a moderate to high positive impact on the community. It will regain the quiet and peaceful character valued by the community, and residents will experience less noise therefore improving their well-being. I conclude this as a high benefit, for the following reasons:

(a) While Saddle Road is a Major Arterial route, and therefore relatively high volumes of traffic can be expected to use it, traffic volumes have increased significantly since closure of the Gorge and this has been cited as having a significant impact on the quality of residential amenity and residential environment experienced by residents.

(b) I note that the community consultation and engagement feedback has been strongly positive to the reversal of this situation and the values

[22] It is understood from the traffic assessment, that approximately 35% of peak traffic flows over the Ranges are travelling west to east, rather than the converse dominant east to west movement. However, it is also noted that the population size on the west (including Palmerston North city) is significantly larger, so as a proportion of the overall population this is a far smaller accessibility movement.

the community places on getting 'their quiet residential community back'.

Woodville

Way of life

Construction

128. Woodville is already experiencing impacts on daily life when accessing employment, education and services (commercial, retail and health) west of the Ranges via Saddle Road. Currently disruptions include increased traffic and road closures due to maintenance and upgrades. Construction traffic using Saddle Road (dependent on direction) has the potential to slow traffic further, thus increasing the commute and reducing time spent at home. However, this is not likely to worsen the situation significantly from the existing environment, given that the anticipated increase in traffic from construction is low.

129. In addition, by the time construction commences it is likely that the current maintenance and upgrade works will have been completed, meaning that the community may then be experiencing fewer closures than they do currently.

130. Collectively, I consider this to be a low negative impact.

Operational

131. Conversely, the operation of the Project will provide a safer, more efficient, resilient and reliable connection to the west than the existing environment. This will ease journeys for work, education, recreation and access to health services. The potential impact is considered to be a moderate to high positive impact, arising largely from reduced time lost to travel and increased certainty in planning and travelling between Woodville and west of the Gorge. In addition, I consider the re-establishment of both the national (SH3) and major arterial route (as separate corridors) will improve resilience of this connection. This will also contribute to positive outcomes for people's way of life.

Community cohesion

Construction

132. The potential exacerbation of congestion and slow journey time on Saddle Road and increased journey time to use Pahīatua Track due to increase

construction traffic on Saddle Road provides a potential further separation of Woodville with communities west of the Ranges. This includes the way people connect, such as through weekend sports and visiting friends and family.

133. Although the duration of this impact is medium term (potentially the length of construction) the severity and scale are considered to be at a lower level and therefore assessed as a potential low to very low negative impact (noting this is assessed as a relative change, to the existing environment conditions).

Operational

134. The operation of the proposed corridor is anticipated to have a moderate positive impact for those in the community connected to the west as it will facilitate a safe and reliable journey to the west of the Ranges to aid the ability to connect with other communities such as Ashhurst and Palmerston North, creating improved cohesion between towns/cities within the region.

135. That said, the potential disruption to community cohesion and connectivity as a result of increased traffic volumes through the main street of Woodville is noted. On the basis that this corridor is already a key State highway route and that the township has established as a 'main street' area, I do not consider these potential cohesion impacts to be significant (they are more a disruption to connectivity and cohesion rather than a severance). On this basis, I consider the increased traffic flows through and along the main street of Woodville will be a low negative impact.

Sustaining oneself

Construction

136. Acknowledging the existing and potential disruptions to businesses that use Saddle Road and some loss of through-traffic, activity generated from construction workers is likely to result in increased service, supply and retail activity and use of services within Woodville due to proximity to the construction site. Over the construction period, this would largely be of benefit to those businesses within Woodville providing relevant services to construction workers such as food and accommodation. For these reasons, and given the relatively low business activity in Woodville currently I consider this to be a potential low positive impact. However, there is also potential for new business development in Woodville as a result of the increased busy-ness of the area (as I have identified for Ashhurst).

Operational

137. The transition back to most traffic travelling east traversing through Woodville has the potential to generate more activity (re-establishing some activities) within Woodville, and this has the potential to benefit retailers and local service businesses. However, from our assessment, some business activity was already declining in Woodville, even prior to the closing of SH3 through the Gorge (in particular it is noted that between 2006 and 2013 there was a 6% decline in businesses recorded by Statistics New Zealand business demographics), to around 110 businesses.

138. The improved ability to commute safely and reliably from Woodville west of the Ranges is likely to be positive for business owners reliant on connections to Palmerston North and may also increase the attractiveness of this area for some future residents (e.g. a population commuting to and from Palmerston North for work). Factoring these considerations in, I consider this is a potential moderate positive impact for the community's ability to sustain oneself.

Quality of environment

Construction

139. Construction of the Project is unlikely to change the quality of the environment within Woodville, be it in terms of its character, amenity value, or wellbeing of residents. Some residents have noted that the vibrancy of the town centre has changed since the closure of the Gorge route, and increased activity from construction workers may contribute to reversing this. Overall it is considered to be of **no impact**.

Operational

140. Many residents of Woodville traverse the Ranges daily to access Palmerston North. Historically the trip through the Gorge contributed to their sense of identity and offered high character and amenity value (it is noted while the Gorge was identified as a valued natural environment by others across the wider community, it was specifically some residents from the Woodville community that referred to it as part of 'their home' or the character of their community). The change has been experienced since the closure of the Gorge (e.g. it is a social effect of the existing environment), but will continue due to the Project bypassing the Gorge. Whilst not a significant impact (and

more a social opportunity) opportunities for mitigation of this are provided in the subsequent section of this report (Recommendations for Mitigation).

141. In addition, the new journey / route has the potential to provide an opportunity to connect to another part of the Ranges from the Gorge and there are opportunities to view the wider surrounds from along the proposed designation corridor to enhance this experience. The improved safety and resilience of the corridor will also enhance the environment and wellbeing for these users (e.g. the sense of safety and reliability for access along the corridor). I consider this will be a potential moderate positive impact on the community.

142. More locally, to the Woodville village, a new and safer journey experience and potential return of the vibrancy of the main street, due to increased activity from the operation of the Project. Noting the following in respect of businesses in Woodville[23]:

(a) 20% are retail trade;

(b) 16% are construction; and

(c) Accommodation and food services provide a further 12% of business activity.

On the basis of this data, I conclude the reinstatement of the 'main-street' has positive impacts for some (particularly those that value the business activity in this area). However, for others, the increased traffic volumes and associated changes to the amenity of the environment (e.g. for the local school) will be a potentially negative impact on the quality of the environment. On balance, and recognising the historic development of Woodville, I consider this to be a moderate positive impact.

PROJECT EXTENT SOCIAL IMPACT ASSESSMENT

143. This assessment considers the construction and operational impacts for residents within and along the corridor, in addition the loss of private land expected to be acquired for the Project (largely addressed through Public Works Act 1981 ("**PWA**") processes).

144. Dependent on the access routes chosen for construction, landowners, businesses and residents (of which there are few) may experience disruption

[23] Statistics NZ Business Demographics Data 2013.

to daily activities. In summary, land uses and activities within or adjoining the Project include the following:

(a) Residential dwellings – rental and owner occupied (unquantified distinction);

(b) Lifestyle blocks – where the principal purpose of the property is residential with a rural setting or outlook (but not necessarily as an activity which is the primary mechanism for sustaining oneself);

(c) Pastoral land – grazing;

(d) Research farm for field trials (1 activity);

(e) Wind farm operation (1 activity);

(f) Covenanted land - QEII National Trust; and

(g) Natural bush, restoration areas.

145. The quantum of impacted properties is relatively few (e.g. approximately 20 residences are identified as adjoining or within 200m of the Project) and 10 properties directly impacted.

146. Potential social or 'way of life' and 'sustaining oneself' impacts include:

(a) For operation of farms (including moving stock within and off the farm), potential restriction of access to driveways or parts of farms at times during construction. This may also impact on the ability to sustain oneself if people cannot operate their businesses effectively, and so will need to be managed with the landowner and/or business operator. Some of these considerations will be managed through property acquisition and lease processes of the PWA, and as such are not specifically considered further here.

(b) For approximately 10 residents (including those on lifestyle blocks along the corridor) within proximity of the Project, changes to visual and audible amenities (as assessed by the reports from Dr Chiles (in respect of noise effects) and Mr Bentley (in respect of landscape effects)). The view will be interrupted by the road, changing a predominantly rural outlook, and new noises will be experienced from roading or intersection changes. This potential impact will be experienced by those people who have residences along the corridor or in proximity to the new intersections proposed between the Project and existing roads.

(c) A potential impact on the quality of the environment and sense of place values for the residents discussed in point (b) above. While physical impacts, such as noise mitigation, can address some of the physical effects of the project, the wider change of character and quality of environment is recognised as a low negative social impact (due to scale of change and the scale of impact).

(d) An increase of traffic for residents and lifestyle block residences on SH3 at each end of the Project, in contrast with the reduced traffic they are currently experiencing due to the Gorge closure. They will experience this increase of traffic and associated noise both during construction and operation of the Project. This will potentially be exacerbated for those in proximity to the roundabouts proposed, as they will require land take and will bring the road closer to some residents. This will potentially disrupt their daily activities and the quality of the environment around them. Whilst this outcome will be similar to the environment prior to the Gorge closure, I similarly consider this to be a low negative impact in comparison to the current environment experienced by these residents.

(e) Loss and disruption to other business activity operating in the area, particularly the loss of business continuity (as is the case for the research and farm trials). While not specifically a 'social impact', it is recognised that this activity supports wider socio-economic operations and as such may have an indirect impact on the ability for people to sustain oneself. Given the low scale and indirect nature of this impact, it has not been further quantified.

147. While the potential physical impacts associated with visual and landscape changes and noise are addressed by other specialists (and specific mitigation measures are proposed in that regard), I also recommend that residents identified as affected are included in detailed design discussions around landscape and noise mitigation, as a means of mitigating these potential social impacts on their quality of environment and sense of place.

RECOMMENDATIONS FOR MITIGATION

148. I recommend the following measures be conditioned to manage and mitigate the identified impacts.

Community engagement and participation

Liaison

149. On the basis of the impacts identified in this SIA, I recommend that a management mechanism is put in place to provide a Project/Community Liaison Person. Such a person (or persons) would be appointed by the NZ Transport Agency (as part of the construction team) for the duration of the construction phase of the Project to be the main and readily accessible point of contact for persons affected by construction works.

150. This measure will assist to ensure that all parties affected by construction works have a single point of contact to a person reasonably available for on-going consultation on matters of concern s. In my experience, this provides a mechanism for people's concerns to be heard and where appropriate, acted upon. This means that disruptions caused by construction, and the consequential adverse impacts this may have on people's way of life, can be responded to and managed.

Communications Plan

151. Furthermore, to address the potential adverse effects associated with construction activities identified in this report (including impacts on people's way of life and how they value their environment and quality of that environment), it is recommended that a Communications Plan is prepared by the NZ Transport Agency prior to construction. Such a Plan would set out procedures detailing how the public, stakeholders, businesses and residents will be communicated with throughout the pre-construction and construction phases of the Project.

152. I recommend that the Communications Plan would include:

   (a) details of the Project Liaison Person, as well as means for these contact details to be found for stakeholders and the public (such as a website, and near the construction site) so that they are clearly visible to the public;

   (b) a list of stakeholders, organisations, businesses and residents who will be engaged with over the design development and construction of the Project – to enable the community to remain involved in these processes. This in particular should include school and childcare facilities in Ashhurst, Woodville and potentially Ballance;

   (c) methods of consultation and matters to be discussed, including:

(i) proposed hours of construction activities, in particular where these are outside of normal working hours or on weekends or public holidays, to acknowledge that such works have the potential to impact on people's way of life;

(ii) methods to deal with concerns raised about such hours;

(iii) methods to provide early notification to businesses of construction activities, particularly any such activities that will or may impact on Saddle Road (and use of Saddle Road for traffic), acknowledging the existing impacts of reliance on Saddle Road but also the potential for construction traffic to exacerbate these impacts;

(iv) methods to communicate on any further disruption or closures (but also the subsequent reinstatement) of the Saddle Road/Pahīatua cycleway route as it is impacted by construction activity and following construction as its reinstatement is enabled, in recognition of this corridor as a Regional cycling route and as a valued 'environmental and tourism' capital for the community. This recommendation acknowledges that the route is currently not recommended for use as a result of the closure of the Manawatū Gorge State highway route; and

(v) methods to communicate on any short-term disruption to access to the Manawatū Gorge walkway and or carpark for that walkway over construction. Again, this acknowledges the importance of this recreational facility for the local and wider regional community and the environmental and sense of place value (environmental and tourism capital) of this asset.

(d) It is recommended that a full suite of communication activities are considered. Appropriate measures should be undertaken to enable the community to be made reasonably aware of the Project, of their opportunity to comment on issues, and the actions and progress that is being made on construction works. The Plan should detail communications activities, for example:

(i) publication of newsletters, or similar, and proposed delivery areas;

(ii) information days, open days or any other mechanisms to facilitate community engagement;

(iii) newspaper advertising, particularly in respect of any road closures, changes to road access etc. over construction;

(iv) notification and consultation with business owners and operators and individual property owners and occupiers with premises/dwellings within 100 metres of active construction, and for all businesses in Woodville and Ashhurst, particularly where such works may impact on access or the amenity of these sites; and

(v) a Project website as a means of providing and maintaining communication with the public.

Community Liaison Group

153. In addition to the above, I recommend that a Community Liaison Group is established to provide ongoing opportunities for representatives of the community to be involved in detailed design and construction planning. The purpose of the Group will be to:

(a) share information on detailed design, including information on:

(i) landscaping;

(ii) public access points or viewing points integrated with the Project;

(iii) opportunities (if any) to integrate the Project design with public access or walkway opportunities to areas such as the Manawatū Gorge; and

(iv) opportunities (if any) for pedestrian access across the new ‘Manawatū River Crossing’ to provide viewshaft to the Gorge. This opportunity is identified in acknowledgement of the ‘sense of identity’ impact that some in the community have identified as being experienced from the loss of the Gorge route, albeit that this impact is associated with the closure of the Manawatū Gorge route. It is acknowledged this is less mitigation for the current Project, but rather that it may be an opportunity to address the impacts of the loss of access to the Gorge resulting from the closure of SH3.

154. The Community Liaison Group forum will also provide an opportunity for:

(a) reporting and responding to concerns and issues raised in relation to construction works, particularly in respect of the existing local roads (Saddle Road, Pahīatua Track and Ballance Valley Road); and

(b) monitoring the effects on the community arising from construction works in these areas.

155. I recommend that regular meetings of the Community Liaison Group be convened (for example, once every three months) throughout the construction period for interested people from the community areas identified (it is recognised that attendance to such a group will not be mandatory). It is also recommended that the group should continue until six months after completion of construction so that on-going monitoring information can continue to be shared, discussed and responded to.

156. The proposed invitation for the Community Liaison Group could include:

(a) representatives of the Ashhurst community (at least 3) and Woodville community (at least 3) as well as Ballance (1), Dannevirke (1), and Palmerston North (1) – noting for accessibility it may be appropriate for the groups to meet separately in Woodville and Ashhurst;

(b) representatives from the Ashhurst, Woodville and potentially Ballance Schools and other childcare facilities;

(c) respective Council representatives;

(d) NZ Transport Agency representatives;

(e) representatives of the construction organisation appointed to construct the Project; and

(f) tangata whenua/iwi representatives (if they wish to participate, noting that these groups are likely to have separate liaison and engagement fora with the NZ Transport Agency and as such they may not see a need to additionally participate in this group).

Recreation and open space

Manawatū Gorge Carpark Reinstatement Plan

157. As part of the Project, the NZ Transport Agency will reinstate the Manawatū Gorge Carpark. Acknowledging the importance of this community facility, both locally and to the wider community, I recommend that a Management and Reinstatement Plan is prepared prior to any works that may affect access to or use of the Manawatū Gorge Carpark and or access to the Manawatū Gorge Walkway during construction and for the reinstatement of the carpark following construction.

158. The Reinstatement Plan should be prepared in consultation with Department of Conservation and Council and community representatives.

159. The purpose of the Plan would be to provide details of how public access will be maintained over construction and for the reinstatement works in this area, where it is directly affected by construction works.

160. The following specific matters should be addressed in any such Plan:

(a) removal of structures, plant and materials associated with construction (unless otherwise agreed with the landowner);

(b) replacement or reinstatement of formal parking areas, boundary fences, landscaping and information/signage;

(c) reinstatement of grassed areas to a similar condition as existed prior to construction;

(d) replacement of trees and other planting removed for construction works; and

(e) details of 'way finding' and interpretation signage within and adjacent to the Manawatū Gorge Carpark (including to the walkway and (if any) potential opportunities identified for pedestrian viewing opportunities on the new bridge).

161. The above recommendations will allow for flexibility to respond to impacts and develop community aspirations during the construction process, helping to further minimise, manage and remedy the potential impacts identified and further develop positive attributes of the operation of the corridor in tandem with the community.

CONCLUSION

162. In summary, at a regional level the social impacts during construction of the Project will relate to the ability to use Saddle Road safely and without additional delays. The level of anticipated construction traffic will not significantly alter the existing environment, however, and will therefore result in only minor additional impacts on the way people live their lives, come together as a community, sustain themselves, and experience the environment (acknowledging the existing conditions for the community as a result of the closure of the Gorge, which is not a specific element of this SIA).

163. The operation of the Project will alleviate current issues with the existing environment and provide a safe, resilient and reliable transport corridor.

The Project will facilitate connections within and beyond the region, positively impacting cohesion and the ability to carry out daily activities and sustain oneself.

164. At a local level, the construction impacts from construction traffic on Saddle Road and through Ashhurst may (at a low level) exacerbate current issues in the existing environment with the way residents can move both within their communities and to other communities and facilities across either side of the Ranges.

165. The operation of the Project will have moderate to high positive impacts from the diversion of traffic away from Ashhurst, more traffic through Woodville and provision of a safer, more reliable and resilient route over the Ranges. This will facilitate improved performance of daily activities. Positive impacts on the ability to sustain oneself will include improved conditions for commuting and operation of businesses. There will also be improved cohesion of and improved connection to other communities. People will experience positive changes to the quality of the Ashhurst environment, helping return it to a quiet, peaceful, village environment.

166. For those residences within or neighbouring the Project extent, management of access and disturbances during construction, and the transition to operation, will need to be managed with landowners to manage potential impacts.

167. Mitigation strategies are recommended to remedy and mitigate the potential effects and respond appropriately as they occur.

Amelia Linzey

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4. LANDSCAPE, NATURAL CHARACTER & VISUAL

IN THE MATTER OF	The Resource Management Act 1991
AND	
IN THE MATTER OF	Notices of requirement for designations under section 168 of the Act, in relation to Te Ahu a Turanga; Manawatū Tararua Highway Project
BY	**NZ TRANSPORT AGENCY** Requiring Authority

TE AHU A TURANGA; MANAWATŪ TARARUA HIGHWAY PROJECT

TECHNICAL ASSESSMENT #4

LANDSCAPE, NATURAL CHARACTER AND VISUAL EFFECTS

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INTRODUCTION

1. My name is **Boyden Henry Evans**. I am a NZILA[1] Registered Landscape Architect and a Partner at Boffa Miskell Limited ("**Boffa Miskell**"), a New Zealand-owned environmental planning and design consultancy. I am the primary author of the assessment of landscape, natural character and visual effects (Technical Report #4) for the Te Ahu a Turanga; Manawatū Tararua Highway Project, Notices of Requirement.

2. Bronwyn Elizabeth Faulkner, a NZILA Registered Landscape Architect and Senior Principal in Boffa Miskell, assisted with the preparation of Technical Assessment #4.

3. The natural character component of the assessment of rivers, streams, wetlands and their margins involved, in addition to Bronwyn Faulkner and me, several other specialist contributors: Dr Adam Forbes (terrestrial ecology), Dr Olivier Ausseil (water quality) and Kieran Miller (freshwater ecology).

4. I have a Bachelor of Science in botany and pedology from Victoria University of Wellington and a post-graduate Diploma in Landscape Architecture from Lincoln University. I am a Fellow of the NZILA.

5. I have been a landscape consultant with Boffa Miskell since 1986 and have worked on a range of projects for corporate and private clients and for territorial authorities and government agencies in various parts of New Zealand. This work includes district and regional landscape assessments and resource studies, landscape and visual effects assessments for many types of development projects. These include infrastructure projects, such as new roads, wind farms, quarries, transmission lines, and rural lifestyle and residential subdivisions. I have also been involved in many site rehabilitation and revegetation projects and have prepared master plans and management plans for reserves and other areas.

6. Key projects in which I have been involved over the past 10 years include:

   (a) Mackays to Peka Peka Expressway;

   (b) Wellington International Airport Runway Extension;

   (c) Wellington City Landscape Evaluation Assessment;

   (d) Hutt City Landscape Evaluation Assessment;

[1] New Zealand Institute of Landscape Architects.

(e) Wairarapa Landscape Evaluation Assessment;

(f) Wellington and Hutt Coastal Natural Character Assessment;

(g) Porirua Coastal Natural Character Assessment;

(h) Hutt River Environmental Strategy;

(i) Otaika Quarry Overburden Disposal Area and Rehabilitation, Whangarei;

(j) Belmont Quarry Overburden Disposal Area and Rehabilitation Hutt City; and

(k) Kiwi Point Quarry s42A Report, Wellington City Council.

7. These projects have involved a combination of landscape and visual effects assessments, identification of outstanding natural features and landscapes, assessment of natural character and subsequently preparing and presenting expert witness evidence. In 2012, I prepared the landscape and visual effects assessment for the Mackays to Peka Peka Expressway project, presented evidence at the Board of Inquiry and then had an ongoing role over the following four years in the detailed landscape design and implementation phases of the project.

Code of conduct

8. I confirm that I have read the Code of Conduct for expert witnesses contained in the Environment Court Practice Note 2014. This assessment has been prepared in compliance with that Code, as if it were evidence being given in Environment Court proceedings. Unless I state otherwise, this assessment is within my area of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

Purpose and scope of assessment

9. Te Ahu a Turanga; Manawatū Tararua Highway Project ("**the Project**") is to provide a new resilient, safe and efficient connection between the eastern and western sides of the Ruahine and Tararua Ranges. The proposed approximately 11.5km route is located on the southern foothills of the Ruahine Range, immediately north of the Manawatū Gorge and south of Saddle Road. This new route will be SH3, replacing the existing State Highway route, which until it was permanently closed ran through the Manawatū Gorge ("**Gorge**").

10. The Assessment of Landscape, Natural Character and Visual Effects, Technical Assessment #4, forms part of the Assessment of Environmental Effects ("**AEE**") being submitted with Notices of Requirement ("**NoR**"). To undertake the assessment, the proposed designation corridor has been divided into six sectors and the assessment of landscape and natural character effects has been undertaken in relation to these sectors. The assessment of effects on visual amenity has been addressed in relation to the whole route as one. Technical Assessment #4 has been informed by the assessment appended to it, namely Appendix 4.A: Natural Character Assessment. Photographs and maps that support the description of the site, the Project, and this assessment, are referred to throughout the report and are included in the drawings and plans submitted in Volume 4 of the AEE.

11. The Environmental and Cultural Design Framework ("**ECDF**") prepared for this Project provides design guidance integral to the landscape outcome, of the proposed new road.

Assumptions and exclusions in this assessment

12. The assessment considers the upper/outer limit of (or realistic 'worst case') actual and potential effects on the environment of the Project, based on the location and the extent of the proposed designation considered and discussed by the Project team during the Project shaping process, potential options to design a road within that designation, and proposed measures to avoid, remedy, mitigate or offset adverse effects (where it is appropriate to do so).

13. In undertaking this assessment, it is acknowledged that, through the detailed design and resource consent processes, the road alignment within the designation corridor will be confirmed, which may affect the levels of landscape, natural character and visual effects as set out in this assessment. The Project Conditions arising from the NoR, together with the principles outlined in the ECDF, will provide the basis for the final road alignment and design, and that design will be the subject of the ‘outline plan’ process provided for in the Resource Management Act 1991 ("**RMA**").

14. Effects have been assessed against the existing environment, which is the current situation with the permanently closed section of SH3 through the Gorge.

EXECUTIVE SUMMARY

15. As with any major infrastructure development of this kind, the Project will have adverse effects on biophysical aspects, landscape character and on the natural character of rivers, streams and their margins. The Project will also give rise to adverse visual effects; for the most part these can readily be mitigated.

16. An integral part of the development of the Project has been the consideration of the designation corridor and potential alignment options by the consultant team to avoid or minimise adverse effects. As a result of this process, potential adverse landscape, natural character and visual effects have been reduced or minimised in several places.

17. The western end of the Project posed the greatest challenges in terms of landscape, natural character and visual effects. This involves a new bridge over the Manawatū River, within the Manawatū Gorge Outstanding Natural Landscape ("**ONL**"), and then the corridor traverses through an area of sensitive landscape comprising valued streams and indigenous vegetation, including two remnant forest areas protected by QEII open space covenants. The Project also traverses the ridgeline of the Ruahine Range, which is identified as an ONL.

18. The avoidance of important areas of indigenous vegetation, reduction of effects on waterways, attention to the detailed design of the alignment, and constraints on construction methods would all assist in reducing the level of adverse effects. These aspects, together with various mitigation measures, including the ecological offsetting as described by Dr Forbes (Technical Assessment #6) and in the ECDF, would all contribute to reducing adverse effects.[2]

19. A summary of biophysical, landscape character and natural character effects as identified is set out below.

Landscape effects

20. The landscape effects of the Project vary from low in some sectors to high in others. The areas where there are high adverse effects is where there are potential large-scale biophysical changes as a result of earthworks, together with removal of areas of high-value indigenous vegetation, which in several places is protected by Queen Elizabeth II Trust ("**QEII**") open space

[2] The Project Conditions describe the 'effects envelopes' and ecological offsetting measures.

covenants. The designation corridor also traverses two ONLs (Manawatū Gorge and the Ruahine Ridgeline). Conditions are proposed to limit the extent of clearance of the highest-value vegetation types; nonetheless, in several places where these high adverse biophysical changes occur, there will also be high adverse effects on landscape character.

21. Embankments formed to support the road and large cuts to existing landform will alter the existing topography and require vegetation removal and, in places, diversion of sections of existing streams. Using bridges instead of embankments or culverts and minimising the Project footprint are all measures that could be used to mitigate adverse effects. Revegetation of areas of indigenous vegetation affected by being fragmented by the Project and creating buffers of new planting to seal and protect the edges of native forest remnants are mitigation measures that should be integral to the Project's detailed design. In places, revegetation to connect isolated forest remnants affected by the Project and connecting these along gullies with the forest in the adjoining Manawatū Gorge Scenic Reserve is another positive offsetting/mitigation measure proposed. The proposed designation conditions address these measures.

22. The Project involves construction of a rural road through a working rural landscape, which has been altered previously by the construction of the Te Āpiti Wind Farm. Both the wind turbines and the construction of the network of access tracks between the turbines had an adverse effect on the original rural character and added new man-made elements; the Project will add a series of new elements, together with new activity. Saddle Road also crosses the Ruahine Ridgeline ONL.

23. While there will be adverse biophysical and natural character effects, these are focused at the western part of the Project. Where high levels of adverse biophysical and landscape character effects do occur, recommended mitigation measures, together with recommendations set out in the ECDF, if fully implemented through the detailed design and construction phases, would provide opportunities for adverse landscape effects to be remedied or mitigated effectively, and for cultural values to be expressed. The table below summarises the biophysical and landscape character effects of the Project in relation to each of the sectors identified.

Table 4.1: Summary of Landscape Effects

Sector	Biophysical Effects	Landscape Character Effects
1: Bridge to Bridge	Low	Moderate Low
2: New Manawatū River/Gorge Bridge	Moderate	High
3: Western Slope	Moderate High	High
4: Te Āpiti Wind Farm and Ridge	Moderate	Moderate High
5: Eastern Slope	Moderate High	High
6: Woodville Gateway	Moderate Low	Moderate

Natural character

Existing levels of natural character

24. Natural character is about condition. It is a term used to describe the naturalness (lack of modification) of coastal and river/stream environments. In the context of the Project, a lack of, or low level of modification, would equate to a high level of naturalness.

25. The assessment of existing levels of natural character of the rivers and streams was undertaken at two scales; a broad-scale assessment, and at a more detailed level focusing on specific areas where the Project crosses waterbodies. A region-wide natural character assessment of rivers, streams and wetlands has not yet been carried out by Horizons, nor by the territorial authorities, so the broad-scale assessment is intended to provide a contextual baseline.

26. Assessment of natural character is not the domain of any one specialist but instead involved inputs from several disciplines (i.e. freshwater and terrestrial ecology, stream morphology, water quality, landscape context and experiential aspects). For this reason, the natural character assessment of the waterways was carried out by a small team of specialists, who individually assessed particular attributes and then worked together to assign an existing level of natural character, and then determined a post development level of natural character.

27. There were no areas of outstanding natural character identified at either scale (refer **section 4.1, Appendix 4.A**).

28. One broad-scale reach, the Manawatū River through the Gorge, was identified as having a high level of natural character (with an assessed level of moderate-high at the proposed crossing point).

29. Three of the streams crossed by the Project have a high level of natural character as outlined in **Appendix 4.A**, at the following locations:

    (a) a stream in what is known as the 'western QEII area', which flows to an area of raupō wetland (chainage 4000-6000);

    (b) a stream in the 'eastern QEII area' (chainage 6100-6500); and

    (c) the location of a stream crossing associated with an existing construction access track from/to Saddle Road.

Effects on natural character

30. The assessments have considered the long-term (permanent) effects of the Project. It is assumed that best practice construction methodologies, including stormwater management, and erosion and sediment control measures will be implemented during construction to avoid or minimise short-term effects. However, it is acknowledged that there will be some short-term effects on natural character, such as temporary stream diversion, removal of vegetation along stream margins and experiential effects.

31. The change to the level of natural character was considered at a site level (crossing point locality) and at an overall stream catchment level for the streams, and at the local reach level for the Manawatū River. This was an important consideration in the assessment process because it acknowledges the interconnectedness of a stream or waterway. The Project crosses the Manawatū River and the streams with high natural character at right angles and thus the extent of disturbance at the crossing points is limited.

32. Based on the methodology, 10 attributes were considered to assess the existing level of natural character, and the Project's effects on natural character. Of these, the Project most impacted on the morphology of the active bed and margins, the aquatic taxa and ecosystem functioning of the active bed, the terrestrial ecology of the margins, and the experiential qualities. The flow regime, water quality, and absence/presence of exotic flora and fauna were not generally considered to be significantly affected over the long-term.

33. The greatest impact of the Project relates to the scale and location of the works footprint in the active bed and margins of the streams. At the local

scale, the filling of the stream gullies with earth embankments results in permanent loss of vegetation, loss or modification of significant lengths of active bed and margin in what are relatively small catchments. At the broader scale, the Project results in fragmentation of ecological communities, and disruption of ecosystem functioning along the streams.

34. Experientially, it is inevitable that the introduction of large-scale earthworks and road activity will dominate the natural environment and tranquil aspects of the small stream gullies, and within the Manawatū River corridor where the proposed new bridge will cross.

35. The areas of greatest sensitivity in terms of potential effects on natural character are those in locations were the existing natural character is highest. Three of the streams crossed by the Project have high natural character. The assessment of natural character by each sector below focusses on these three streams.

36. A reduction in natural character from High to Moderate (or less) is considered to constitute a significant reduction in the level of natural character[3]. Waterbodies with high natural character are more sensitive to change, which could adversely impact on the attributes and qualities than those that have a moderate or low level of natural character. A reduction from High to Moderate is considered to be significant as it requires reductions in several of the 10 assessment attributes for the overall level of natural character to be affected.

37. The assessment has determined that the existing high natural character of two streams (QEII West (chainage 4000-6000) and QEII East (chainage 6100-6400)) may be significantly reduced by the Project. In both situations, the footprint of the alignment and construction works could cause permanent loss to relatively large sections of the active bed and stream margins, in what are relatively small gullies and catchments.

38. Table 4.2 sets out a summary of effects on natural character. While natural character of these stream/river crossings would be diminished by the Project, the proposed mitigation, supported by the Project Conditions will go some way to reduce the level of effects on natural character. That is, refinement of the road alignment, and minimising construction works footprints to reduce the quantum of the streams affected, combined with the re-establishment of

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[3] Horizons One Plan Objective 6-2(b)(ii) provides the following direction: *"Adverse effects, including cumulative adverse effects are: (ii) avoided where they would significantly diminish the attributes and qualities of areas that have high natural character, and…"*

vegetation in the catchments, would reduce the impact on natural character of the stream crossings.

39. In addition, design guidelines in the ECDF, once implemented during detailed design will also assist to reduce adverse effects of natural character on the streams.

40. The various alignment options and mitigation measures that were considered and assessed are described in detail in **Appendix 4.A** and summarised under each of the sectors.

Table 4.2: Summary of changes to natural character (at crossing locations)

Location	Current Condition	Post Construction Condition
Manawatū River Crossing	Moderate/High	Moderate
Chainage 4000-6000		
Lower stream/wetland	High	Moderate/High
QE II West	High	Moderate
QEII East **(chainage 6100-6400)**	High	Moderate
East End Stream **(chainage 12700-13100)**	Moderate	Moderate/Low
Stream Crossing construction access to Saddle Road	High	Moderate/High

41. Table 4.2 sets out the levels of natural character at a site-specific scale but when considered at an overall stream scale, the changes in the level of natural character is diminished. For the QE West stream, the natural character at an overall stream scale would change from High to Moderate/High. For the QEII East stream and the stream adjoining the construction access, the natural character would be unchanged (Table 4.3).

Table 4.3: Summary of changes to areas of high natural character (whole streams)

Location	Current Condition	Post Construction Condition
Chainage 4000-6000 **QE II West and lower stream/wetland**	High	Moderate/High
QEII East **(chainage 6100-6400)**	High	High
Stream construction access to Saddle Road	High	High

Visual effects

42. The focus of the assessment of visual effects is on the Project's visual effects on the receiving environment, given that it would be a new element and activity. The visual effects in terms of road users has also been a consideration, and the design principles and design outcomes covered in the ECDF describes these. These include creating memorable experiences for users through maintaining views for drivers descending the Ruahine Range, maintaining views of landscape features such as the Manawatū Gorge Scenic Reserve and the Te Āpiti Wind Farm, provision of lookout points and safe stopping places, integrating batter slopes with the adjacent landform, provision of ecological and amenity planting, and design of structures such as bridges to enhance the experience of road users and not compete or detract from the landscape. Views from the road will be considered as part of confirming a road alignment and preparing outline plans.

43. The potential viewing audiences of the Project are limited because of distance from both Ashhurst and Woodville, the two areas of concentrated residential settlement, and screening effects of both topography and vegetation. Overall, adverse visual effects can readily be mitigated from these two viewing audiences through the provisions set out in the ECDF and draft Project Conditions.

44. The only area where there will be a high level of visual effects are in the environs of the new bridge across the Manawatū River. The scale of the bridge and its contrast with the largely natural setting would dominate this area of the Manawatū River environment. However, the design of the bridge, treatment of the earthworks, and mitigation planting would help to integrate the bridge in its landscape setting.

45. A summary of the level of visual effects as identified from each representative viewpoint is set out below:

Table 4.4: Summary of Visual Effects

Viewpoint	Level of Effect
The Terrace Ashhurst	Low
SH3 Bridge	Moderate
New Manawatū Bridge from SH3	High
Te Āpiti Wind Farm Lookout	Moderate-low
Junction of SH3 and Hope Road	Moderate

PROJECT DESCRIPTION

46. A standard project description is provided in Volume 2 of the AEE, Part C Description of Project.

47. Sector-specific descriptions of the Project that relate to potential landscape, visual and natural character effects are included with the assessment of each sector below.

Environmental and Cultural Design Framework

48. The ECDF (**Volume 2 of the AEE, Part J Appendix Two**) is integral to shaping the Project. It sets out the environmental and cultural context, identifies design principles, and the outcomes sought which will then guide the detailed design of the Project.

49. The environmental design principles set out in the ECDF demonstrate how the Project will be integrated into the landscape to minimise impacts where possible. Consequently, the ECDF provides a principled framework for developing the Project design, including measures to avoid, mitigate and remedy potential effects, discussed in this assessment.

50. The ECDF sets out the expected landscape, environmental, and cultural design outcomes for the Project. It has been developed in consultation with iwi. Key stakeholders have also been consulted as part of its preparation. The ECDF incorporates the findings from this assessment and creates a point of reference for other specialist technical inputs to provide an integrated approach to the landscape.

EXISTING ENVIRONMENT

51. **Appendix 4.B** contains photographs to support the descriptions below and provide context to the assessment.

52. **Volume 4**, **Drawing C-01** shows the Project in its regional context. Located in the southern foothills of the Ruahine Ranges, the Project will provide a new road link between the Manawatū in the west and Tararua in the east. With the closure of SH3 through the Gorge, Saddle Road currently handles much of the east-west traffic. The Project straddles the districts of three territorial authorities: Palmerston North City Council, Manawatū District Council and Tararua District Council. All three territorial authorities are in the region of the Manawatū-Wanganui Regional Council ("**Horizons**").

53. The landscape north of the Gorge comprises steep hill country ranging from 200m asl[4] in the south to 400m asl to the north with deeply incised gullies (**Drawing C-04, Volume 4**). Further north, the landform rises steeply to Wharite Peak, a prominent landmark at 920 metres asl on which a television repeater tower is located. The vegetated southern slopes of Wharite Peak are part of the Ruahine Forest Park. Many of the gullies north of the Gorge have remnant or regenerating native vegetation and areas of exotic scrub.

54. The Manawatū Gorge Scenic Reserve (621 ha.) extends on both sides of the Gorge and provides a distinctive contrast to the surrounding farmland. It also provides a contextual southern 'boundary' to the Project. The Manawatū River flows through the Gorge from the east to west, bisecting the North Island's main axial ranges.

55. Tectonic forces have influenced landform both directly through active faulting and folding and indirectly as a result of effects on stream patterns and drainage. It is a relatively simple and clearly defined landscape of plains, terraces and steep broken hill country.

56. The Project is situated between Saddle Road to the north and the Manawatū Gorge Scenic Reserve to the south and runs through part of the 55-turbine Te Āpiti Wind Farm. South of the Gorge, the Tararua Wind farm is located on the Tokomaru Marine Terrace and adjoining hill slopes. Together, these two wind farms have changed the character of the previously farmed rural landscape.

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[4] Above sea level.

57. To the west of the ranges, the Manawatū River flows through the relatively young Manawatū Plain landscape (c. 500,000 years). The old seabed of the Manawatū Plain has been affected by movements in the underlying rock, producing a series of domes with intervening low areas. The domes have controlled the course of the Manawatū River; once it emerges from the Gorge, the river does not take a direct course across the plain but meanders generally south-westwards. The Pohangina River, which flows between the Ruahine Range on the east and the Pohangina Dome on the west, joins the Manawatū River at Ashhurst. The Pohangina Valley occupies the area between the Ruahine Ranges and the Dome.

58. At the broad scale, the landscape is expansive, comprising several easily recognised landforms – mountain ranges, hills, plains and terraces. However, the landscape in the context of the corridor is more complex with short broken ridges, spurs, and deep gullies. The level of wind exposure is also high and hence the development of several wind farms along the Tararua/Ruahine ridgeline. Internationally, the performance of the wind turbines in these wind farms ranks among the best in the world.[5]

Landform

59. The Project is located on part of a landform referred to as the Manawatū Saddle, a structural sag in the otherwise continuous mountain axis formed by the Ruahine and Tararua Ranges. The designation corridor traverses a short section on the edge of the Manawatū Plain then crosses the Manawatū River near the confluence with the Pohangina River before rising quickly up the steep hill slopes to a flattish area along the ridge crest, and then descending through steep hill country on the eastern side and then on to the alluvial river plain west of Woodville.

60. Slopes vary in steepness over short distances along the corridor (**Drawing C-03, Volume 4**). Slips are reasonably common throughout the area and consequently, there are high sediment loads in many of the streams and waterways.

Vegetation

61. The Project area and surrounding hill country would have been covered in dense podocarp-broadleaf native forest (see Figure 6.2 in Technical Assessment 6: Terrestrial Ecology). Clearing of this forest on the hill country

[5] New Zealand Wind Energy Association, http://www.windenergy.org.nz/.

commenced around the turn of the twentieth century following almost wholesale clearance of the adjoining fertile plains. Forest clearance continued steadily as landowners converted forested land into pasture (**Drawing C-08, Volume 4**)

62. Extensive areas of native forest are located on both sides of the Gorge, much of which is protected by the Manawatū Gorge Scenic Reserve administered by the Department of Conservation. A popular network of walking tracks extends through the native forest on the southern side of Gorge and in a few places, there are views from open parts of the track to the Manawatū Gorge, Te Āpiti Wind Farm and the Tararua Wind Farm. Native forest covers the upper slopes of Wharite Peak to the north of the corridor.

63. Regionally, these areas of native vegetation are important ecologically and contribute to the vegetation framework and its habitat values. There are forest remnants that landowners have protected with QEII[6] open space covenants and the corridor runs through two of these covenanted areas (while avoiding several others in the vicinity). The Ruahine and Tararua Ranges are very exposed. A distinctive and important landscape along this section of the axial range has been created by the large area of continuous forest that has been protected in the Manawatū Gorge Scenic Reserve and supplemented by the areas of forest protected by QEII open space covenants.

64. Throughout, there are areas of young regenerating seral native vegetation, generally dominated by kānuka, on steep gully sides and in gully bottoms and that are relatively inaccessible to stock and form part of the mosaic of vegetation cover. While the Manawatū Gorge Scenic Reserve and Ruahine Forest Park are fenced to exclude domestic stock, as are the QEII open space covenants, much of the other areas of native forest is not fenced and is browsed and trampled by stock.

65. Most of the area within the corridor and on the surrounding area is in pasture with shelterbelts, small woodlots of exotic conifers, poplar planting for erosion control on steep hill faces, and amenity plantings around dwellings and farm buildings. While the extent of tall exotic vegetation across the site is not extensive, it contributes to the overall landscape character.

[6] Which are protected under the Queen Elizabeth the Second National Trust Act 1977.

Land use

66. The townships of Ashhurst on the western side of the Ruahine Range and Woodville on the eastern side are situated on the terraces and plains on either side of the ranges. The Ruahine Range not only separates the two townships but also form a prominent and distinctive skyline, which is highly visible from the surrounding low-lying countryside. The ridgeline is identified as an ONL.

67. A road was formed through the Gorge in 1872 and by 1900 very little native forest remained on the plains. Clearing of the hill country started later but even by 1900 major in-roads into the forest had been made.

68. The hill country has therefore been in pastoral use, with sheep and beef cattle, for the best part of a century and it is only relatively recently that new land uses have been introduced (e.g. exotic woodlots, wind farms). The development of the Te Āpiti and Tararua Wind Farms introduced a new sustainable land use and has provided landowners who have turbines on their land with another income stream. The development of the wind farms is an addition to the district's working rural landscapes and has allowed the primary farming use to continue largely unaffected and assisted by the network of turbine access tracks.

Landscape character areas

69. Landscape analysis that considered the wider landscape, in terms of differences in landform, land cover and land use, identified five landscape character areas through which the Project traverses (**Drawing C-09, Volume 4**). These landscape character areas are listed and described below[7]:

    (a) Manawatū River and Pohangina River terraces;

    (b) Western hill country;

    (c) Ruahine ridge crest;

    (d) Eastern hill country; and

    (e) Manawatū River valley.

[7] These landscape character areas are different to the six Project sectors that have been defined.

Manawatū River and Pohangina River terraces

70. The Pohangina and Manawatū Rivers run along the eastern edge of the expansive Manawatū Plain that extends westwards to the coastal dunes. The river terraces form an abruptly defined edge to the eastern hill country. Willows have been planted along the edges of both the Manawatū and Pohangina Rivers. The eastern terrace faces along the Pohangina River are well vegetated and dominated by native species. Native vegetation extends from the terrace face and on to the terrace itself in the vicinity of the corridor. There are also open areas of pasture on this terrace and stock have browsed and trampled the areas of unfenced native vegetation. In contrast, the Manawatū River terraces, south of the Gorge, are grazed with exotic woodlots, shelterbelts and groups of amenity trees.

71. Parahaki Island, a site of cultural significance, is an area of elevated gravel beaches with rough pasture and willows along the edges located at the mouth of the Gorge at the confluence of the Manawatū and Pohangina Rivers (**Drawing C-05, Volume 4**). Parahaki Island, together with the adjoining Manawatū Gorge Scenic Reserve (which extends on both sides of the Gorge) is recognised as a Regionally Outstanding Natural Feature in the Horizons One Plan (**Drawing C-06, Volume 4**)

72. Manawatū District Council is considering a future plan change[8] for an area north side of the Manawatū River adjoining the Manawatū Gorge Scenic Reserve as an Outstanding Natural Feature.

Western hill country

73. The western hill country rises steeply from the river terraces and is broken by deeply incised gullies and streams, many of which are well vegetated with stands of mature native forest in the gully bottoms and on the sides, together with areas of young regenerating native vegetation and exotic scrub. The hill country is extensively grazed.

74. Saddle Road is located to the north and well separated from the Project by a deep, well vegetated gully. Two areas of mature native forest extending over part of an adjoining gully system located within the corridor are protected by QEII open space covenants.

[8] Future PC65.

75. Turbines of the Te Āpiti Wind Farm are located on both sides of the Project and sited on the flatter spurs and connected by a network of well-formed access tracks.

Ruahine ridge crest

76. At the crest of the Ruahine Range, a wide rolling area of grazed farmland separates the western hill slopes from the generally steeper eastern hill slopes. The Te Āpiti Wind Farm extends over this area with the eastern-most turbine located on the edge of the adjoining steep hill slopes. Te Āpiti is one of several wind farms that have been built along the Tararua – Ruahine Ranges. The Tararua Wind Farm is located on a plateau immediately south of the Gorge.

77. The series of highest ridges and hilltops along the Ruahine (and Tararua) Ranges are recognised as a Regionally Outstanding Natural Feature; the Manawatū District Plan identifies the ridgeline of the Ruahine Range as an outstanding landscape and the Tararua District Plan identifies the *"skyline of the Ruahine Ranges"* in its schedule of natural features and landscapes.

78. The Te Āpiti Wind Farm substation and operational area is located on the ridge crest, as are groups of farm buildings and yards; Cook Road is also located on the crest and runs south off Saddle Road towards the Project. There are small stands of remnant native forest present, several of which are protected by QEII Trust open space covenants.

79. The rolling ridge crest also extends into the upper sections of the Manawatū Gorge Scenic Reserve, which then drops steeply into the river gorge below.

Eastern hill country

80. The eastern hill country is extensively grazed. It is generally steeper and more broken than on the western slopes and is characterised by short narrow spurs and deep gullies, many of which have streams and areas of native and exotic scrub. Scrub has been sprayed and recently cleared off many of the hill faces and there are small slips on several hill faces. Exotic pine woodlots are well established and widely-spaced poplar trees have been planted on erosion-prone slopes. The AgResearch farm straddles the Project in this character area.

81. The streams draining this area flow directly into the Gorge or on to the Manawatū River plain to the east and then into a series of smaller streams and drains, eventually ending up in the Manawatū River.

Manawatū River valley

82. The headwaters of the Manawatū River are in the Ruahine Range northwest of Norsewood. The Manawatū River is unique among New Zealand rivers in that it starts east of the axial ranges and has its outflow on the west. Unlike the river terraces along the Pohangina and Manawatū Rivers on the western side of the Ruahine Range, on the east, there is an abrupt transition between the river flats and the steep hill country. There are patches of remnant podocarp forest at the bottom of the toe slopes where it is wet and poorly drained and there are many small tributaries and farm drains, which eventually discharge into the Manawatū River.

83. Where the corridor joins the existing road network west of Woodville, the land is well subdivided and intensively farmed. There is also a cluster of rural lifestyle properties in this area.

84. Moving away from the edge of the hill country, the underlying river gravels ensure the area is well-drained, with shelterbelts along the edges of paddocks and along streams and waterways, together with groups of amenity trees around dwellings.

Natural character

85. The detailed methodology, including the attributes used for assessing natural character is provided in **Appendix 4.A**, and summarised in the methodology section below.

86. A high level of natural character means the waterbody is less modified and vice versa. The level of natural character has been assessed on a five-point scale[9] from very high to very low. Those areas assessed as having High or Very High natural character are then reassessed to determine whether they qualify as Outstanding (also refer paragraph 105).[10]

87. The assessment of the level of existing natural character of the rivers and streams has been undertaken at two scales; a broad-scale assessment, and at a more detailed level focusing on where the corridor designation crosses rivers and streams (refer **Drawings C-10 and C-11, Volume 4**). The existing level of natural character is summarised in the table below. No areas of ONC were identified.

[9] A five-point scale was used because the methodology adopted for the Project was developed and applied in natural character assessments of several South Island rivers. A decision was made to retain the five-point scale but to acknowledge that in-between ratings can be used.
[10] The Methodology section of this report provides more detail, as does Appendix 4.A Natural Character Assessment.

Table 4.5: Summary of Existing Natural Character

		Existing Level of Natural Character
Broad-scale Reaches	Manawatū Gorge	High
	Manawatū River below SH3 bridge	Moderate/Low
	Lower Pohangina River	Moderate/High
	Generic streams along the proposed designation corridor	Moderate
Detailed Sites	New Manawatū River crossing	Moderate/High
	West stream (QEII stream crossing to wetland north of Manawatū River)	High
	East QEII stream crossing	High
	Stream crossing-construction access	High
	Streams at eastern end of designation	Moderate

Associative values

88. Consideration of associative or shared and recognised values are an important part of understanding and assessing a landscape. To gain an understanding of the values that are shared and recognised by the wider community, I have relied on available published information and field work. Given that the Gorge is a well-recognised and distinctive landscape, there are communities on both sides of the ranges, and from further afield, that identify with or have special associations with the Gorge, Ruahine and Tararua Ranges, and environs.

89. To many travelers, driving the (now closed) section of SH3 through the Gorge represented a 'gateway' between the east and west. This sentiment is also felt by travelers currently driving over 'the Ruahines' via Saddle Road. For others, the Gorge provides a boundary and a sense of identity, separating east and west. The Gorge has long been a transport and communication route between east and west, first for Māori and later for Pākehā.

90. Information displayed at the Te Āpiti carpark sited near the proposed new Manawatū Bridge explains that the Gorge and environs hold a special significance for Rangitāne o Manawatū. Rangitāne refer to the Gorge as Te Āpiti (narrow gorge) and it was the preferred access route connecting

western Rangitāne with their eastern Rangitāne Tū Mai Rā kinsmen.[11] Above the river on the edge of the Ruahine range is a large reddish rock, Te Ahu a Turanga imua (the sacred place of Turanga). Turanga was an ancestor of Rangitāne and, according to Māori in the area, Te Ahu a Turanga remains above water even when the river experiences its highest floods.

91. As detailed in Technical Assessment 5, for Pākehā, the Gorge was the key link in early communication between the provinces of Wellington and Hawke's Bay. In 1867 a bridle track was cut through the Gorge and a road, only one coach wide, was completed five years later. From 1877 to 1881 Rangitāne leaders Huru te Hiaro and Nireaha Tāmaki ran a ferry service using two large waka connected by decking. In 1886, construction started on the railway on the northern side of the Gorge and the four and half miles of line, 27 bridges and three tunnels, was opened in 1891. The first Ashhurst bridge was opened in 1886 but 10 years later it was swept away in a flood; it was later replaced by a one-way bridge in 1909.

92. With the construction of the road and railway line, a settlement developed at the eastern end of the Gorge (around Ballance). When the railway through the Gorge was completed, the settlement gradually disappeared apart from a few houses, including that of the toll bridge keeper. (A toll gate was set up by the Government to recoup some of the road and railway line building costs.)

93. The protection of the 621 ha of native forest on both sides of the Gorge as a scenic reserve, managed by the Department of Conservation ("**DOC**"), created (until the recent closure) a dramatic landscape for drivers to experience through the Gorge. DOC has developed three Manawatū Gorge walks on the southern side of the Gorge; two shorter walks, and a 10.1km walk (one-way). At the western end of the Gorge, the new bridge that is part of the Project crosses over the Manawatū Gorge Track carpark. The recreational values of the Gorge have steadily risen with visitor numbers on the Manawatū Gorge Tracks, increasing by 350 percent since 2012.

94. The walks form part of a comprehensive 10-year plan for the area promulgated by the Te Āpiti Governance Group, which is led by DOC and Horizons and involves the NZ Transport Agency, Rangitāne, KiwiRail, Palmerston North City Council, Tararua District Council and Manawatū District Council. The aim of that project is for these organisations to work together to link all reserve areas, the river, road and rail line and some

[11] The Rangitāne Tū Mai Rā area of interest, as identified in the Rangitāne Tū Mai Rā (Wairarapa Tamaki nui-ā-Rua) Deed of Settlement, includes the Manawatū River and its tributaries.

adjoining private land to be managed as a single entity. A shelter and interpretation area at the eastern end of the carpark describes the aims of that project and an outline of the natural and cultural history of the area (the content of that signage is referred to above).

95. Meridian Energy's 1150 ha Te Āpiti Wind Farm is located on the Ruahine Range north of the Gorge and has become a landmark in the area, with access off Saddle Road to a public viewing area. The 55-turbine wind farm was built in 2004 and generates enough electricity to supply about 39,000 homes; it was the first wind farm to supply electricity into the national grid. Some of the turbines in the Te Āpiti Wind Farm, and the Tararua Wind Farm are visible from a very limited number of places on the walking tracks in the Manawatū Gorge Scenic Reserve.

96. Several landowners whose farms are located on the slopes of the Ruahine Ranges north of the Gorge, have recognised the landscape and biodiversity values of native forest remnants and the contribution these areas make at both a local and regional scale and have sought to protect and manage them. This has involved fencing native forest remnants to exclude stock, and pest plant and animal control programmes. One landowner whose property lies within the Project (and is leased to Meridian and accommodates part of the Te Āpiti wind farm) has protected several areas of native forest with QEII open space covenants. While such forest remnants are relatively small, it is their collective value that is important, providing habitat connections between covenanted areas and to the tract of tall native forest in the Manawatū Gorge Scenic Reserve.

METHODOLOGY

Introduction

97. The methodologies used in this assessment of landscape, natural character and visual effects are based on what I consider as current best practice. The methodologies have been refined by Boffa Miskell landscape architects[12] over several years as a result of involvement in a wide range of projects and tested in council hearings and the Environment Court. The landscape, natural character and visual effects assessment methodologies are included in **Appendices 4.A and 4.C**

[12]Boffa Miskell ecologists were also involved in developing the natural character methodology.

98. I have set out below a summary of the approach to this assessment, which considers the interrelated assessments of landscape, natural character and visual effects. The assessments of effects for landscape and natural character have been carried out for each of the six separate Project sectors with the visual effects assessment focusing on the Project overall.

Project sectors

The Project sectors are shown on **Drawing C-02, Volume 4** and in more detail on **Drawings A-00 to A-10, Volume 4.** The sectors are:

(a) Bridge to bridge (existing SH3 bridge to new bridge);

(b) New Manawatū River/Gorge bridge;

(c) Western slope;

(d) Te Āpiti Wind Farm and ridge;

(e) Eastern slope; and

(f) Woodville gateway.

Landscape effects assessment

99. Landscape is defined in the NZILA Practice Note[13] as follows:

> *"Landscape is the cumulative expression of natural and cultural features, patterns and processes in a geographical area, including human perceptions and associations."*

100. Assessing landscape effects involves consideration of both the magnitude of the change and the sensitivity of the landscape to change. Determining the overall level of landscape effects requires an understanding of the nature of the landscape resource (biophysical and landscape character) and the scale and nature of change resulting from a proposed development. The table below assists to explain the process.

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[13] NZILA Best Practice Note, 2010

Table 4.6: Determining the level of landscape effects[14]

Contributing Factors		Higher	Lower
Nature of Landscape Resource	Susceptibility to change	Limited existing landscape detractors which make the landscape or feature highly vulnerable to the type of change which would result from a proposed development.	Many existing detractors which enable the feature or landscape to easily accommodate the proposed development without undue consequences.
	The value of the landscape	Includes important biophysical, sensory and/or associative attributes. The landscape requires protection as a matter of national importance (ONF/L).	Lacks any important biophysical, sensory or associative attributes. The landscape is of low or local importance.
Magnitude of Change	Size or scale	Total loss or addition of key features or elements. Major changes in the key characteristics of the landscape, including significant aesthetic or perceptual elements.	Most of key features or elements are retained. Key characteristics of the landscape remain intact with limited aesthetic or perceptual change apparent.
	Geographical extent	Wider landscape scale.	Site scale, immediate setting.
	Duration and reversibility	Permanent. Long term (over 10 years).	Reversible. Short term (0-5 years).

Landscape sensitivity

101. For the Project, matters that increase the sensitivity of a landscape to change include:

(a) statutory or legal recognition of special values or qualities such as Outstanding Natural Feature or Landscape status, reserves, QEII open space covenants, and other statutory overlays;

(b) community shared and recognised values, such as historic, scenic and recreational values of a place, high public use and high visibility locations;

(c) culturally significant sites or associations for those with mana whenua and the wider community; and

(d) high value biophysical features and streams, rare or threatened ecological communities.

14 Source: Boffa Miskell Landscape Assessment Methodology, Appendix 4.C.

102. The landscape effects assessment considers the potential effects in terms of biophysical effects and effects on landscape character, including potential impacts on associative/shared and recognised values.

Biophysical effects

103. This considers the extent and significance of modifications to landform, waterways, vegetation and habitat. The effects on landform considered the proposed alignment with reference to the LiDAR[15] model, together with an analysis of cross sections and long sections generated by the civil engineering team. Collaboration with the terrestrial and freshwater ecologists in the team provided ecological detail. The nature and scale of biophysical change was considered in relation to the sensitivity of the location to the potential changes.

Table 4.7: Biophysical effects

Level of effect	Indicative Examples
Very High	Total loss of key features/attributes
High	Fundamental alteration to most key features/attributes
Moderate High	Alteration to several key features/attributes-considerably changed
Moderate	Alteration to one key feature/attribute –partially changed
Moderate Low	Minor change to a key feature/attribute–similar to before
Low	Very slight change/change barely distinguishable
Very Low	No measurable change

Landscape character effects

104. Landscape character is derived from a combination of landform, land cover and land use that makes one area different from another. The effects on landscape character relate to changes in land use (new or different activities), changes to existing patterns and elements in the landscape, such as vegetation, waterbodies, landform, and settlement patterns.

105. The introduction of the Project into the Manawatū/Tararua landscape, including earthworks, structures, planting, and traffic, combine to potentially change the existing landscape character.

[15] LiDAR is an acronym of ‘light detection and ranging’; it is an aerial survey method used to make high-resolution maps.

Table 4.8: Landscape character effects

Level of Effect	Indicative Examples
Very High	Complete change of landscape character
High	Fundamental alteration to key features / attributes, composition largely changed
Moderate High	Alteration to several key elements or features / attributes / patterns; major change to composition.
Moderate	Alteration to one key element or feature / attribute, composition / pattern partially changed
Moderate Low	Minor change to underlying composition / pattern, similar to before
Low	Very slight change to landscape character, change barely distinguishable
Very Low	No discernible change

Associative values

106. Parts of the Project area have various levels of significance in terms of associative or shared and recognised values for those with mana whenua and the wider community. Consideration of associative values has been taken into account as part of landscape sensitivity. It is beyond the scope of this assessment to assess how cultural values may potentially be affected. I have relied on the information provided by iwi to the NZ Transport Agency about cultural impacts, and Technical Assessment 6: Historic Heritage and Archaeology.

107. Having said that, the development of the ECDF is an iterative process that involves consultation and input from those with mana whenua and from community stakeholders. Through this process and the design guidance provided by the ECDF, the expression of community values will provide a framework for these aspects to be incorporated into the detailed design of the alignment.

Natural character effects assessment

108. Natural character in an RMA (section 6(a)) context relates only to waterbodies and their margins, rather than the landscape as a whole.

109. The detailed methodology, including the attributes used for assessing natural character is provided in **Appendix 4.A: Natural Character Assessment**, and summarised in the methodology section below.

110. Natural character is a term to describe the naturalness (lack of modification) of river environments. Natural character is the expression of natural

elements, patterns and processes and the extent that any physical modifications has incurred including the presence of built structures. It also includes the perceptual or experiential[16] component of naturalness.

111. The degree or level of natural character within an environment depends on:

(a) The extent to which natural elements, patterns and processes occur;

(b) The nature and extent of modifications to the ecosystems and riverscape;

(c) The highest degree of natural character (greatest naturalness) occurs where there is least modification; and

(d) The effect of different types of modification upon the natural character of an area varies with the context and may be perceived differently by different parts of the community.

112. Natural elements incorporate all key features of a river, such as the water, bed and banks, as well as attributes occurring within the river environment, such as geological formations, native vegetation and fauna. Natural patterns take the channel and the riparian edge into account, together with the patterns created by humans on adjacent land, such as shelterbelts, land use boundaries, etc. Natural processes include river/ lake dynamics, flows and currents, erosion, freshes and floods, and regeneration processes of riparian vegetation and ecological health.

113. For the purposes of the natural character assessment, the streams and rivers have been considered to comprise three components: context; margin; and active bed:

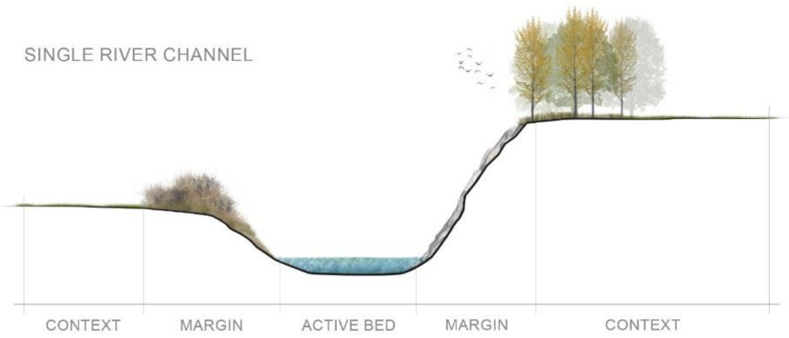
Context: refers to the wider catchment landscape adjacent to the stream/river, and considers the land use, landform and vegetation cover that contributes to the overall character of the river and its margins.

Margin: refers to the strip of land between the active bed and the wider landscape context. River processes, patterns and influences will be evident in the margin, such as occasional flooding, old banks and channel patterns, and river gorge wind flow.

Active Bed: for single stream incised rivers/streams, the active bed comprises the river/stream channel. For wider riverbeds and those with a

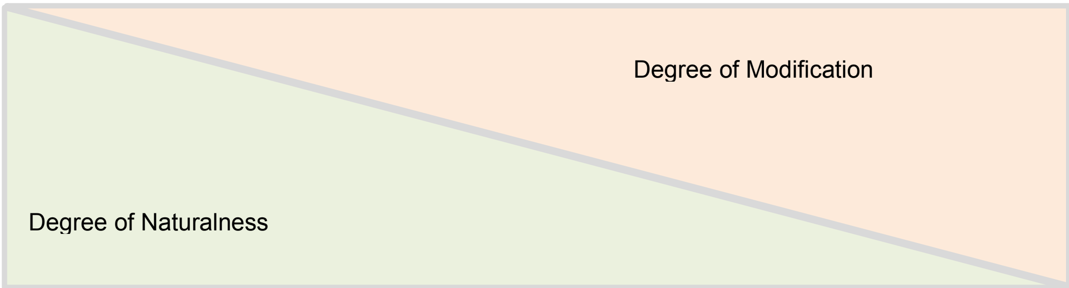
[16] The meaning of this term in respect of an 'all river corridor' is explained below.

braided character, the active river bed includes wetted areas/channels and may include dry margins, islands, banks abandoned channels, flood channels, and side channels and bars of a braid plain that form part of the river's natural migration across the riverbed. The diagrams below show the active bed, margin and context of a single river channel and braided river in accordance with the descriptions above.



114. The methodology adopted to assess the level of natural character involves a two-step process. In the first step, natural character is assessed in relation to a five-point scale with the ability for in-between ratings if required, as set out in the diagram below, (which also illustrates the relationship between the degree of naturalness and degree of modification). A high level of natural character means the waterbody is less modified and vice versa.

Very High	High	Moderate	Low	Very Low



115. The second step involves a re-assessment of those areas assessed as having High or Very High natural character to determine whether they qualify as Outstanding.

116. A river or stream reach with 'Outstanding' natural character ("**ONC**") should, 'Exhibit a combination of natural elements patterns and processes that are exceptional in their extent, intactness, integrity and lack of built structures and other modifications'.[17] An area of ONC should encompass the entire width of the river corridor, rather than applying to an individual component of a reach (context, margin, active bed), so that intact interrelated sequences of ecological systems and natural processes are included.

117. The approach to assessing natural character of the rivers and streams has been undertaken at two scales; a broad-scale assessment, and at a more detailed level focusing on river/stream crossings (refer **Drawing C-11, Volume 4**). Given that a regional natural character assessment has not been carried out by Horizons or the territorial authorities, the broad-scale assessment of the existing natural character was carried out to provide context and a baseline.

118. The broad-scale assessment covers a range of river environments with different attributes and qualities. The broad-scale assessment has provided a context for the identification of 'hot spots' at the river stream crossings, which are the focus of the detailed assessment.

119. For the detailed assessments, the existing level of natural character was first determined and the changes to natural character were assessed as a result of the potential effects of the Project. The assessment has considered the long-term operational outcomes of the Project as opposed to the construction effects, some of which will be temporary.

120. The broad-scale river reach assessment considers the Manawatū River from the Ballance Bridge to the confluence with the Pohangina River, and then south to Forest Hill Road, and from the confluence with the Pohangina River north to the Saddle Road Bridge. The assessment was considered in relation to three reaches and the collective generic stream crossings which form tributaries to the north of the Gorge, that is:

    (a) the Gorge;

    (b) Manawatū River below SH3 bridge;

[17] Boffa Miskell derived definition.

(c) Pohangina River from confluence to Saddle Road bridge; and

(d) generic stream crossings along the designation corridor.

121. The detailed assessment considers the existing natural character at five main river and stream crossings:

(a) the new Manawatū River bridge crossing (CH3600-4000);

(b) the crossing of a western stream (including QEII open space covenant and wetland at northern approach to new Manawatū River bridge) (CH4000-5900);

(c) the eastern QEII open space covenant stream crossing (CH 6100-6300);

(d) a stream crossing at eastern end of the Project (CH12800-13000); and

(e) a stream crossing at the western end for construction access to Saddle Road.

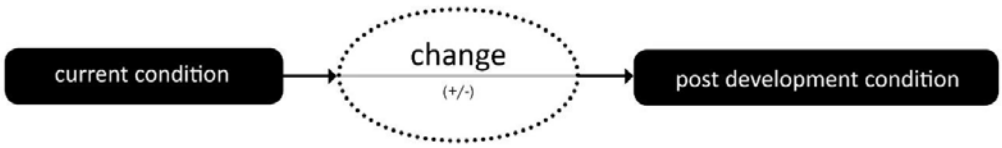
122. The process to assess the level of natural character involves an understanding of the many systems and attributes that contribute to a waterbody including abiotic, biotic and experiential factors. Consequently, this requires inputs from a range of disciplines – freshwater and terrestrial ecologists, water quality expertise, and landscape architects. A small team of specialists carried out the natural character assessment, first assessing the existing level of natural character and then the level of natural character post development (refer **Appendix 4.A**).

123. The assessment framework and attributes used are summarised below:

Table 4.9: Natural Character Components

Active Bed	
Attribute Group	**Natural Character Attributes**
Abiotic	Flow regime – how natural/modified are the flows. Active bed/body shape, including sedimentation, structures and human modifications Water quality
Biotic	Indigenous taxa assemblages Ecosystem functioning Exotic aquatic flora and fauna
Margin	
Abiotic	Structures and human modifications
Biotic	Terrestrial ecology
Context	
	Land use - degree of modification - broader scale landscape modification beyond the immediate river margin. Terrestrial ecology including vegetation, animals, habitats.
All River Corridor	
Experiential	Human perception of how natural a place appears, underpinned by the biotic and abiotic attributes (above). It includes the remote/untamed experience a place may provide and experiential attributes such as sounds, smells and transient values.

124. The assessment of effects on natural character is essentially understanding the degree of change from the existing level of natural character to the future level of natural character anticipated by the proposed development.



125. The natural character effects assessment involves the following steps:

(a) assessing the existing level of natural character;

(b) assessing the level of natural character anticipated; and

(c) considering the significance of the change.

126. For this assessment, a reduction in natural character from High to Moderate or less is considered to *"significantly diminish the attributes and qualities of areas that have high natural character" (*Horizons One Plan Objective 6-2).[18]

127. Such a reduction is considered to be significant because it requires several of the 10 assessment attributes (above) to reduce for the overall level of natural character to be affected. Waterbodies with high natural character are more sensitive to change that could adversely impact on the attributes and qualities than those that have a moderate or low level of natural character. The interrelated nature of the attributes means that modification of a waterbody will typically result in a reduction to the rating of several attributes, rather than just one.

Visual effects assessment

Visual amenity values

128. The term 'amenity values' is defined in the RMA as, "*those natural or physical qualities and characteristics of an area that contribute to peoples' appreciation of its pleasantness, aesthetic coherence, and cultural and recreational attributes*".[19] Amenity includes a combination of many factors, such as: visual amenity, ambient noise, air quality, and recreational and cultural attributes.

129. Visual amenity contributes to people's appreciation of the pleasantness and aesthetic coherence of a place and is a component of its overall amenity. This assessment considers the effects of the visual change that the Project would bring to the outlook and views of the viewing audience.

Magnitude of visual effects

130. Assessing visual effects involves consideration of both the scale and nature of the visual change and the nature and sensitivity of the viewing audience.

Nature of the viewing audience

131. The nature of the viewing audience is assessed in terms of the sensitivity of the viewing audience to change and the value attached to views. The value or importance attached to particular views may be determined with respect to its popularity or the numbers of people affected.

132. People more sensitive to change typically include:

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[18] The team of specialist contributors who undertook the Natural Character Assessment determined the threshold of what constitutes "*significantly diminish.*"

[19] RMA, s 2(1).

(a) nearby residents;

(b) people engaged in outdoor recreation whose attention or interest is likely to be focused on the landscape and on particular views;

(c) visitors to heritage areas or other important visitor attractions; and

(d) communities where views contribute to the landscape setting or local identity.

133. The table below assists to explain the variables.

Table 4.10: Determining the level of visual effects[20]

Contributing Factors		Higher	Lower
Nature of the Viewing Audience	**Susceptibility to change**	Views from dwellings and recreation areas where attention is typically focused on the landscape.	Views from places of employment and other places where the focus is typically incidental to its landscape context. Views from transport corridors.
	Value attached to views	Viewpoint is specifically recognised by the community, such as an important view shaft, identification on tourist maps or in art and literature. High visitor numbers.	Viewpoint is not typically recognised or valued by the community. Infrequent visitor numbers.
Magnitude of Change	**Size or scale**	Loss or addition of key features in the view. High degree of contrast with existing landscape elements (i.e. in terms of form scale, mass, line, height, colour and texture). Full view of the proposed development.	Most key features of view retained. Low degree of contrast with existing landscape elements (i.e. in terms of form scale, mass, line, height, colour and texture. Glimpse / no view of the proposed development.
	Geographical extent	Front on views. Near distance views; Change visible across a wide area.	Oblique views. Long distance views. Small portion of change visible.
	Duration and reversibility	Permanent. Long term (over 15 years).	Transient / temporary. Short term (0-5 years).

Visibility

134. Visibility is generally a key determinant in defining the extent of a study area as it may generate effects across all three assessment aspects – biophysical,

[20] Source: Boffa Miskell Methodology.

visual amenity, and landscape character. A tool often used for determining the extent of visibility is a zone of theoretical visibility ("**ZTV**") analysis. While ZTV analyses are very useful, they need to be interpreted with caution and considered as an indicative tool to identify features visible from any given point. It is important to understand the parameters and data used to generate a ZTV.[21]

135. Given the linear nature of the corridor and that it straddles both sides of the Ruahine Ranges, ZTV maps were produced from both the eastern and western locations. The ZTV maps are based on LiDAR contour data with the 3D model of the road corridor incorporated into the ZTV mapping.

136. To understand who will be affected by the Project, an analysis of the potential viewing population was carried out. The viewing audience falls into two broad groups:

    (a) Resident population: those residents located in Ashhurst and environs, rural and rural lifestyle residents on properties west of Woodville, and residents on Saddle Road.

    (b) Transient population: people using the roads, public spaces, and public facilities from where views of the proposed road may occur, albeit for short periods of time.

137. Computer-generated indicative visual simulations were produced from five viewpoints, all of which are publicly accessible locations.[22] Visual simulations are a well-recognised tool to better understand the extent and nature of visual effects. They do not, however, claim to reproduce what is perceived by the human eye. The preparation of the indicative visual simulations followed professional best practice as set out in the guidelines adopted by the NZILA.[23]

NATIONAL AND INTERNATIONAL BEST PRACTICE CRITERIA

138. This landscape and visual effects assessment methodology has been undertaken with reference to the *Quality Planning Landscape Guidance Note*[24] and its signposts to examples of best practice which include the *UK*

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[21] Appendix 4.C provides detail of the ZTV methodology.
[22] The visual simulations are indicative because a road alignment has not been confirmed. As part of developing the outline plan of works (OPW) visual aspects will be further addressed. The OPW will allow for a more comprehensive confirmation of the mitigation of any potential effects once design has progressed and a construction methodology has been finalised
[23] NZILA Best Practice Guide: Visual Simulations BPG 10.2.
[24] http://www.qualityplanning.org.nz/index.php/planning-tools/land/landscape.

Guidelines for Landscape and Visual Impact Assessment[25] and the *New Zealand Institute of Landscape Architects Guidelines for Landscape Assessment.*[26]

STATUTORY CONSIDERATIONS, INCLUDING NATIONAL STANDARDS, REGIONAL AND DISTRICT PLANS, AND OTHER RELEVANT POLICIES

139. There are several statutory considerations relevant to landscape, visual, and natural character effects, as explained in the AEE report, and they have been considered in undertaking this assessment. They include matters included in Part 2 of the RMA, including section 6(a) and section 6(b), and associated objectives, policies, and rules in Horizons' One Plan and the relevant district plans. Some key provisions from these plans are described below.

One Plan

140. Horizons Objective 6-2 provides as follows:

"(b) Adverse effects, including cumulative adverse effects, on the natural character of the coastal environment, wetlands, rivers and lakes and their margins, are:

(i) avoided in areas with outstanding natural character, and

(ii) avoided where they would significantly diminish the attributes and qualities of areas that have high natural character, and

(iii) avoided, remedied or mitigated in other areas.

(c) Promote the rehabilitation or restoration of the natural character of the coastal environment, wetlands^, rivers^ and lakes^ and their margins."

141. Schedule G of the Horizons One Plan identifies two Outstanding Natural Features and Landscapes of relevance to the Project, namely:

"l) The series of highest ridges and highest hilltops along the full extent of the Ruahine and Tararua Ranges, including within the Tararua and Ruahine Forest Parks;

m) Manawatū Gorge, from Ballance Bridge to the confluence of the Pohangina and Manawatū Rivers, including the adjacent scenic reserve"

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25 Landscape Institute and Institute of Environmental Management and Assessment (2013) Guidelines for Landscape and Visual Impact Assessment, 3rd Edition (GLVIA3).

26 Best Practice Note Landscape Assessment and Sustainable Management 10.1, NZILA.

142. The AEE report sets out the other provisions of the One Plan relevant to ONFLs.

Manawatū District Council

143. Manawatū District Council is preparing a future plan change to give effect to the One Plan and directives within the Manawatū District Plan. The future plan change will be known as PC65 – Outstanding Natural Features and Landscapes ("**Future Plan Change**") and is due to be notified in November 2018. The draft of the Future Plan Change has identified an ONLF (ONLF 10 Manawatū Gorge) at the western end of the Gorge adjoining the Manawatū Gorge Scenic Reserve. The defined area of the draft ONLF encompasses and extends the regional ONL in that area.

144. Objective LU8 which relates to the rural character and amenity of the district in general:

"To maintain and where appropriate enhance the rural character and amenity of the District's rural areas, which includes:

…

ii) A landscape within which the natural environment (including farming and forestry landscapes) predominates over the built one.

…

iv) The natural quality of the District's indigenous forest areas, rivers, lakes, wetlands and coastal strip."

145. Objective LU9 of the Manawatū District Plan identifies outstanding landscapes that need to be considered in relation to the Project:

"To protect and where appropriate enhance the quality of the District's outstanding landscapes, namely:
a) Pohangina River and river valley (delineated on Maps 16/17d) The ridgeline of the Ruahine ranges."

Tararua District Council

146. Objective 2.6.2.1 of the Tararua District Plan relates to amenity values and environmental quality:

"To maintain and/or enhance amenity values and environmental quality in the District, for present and future generations.

2.6.2.2 Policy

(a) To manage the adverse effects of activities on amenity values by specifying minimum environmental standards for the development and maintenance of such activities.

147. Objective 2.6.4.1 relates to the Protection of Natural Features and Landscapes, significant trees and significant indigenous vegetation and significant habitats of indigenous fauna from inappropriate subdivision use or development. Policy 2.6.4.2 is to identify particular natural features and landscapes that contribute in a significant way to the amenity and environmental quality of the District and to classify them.

148. Schedule 3.3 identifies several Natural Features and Landscapes, including:

304 Skyline of the Ruahine Ranges – Cat.B (Map 6)

305 Manawatū Gorge, downstream of Ballance Bridge, including the adjacent Scenic Reserve – Cat.B (Map 6)

149. Related policy for identified natural features and landscapes is covered by Policy 2.6.4.1 c):

"To encourage the protection of significant trees, significant indigenous vegetation, significant habitats of indigenous fauna, and identified natural features and landscapes from inappropriate subdivision, development or use, and to promote public access where this will not adversely affect conservation or private property values."

150. Objective 2.6.6.1 is:

"*To protect the natural, scenic, ecological, cultural and amenity values of the District's lakes, rivers, and wetlands and maintain and/or enhance public access to and along their margins."*

Outstanding Natural Landscapes

151. There are several areas identified as ONLs in the vicinity of the corridor (**Drawing C-06, Volume 4**). The Project traverses two of these, the Ruahine Ridgeline ONL and the Manawatū Gorge ONLF. Neither of these ONLs have

been spatially defined and mapped in the relevant statutory plans. Instead, they are described in the respective district plans and the One Plan; for the purposes of this assessment they were interpreted and mapped by Boffa Miskell. I provided the draft map to each of the three respective Councils and to Horizons to review and verify. **Drawing C-06, Volume 4** illustrates the outcome of this process.

152. The Project cannot avoid crossing the Manawatū Gorge ONL or the Ruahine Ridgeline ONL. Where the Project crosses the Ruahine Ridgeline it will be in a section of cut based on the gradients to be attained. The new bridge over the Manawatū River will cross the Manawatū Gorge ONL. There will be landscape effects in relation to both ONLs but limited visual effects at the Ruahine Ridgeline crossing because the alignment will be visually contained by landform. The crossing of the Manawatū Gorge ONL will however, be visually prominent.

PROJECT SHAPING

153. The Detailed Business Case report ("**DBC**") completed in March 2018 describes the process of considering options. The options assessment process is summarised in Part E of the AEE. The Project being addressed in this assessment was selected following a multi criteria analysis ("**MCA**") process carried out in the latter part of 2017. I was a part of the team of specialists undertaking the MCA, and I provided landscape and visual inputs into the process. This process involved site visits and field work, a series of team workshops, analysis of the alignments prepared by the road designers and each specialist identifying and rating the adverse and beneficial aspects of each option.

154. Initially, a long list of 18 options was assessed and from this, a short list of four options was identified and assessed further. From the short list, one corridor alignment was selected for further development (Option 3). Option 3 is the focus of this assessment.

155. Since that time, the NoR investigations have involved a high level of collaboration amongst the Project team responsible for carrying out the technical assessments. There has also been considerable contact and involvement of the technical specialists with stakeholders (i.e. staff from the three territorial authorities, Horizons and their consultants, and with iwi). This included attendance by representatives from the different stakeholder groups and iwi at a series of meetings and workshops.

156. In this iterative process, the issues and concerns raised by the technical specialists and stakeholders have been considered and addressed with the aim of avoiding or, where that is not possible or practicable, minimising adverse effects. The Preliminary Design Philosophy report outlines the design development that was undertaken as part of the NoR process. The design changes resulting from this collaboration and agreements arrived at the workshops include several that have responded to potential adverse effects on landscape, natural character and visual aspects, including:

(a) Amending designation boundaries to reduce effects on sensitive landscape areas and to provide better opportunities for incorporating landscape and ecological mitigation measures;

(b) Reducing the extent of cut on the approach to the new Manawatū River bridge;

(c) Development of the new bridge alignment over the Manawatū River to minimise adverse effects on a significant area of old growth indigenous forest on the north bank;

(d) Development of a viaduct/long bridge option on the northern side of the Manawatū River to minimise the Project footprint;

(e) Extending the new Manawatū River bridge on the southern side to avoid a bridge embankment encroaching on the Te Āpiti carpark;

(f) Incorporating a bridge as to opposed to a culvert to cross one of the stems in the QEII West Stream crossing; and

(g) Amending the corridor designation and the indicative alignment on the descent to Woodville to limit the number of potential stream crossings.

157. The Project has been adjusted to avoid or minimise effects but in some locations adverse landscape, natural character or visual effects cannot be avoided. In places there will be high adverse landscape, natural character or visual effects, and in others mitigation measures will reduce some high adverse effects but not in every place where they occur.

158. The final design for the Project will be developed when a contractor is procured to undertake the works. At the completion of detailed design and prior to construction starting, the NZ Transport Agency will submit an outline plan or plans of the works to the territorial authorities under section 176A of

the RMA, which will outline the detailed design elements of the Project (in respect of works within their respective jurisdictions).

159. The outline plan(s) must detail the following information, in accordance with section 176A(3) of the RMA:

(a) the height, shape, and bulk of the public work, project, or work;

(b) the location on the site of the public work, project, or work;

(c) the likely finished contour of the site;

(d) the vehicular access, circulation, and the provision for parking;

(e) the landscape treatment proposed; and

(f) any other matters to avoid, remedy, or mitigate any adverse effects on the environment.

160. The outline plan(s) will provide details of the potential effects and proposed mitigation measures, including in relation to visual and landscape matters (including design plans and mitigation).

161. The outline plan(s) will also include various management plans and other documents, including the Landscape Management Plan and updated ECDF.

162. The outline plan approach will allow for a more comprehensive confirmation of the mitigation of any potential effects once design has progressed and a construction methodology has been finalised. I understand that the NZ Transport Agency is proposing to engage further with specific communities prior to finalising the detail to be submitted in the outline plan(s) (including the Landscape Management Plan and updated ECDF). This engagement will enable further community consideration of landscaping and design details and information relating to communication during construction.

163. The outline plans may be submitted in stages, or to represent specific elements of the Project, and therefore there may be multiple plans. The detail within any outline plan will have to address the actual or potential effects of the works and how they will be mitigated. For example, the detailed design will necessitate a specific assessment of potential visual effects especially if new structures are introduced and specific mitigation recommended to address these effects.

164. On lodgment of the outline plan(s), the territorial authorities will review the details as provided and may request changes before construction is commenced.

ASSESSMENT OF LANDSCAPE AND NATURAL CHARACTER EFFECTS

165. The Project will have adverse effects on biophysical aspects, landscape character, and on the natural character of rivers, streams and their margins.

166. The effects assessment below explains, relative to each sector: the key landscape characteristics; the potential changes that will result from the Project; and each type of effect (biophysical, landscape character, and natural character). It summarises each level of effect in that sector (in table form) and explains recommended measures to avoid and minimise adverse effects, including mitigation and offsetting.

167. The assessment of natural character in each sector focusses on major streams and wetlands with high natural character, and the avoidance and minimisation of potential adverse effects that may result from the Project. All major streams affected by the Project are described and assessed in **Appendix 4.A**.

168. More generally, the Project also has the potential to have adverse effects on other areas of natural character, due to the nature and modification of the works required. In those areas, I consider that, subject to specific site responsive construction methods and measures to minimise effects implemented in conjunction with the ECDF principles (which will be detailed in resource consent applications for those works) together with consent conditions, potential adverse effects on natural character will be sufficiently avoided, remedied and mitigated.

Sector 1: Bridge to bridge (existing SH3 bridge to new bridge)

169. Refer also to the photographs in **Figure 1, Appendix 4.B**.

Key landscape characteristics of sector

170. This sector is characterised by established farmland and the existing SH3 route. The area is dominated by grazed pasture with shelterbelts and woodlots. SH3 is a prominent element through the area, bookended by the Manawatū River.

Potential changes resulting from the Project

171. Potential changes in this sector relate to new sections of SH57, the carpark access road, and a roundabout that will also be located on farmland (where a small number of mature exotic trees may need to be removed). The indicative road alignment largely follows the existing SH3 alignment but crosses farmland at the western end.

172. The roundabout will create a threshold for traffic on SH3 and from SH57. The design treatment of the roundabout provides an opportunity to integrate it into the surrounding landscape. This could involve tree planting to create a distinctive landscape setting and threshold as set out in the ECDF. Overhead LED lighting will be included at the roundabout.

Biophysical effects

173. Because of the flat topography, the earthworks through this sector will be relatively minor. The proposed southern bridge abutment uses the natural topography to gain elevation but fill embankments will also be required.

Landscape character effects

174. The Project will not substantially change the landscape character of the area, given SH3 and the existing road environment. While the new road with four lanes and a roundabout will have an increased footprint, the traffic volumes will be similar to that of the existing SH3. The addition of overhead lighting at the roundabout will affect what is currently a dark, rural environment. The existing SH57 and SH3 intersection is lit, it is anticipated that the lighting associated with the roundabout would be brighter and more intense.

Natural character effects

175. The works in this sector do not encounter any major streams or wetlands, and so a natural character assessment was not carried out.

Table 4.11: Effects Summary

Type of effect	Level of effect
Biophysical	Low
Landscape character	Moderate Low
Change in level of natural character	N/A

Measures to avoid, remedy or mitigate adverse effects

176. I recommend the following measures be undertaken during detailed design of the Project to avoid or reduce adverse effects:

    (a) the alignment avoids the need for large cuts into the slopes to the east; and

    (b) the south abutment of the bridge is located south of the existing SH3 to provide a more open area underneath the bridge on the river margin for visitor carparking.

177. I recommend that the environmental principles and design guidance detailed in the ECDF should provide the fundamental design guidance for detailed design of the road alignment to ensure potential landscape and visual effects are avoided and minimised, and that beneficial environmental and cultural opportunities can be realised.

Sector 2: New Manawatū River Bridge

178. Refer also to the photographs in **Figure 1, Appendix 4.B**.

Key landscape characteristics of sector

179. The key landscape characteristics of this sector are as follows:

    (a) The Manawatū River at the bottom of the steep sided Gorge opens out upstream of the confluence with Pohangina River.

    (b) The river crossing location is a culturally significant area; in particular, Parahaki Island is immediately downstream of the crossing point.

    (c) The Te Āpiti carpark and information shelter are a popular recreational destination providing access to the Manawatū Gorge Scenic Reserve and walking trails.

    (d) An ONL extends down to the confluence of the Manawatū and Pohangina Rivers, including Parahaki Island (Schedule G of the Horizons One Plan).

180. Manawatū District Council is proposing a future plan change, which would see the area on the northern side of the river between the Manawatū Gorge Scenic Reserve and the Pohangina River become an ONLF.

Potential changes resulting from the Project

181. Potential changes resulting from the Project in this sector relate to the addition of a large bridge structure across and within the river corridor, traffic activity, and vegetation clearance, as further explained below. The bridge deck would sit approximately 30m above the water. The north abutment would land on a spur just beyond the railway line, and the south abutment would be positioned immediately south of the existing SH3 and carpark. Bridge piers will be located in the river margins and possibly in the river channel.

182. The Project will also result in the addition of traffic activity and noise within the river corridor and vegetation clearance and landform modification at the proposed bridge abutments and pier locations.

Biophysical effects

183. The biophysical changes relate to the landform modification and vegetation clearance required to construct the bridge abutments and piers. The abutments are located beyond the immediate river margins. The spur where the north abutment is proposed supports regenerating secondary broadleaf and kānuka forest. Dr Forbes has recommended specific constraints on the clearance of different vegetation types in that area.[27] The proposed south abutment is on the existing SH3 embankment in farmed pasture. Collectively, these are Moderate effects.

184. The river margins where piers may be located are quite modified and the vegetation is a mix of native and exotic species.

185. In addition to the permanent biophysical effects referred to above, there will also be short term construction effects to enable the bridge to be built. This will involve providing temporary access and parking arrangements to the Manawatū Gorge carpark, and measures to enable construction of the bridge piers.

[27] The Project Conditions contain the 'effects envelopes' determining the constraints on vegetation clearance.

Landscape character effects

186. The introduction of the bridge spanning the river and associated traffic will significantly change the character of the river corridor. Its elevation and form, together with the introduction of traffic activity will change the spatial, remote and quiet quality of the river environment, particularly for river users such as fishers, kayakers and people using the Gorge carpark.

187. Effects on landscape character will be heightened during construction of the bridge given the presence and activity of machinery, construction workers, and storage of construction materials and plant, but these will be temporary effects.

Associative values

188. The bridge within the river corridor and adjacent to Parahaki Island, together with the recreational carpark, make this area sensitive to change due to the shared and recognised values held by the community and cultural values for those with mana whenua.

189. Engagement with tangata whenua and community stakeholders through the ECDF process has generated and promoted ideas in relation to the design treatment of the bridge and redevelopment of the carpark as a gateway to the Manawatū Gorge Scenic Reserve.

Natural character effects

190. The existing level of natural character of this sector has been determined as Moderate/High (refer to **Appendix 4.A**). The moderately degraded water quality of the river and the modification along the river margins have adversely affected natural character in the area. In addition, the carpark, SH3, railway embankment and box culvert under the railway line have all physically modified the river margins and the attributes and qualities of the area; the presence of willows and other exotic plant species have also contributed to this.

191. In terms of overall context, the rating is also Moderate/High. While indigenous vegetation dominates on the north bank and upstream to the Gorge, the south bank is relatively modified (farmland and shelter belts). The Gorge with its steep heavily vegetated slopes and swift flowing river have high experiential values, but the road and rail modifications detract from this largely intact natural environment.

192. The level of natural character will reduce from Moderate/High to Moderate, due largely to the detrimental effect on the experiential qualities of the remoteness and naturalness of the river corridor, especially for people using the river. A new and large-scale structure across the river corridor will reduce the level of naturalness of the corridor from beyond the immediate bridge site (e.g. Manawatū Gorge Scenic Reserve, and Ashhurst Domain).

193. The river margins will be modified under the bridge deck due to both physical modification and the long-term sheltering effect from light and rain, which will affect regeneration of vegetation. It may also result in structural protection of the river margins to protect them from the effects of flooding.

194. Avoiding bridge piers in the river bed and artificial rip rap for pier or bank protection would help to minimise adverse effects on natural character. However, piers would need to be considered in relation to the overall design of the bridge and its visual appearance, and also to wider landscape effects. While one carefully sited pier in the river bed would have a relatively limited adverse effect, more than one could increase the effects on natural character.

Table 4.12: Effects summary

Type of effect	Level of effect
Biophysical	Moderate
Landscape character	High
Change in level of natural character	From Moderate/High to Moderate

Design measures to avoid, remedy or mitigate adverse effects

195. I recommend the following measures be undertaken during detailed design of the Project to avoid or reduce adverse effects:

(a) Any alignment within the designation corridor would have a similar level of biophysical and natural character effects. A more westerly alignment would require a longer bridge and perhaps additional piers in the river and also bring the alignment closer to Parahaki Island. A more easterly bridge alignment would have benefits in terms of reducing potential adverse landscape and natural character effects in the next sector.

(b) Bridge design should seek to minimise the number and size of piers in the river corridor.

196. I recommend the following measures be undertaken during detailed design of the Project to minimise or offset adverse effects:

(a) Replace/restore indigenous vegetation and habitats disrupted by the construction process.

(b) The bridge design should seek to respect the distinctive landscape setting at mouth of the Gorge, and the fact that it crosses an ONL. This would involve attention to the bridge alignment and overall form, its detailed design and materials used in its construction. There is an opportunity for the bridge to be an 'elegant' structure that reflects its location at the confluence of two major rivers and avoids dominating the surrounding tall native vegetation on the north side. The ECDF provides the opportunity to explore and to appropriately express the cultural narrative and shared values of the Manawatū River and Parahaki Island.

(c) The environment under the bridge on the south side should aim to create a quality public space for visitors at the entrance to the Manawatū Gorge Scenic Reserve walking tracks.

197. The ECDF process has included engagement with those with mana whenua and community stakeholders to promote the development of themes and design expressions for the bridge as well as the new carpark area and gateway to the Manawatū Gorge Scenic Reserve.

Sector 3: Western Slope

198. Refer also to the photographs in **Figure 1, Appendix 4.B**.

Key landscape characteristics of sector

199. The key landscape characteristics in this sector are as follows:

(a) Deeply incised and densely vegetated stream originating just upslope of the corridor and discharging into the River at the proposed new bridge crossing. This area has a High level of natural character.

(b) Stream identified as high value (aquatic ecology). A seep wetland at the lower end of the stream gully supports a small stand of swamp maire, which are classified as Threatened species. This wetland is hydrologically separate from the stream.

(c) The Project extends over the same stream and gully system in two places. At the upper end, the Project traverses a QEII open space covenant and steep vegetated gully and ravines with high value old growth indigenous forest. At the lower section there is c.300-year old growth forest, a stand of swamp maire, three high value streams/tributaries, raupō seepage wetland, and kānuka forest on the hill faces adjoining the Manawatū Gorge Scenic Reserve.

(d) The Project is immediately adjacent to the Manawatū Gorge Scenic Reserve, and in the vicinity of Parahaki Island, identified as a culturally significant area. It also traverses an Outstanding Natural Landscape as identified in Schedule G of Horizons One Plan.[28]

(e) The lower part of the catchment forms part of the Manawatū River margin and is visible from the Manawatū Gorge Scenic Reserve carpark on the south bank.

Potential changes resulting from the Project

200. Potential changes that will result from the Project in this sector relate to installation of access tracks, spoil sites and stormwater management elements, cuts and fill, vegetation clearance, culverts and stream diversion, bridges over streams, embankments, and loss or fragmentation of indigenous ecological communities, as explained further below. Some of these effects will be temporary, such as provision of construction access tracks (which

[28] This area has also been identified by Manawatū District as a future ONL.

would be rehabilitated as part of mitigation measures), and stream diversion to enable construction.

201. The nature and scale of changes would depend on the Project alignment selected. Various options were considered for this sector that would have resulted in quite different outcomes. A westerly bridge alignment constructed on embankments after it crosses the Manawatū River, would have required extensive earthworks, stream diversion and removal of a valued area of old growth indigenous forest to accommodate the footprint. That option cannot proceed, because it would exceed the proposed 'effects envelope' (recommended by Dr Forbes).[29]

202. The current indicative alignment of the Project, comprising an easterly bridge alignment across the river, together with a second bridge to form a 'viaduct/long bridge' spanning the raupō wetland, would avoid the old growth indigenous forest and avoid stream diversion.

203. Two QEII open space covenants are crossed by the Project. One is located in this sector, referred to as **QEII west** at CH5600-6000 and another in Sector 4 – **QEII east** at CH6100-6400.

204. The alignment through the sector will result in landform changes. Landform modification will also occur at disposal sites, construction access tracks and for stormwater management features.

205. There will be vegetation clearance and landform modification in the steep gullies at the QEII west upper stream crossing. The road formation is likely to involve substantial cuts to the existing ground levels where the alignment crosses the two arms of the gully system in the headwaters of the stream. A culvert or 3-span bridge would cross the west arm, and a 60-80m long culvert is required to span the east arm. Both crossings require the removal of indigenous vegetation: old-growth forest and advanced secondary broadleaf forest in the west arm, and advanced secondary broadleaf forest in the east arm. Both the extent of vegetation clearance and the construction footprints would be relatively large in relation to the size of the QEII covenant occupying the designation corridor.

206. The extent of fill to form a road embankment in the westerly alignment option would have been in the order of 400m long, 100m wide, together with cuts

[29] The Project Conditions set out the 'effects envelopes', tabulating the limits of the different types of indigenous vegetation that can be removed or affected as part of the Project.

resulting in significant modification of the lower end of the stream gully (CH 4000-4400); again, that is no longer being progressed as a design option.

207. Loss and fragmentation of the indigenous ecological communities (i.e. very high and high value ecosystems) under any embankment, together with an allowance for construction and ground improvement footprints, would potentially have affected the raupō seep wetland, swamp maire stand, old growth forest and kānuka forest. Dr Forbes (in technical assessment report 6) therefore proposed constraints on the clearance of different types of vegetation, to ensure that effects can be appropriately addressed through offsets and mitigation measures.

208. The current indicative design, namely the easterly alignment of the 'viaduct / long bridge' option, would involve construction of a second approximately 130m long bridge spanning over much of the raupō wetland and stand of swamp maire and not encroach on the old growth indigenous forest. This option would have a smaller footprint, require less earthworks, avoid stream diversion and avoid removal of old growth forest.

209. Two stream tributaries join the main stream under the area anticipated to be covered by the embankment footprint and another stream flows from the Scenic Reserve near CH4000. Sections of stream will be affected by the Project and will require culverting or permanent diversion. Diverted streams are likely to be replaced by rock armoured channels to protect the road embankments. Culverts under the embankment would need to be at least 100m long. To facilitate construction an access track from the north bank of the Manawatū River to Saddle Road will largely require upgrade and widening of existing farm tracks, together with some new sections of track and also one stream crossing via a bridge or culvert.

Biophysical effects

210. From the proposed northern bridge abutment, the proposed designation corridor traverses the lower end of the stream catchment and ascends the pasture covered hill country before crossing the same stream again at its upper end (CH5600-5900). A wide extensive gully area in pasture located to the east of the alignment has been identified as a soil disposal area.

211. The biophysical effects in this sector are greatest at the upper stream crossing (CH5600 to 5900) and lower part of the gully (CH4100 to 4400). Between these two areas, the stream catchment will remain physically

unaltered, but given the width of the footprint to accommodate the four lanes of road, significant earthworks will be required.

212. At the lower end of the gully, the scale of the option requiring the large embankment footprint and associated construction/ground improvements, stream diversion, wetland loss, together with the loss or modification of high value ecological systems, would combine to significantly and permanently alter the biophysical nature of this part of the catchment. However, the indicative ‘viaduct / long bridge’ alignment, would result in much less landform modification.

213. The upper stream crossing where a bridge over the deep western gully and a culvert over the eastern gully are proposed lie within an area protected by a QEII open space covenant. The alignment is likely to be in a cut through this section, and this together with earthworks required for the bridge abutments and an 80m culvert, will significantly alter the landform at the head of this catchment. In addition, clearance of the dense indigenous vegetation in the gullies will be necessary under the alignment footprint and for construction access.

214. Upgrading the existing farm tracks to form the construction access from Saddle Road to the south abutment of the proposed new Manawatū Bridge (CH4000) will require vegetation clearance and earthworks. Most of these works are required south of the stream crossing where the topography becomes steeper and is more densely vegetated. The vegetation that would need to be cleared is primarily kānuka, but there are various groves of remnant forest trees (tōtara, maire, miro, tītoki) that should be retained where possible.

215. The existing farm access track is located in the Pohangina River ONL. While upgrading of the track for use as a construction access will result in widening and modification, it will not significantly impact on the landscape values of the ONL.

Landscape character effects

216. The lower end of this sector is very much a part of the Manawatū River margin where the Gorge ends, and the river begins to open out. This area has a relatively secluded and enclosed character, dominated by indigenous forest in the adjacent Manawatū Gorge Scenic Reserve and throughout the lower part of the gully. The construction of a four-lane road through this area ---will unavoidably significantly change the landscape character.

217. As the proposed designation corridor extends away from the river, the character is dominated by open grazed hill country, dissected by steep and densely vegetated gully systems. The Te Āpiti Wind Farm has already modified this hill country landscape with the introduction of turbines and access roads. A four-lane road, together with traffic movement and associated noise, will further change the landscape character of this rural landscape.

Natural character effects

218. The existing level of natural character for this stream catchment has been assessed as High (refer to **Appendix 4.A**). This is due to the attributes and qualities of the largely unmodified nature of the active bed and margins, high aquatic values and ecosystem functioning. While not fully intact, indigenous vegetation is generally continuous along the length of the stream. The QEII covenant is fenced to exclude grazing stock and other parts of the gully are extremely steep, which generally restricts stock access. The freshwater ecology assessment has identified this stream as having a high value.

219. In the lower catchment, the level of natural character would have been reduced from High to Moderate/Low if the Project had retained flexibility for a westerly alignment with embankments. This would have been due to the permanent loss of the raupō wetland, old growth forest and swamp maire, introduction of a 100m long culvert, and permanent diversion of 200m of the stream. Again, the western embankment option cannot be progressed, however.

220. If a viaduct/long bridge easterly alignment (as indicatively shown on the plans) were adopted by the Project, the level of natural character would be reduced from High to Moderate/High because it would have a smaller footprint and avoid the raupō wetland, stream diversion and the old growth indigenous forest.

221. At the upper crossing, the effect on natural character would also depend on the Project option. In the worst-case, level of natural character would reduce from High to Moderate. This is due to the physical modification by the road alignment being cut down into the stream gully, construction of a culvert, bridge abutments and piers. The culvert will permanently alter the active stream bed and impact on the aquatic ecosystem functioning. Dense indigenous vegetation along the stream margins will need to be removed under the alignment and construction footprints.

222. In addition to the natural character effects outlined above, the experiential qualities of a quiet, remote and largely natural stream gully will be significantly changed by the physical presence and activity of traffic from a road.

223. The localised effects on natural character at the two crossing points are outlined above. If considered at a catchment-scale, the modification to the approximately 1.5km long stream affects about 450m of its length. Between the two sites of modification, the stream and its margin will remain in their current state. Dealing at the whole stream scale with the viaduct/long bridge, together with the bridge across one of the arms of the QEII West covenant, the overall change to the level of natural character will reduce from High to Moderate/High.

224. The construction access road from Saddle Road (which is currently an access track) crosses a stream that has a High level of natural character. The crossing is anticipated to be a bridge or culvert. While the new structure will slightly reduce the level of natural character at the crossing site, overall, it will not adversely affect the level of natural character of the stream.

225. While natural character of the stream crossings would be diminished by the Project, the proposed mitigation measures below, supported by the Project Conditions, will go some way to reduce the level of effects on natural character. In addition, the outline plan(s) as described above will outline the detailed design elements of the Project. This will involve refinement of the road alignment, and minimising construction footprints to reduce the quantum of the streams affected; combined with the re-establishment of vegetation in the catchments, this would reduce the impact on natural character of the stream.

226. In addition, design guidelines in the ECDF, once implemented during detailed design, will also assist to reduce adverse effects of natural character on the streams.

Associative values

227. The lower area is part of an area between the Manawatū Gorge Scenic Reserve and the confluence of the Manawatū and Pohangina Rivers being considered by Manawatū District Council as a future ONL. The upper part of the designation crosses through a QEII open space covenant.

Table 4.13: Effects summary

Type of effect	Level of effect
Biophysical	Moderate High
Landscape character	High
Change in level of natural character- upper crossing	From High to Moderate
Change in level of natural character- lower catchment (viaduct/long bridge)	From High to Moderate/High
Change in level of natural character- whole stream catchment	From High to Moderate/High
Change to level of natural character - Stream Crossing construction access to Saddle Road	From High to Moderate/High
Change to level of natural character - construction access to Saddle Road- whole stream.	Unchanged

228. Table 4.13 sets out the changes in natural character for the lower and upper stream crossings at a site scale and also at a stream scale. When considered at an overall stream scale the changes in the level of natural character is diminished; the natural character would change from High to Moderate/High.

Design measures to avoid, remedy or mitigate adverse effects

229. I recommend the following measures be undertaken during detailed design of the Project to avoid or reduce adverse effects:

    (a) Alignment to avoid the most sensitive ecological areas, wetland and stream beds and reduce area lost or disturbed, by minimising the construction footprint.

    (b) Use bridges instead of embankments and culverts to potentially reduce the construction impacts and permanent footprints through sensitive areas, or otherwise situate any embankment so that vegetation clearance is avoided or minimised and within the specified 'effects envelopes' (and thus able to be offset effectively) specified by Dr Forbes.

    (c) Minimise requirements to temporarily or permanently divert streams.

230. I recommend the following measures be undertaken during detailed design of the Project to minimise or offset adverse effects:

(a) Replace/restore indigenous vegetation and habitats.

(b) Any measures to mitigate or offset the effects on natural character in this stream catchment must deliver benefit to the stream and its margins within this catchment as opposed to elsewhere in the Project. The Project works will impact of the natural elements, patterns and processes of this particular stream system and improving the natural character of a different catchment will not deliver benefits to this catchment.

(c) Removal of grazing stock from the area around the open space covenant to result in a relatively rapid regeneration given the excellent local indigenous seed source. There are limitations to the quantum of mitigation measures possible within this catchment to offset the landscape and natural character effects given the relatively short length of the catchment.

(d) Revegetation and protection of indigenous forest cover in the upper catchments, above the indicative alignment, that are currently in pasture would be effective mitigation and improve the ecological values and water quality of the stream headwaters.

Sector 4: Te Āpiti Wind Farm and Ridge

231. Refer also to the photographs in **Figure 2** in **Appendix 4.B**.

Key landscape characteristics of sector

232. The key landscape characteristics of this sector are as follows:

(a) The high ridge tops, the Te Āpiti Wind Farm, and the QEII covenanted area, as explained below.

(b) This 3.9 km section of the Project traverses the high ridge tops and the Te Āpiti Wind Farm. The wind turbines and access roads are dominant features throughout the sector and they have modified the character of the hill country farmland through the introduction of the wind turbines, which are often referred to as ‘industrial’ elements.

(c) Several steep vegetated gully systems dissect the rolling to steep hill country. The designation corridor crosses through one of the several QEII covenanted gullies in this sector at CH6100 to 6400. Vegetation in the covenant is secondary broadleaf forest and scrubland.

(d) The stream in the QEII gully is identified as high value for its fresh water ecology values.

(e) In Horizons One Plan, the *"highest ridges and highest hilltops of the Ruahine Ranges"* are recognised in Schedule G as a Regionally Outstanding Natural Feature and Landscape. The Manawatū District Plan identifies the ridgeline of the Ruahine Range as an ONL and the Tararua District Plan identifies the "*skyline of the Ruahine Ranges*" in its schedule of natural features and landscapes.

Potential changes resulting from the Project

233. Potential changes resulting from the Project in this sector relate to the installation of access tracks, culverts, earthworks, vegetation clearance, and spoil disposal sites. These are explained further below.

234. The hilly and often steep topography require substantial earthworks along the full length of the alignment forming either cut or on fill batters. Some of the cuts are up to 48m deep.

235. A new access road to service the Te Āpiti Wind Farm runs parallel to the road alignment for 2.0 km (between CH6100 and 8100). This will widen the overall Project footprint, and the impact of accommodating this access road will be proportionally greater across small gully systems. A new access road to a wind turbine at CH5900 will require large cuts and fill on the upper slopes of the stream gully.

236. The indicative alignment has an approximately 350m long footprint through the QEII east covenant, which comprises three arms of the stream headwaters, each of which has tributaries assessed as having high value. The road formation for the main alignment and adjacent wind farm access road will substantially modify the headwaters of the stream through a combination of cut and fill earthworks and three culverts.

237. In addition, the indicative alignment requires cuts into the gullies and three culverts will be required under the alignment. Approximately 450m of stream would be covered by the earthworks footprint.

238. With respect to vegetation clearance, removal of secondary broadleaf forest will be required in the western arm and lower value shrublands in the eastern gullies.

239. It is also expected that spoil disposal sites, which are not shown on the plans, will be required through this area.

Biophysical effects

240. The physical change to the landforms within the proposed designation corridor is substantial due to the hilly topography and the amount of fill in the small gullies. However, the scale of the wide hill crest area has capacity to accommodate this scale of physical change, but the gullies less so.

241. Apart from the vegetation in the QEII covenant, there is very little other high value vegetation that would need to be removed within the proposed designation corridor in this sector.

242. Given the combination earthworks and the vegetation affected in the QEII covenant the level of biophysical effects have been assessed as a Moderate.

243. Formation and shaping of spoil disposal sites adjacent to the road footprint during construction will require earthworks and disturbance, but these effects will be temporary.

Landscape character effects

244. The construction of a new road, associated earthworks and traffic activity will introduce a dominant new element to this area. During construction, effects on landscape character will be amplified given the extent of works and activity. The new road will change the landscape character from farmland/wind farm to a busy and noisy road environment. In terms of land use and farming, the Project will also create a barrier and separation between the north and south areas.

Natural character effects

245. Natural character effects were considered for the stream and its margins within the QEII covenant. The existing level of natural character of the entire stream (from its headwaters just above the alignment to the Manawatū River) was assessed as being High/Very High.

246. The localised effects to the corridor crossing on the natural character of the stream are relatively high. This is due to the large footprint in all three arms of the gully due to the cutting down of the landform, installation of culverts, construction disturbance and associated vegetation removal.

247. When considered at a whole stream level (1.8km long) the adverse effects are somewhat diluted because much of the stream is situated in the Manawatū Gorge Scenic Reserve and has a high level of natural character.

248. Because the adverse effects are high, mitigation measures could be adopted, in particular structures / bridges, which would reduce the footprint in streams,

or a road alignment further north within the designation corridor would reduce effects on natural character.

Table 4.14: Effects summary

Type of effect	Level of effect
Biophysical - Magnitude of effect	Moderate
Landscape Character - Magnitude of effect	Moderate High
Change in level of natural character - Stream Crossing	From High to Moderate
Change in level of natural character - Whole stream assessment	No change

249. Table 4.14 sets out the change in level of natural character at both a site-specific scale and at an overall stream scale. At the overall stream scale, the changes in the level of natural character is diminished, the natural character would not change.

Design measures to avoid, remedy or mitigate adverse effects

250. I recommend the following measures be undertaken during detailed design of the Project to avoid or reduce adverse effects:

(a) Locate the alignment to avoid the most sensitive ecological areas, and streams to reduce the footprint in the QEII covenant area and in other stream gullies. In this location, a northern-most alignment would be the best option.

(b) Use bridges instead of culverts, where possible, to reduce the construction and permanent footprints through sensitive areas.

(c) Revegetation and protection of the upper stream catchments in the QEII covenant which are located above the alignment and currently in pasture. Restoration of indigenous riparian vegetation cover of these upper areas would be effective mitigation and improve the ecological values and water quality of the stream headwaters and offset the stream bed and margins that will be permanently lost under culvert and embankment footprints.

251. Corridor-wide design guidance to mitigate adverse effects, and realise beneficial opportunities, will be provided through the ECDF.

Sector 5: Eastern Slope

252. Refer also the photographs in **Figure 2, Appendix 4.B**.

Key landscape characteristics of sector

253. The key landscape characteristics of this sector are related to the 3.0 km section of the corridor that descends from the high ridges to the toe of the hills where they meet the plains. This hill country is steeper and more broken than the western slope and is characterised by short narrow spurs and deep gullies, many of which have streams and areas of native and exotic scrub as well as exotic woodlots and shelter belts.

254. Several of the streams that drain in the area are generally of a lower value in terms of their freshwater quality.

Potential changes resulting from the Project

255. Potential changes resulting from the Project relate to substantial earthworks, stream diversion / culvert, bridge and vegetation clearance, as explained further below.

256. As for much of the proposed designation corridor, the broken topography requires substantial earthworks with the whole length of the alignment in cut or on fill as it traverses the multiple ridges and gullies.

257. The proposed designation corridor encounters a section of stream tributary at the toe of the hill country and this crossing will need to be culverted or the stream diverted. This tributary then flows into a stream which the corridor crosses with a bridge (both the tributary and the stream have been assessed together in terms of effects on natural character).

258. Three areas of secondary broadleaf forest will need to be cleared. Other vegetation that would also need to be removed is pine woodlots and mixed native/exotic scrub.

Biophysical effects

259. The most substantial biophysical effects relate to the physical change to the topography to enable road construction. This would involve filling sections of gully and cutting through ridges and soil disposal sites.

260. The removal of areas of secondary broadleaf native forest will cause additional biophysical effects resulting from fragmentation and opening up the edges of these stands to the effects of wind and weeds.

261. During construction, the extent of biophysical effects will in places be larger than the final footprint, but some of these will be temporary. Developing soil disposal sites and shaping them to their final form will require earthworks being carried out prior to these areas being hydroseeded and managed as pasture.

Landscape character effects

262. The eastern slope is rugged and wild with limited small-scale infrastructure, such as: farm access tracks, stock fences, stock water and dams. Landscape character will be affected by the introduction of the proposed designation corridor with steep cut faces slicing through this farmed landscape. In addition, soil disposal sites will alter the existing hilly topography. This will contrast with the fine scale and texture of the topography. It will physically and visually bisect the hill country and introduce traffic activity into the relatively quiet rural environment.

263. Various areas of native and exotic vegetation will be removed to facilitate construction but, in the context of the broader landscape, the effects on landscape character will be relatively limited.

264. During construction, the effects on landscape character will be heightened because of the level of disturbance, presence and activity of construction machinery, and overall construction activity. Many of the construction effects will, however, be temporary and will reduce upon completion of the Project, including implementation of the mitigation measures as set out in the Project Conditions and in the ECDF.

Natural character effects

265. The stream and tributary are not considered to be high-value streams for their freshwater qualities.

266. The streams are already reasonably modified through farming activities including: channelising and straightening, removal of riparian vegetation, and stock access.

267. The physical change to the streams and their margins will be the greatest change to natural character in this sector.

Table 4.15: Effects summary

Type of effect	Level of effect
Biophysical	Moderate High
Landscape character	High
Change in level of natural character- tributary and stream	Moderate to Moderate Low

Design measures to avoid, remedy or mitigate adverse effects

268. I recommend the following measures be undertaken during detailed design of the Project to avoid or reduce adverse effects:

(a) Locate the alignment to avoid streams if possible.

(b) Use bridges instead of culverts, where possible, to reduce the construction and permanent footprints over streams.

269. I recommend effective mitigation could be achieved through planting new buffers of indigenous vegetation along the edges of the areas of secondary broadleaf vegetation fragmented by the corridor. Planting for slope stability and landscape amenity planting in strategic locations would also assist to integrate the Project into the landscape. Corridor-wide design guidance to mitigate adverse effects and realise beneficial opportunities will be provided through the ECDF.

Sector 6: Woodville Gateway

270. Refer also the photographs in **Figure 2, Appendix 4.B**.

Key landscape characteristics of sector

271. The key landscape characteristic of this sector is that it is a distinctly rural area. Subsequently, the area is dominated by open grazed pasture farmland with shelterbelts. The hills of the eastern slope form a dominant backdrop to the flat plains.

272. In addition, SH3 is located nearby with several dwellings along the southern side of the sweeping curve west of Woodlands Road.

Potential changes resulting from the Project

273. Potential changes resulted from the Project in this sector relate to cuts, embankments, soil disposal sites and a new roundabout.

274. The new SH3 alignment cuts across the flat farmland and rises on embankments to gain elevation before ascending the hills of the eastern rise.

275. A new roundabout will be located near the SH3 and Woodlands Road intersection. The roundabout will service five exits and have a footprint of approximately 100m x 100m. Overhead LED lighting will be included in the roundabout and for 120-180m along both legs of SH3. Three poles associated with electricity transmission lines on Woodlands and Troup Road may need to be relocated to allow for the new roundabout.

Biophysical effects

276. There will be relatively low biophysical effects in this sector caused by the earthworks through it, which are relatively minor and can (with final shaping and hydroseeding) be integrated with the surrounding farmed landscape. This because of the flat topography; apart from the embankments, which will have a moderate effect at the northern end. Mature shelterbelt trees will need to be removed near the stream crossing.

Landscape character effects

277. The presence of a new road corridor across the open farmland between the eastern rise and the intersection with SH3 will change the rural character of the area. Although there are other roads throughout the area, the substantial linear structure, together with associated traffic activity will impact on the rural environment.

278. The Project will slightly change the landscape character of the area at the southern end of the sector (Woodlands Road). While the existing SH3 road environment already exists in this locality, the presence of a relatively busy roundabout will add a level of complexity to the traffic environment and increase its overall footprint.

279. The addition of overhead lighting at the roundabout will introduce light into an otherwise dark rural environment. The proximity of the roundabout to Woodville goes some way in reducing the incongruity that can occur when islands of light are isolated in dark rural landscapes. The roundabout at night will mark the boundary of Woodville with its rural hinterland.

280. The light may well be apparent from several nearby residences (100m to 300m away) but given the ability to direct and confine light emitted from LED fittings, together with potential screening by shelterbelts and other vegetation, this is unlikely to have an adverse effect.

Natural character effects

281. The works in this sector do not encounter any major streams or wetlands.

Table 4.16: Effects summary

Type of effect	Level of effect
Biophysical	Moderate Low
Landscape character	Moderate
Change in level of natural character	N/A

Design measures to avoid, remedy or mitigate adverse effects

282. I recommend that, to avoid or reduce adverse effects, the alignment is located to avoid the most sensitive ecological areas, and to minimise effects on streams.

283. I recommend that effective mitigation could be achieved through the shaping, hydroseeding and strategic planting of the road embankments to help integrate the elevated corridor with the flat plains and eastern slope. Ensuring that large parts of the embankments could be used for grazing would also assist with integration of the corridor into the landscape.

284. Again, the ECDF will guide mitigation measures and help realise beneficial opportunities such as gateway identification.

ASSESSMENT OF VISUAL EFFECTS

285. Given the focus of the NoR is on a designation corridor as opposed to a detailed road alignment, the assessment of visual effects, which often affect viewing audiences from well outside the corridor, was carried out as a separate exercise. An analysis of the different viewing audiences and their levels of visibility of the designation corridor and the potential visual effects was carried out supported by maps and indicative visual simulations.

ZTV and representative viewpoint locations

286. Given the nature of the visual catchments and separate viewing audiences on either side of the Ruahine Range, two separate ZTV maps were produced initially, one from the west and one from the east. After further analysis and field work, ZTV maps were also produced from two other observer locations;

the southern end of the SH3 bridge and from the southern side of the proposed new bridge across the Manawatū River.

287. On the western side of the Ruahine Range, two viewer observation points were selected; one at the top of the river terrace on the south-eastern of edge Ashhurst (corner of Mulgrave and Durham Street) and a second from The Terrace at the north-eastern edge of Ashhurst. To illustrate the extent of the viewshed from Ashhurst, a ZTV map was generated from the south-western observer point (**Drawing LVA-01, Volume 4**). Another western observer point was also selected (from the SH3 bridge) and another ZTV map generated (**Drawing LVA-02, Volume 4**). From these locations, the river terraces on the eastern side of the Pohangina River and lower hill faces are visible as are the upper slopes and the turbines of the Te Āpiti Wind Farm.

288. A ZTV was also produced from one other western location, the approach to the existing Manawatū Gorge Scenic Reserve carpark on southern side of the river near where the proposed new bridge will cross (**Drawing LVA-03, Volume 4**). Here, the visual catchment is confined by the existing topography which would obscure much of the proposed designation corridor as it rises on the hill slopes.

289. The size of the viewing audience on the eastern side of the Ruahine Range is limited. An observer location was selected 1.3km west of Woodville near to where the corridor joins the existing SH3 (**Drawing LVA-04, Volume 4**). From this location, fairly long stretches of the proposed designation corridor would potentially be visible because of the alignment and orientation.

290. Using the ZTV, field work was carried out to identify representative publicly accessible viewpoints for indicative visual simulations to be prepared (e.g. from local roads, parks and recreation areas, public and semi-public areas and facilities).

291. Given that the corridor traverses through a rural, sparsely settled area, the selection of representative viewpoints for visual simulations is relatively limited. Selection of representative viewpoints focused on locations from the following areas:

(a) Saddle Road;

(b) SH3;

(c) SH57;

(d) Ashhurst and Woodville townships; and

(e) areas used by the public, such as the Ashhurst Domain and the Manawatū Gorge Scenic Reserve track network.

292. Five representative viewpoint locations were subsequently selected for indicative visual simulations (**Drawing LVA-05, Volume 4**); these are described below.

The Terrace, Ashhurst (Drawing LVA-06, Volume 4)

293. Situated on The Terrace on the north-eastern edge of Ashhurst there are panoramic views from residential dwellings across the Pohangina River flats to the western hill slopes of the Ruahine Range, the turbines of the Te Āpiti Wind Farm, the forest in the Manawatū Gorge Scenic Reserve and the Tararua Wind Farm in the distance. From here, landform and vegetation obscure the new bridge over the Manawatū River and much of the proposed designation corridor on the northern side of the Manawatū River. Only a short section of the proposed corridor on the mid slopes would be visible.

Effects summary

294. There would be a Low level of visual effects from the residential properties on the edge of Ashhurst, because of the limited scale of the visual changes and the 1.9km viewing distance.

SH3 Bridge (Drawing LVA-07, Volume 4).

295. Travelling east over the SH 3 bridge, there are transient panoramic views to the Ruahine Range with the forest of the Manawatū Gorge Scenic Reserve in the mid-ground and the turbines of the Te Āpiti Wind Farm silhouetted on the skyline. The vegetation growing on the terrace face of the Pohangina River and on the terrace itself, the willows along the edge of the Manawatū River and the native forest of the Manawatū Gorge Scenic Reserve provide the landscape setting for the new bridge over the Manawatū River. Landform, together with the stand of native vegetation on the terrace, would partially obscure the proposed designation corridor on the northern side of the river.

296. For road users, views of the new bridge and corridor would introduce additional modification into an area of landscape currently dominated by natural elements and seen below wind turbines along the skyline. The new bridge would be partially screened by exotic trees along the river margins. Beyond this, the proposed designation corridor would be visible through

indigenous vegetation as it rises onto the mid slopes of the western slope which extend along the northern side of the river.

Effects summary

297. Overall the level of visual effects would be Moderate.

SH 3 Approach to New Manawatū Bridge (Drawing LVA-08, Volume 4)

298. The existing stretch of road from the SH3 and SH57 intersection will be retained to provide access to the Manawatū Gorge Walkway carpark. The new road will be located on the river terrace to the east, and the southern abutment of the new bridge will be located on the edge of this terrace.

299. From here, the bridge will be prominent feature, crossing over the carpark against the backdrop of the dense forest of Manawatū Gorge Scenic Reserve beyond and wind turbines silhouetted on the skyline. While existing trees and other vegetation in the mid-ground would provide some screening of the bridge/road, the view would still be dominated by the bridge. The design of the bridge, treatment of the earthworks and mitigation planting would help to integrate the bridge in its landscape setting. However, the bridge, because of its scale and its contrast with the largely natural setting, would dominate this area of the Manawatū River environment.

Effects summary

300. Overall the level of visual effects would be High.

Te Āpiti Wind Farm Lookout on Saddle Road (Drawing LVA-09, Volume 4)

301. Views from the Te Āpiti Warm Farm Lookout enable visitors to observe wind turbines up close in this open, hummocky rural landscape. From here, wind turbines are seen dispersed throughout areas of pasture and pockets of exotic and indigenous vegetation. Further to the south, the Tararua Wind Farm is visible along the Tararua Ranges beyond the Gorge.

Effects summary

302. The proposed designation corridor will be visible in this context and introduce areas of cut and fill which modify the undulating landform in the mid-ground. This will extend the degree of modification apparent along this area of the Ruahine Range with a Moderate-Low level of effect.

Junction of SH3 and Hope Road (Drawing LVA-10, Volume 4)

303. Along the flat farm land west of Woodville, the view is characterised by rural land use which extends onto the backdrop of the Ruahine Range. Much of the surrounding land cover is pasture with dispersed shelter belts, farm fences, farm buildings, pine woodlots and indigenous vegetation becoming more prevalent along the toe slopes. The 'crumpled' form of the skyline along the Ruahine Range and the presence of wind turbines within the Te Āpiti Wind Farm are also characteristic features of this view.

Effects summary

304. In this context, the corridor will be seen traversing the toe slopes of the Ruahine Range and disrupt part of the broader natural landform with visible road embankments and cut slopes. This would generate a Moderate level of visual effect.

Table 4.17: Summary of Visual Effects

Viewpoint	Level of Effect
The Terrace Ashhurst	Low
SH3 Bridge	Moderate
New Manawatū Bridge from SH3	High
Te Āpiti Wind Farm Lookout	Moderate-low
Junction of SH3 and Hope Road	Moderate

MEASURES TO AVOID, REMEDY OR MITIGATE THE ACTUAL OR POTENTIAL ADVERSE VISUAL EFFECTS

305. Refer to section assessments for the proposed mitigation measures for landscape and natural character effects. This section deals with proposed mitigation measures in relation to visual effects. The next section provides a tabulated summary of all the recommended mitigation measures for the landscape, natural character and visual effects.

306. The level of visual effects in relation to much of the corridor have been assessed as moderate or lower. The only area where the visual effects are high is in relation to the proposed new bridge over the Manawatū River. Given that the bridge is a new, large-scale structure introduced into a landscape where natural elements prevail, visual effects cannot be avoided. I recommend measures that would mitigate visual effects below.

307. The alignment of the bridge, its design, materials and finishes will all assist in reducing visual effects. The relationship of the bridge to its landscape context and the way it meets the land (i.e. piers and abutments) are important factors in reducing the scale of visual effects. While the bridge can provide a threshold and act as 'gateway' for road travelers, the aim should be for it not to dominate its location and setting. The bridge design can still be distinctive and incorporate strong cultural references, but it should respect its landscape context.

308. The visual integration of the bridge into the landscape will also depend on the level of disturbance that occurs during its construction and the amount and success of the site rehabilitation that follows. The proposed Project Conditions set out the 'effects envelope' in relation to the constraints on the limits of vegetation removal, and the measures that need to be addressed in the Landscape Management Plan, Ecological Management Plan and the ECDF.

309. In terms of mitigating visual effects of the Project for residents in Ashhurst and Woodville, and from rural properties in the environs, the greatest influence will be: the extent of the Project footprint, details of the execution, and finishes of earthworks. The Project is situated in a working rural landscape and the scale and type of site rehabilitation should reflect and respect this. The Landscape Management Plan and the ECDF set out the matters that need to be addressed to achieve this.

310. Ensuring a smooth transition of the junction between cut and batter slopes and soil disposal areas and the adjoining landform will be important. Planting along the edges of areas of native vegetation to provide protection from wind and ensuring areas of rehabilitation planting follow 'natural' boundaries, will assist with visual integration. Densely planting with native or other species along both sides of the road would produce a totally inappropriate visual result and diminish the visual opportunities that the Project will offer (i.e. expansive views whether travelling east or west, views to the Manawatū Gorge Scenic Reserve and to the turbines of the Te Āpiti and Tararua Wind Farms). However, planting in strategic locations along the designation corridor to achieve landscape and ecological outcomes appropriate to the landscape setting and context will be required. The details of this will be set out in the outline plan(s), Landscape Management Plan, Ecological Management Plan and ECDF.

311. Given the steep and (in places) unstable topography, erosion planting using a proven range of tree species should be included as part of site rehabilitation would have long-term site stability and visual benefits. Areas where this type of planting should be undertaken would be addressed as part of the Landscape Management Plan. For many people, travelling through a landscape with slips and sheet erosion creates strong negative impressions so how a new road sits 'in' as opposed to 'on' the landscape is an important visual consideration.

312. The ECDF sets out a series of corridor design principles in relation to the location, design and appearance of the elements that will be form part of the Project. The ECDF has drawn in part on the findings from the technical assessments. It sets out design outcomes that should be incorporated into the brief for the detailed design and consenting phases of the Project.

SUMMARY OF RECOMMENDED MITIGATION FOR LANDSCAPE, VISUAL AND NATURAL CHARACTER EFFECTS

Table 4.18: Summary of mitigation measures

Sector	Location specific mitigation for development during detailed design
1 **Bridge to Bridge (existing SH3 bridge to new bridge)**	**Measures to avoid and reduce adverse effects:** a) The alignment avoids the need for large cuts into the slopes to the east; b) The south abutment of the bridge is located south of the existing SH3 to provide a more open area underneath the bridge on the river margin for visitor carparking.
2 **Manawatū River Bridge**	**Measures to avoid and reduce adverse effects:** c) Any alignment within the proposed designation corridor would have a similar level of biophysical and natural character effects. A more westerly alignment would require a longer bridge and perhaps additional piers in the river and also bring the alignment closer to Parahaki Island. A more easterly alignment of the bridge would enable the 'long bridge / viaduct' option to be achieved in sector 3 and the old growth indigenous forest to be avoided. d) Bridge design should seek to minimise the number and size of piers in the river corridor. **Measures to mitigate/offset effects:** e) Replace/restore indigenous vegetation and habitats disrupted by the construction process. f) The bridge design should seek to respect the distinctive landscape setting at mouth of the gorge. This would involve attention to the bridge alignment and overall form, its detailed design and materials used in its construction. There is an opportunity for the bridge to be an 'elegant' structure that reflects its location at the confluence to two major rivers and the dominance of the surrounding tall native vegetation on the

Sector	Location specific mitigation for development during detailed design
	north side. The ECDF provides the opportunity to explore and to appropriately express the cultural narrative and shared values of the Manawatū River and Parahaki Island. g) The environment under the bridge on the south side should aim to create a quality public space for visitors at the entrance to the Manawatū Gorge Scenic Reserve walking tracks
3 **Western Slope**	**Measures to avoid and reduce adverse effects:** h) Alignment to avoid the most sensitive ecological areas, wetland and stream beds and reduce area lost or disturbed, by minimising the construction footprint (in line with recommended effects envelopes). i) Use bridges instead of embankments and culverts or otherwise reduce the construction impacts and permanent footprints through streams / sensitive areas (within the constraints identified). j) Minimise requirement to temporarily or permanently divert streams. k) An eastern-most alignment that minimises the removal and effects on the old growth native forest and stream (in line with recommended effects envelopes). **Measures to mitigate/offset effects:** l) Replace/restore indigenous vegetation and habitats. m) Any measures to mitigate the effects on natural character in this stream catchment must deliver benefit to the stream and its margins within this catchment as opposed to elsewhere in the Project. The Project works will impact of the natural elements, patterns and processes of this stream system and improving the natural character of a different catchment will not deliver benefits to this catchment. n) There are limitations to the quantum of mitigation measures possible within this catchment to offset the landscape and natural character effects given the relatively short length of the catchment. The permanent footprint is relatively large in comparison to the size of the gully and therefore this reduces the length of stream that can be improved through mitigation. In addition, the gully is already reasonably well vegetated. Removal of grazing stock from the area around the open space covenant would, however, result in a relatively rapid regeneration given the excellent local indigenous seed source. o) Effective mitigation could be achieved through revegetation and protection of the upper catchments, above the alignment, currently in pasture. Restoration of indigenous forest cover of these upper areas would improve the ecological values and water quality of the stream headwaters.
4 **Te Āpiti Wind Farm and Ridge**	**Measures to avoid and reduce adverse effects:** p) Locate the alignment to avoid the most sensitive ecological areas, and streams to reduce the footprint in the QEII covenant area and in other stream gullies. In this location, a northern-most alignment would be the best option. q) Use bridges instead of culverts, where possible, to reduce the construction and permanent footprints through streams. **Measures to mitigate/offset effects:**

Sector	Location specific mitigation for development during detailed design
	r) I recommend that effective mitigation could be achieved through revegetation and protection of the upper stream catchments in the QEII covenant which are located above the alignment and currently in pasture. Restoration of indigenous forest cover of these upper areas would improve the ecological values and water quality of the stream headwaters and offset the stream bed and margins that will be permanently lost under culvert embankment footprints.
5 **Eastern Slope**	**Measures to avoid and reduce adverse effects:** s) Locate the alignment to avoid the most sensitive ecological areas, and streams, and minimise the length of stream impacted by the alignment. t) Use bridges instead of culverts to reduce the construction and permanent footprints through streams. **Measures to mitigate/offset effects:** u) I recommend effective mitigation could be achieved through planting new buffers of indigenous vegetation along the edges of the areas of secondary broadleaf vegetation fragmented by the corridor.
6 **Woodville Gateway**	**Measures to avoid and reduce adverse effects:** v) The alignment is located to avoid the most sensitive ecological areas, and to minimise effects on streams. **Measures to mitigate/offset effects:** w) I recommend that effective mitigation could be achieved through the shaping and strategic planting of the road embankments to help integrate the elevated corridor with the flat plains and eastern slope. Ensuring that large parts of the embankments could be used for grazing would also assist with integration of the corridor into the landscape.
Corridor wide design to mitigate adverse effects and realise beneficial opportunities through ECDF	
I recommend that the environmental principles and design guidance detailed in the ECDF should provide the fundamental design guidance for detailed design of the road alignment to ensure potential landscape and visual effects are avoided and minimised, and that beneficial environmental and cultural opportunities can be realised.	

DRAFT CONDITIONS

313. The draft Project Conditions include provisions to avoid, remedy and mitigate adverse effects on landscape visual amenity and natural character. In addition to the targeted measures for landscape, visual and natural character (detailed below) the conditions that address ecological effects and the ECDF are closely interrelated and combine to support each other to achieve mitigation measures that serve multiple purposes.

314. Condition 5 covers the requirements for the OPW, including the requirement to prepare a Landscape Management Plan ("**LMP**") (5.c) ii E). Condition 12 details what must be included in the LMP. The LMP needs to be consistent with the ECDF and provide detail on how the planting and vegetation management will be implemented and managed, how the earthworks will be integrated into the landscape and other measures that will assist to reduce adverse effects and restore affected areas.

315. Condition 5(e) specifically addresses the potential effects on natural character for the streams identified as having high natural character and sets out maximum envelopes of stream length that could be permanently modified.

316. Condition 11 requires that the preliminary ECDF must be updated during the detailed design phase of the project.

Boyden Evans

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4.A
NATURAL CHARACTER ASSESSMENT

Boffa Miskell

Te Ahu a Turanga; Manawatū Tararua Highway Project

Appendix 4.A: Natural Character Assessment
Prepared for NZ Transport Agency

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Document Quality Assurance

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The Figures referred to in this report are included in either Appendix 4.B (Supporting Photographs) of the Landscape, Natural Character and Visual Effects Assessment (Technical Assessment #4) or in the Drawing set, Volume 4.

1.0 NATURAL CHARACTER ASSESSMENT

This document provides the detail and background of the methodology for the natural character assessment and the findings and conclusions from the assessment undertaken in support of Technical Assessment #4 (*Landscape, Natural Character and Visual Effects Assessment)* for the Te Ahu a Turanga; Manawatū Tararua Highway Project NoR application.

1.1. Summary of Findings – Natural Character Assessment

Existing Levels of Natural Character

The assessment of existing levels of natural character of the rivers and streams was undertaken at two scales; a broad-scale assessment, and at a more detailed level focusing on specific locations where the Project crosses rivers and streams that were considered to have the highest level of natural character.

A region-wide natural character assessment of rivers, streams and wetlands has not yet been carried out by Horizons nor by the territorial authorities, so the broad-scale assessment is intended to provide a contextual baseline of the existing level of natural character. An assessment of effects by the Project on the level of natural character for the broad-scale reaches was not undertaken.

There were no areas of outstanding natural character identified at either scale.

One broad-scale reach (Manawatū Gorge) was identified as having a high level of natural character.

Three of the streams crossed by the Project were assessed as having a high level of natural character. Those streams and Project crossings are the:

- QEII West stream crossing to raupō wetland. (chainage 4000-6000);
- QEII East stream crossing (chainage 6100-6500); and
- Stream Crossing construction access to Saddle Road.

Effects on Natural Character

The assessment of effects on natural character is essentially understanding the degree of change from the existing level of natural character to the future level of natural character anticipated by a proposed development. This effects assessment did not consider the changes in natural character of the broad-scale reaches; instead, it focussed on the locations where the Project crosses streams and the Manawatū River.

The assessments have considered the long-term (permanent) effects of the Project. It is assumed that best practice stormwater management and erosion and sediment control measures will be implemented during construction to avoid or minimise short term adverse effects.

Assessments for the stream crossings were considered at two scales; the actual location of the crossing where the physical changes would occur, and on the stream overall. Generally, the direct effects of the modification to the stream have the greatest impact at that location. However, because streams are connected physical and biological systems from headwaters to the lower catchments, modifications can affect the whole stream system.

Based on the methodology, 10 natural character attributes were used to assess the level of natural character. Of these, the Project impacted most on the morphology of the active bed and margins, the aquatic taxa and ecosystem functioning of the active bed, the terrestrial ecology of the margins, and the experiential qualities. The flow regime, water quality, and absence/presence of exotic flora and fauna were not generally considered to be significantly affected over the long term.

The greatest impact of the Project relates to the scale and location of the proposed works' footprint in the active bed and margins of the streams. At the crossing points, the filling of the stream gullies with earth embankments results in permanent loss of existing vegetation, loss or modification of significant lengths of active bed and margin in what are relatively small catchments. At the broader scale, the Project results in fragmentation of ecological communities and disruption of ecosystem functioning along the streams.

Experientially, it is inevitable that the introduction of large scale earthworks, and road activity will dominate the natural environment and tranquil aspects of the small stream gullies, and within the Manawatū River corridor where the proposed new bridge will cross.

The areas of greatest sensitivity in terms of potential effects on natural character are those in locations where the existing natural character is highest. Three of the waterbodies crossed by the Project have high natural character.

A reduction in natural character from High to Moderate (or less) is considered to constitute a significant reduction in the level of natural character.[1] Waterbodies with high natural character are more sensitive to change that could adversely impact on the attributes and qualities than those that have a moderate or low level of natural character. A reduction from High to Moderate is considered to be significant as it requires reductions in several of the 10 natural character attributes for the overall level of natural character to be affected.

The assessment has determined that the existing high natural character of two streams would be significantly reduced by the Project if certain options for the final road alignment and design were selected (i.e. QEII West, chainage 4000-6000 and QEII East, chainage 6100-6400). In both situations, the footprint of the alignment and construction works could cause permanent loss to relatively large sections of the active bed and stream margins, in what are relatively small gullies and catchments.

However, if the final road alignment and design option for QEII West stream were to include a viaduct/long bridge, and the stream not diverted, the effects on natural character would be reduced. Similarly, with the QEII East stream, the effects on natural character could be reduced by an option where the footprint is minimised and bridges or small footprint structures used to span the three gullies instead of culverts.

In all locations, adoption of various mitigation measures will be integral to achieving reduced effects on natural character. This is especially so at the QEII West and QEII East stream locations.

Table 1 sets out the expected change to the level of natural character at the specific crossing locations. However, when considered at an overall stream scale, the change in the level of natural character is reduced. Table 2 summarises the change to natural character for the whole stream and considers just those streams with existing high natural character.

While natural character would be diminished or significantly diminished either at a crossing site or whole stream scale, opportunities exist within the proposed designation to undertake a detailed design of the road alignment and implement mitigation measures that would reduce the scale of impact on the waterbodies and their margins.

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[1] Interpretation of Horizons Objective 6.2 (b) (ii) *avoided where they would significantly diminish the attributes and qualities of areas that have high natural character…".* What constitutes "*significantly diminish" was d*iscussed and agreed to by the specialist contributors who undertook this assessment.

Table 1: Summary of changes to natural character (at crossing locations)

Location	Current Condition	Post Construction Condition
Manawatū River Crossing	Moderate/High	Moderate
Chainage 4000-6000 **Lower stream/wetland** **QE II West**	 High High	 Moderate/High Moderate
QEII East **(chainage 6100-6400)**	High	Moderate
East End Stream **(chainage 12700-13100)**	Moderate	Moderate/Low
Stream Crossing construction access to Saddle Road	High	Moderate/High

Table 2: Summary of changes to areas of high natural character (whole streams)

Location	Current Condition	Post Construction Condition
Chainage 4000-6000 **QE II West & Lower stream/wetland**	High	Moderate/High
QEII East **(chainage 6100-6400)**	High	High
Stream Crossing construction access to Saddle Road	High	High

Mitigation

The most effective form of mitigation would be to avoid and reduce the scale of the impact on waterbodies and their margins through design of the alignment. Other mitigation measures should seek to minimise the Project footprint in waterbodies through use of structures such as bridges and retaining walls in preference to earth embankments and culverts. Development and adoption of low impact construction methodologies are also key to mitigation of effects on natural character.

A second tier of mitigation would be to enhance the natural character of the stream catchments, including measures such as stock-proof fencing and permanent retirement from grazing, restoration planting, and permanent legal protection of these catchments.

1.2. Statutory Framework

Resource Management Act

Natural character in an RMA (section 6(a)) context relates only to waterbodies and their margins, rather than the landscape overall. The Project crosses the Manawatū River and several streams.

Horizons One Plan Provisions

Provisions in The Horizons One Plan RPS provides guidance for the assessment (noting "natural character" is not defined within the plan).

> *Objective 6.1.3*
>
> *Introductory Text in 6.1.3 Natural features, Landscapes and Natural Character*
>
> *"Preservation of the natural character of the coastal environment, wetlands, rivers, lakes and their margins is also a matter of national importance. Natural character is generally accepted as being an expression of:*
>
> *• natural landform,*
>
> *• natural water bodies (lakes and rivers) and the sea,*
>
> *• vegetation cover (type and pattern),*
>
> *• natural processes associated with the weather and the ecology,*
>
> *• wildness, exposure, and the natural sculpturing of landforms and vegetation, and*
>
> *• the wider landscape context and the site's* relationship to this.*
>
> *Natural character is a sliding scale and varies from a low degree of natural character, such as urban environments, to a high degree of natural character (for example, Tongariro National Park).*

The approach of the One Plan is to at least maintain, and enhance where appropriate, the current degree of natural character of the coastal environment, wetlands, rivers, lakes and their margins by:

• continuing to provide a regional policy on natural character to guide decision-making,

• protecting and managing indigenous biological diversity, important wetlands, rivers and lakes as described elsewhere in this Plan and restoring and rehabilitating natural character where appropriate.

The natural character of rivers, lakes and their margins can be adversely affected by activities, in particular structures and flood mitigation measures, such as stopbanks. It is important that preservation of the natural character of rivers, lakes and their margins, where this is reasonable, is considered when making decisions on relevant activities. The natural character of wetlands can best be provided for by proactively managing the top 100 wetlands in the Region (as provided for in the sections of this chapter dealing with indigenous biological diversity)."

Objective 6-2

(b) Adverse effects, including cumulative adverse effects, on the natural character of the coastal environment, wetlands, rivers and lakes and their margins, are:

> *(i) avoided in areas with outstanding natural character, and*
>
> *(ii) avoided where they would significantly diminish the attributes and qualities of areas that have high natural character, and*
>
> *(iii) avoided, remedied or mitigated in other areas.*

(c) Promote the rehabilitation or restoration of the natural character of the coastal environment, wetlands, rivers and lakes and their margins.

Policy 6-8

(a) The natural character of the coastal environment, wetlands^, rivers^ and lakes^ and their margins must be preserved, and these areas must be protected from inappropriate subdivision, use and development.

(b) The natural character of these areas must be restored and rehabilitated where this is appropriate and practicable.

(c) Natural character of these areas may include such attributes and characteristics as:

- *(i) Natural elements, processes and patterns,*
- *(ii) Biophysical, ecological, geological, geomorphological and morphological aspects,*
- *(iii) Natural landforms such as headlands, peninsulas, cliffs, dunes, wetlands, reefs, freshwater springs and surf breaks,*
- *(iv) The natural movement of water and sediment including hydrological and fluvial processes,*
- *(v) The natural darkness of the night sky,*
- *(vi) Places or areas that are wild and scenic,*
- *(vii) A range of natural character from pristine to modified, and*
- *(viii) Experiential attributes, including the sounds and smell of the sea; and their content or setting."*

6.7 Explanations and Principal Reasons

The preservation of the natural character of the coastal environment, wetlands, rivers and lakes and their margins is a matter of national importance. The approach of the One Plan is to maintain the current degree of natural character of the coastal environment, wetlands, rivers and lakes and their margins and to restore and rehabilitate natural character where appropriate. The objectives, policies and methods adopted in this document aim to achieve this by:

(a) *providing policy guidance on matters to be taken into account when exercising functions and powers under the RMA and when making decisions on applications which may affect natural character;*

(b) *the restoration and rehabilitation of natural character where appropriate; and*

(c) *actively protecting and managing indigenous biodiversity, wetlands, and rivers and lakes as described in other parts of this document.*

2.0 ASSESSMENT APPROACH AND SCOPE

2.1. Assessment Steps

The process to assess the level of natural character involves an understanding of the many systems and attributes that contribute to a waterbody including abiotic, biotic and experiential factors. Consequently, this requires input from a range of technical disciplines such as river hydrology and morphology, aquatic and terrestrial ecology, water quality, and landscape architecture. The natural character assessment was undertaken by a small team of experienced practitioners:

(a) Dr Olivier Ausseil (water quality);

(b) Dr Adam Forbes (terrestrial ecology);

(c) Kieran Miller (freshwater ecology); and

(d) Bronwyn Faulkner / Boyden Evans (landscape context / experiential).

The assessment involved the following broad steps:

(a) Reviewing and confirming the methodology and assessment criteria amongst the team (including geographical extent and identification of broad-scale reaches and detailed sites).

(b) Assessing the current condition of existing natural character (including identifying any areas of High or Outstanding natural character).

(c) Assessing the anticipated change to natural character resulting from the Project and the significance of that change (i.e. scale of effect on existing natural character).

2.2. Use of two scales for the assessment

The assessment of the existing level of natural character of the rivers and streams for this Project was carried out at two scales; a broad-scale assessment and at a more detailed level focusing on specific locations where the Project crosses streams and the Manawatū River (**Drawing C-11, Volume 4**).

Given that a regional natural character assessment has not been carried out, the broad-scale assessment provides a wider context and a suitable local baseline level of natural character beyond the designation corridor. The broad-scale assessment considers reaches of both the Manawatū and Pohangina Rivers in the general vicinity of the proposed designation corridor. This broader context covers a range of river environments with different attributes and qualities. The broad-scale assessment also provided a context for the identification of 'hot spots' at the river and stream crossings, which are the focus of the detailed assessment.

An assessment of the potential effects on the level of natural character was not undertaken for the broad-scale reaches. The effects assessment focussed on the locations where the Project crosses streams and the Manawatū River.

For the assessments of stream and river crossings, the existing level of natural character was first determined and subsequently, the changes to the level of natural character were assessed as a result of the potential effects of the Project.

3.0 NATURAL CHARACTER METHODOLOGY

The methodology used in this assessment is based on current best practice which has its foundations in the widely accepted methodology for natural character assessment in coastal environments (in relation to that developed in response to the NZCPS) and several previous and current South Island river assessments undertaken by Boffa Miskell for different regional councils (i.e. Marlborough, Otago, Canterbury).

The methodology set out below has been reviewed by John Hudson (landscape architect) from the joint team of technical experts appointed for this Project by Palmerston North City Council, Manawatū District Council, and Tararua District Council.

3.1. Natural Character

Natural character is a term used to describe the naturalness of river/stream environments. The degree or level of natural character within an environment depends on:

- the extent to which natural elements, patterns and processes occur;
- the nature and extent of modifications to the ecosystems and landscape/riverscape;
- the highest degree of natural character (greatest naturalness) occurs where there is least modification; and
- the effect of different types of modification upon the natural character of an area varies with the context and may be perceived differently by different parts of the community.

The attributes and qualities considered to assess the naturalness of rivers and other water bodies relate to the degree of intactness of the natural elements, patterns and processes, including the extent of any physical modifications to landforms or presence of built structures. It also includes the perceptual or experiential component of naturalness.

Natural elements incorporate all key river elements, such as the water, bed and banks, as well as particular attributes occurring within the river environment, such as geological formations, indigenous vegetation and fauna.

Natural patterns take the channel and the riparian edge into account, and those patterns created by humans on adjacent land, such as shelterbelts, land use boundaries, etc.

Natural processes include river / lake dynamics, flows and currents, erosion, freshes and floods, and regeneration processes of riparian vegetation and ecological health.

3.2. River Components

The natural character assessment of the rivers and streams comprise three components: context, margin, and active bed.

Context

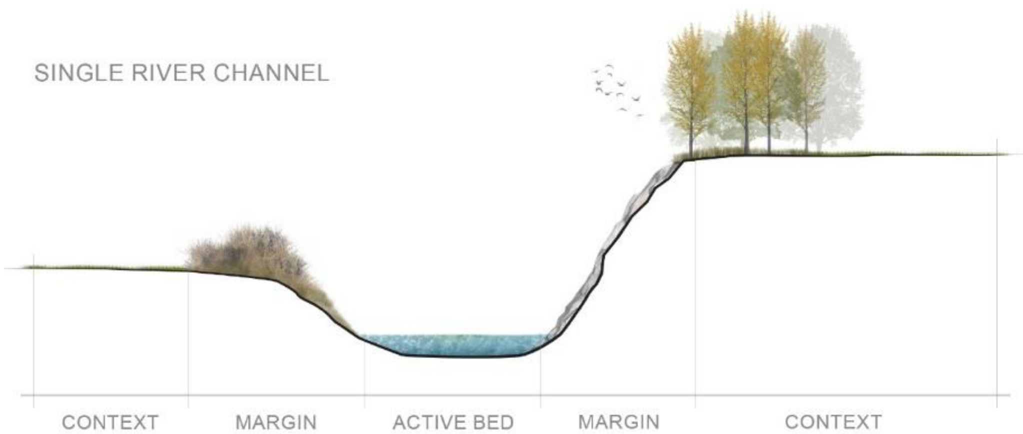
Refers to the wider landscape context of the catchment adjacent to the river/stream and considers the land use, landform and vegetation cover that contributes to the overall character of the river its margins.

Margin

Refers to the area between the active bed and the wider landscape context. River processes, patterns and influences will be evident in the margin, such as occasional flooding, former banks and channel patterns, and river gorge wind flow. From locations within a river/ margin, the active bed should be a dominant feature. The margin is typically narrow and may incorporate terraces, banks, stop banks, abandoned riverbed, small floodplains, river and stream estuaries and built infrastructure. Generally, topographic features define the extent of the margin such as the top of banks and the base of terraces. Vegetation boundaries can also define the margin extent such as where shrubland or forest adjoins grazed pasture.

Active Bed

For single stream incised rivers, the active bed comprises the actual river channel. For wider riverbeds and those with a braided character, the active river bed includes wetted areas/channels and may include dry margins, islands, banks, abandoned channels and bars of a braid plain that form part of the river's natural migration across the riverbed, as well as flood channels and side channels.




BRAIDED RIVER
FLOOD CHANNEL
ISLAND
CHANNEL
CONTEXT
MARGIN
ACTIVE BED
MARGIN
CONTEXT

3.3. Assessment Framework and Attributes

Table 3 below describes the assessment framework and the 10 natural character attributes and qualities assessed for each of the identified locations. The framework recognises that each of the three components of the river have different attributes and qualities to be considered. The attributes that comprise natural character of a river/stream can be clustered into three attribute groups- Abiotic, Biotic and Experiential.

The attributes and qualities assessed (below) include, but are not limited to, the attributes and characteristics, relevant to freshwater environments, listed in Horizons One Plan Policy 6-8(c).

Table 3: Assessment Framework

Attribute Group	Natural Character Attributes
Active Bed	
Abiotic	Flow Regime – how natural/modified are the flows. Active bed/body shape, including, sedimentation structures and human modifications Water Quality
Biotic	Indigenous taxa assemblages Ecosystem functioning Presence / absence of exotic aquatic flora and fauna
Margin	
Abiotic	Structures and human modifications
Biotic	Terrestrial ecology
Context	
	Land use- degree of modification - broader scale landscape modification beyond the immediate river margin. Terrestrial ecology, including vegetation, animals, habitats.
All River Corridor	
Experiential	Human perception of how natural a place appears, underpinned by the biotic and abiotic attributes (above). It includes the remote/ untamed experience a place may provide and experiential attributes such as sounds, smells and transient values.

3.4. Level of Natural Character

The methodology adopted to assess the level of natural character involves a two-step process. In the first step, natural character is assessed in relation to a five-point scale with the ability for in-between ratings if required, as set out in the diagram below. This diagram also illustrates the relationship between the degree of naturalness and degree of modification. A high level of natural character means the waterbody is less modified and vice versa.

Very High	High	Moderate	Low	Very Low

Each of the 10 natural character attributes for each location were assessed and assigned a level of natural character (very high to very low). These 10 ratings were then ordered/listed from very high to very low and the median rating (middle of the list) identified as the overall level of natural character for that location. No weightings were applied to any of the attributes.

3.5. Outstanding Natural Character (ONC)

The second step involves a re-assessment of those areas assessed as having High or Very High natural character to determine whether they qualify as Outstanding.

A river or stream reach with ONC should *“Exhibit a combination of natural elements patterns and processes that are exceptional in their extent, intactness, integrity and lack of built structures and other modifications”*[2]. An area of ONC should encompass the entire width of the river corridor, rather than simply applying to an individual component of a reach (i.e. context, margin, active bed), to ensure that intact interrelated sequences of ecological systems and natural processes are included.

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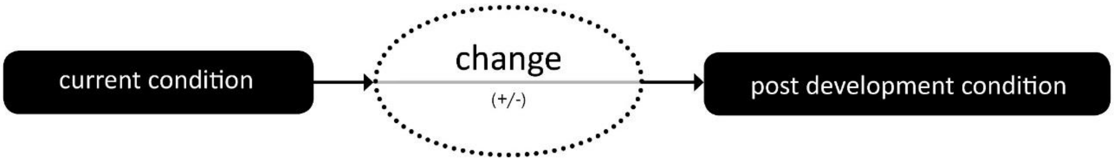
[2] Boffa Miskell derived definition.

To determine areas of ONC, any river reach where all three components are identified as having High or Very High natural character will be considered to determine if any part of that reach would qualify as being Outstanding.

3.6. Effects on Natural Character

An assessment of the effects on natural character of an activity involves consideration of the proposed changes to the current condition compared to the existing. This can be negative or positive.



The natural character effects assessment involves the following steps;

(a) assessing the existing level of natural character;

(b) assessing the level of natural character anticipated; and

(c) considering the significance of the change.

Horizons One Plan Objective 6-2 (b) (ii) requires interpretation of the phrase "*significantly diminish the attributes and qualities of areas that have high natural character…*

In this assessment, a reduction in natural character from High to Moderate (or less) is considered to constitute a significant reduction in the level of natural character[3]. Waterbodies with high natural character are more sensitive to change that could adversely impact on the attributes and qualities that contribute to the high natural character, than those areas that have a moderate or low level of natural character. A reduction from High to Moderate is considered to be significant, as it requires reductions in several of the 10 assessment attributes for the overall level of natural character to be affected. The interrelated nature of the attributes means that modification of a waterbody will typically result in a reduction to the rating of several attributes, rather than just one.

[3] Interpretation of Horizons Objective 6.2 (b) (ii) *avoided where they would significantly diminish the attributes and qualities of areas that have high natural character.* The threshold of what constitutes *significantly diminish* was determined by the team of specialist contributors who carried out the Natural Character Assessment.

3.7. Natural Character Assessment Matrix

The assessment matrix below contains indicative descriptions for each of the assessment criteria and for each of the ratings from very high to very low (with the ability for in-between ratings if required). It provides consistency of ratings between sites and the changes to the level of natural character resulting from the Project. The initial development of the matrix by Boffa Miskell was grounded in natural character assessments prepared for coastal environments and rivers for various regional and district councils around New Zealand. The matrix was reviewed and refined by the team of specialists who undertook this assessment to make it applicable to this Project.

Table 4: Natural Character Assessment Matrix

Active Bed/Channel/Wetland Body	Very Low	Low	Moderate	High	Very High
Abiotic - Flow Regime The flow regime characteristics of a river with a given catchment size and location. Change to critical flow statistics relative to naturalised flow. Inflow/outflow controlled Occurrence of impoundments or large diversions of flows including flood harvesting. Proportion of flows diverted or impounded. Proportion of available allocation abstracted.	Very highly modified or diverted flow/water take (e.g. no natural flow regime through the obstruction by large-scale dams and diversions that drastically alter flood, fresh and low flow statistics relative to naturalised flows. Surface water takes over-allocated.	Highly modified or diverted flow. High level of alteration to flood, fresh and low flow statistics relative to naturalised flows. (e.g. through the introduction of small scale dams, substantial flood harvest irrigation takes, races or flood bypass channels. Surface water takes at or close to allocation.	Moderately modified or diverted flow (e.g. several irrigation takes removing a moderate proportion of 7DMALF or targeting flood flows. Moderate alteration of flow statistics.	Relatively low levels of modified or diverted flow (e.g. few irrigation takes removing a minor proportion of low surface water takes <50% of allocation, or no takes focussed on flood harvest.	Highly natural flow regime with no/very limited modifications to flow statistics. Minor water takes, no controlled in/out flows.
Physical change and dynamics of river and water movement resulting from natural seasonal floods and flows- movement of alluvial loads, sediments, flushing of algae and weeds.	Few or no natural elements, patterns, processes remain	Some key natural processes are no longer able to operate	Most natural dynamic processes generally intact with some interference	Natural dynamic processes largely intact	Natural dynamic processes virtually or completely intact
Degree of wetland hydrology intactness	Wetland surface and groundwater hydrology very highly modified, wetland extent largely reduced, overwhelming invasion by dryland species	Wetland surface or groundwater hydrology modified, wetland extent reduced and dryland species invaded	Wetland surface or groundwater hydrology may be modified but wetland extent represents close to natural extent. Invasions of dryland species localised and naturally contained	Wetland surface or groundwater hydrology intact. Wetland extent natural. Low levels of dryland species invasions	Wetland surface or groundwater intact. Natural wetland extent. Secure from dryland species invasions

Active Bed/Channel/Wetland Body	Very Low	Low	Moderate	High	Very High
Abiotic - Active bed/body shape, including structures and human modifications Includes, groynes, diversions, gravel extractions, irrigation infrastructure, roads, bridges, transmission lines or boat ramps. Extent of change to active bed or water surface profile. 'Training of braided rivers through straightening and narrowing of braid plain.	Channel/lake/wetland very Highly modified (i.e. by a dam, weir or flood defence structure, reclamation straightened, channelised (often with concrete or rock fill banks). Braid plain significantly narrowed and straightened	Highly modified. Semi natural reaches/body or channel shapes in some areas. Significant parts have been affected or by human intervention, modification (i.e. suburban/intensive Agriculture/hort land use: gravel extraction, Channel diversions and reshaping, narrowing and straightening of braid plain. Long stretches of flood protection structures (stopbanks, groynes, riprap). Substantial water take structure/physical modifications that modify the channel in localised areas. Jetties in lake bed.	Generally natural Occasional 'sections' with human modifications (i.e. a settled rural landscape with bridge/ aqueduct supports, pylon footing, long stretches of stopbanks, groynes). Removal of meanders from braid plain. Gallery water takes that modify the channel in localised areas. Moorings in lake bed.	A highly natural river/lake with limited human intervention (i.e. occasional bridge abutments/ power pole within the river channel); water monitoring devices/ gauges with very localised effect. Minor or short stretches of modifications to braid plain.	Overwhelmingly natural with no/ very limited evidence of human interference. Any water takes are ground water takes outside the channel. Braid plain unmodified
Wetlands	Wetlands extensively reclaimed or modified by hard structures	Large areas of wetland reclamation or surface modification	Few areas of wetland reclamation or modification by hard structures	Only localised areas of wetland reclamation or modification by hard structures	No impacts by reclamation or hard structures on wetland body

Active Bed/Channel/Wetland Body	Very Low	Low	Moderate	High	Very High
Abiotic - Water Quality Water quality and aquatic habitat quality; clarity, sedimentation, nutrient and bacterial levels etc. This should account for both the main channels of the river/the wetland body as well as lateral aquatic habitats if any (Including those outside of flood defences). Habitat changes due to fine sediment, draining, stock trampling or choking by exotic trees/ shrubs	Very highly contaminated or permanently discoloured water displaying very high levels of human induced changes to the water quality with limited life supporting capacity (e.g. within polluted urban/industrialised areas or intensive farming); Lateral habitats drained, removed or separated from the active channel or wetland body. No flushing flows. Measured by: Contaminant concentrations do not meet NPS-FM 2014 bottom lines, are causing national bottom lines for periphyton to be breached or exceed ANZECC 2000 80% protection guidelines.	Water usually displaying high levels of contamination mainly from adjacent diffuse sources from land use activities (agricultural leaching etc); Lateral streams and wetlands are diminished in area, unnaturally silted and/or choked with exotic weeds. Lateral channels not exposed to lateral migration of flooding/flushing by surface flows. Measured by: Median contaminant concentrations exceed the 95% confidence intervals (CIs) of the trigger values[4] set out in McDowell et al. (2013)[5].	Water displaying reasonable levels of naturalness although contains occasional high-moderate levels of human induced changes to part of the waterway or infrequent times; Some impact to habitat quality but lateral habitats generally intact and subject to active surface migration and flooding/ flushing, Measured by: Median contaminant concentrations are within the 95% CIs of the trigger values set out in McDowell et al. (2013) but exceed the trigger value thresholds.	Water displaying relatively high levels of water quality with small or rare amounts of impurities caused further upstream (e.g. by occasional stock crossing or forest harvesting); Lateral habitats in good condition despite occasional stock ingress or exotic vegetation. Lateral habitats subject to active channel migration and flooding/ flushing. Measured by: Median contaminant concentrations exceed the median reference conditions[6] set out in McDowell et al. (2013) but are below the trigger value thresholds. Note – in many cases contaminant concentrations will be within the 95% CIs of the median reference conditions.	Highly natural water and lateral habitat quality. Displaying no human induced changes. Measured by: Median contaminant concentrations are at or below the median reference conditions set out in McDowell et al. (2013).

[4] Trigger values indicate that there is a ‘potential risk’ of adverse effects at a site
[5] McDowell, R.W., Snelder, T.H., Cox, N. 2013. Establishment of reference conditions and trigger values for of chemical, physical and micro-biological indicators in New Zealand streams and rivers. AgResearch Client Report. Prepared for the Ministry for the Environment.
[6] Reference conditions are defined as the chemical, physical or biological conditions that can be expected in streams and rivers with minimal or no anthropogenic influence.

Active Bed/Channel/Wetland Body	Very Low	Low	Moderate	High	Very High
Biotic - Exotic Aquatic Flora and Fauna Presence of exotic aquatic flora and fauna within the river channel/wetland body or lateral habitats (including waterweeds, exotic fish, and invasive alga e.g. didymo) can reduce the natural character of the river/wetland. This does not include vegetation on 'islands' within the river channel. This is contained under 'braid plain vegetation'. Algal blooms may be evident in some rivers due to seasonal low flows. Expert ecological judgement will be required to assess extent and may have a bearing on the degree of naturalness of this primary attribute.	System "choked" with exotic aquatic flora and fish communities dominated by exotic species	Large areas of introduced flora and fauna (including exotic fish) evident (in approximately 75% of river/wetland)	Occasional stretches (some quite long) of introduced flora and fauna evident within waterway (approx. 50% of river/wetland)	Small, often isolated pockets of introduced flora and fauna evident (less than 20% of total river/wetland). However, river/wetland displaying very high levels of naturalness. Fish communities dominated by native species	No evidence of introduced flora or fauna within the river channel/wetland body
Biotic – Indigenous taxa assemblages The presence of species forming aquatic communities and the level that they are in terms of representing unmodified habitat potentials.	Expected species largely absent	Most expected species absent with remnant population structure highly modified	Some expected species absent with moderate modification to population structure	Virtually all expected species present but population structure is modified	Virtually all expected species present and their population structure virtually unmodified
Biotic – Ecosystem functioning	Original ecosystem functions rare or absent	Most ecosystem functions varying well outside natural range	Some ecosystem functions varying outside natural range	Almost all ecosystem functions intact	All ecosystem functions virtually intact

Margin	Very Low	Low	Moderate	High	Very High
Structures and human modifications Includes, dams, groynes, stopbanks, diversions, gravel extractions, irrigation infrastructure, roads, bridges, transmission lines or boat ramps, 4WD tracks, recreational facilities-carparks, toilets,	Completely modified or artificial (i.e. by a dam, weir or flood defence structure such as extensive stopbanks or groynes)	Significant parts of the margins have been affected or encroached upon by human intervention (i.e. suburban/highly managed agricultural land, including: gravel workings, part channelisation). Roads or railway lines immediately adjacent to the banks requiring protection	Occasional 'reaches' with human modifications (i.e. a settled rural landscape with bridge/ aqueduct supports, pylon footings across river corridor). Occasional localised water takes and pump stations. Informal occasional 4 WD track or walking trails on banks. Boat ramps on lake edge	Limited human intervention (i.e. occasional bridge abutments/ power pole within the river channel)	Overwhelmingly natural with no/ very limited evidence of human interference
Terrestrial Ecology Vegetation – Indigenous/exotic vegetation, ecological value, quality habitat. Natural patterns and processes. Fauna - including birds, lizards, pest animals	Absence of vegetation due to human induced changes or limited presence (in pockets) of managed exotic vegetation. Natural patterns and processes absent	Sporadic vegetation or predominance of managed exotic vegetation such as plantations/woodlots, pest plant species with few of native species and limited pattern and process	Includes some indigenous species (i.e. indigenous understorey regeneration or seral assemblages) but exotic vegetation (i.e. willows/ gorse) predominates and contributes most to natural pattern and process	Indigenous vegetation present in a fragmented mosaic of native and exotic communities. Several successional stages with mature ecosystem components present. Resembling high levels of natural pattern and process	Overwhelmingly indigenous vegetation, of predominantly mature ecosystem elements, with no or few introduced species and resembling reference levels of natural pattern and process
Bird Habitat River and lake margins provide habitat for resident and migratory bird populations. Larger river margins and riverbeds potentially provide more habitat	Expected species virtually absent	Most/many expected species absent with remnant population structure highly modified	Some expected species absent with moderate modification to population structure	All expected species present with slight modification to population structure. Very likely to contain species and habitats of high conservation value.	Contains species and habitats of high conservation value

Context	Very Low	Low	Moderate	High	Very High
Land use - Extent of intensification or modification. Modification of landforms and physical features such as stopbanks, gravel extraction. Agricultural use intensification of land use, including urban areas. Recreational facilities (carparks, campgrounds toilets, mown grass, signage, cycleways and paths) Roads and State Highways. Include catchment modifications if ecologically linked to the waterway. Protected natural areas such as reserves, parks and estates managed by DOC may indicate a higher natural character.	Heavily modified landscape (urban) with limited vegetation	Large areas of Suburban/residential development, or large-scale areas of intensive agriculture forestry, orchards, vineyards; road, rail, transmission line infrastructure follows river corridor	Settled pastoral landscape with areas of commercial forestry and pockets of indigenous vegetation. Road, rail, transmission line infrastructure crosses river corridor	Fragmented indigenous and rural landscape; Extensive pastoral farming; Informal occasional 4 WD track or walking trails	Overwhelmingly indigenous landscape with no or very little human modification
Terrestrial Ecology Including vegetation, animals, habitat	Exotic and invasive biota dominate. Indigenous ecosystems functions heavily impaired or absent	Exotic and invasive biota very common. Few/small areas indigenous ecosystems. Limited levels of ecosystem functionality remain	Exotic and invasive biota regularly present, pockets of intact indigenous ecosystems. Some ecosystem functionality	Exotic biota may occur and invasive biota rare Almost all ecosystem functions intact. Very likely to contain species and habitats of high conservation value	Exotic biota may occur but virtually no invasive species. Most ecosystem functions are intact Contains species and habitats of high conservation value

Experiential	Very Low	Low	Moderate	High	Very High
Views, sounds and smells Sense of untamed and remoteness	No or rare sense of wildness or remoteness Dominant human	Limited sense of wildness and remoteness for long stretches Strong human influences for long stretches	Regular opportunities to experience wildness and remoteness Human obvious but not dominant influence	Predominantly wild and remote Limited human interference	Overwhelming sense of wildness and remoteness Rare human influence

4.0 EXISTING LEVEL OF NATURAL CHARACTER ASSESSMENTS

4.1. Summary - Existing Level of Natural Character

This section includes the assessments of the existing level of natural character of the broad scale reaches and the detailed assessment areas.

Table 5: Summary Tables – Existing Level of Natural Character

		Existing Level of Natural Character
Broad-scale Reaches	Manawatū Gorge	High
	Manawatū River below SH3 bridge	Moderate/Low
	Lower Pohangina River	Moderate/High
	Generic streams along the designation corridor	Moderate

		Existing Level of Natural Character
Detailed Sites	New Manawatū River Crossing	Moderate/High
	West stream (QEII stream crossing to wetland north of Manawatū River)	High
	Stream crossing- construction access to Saddle Road	High
	East QEII Stream Crossing	High
	Streams at eastern end of designation	Moderate

Those areas assessed as having High or Very High natural character were subsequently considered to determine whether they would qualify as having outstanding natural character (refer section 3.5).

The study team did not consider that any of the reaches or sites achieved the threshold of 'outstanding'. That is, "*Exhibit a combination of natural elements patterns and processes that are exceptional in their extent, intactness, integrity and lack of built structures and other modifications*"[7].

[7] Boffa Miskell derived definition.

While sections of a reach or some attributes of a reach may have been rated as high or very high, there was no contiguous area/waterbody which was sufficiently unmodified, intact and of a high enough quality to be considered to have an outstanding level of natural character.

BROAD SCALE REACH ASSESSMENTS

4.2. Manawatū Gorge (Figure 3, Appendix 4.B)

The 7 km long Manawatū Gorge runs east west through the Tararua Ranges and is unique in New Zealand for being the only river to flow through a hill range. The Manawatū River starts east of the axial ranges and has its outflow on the west.

The river and gorge lie within the Manawatū Gorge Scenic Reserve, identified in Schedule G of the Horizons One Plan as an Outstanding Natural Landscape:

> *"Manawatū Gorge, from Ballance Bridge to the confluence of the Pohangina and Manawatū Rivers, including the adjacent scenic reserve*
>
> *(i)Visual and scenic characteristics, particularly provided by its distinctive landscape*
>
> *(ii) Geological feature, provided by being the only river in New Zealand to drain both east and west of the main divide*
>
> *(iii) Ecological significance, provided by its regenerating indigenous vegetation and remnant indigenous shrubland*
>
> *(iv) Scientific value, particularly for its geology."*

The upper catchment beyond the gorge is large and consists of four sub-catchments (Upper Gorge, Upper Manawatū, Tiraumea and Mangatainoka). The catchment land use includes intensive production farmland on the floodplains and flatter land, and farmed hill country, undeveloped land, exotic and indigenous forest and conservation areas.

Table 6: Manawatū Gorge – Existing Level of Natural Character

River Component	Attribute groupings	River Natural Character Attributes	
Active bed	Abiotic	Bed morphology/modification The narrowness of the gorge generally confines the river to a single channel, with minor braiding occurring in places, especially during low flows.	High

River Component	Attribute groupings	River Natural Character Attributes	
		The river has cut a gorge through sandstone and mudstone, with some basalt and mudstone (late Triassic to early cretaceous) (GNS Science, 2018). The active channel remains natural and largely unmodified with man-made structures restricted to the Ballance Bridge piers.	
		Flow regime Some abstraction upstream. Seasonal floods and freshes; low flows still occur.	High
		Water Quality Water quality in the Manawatū River through the gorge is moderately degraded. Concentrations of key nitrogen (NO3-N) and phosphorus species (DRP) are substantially higher than natural background levels. The high nutrient concentrations and poor water clarity the Manawatū River means there is a risk of environmental impairment. It is important to note that periphyton monitoring data collected at the Upper Gorge monitoring site suggests that, despite being increased above natural state, nutrients are not causing periphyton growth at levels that would significantly affect the aesthetics of this section of the Manawatū River. Water clarity is sufficiently reduced compared to natural level that some impairment of aesthetic and possibly ecological values can be expected. Under normal conditions pathogen levels are only slightly elevated above natural state in the Manawatū River through the gorge. However, sporadic faecal contamination does occur, and this section of the river is unsuitable for swimming up to 30% of the time (based on the swimming maps on the MfE website). Ammoniacal-nitrogen (NH4-N) concentrations are at or near natural state. Typical stormwater contaminants, such as copper, zinc and hydrocarbons, likely to be only very slightly elevated compared with natural state, as there is little impervious surface cover in the upstream catchment, noting however the historic stormwater inputs from the Manawatū Gorge Road.	Moderate
	Biotic	Aquatic indigenous taxa assemblages – Macroinvertebrate indices (MCI & QMCI) from 2017 sampling data (provided by Horizons) for the upper gorge area are indicative of good water quality. However, it must be noted that macroinvertebrate sampling is designed for wadeable streams as opposed to rivers. Greater stonefly diversity and abundance would have been expected within the sample. Fish diversity from the FFDB records show an array of indigenous species present within the Manawatū and Pohangina Rivers and connecting waterways. There are no downstream barriers to fish migration and, from a conservative approach, it could be assumed there is a natural assemblage of indigenous species using the Manawatū River as habitat or as a corridor.	High
		Ecosystem Functioning The river bed within the Manawatū Gorge is unmodified and functions are likely to be similar to what was occurring historically. Modification on the surrounding banks (and	High

River Component	Attribute groupings	River Natural Character Attributes	
		Parihaki Island) includes changes in vegetation type and a slight increase in impervious surfaces (adjacent road and railway corridor). Although this area is outside the active bed, it has an effect on the functions within the Manawatū River. These changes may have had an impact on functions such as organic matter input, decontamination of pollutants and habitat for aquatic fauna.	
		No exotic aquatic macrophytes were observed although some species are likely to be present. FFDB records show perch have been recorded within the general area, while brown trout were also recorded during the fish survey within a gully system (and in FFDB records). A conservative approach assumes fish populations are dominated by indigenous species.	High
Margin	Abiotic	Morphology/modification The margins of the river comprise the steep vegetated banks up to and including the SH3 and rail formations. Margins consist of steep vegetated slopes with rocky outcrops and cliff faces. Modifications related to the road and railway extend the full length of the gorge on both sides and combine to constitute significant physical modification of the river margins including cut platforms, associated buildings, bridges, culverts, signals, signs, bank stabilisation and retaining structures.	Moderate
	Biotic	Terrestrial Ecology The margins of the Manawatū River Gorge assessment reach are subjected to frequent disturbance meaning those species present at the margin are adapted to a high frequency of disturbance. This characteristic, limits the ecological quality of the marginal zone. Due to the confined nature of the active bed in the gorge, terrestrial flora and fauna elements associated with braided river beds naturally largely do not exist. Exotic species are a feature of frequently disturbed areas thus detracting from the natural state of the margin.	Moderate
Context	Abiotic and Biotic	Terrestrial Ecology Including vegetation, animals, habitat The hillslopes landward of the river margin are predominantly covered in indigenous forest of differing statures, compositions, and stages of succession. Upper slopes (i.e., above the road, (true left) or railway line (true right)) feature areas of well-developed high value indigenous forest communities representing pre-human vegetation cover types. The terrestrial ecology values (species and habitats) present are of high conservation value and the area has DoC Scenic Reserve status. The forests and associated habitats contribute to ecological pattern and process at landscape scales The river's context comprises the steep slopes either side of the river beyond the margins. The steep slopes are dominated by dense indigenous forest cover, and generally remain physically unmodified due to the protection of the Manawatū Gorge Scenic Reserve status. Grazed farmland extends almost to the railway line on the north bank at the eastern end of the gorge. While there is little evidence of	Very high

River Component	Attribute groupings	River Natural Character Attributes	
		man-made modification erosion of the steep grassed slopes is common. On the south side of the gorge, numerous and slips (and measures taken to control them) have been caused by the undercutting for the SH3 platform.	
All (focus on active bed and margin)	Experiential	The dramatic nature and significant scale of the 7km gorge with its steep vegetated slopes and swift river have high experiential values, albeit the road and rail modifications detract from the feeling of remoteness and pristine natural environment	High
		Overall level of natural character	**High**

4.3. Manawatū River Reach below SH3 Bridge (Figure 3, Appendix 4.B)

This reach extends approximately 9km from the SH3 to Forest Hill Road. The river catchment combines the Pohangina River and upper Manawatū catchments. The reach flows through high production farmland and includes several gravel extraction operations which occupy the old floodplains and river terraces.

Table 7: Manawatū Gorge below SH 3 Bridge – Existing Level of Natural Character

River Component	Attribute groupings	Natural Character Attributes	Level of Natural Character
Active bed	Abiotic	Bed morphology/modification The reach flows through unconsolidated to poorly consolidated mud, sand, gravel and peat. The alignment of the active bed of the river has been constrained and straightened removing several meanders and side channels (since 1949) and general narrowing of the river bed. Although constrained, the characteristic braided river channel and gravel islands and banks are evident at low flows. Modifications and structures in the active bed include the SH3 bridge piers.	Low
		Flow regime Flow regime remains natural with no management of flows in the upstream catchments. (any water abstraction upstream not included). Flows change with seasonal floods, higher flows in the winter and low flows in the summer. High flows in the order of 1200 cumecs, low summer flow in order of 14 cumecs. Summer low flows can result in poorer water quality. LAWA – no data	High
		Water Quality	Moderate

River Component	Attribute groupings	Natural Character Attributes	Level of Natural Character
		Below the SH3 bridge, water quality in the Manawatū River is moderately degraded. Concentrations of key nitrogen species (NO3-N & NH4-N) are substantially higher than natural background levels, but the potential for this to cause environment impairment is offset by the relatively low phosphorus concentrations in this section of the Manawatū River. That nutrients levels are not causing environmental impairment in this section of the Manawatū River is supported by the low level of periphyton growth observed at the Horizons Regional Council monitoring site at Upper Gorge. Water clarity is sufficiently reduced compared to natural level that some impairment of aesthetic and possibly ecological values can be expected. Under normal conditions pathogen levels are only slightly elevated above natural state in the Manawatū River downstream of the SH3 bridge. However, sporadic faecal contamination does occur, and this section of the river is unsuitable for swimming up to 30% of the time (based on the swimming maps on the MfE website). Typical stormwater contaminants, such as copper, zinc and hydrocarbons, likely to be only very slightly elevated compared with natural state, as there is little impervious surface cover in the upstream catchment, noting however the historic stormwater inputs from the Manawatū Gorge Road.	
	Biotic	Aquatic indigenous taxa assemblages Macroinvertebrate indices (MCI & QMCI) from 2017 sampling data (provided by Horizons) for the Manawatū River (at Teacher's College) are indicative of good/excellent water quality. However, macroinvertebrate sampling is designed for wadeable streams as opposed to rivers. Greater stonefly diversity and abundance would have been expected within the sample. Fish diversity from the FFDB records show an array of indigenous species present within the Manawatū and Pohangina Rivers and connecting waterways. There are no downstream barriers to fish migration and, from a conservative approach, it could be assumed there is a natural assemblage of indigenous species using the lower Manawatū River as habitat or as a corridor.	High
		Ecosystem Functioning The river bed within the lower Manawatū River is unmodified and functions are likely to be similar to what was occurring historically. Modification on the surrounding banks includes changes in vegetation type (to a catchment dominated by agriculture). Although this area is outside the active bed, it has an effect on the functions within the Manawatū River. These changes may have had an impact on organic matter input, decontamination of pollutants and habitat for aquatic fauna. Water infiltration within the riparian margins is also likely to have been affected through a change in catchment land use with higher rates of infiltration.	High
		Exotic aquatic Flora and Fauna No exotic aquatic macrophytes were observed, although some species are likely to be present. FFDB records show perch have been recorded within the general area, while brown trout were also recorded during the fish survey within	High

River Component	Attribute groupings	Natural Character Attributes	Level of Natural Character
		a gully system (and in FFDB records). A conservative approach assumes fish populations are dominated by indigenous species	
Margin	Abiotic	Morphology/modification The margins are predominantly modified through river protection works, willow planting and stopbanks. Several gravel extraction operations are located adjacent to the river. Other structures in the margins include stormwater outfalls and oxidation ponds.	Low
	Biotic	Terrestrial Ecology The margins of the lower Manawatū River assessment reach are lined with narrow stands of exotic trees. Intervening areas are dominated with exotic pasture and weed species. The margins are generally grazed, or a mixture of rank grass and weedland. The exposed gravel beach and wetted margin habitats provide seasonal habitat for bird species of conservation concern and reliant on the gravel river beds for breeding (e.g., black-fronted and banded dotterel). Thus, the terrestrial values of the riverbed vary with season (highest September to February). The terrestrial portions of the river bed make an important contribution to the breeding migration patterns of river bed birds and thus pattern and process values are high. The disturbance regime is too high for the persistence of other significant terrestrial fauna (lizards) and terrestrial invertebrate communities.	Moderate
Context	Abiotic and Biotic	Terrestrial Ecology Including vegetation, animals, habitat The wider floodplain landward of the river margin is predominantly exotic pasture, with horticultural crops, exotic conifer stands, aggregate extraction; effluent treatment ponds are also present. Indigenous vegetation communities are restricted to a sparse indigenous treeland and small areas of shrub-hardwood species regenerating where disturbance regimes allow. Ecological patterns, processes, and functions are highly impaired High production pasture and horticulture are the dominant land uses of the old floodplains adjacent to the river, which was historically lowland forest. Some of the low-lying land is potentially subject to flooding beyond the stopbanks. The topographical patterning of old river channels, meanders and terraces are still evident in places, often defined by vegetation.	Low
All (focus on active bed and margin)	Experiential	The modified margin and context of the river, dominated by exotic pasture, gravel extraction operations and stopbanks significantly reduce the overall naturalness of the river. The straightened river channel and lack of riparian vegetation gives the reach canal-like appearance.	Low
		Overall level of natural character	**Moderate Low**

4.4. Lower Pohangina River Reach (Figure 3, Appendix 4.B)

This 3 km reach extends from the Saddle Road bridge to the SH3 bridge and includes the confluence with the Manawatū River. The true left bank of the river is contained by the natural banks at the toe of the hills. The land on the true right is farmland overlying old braid plains and river terraces. The Pohangina catchment is a 55,000ha sub catchment of the Manawatū River with predominant land uses of grazed farmland and exotic and indigenous forest.

Table 8: Lower Pohangina River – Existing Level of Natural Character

River Component	Attribute groupings	Natural Character Attributes	Level of natural Character
Active bed	Abiotic	Bed morphology/modification The active bed of the river has been constrained and straightened removing meanders as part of physical training of the river upstream of the rail and SH3 bridges (based on historic maps) Within the constrained bed the river retains braided characteristics with meandering channels, exposed sand/gravel islands and margins. Frequent flood events shift the river channels across the bed and at the confluence of the two rivers. It appears that frequent high flows and floods run bank to bank as there is little vegetation established within the braid plain. Structures in the active bed include the bridge piers of the two road and rail bridges and groynes upstream of the SH3 bridge.	High
		Flow regime Flow regime remains natural with no management of flows in the upstream catchments. Flows change with seasonal floods with higher flows in the winter and low flows in the summer. High flows in the order of 339 cumecs, low summer flow in order of 2.8 cumecs. LAWA – no data	High
		Water Quality Water quality in this section of the Pohangina River is generally degraded. Concentrations of key nitrogen (NO3-N & NH4-N) and phosphorus species (DRP) are substantially higher than natural background levels, and water clarity is significantly reduced. The high nutrient concentrations and poor water clarity the Pohangina River means there is a risk of environmental impairment. It is important to note that periphyton monitoring data collected at the Mais Reach monitoring site suggests that, despite being increased above natural state, nutrients are not causing periphyton growth at levels that would affect the aesthetic values of this section of the Pohangina River. While pathogen levels are elevated above natural state, this section of the Pohangina river is generally	Moderate

River Component	Attribute groupings	Natural Character Attributes	Level of natural Character
		suitable for swimming (based on the swimming maps on the MfE website). Stormwater contaminants, such as copper, zinc and hydrocarbons, are likely to be at or near natural state, as there is very little impervious surface cover in this catchment	
	Biotic	Aquatic indigenous taxa assemblages – Macroinvertebrate indices (MCI & QMCI) from 2017 sampling data (provided by Horizons) for the Pohangina River (at Mais Reach) are indicative of excellent water quality. However, it must be noted that macroinvertebrate sampling is designed for wadeable streams as opposed to rivers. Fish diversity from the FFDB records show an array of indigenous species present within the Manawatū and Pohangina Rivers and connecting waterways. There are no downstream barriers to fish migration and, from a conservative approach, it could be assumed there is a natural assemblage of indigenous species using the Pohangina River as habitat or as a corridor.	Very High
		Ecosystem Functioning The river bed within the Pohangina River is unmodified and functions are likely to be similar to what was occurring historically. Modification on the surrounding banks includes changes in vegetation type (to a catchment dominated by agriculture). Although this area is outside the active bed, it has an effect on the functions within the Manawatū River. These changes may have had an impact on functions such as organic matter input, decontamination of pollutants and habitat for aquatic fauna. Water infiltration within the riparian margins is also likely to have been affected through a change in catchment land use with higher rates of infiltration.	High
		No exotic aquatic macrophytes were observed although some species are likely to be present. FFDB records show perch have been recorded within the general area, while brown trout were also recorded during the fish survey within a gully system (and in FFDB records). A conservative approach assumes fish populations are dominated by indigenous species.	High

River Component	Attribute groupings	Natural Character Attributes	Level of natural Character
Margin	Abiotic	Morphology/modification The margins of this river reach include Parahaki Island and other areas outside the active river bed (such as the island near the Ashhurst Domain). The river margins on the true left of the river are largely unmodified except for protection works and structure of the two bridge approaches. The true right margin has been modified to contain the river (based on historic maps). Parahaki Island it is flat low-lying river island with the main stem of the Manawatū River flowing around the north side and a secondary channel along the south. The shape and form of the island clearly expresses its the formative processes of a water formed landform. Vegetation on the island is dominated by exotic species (rank grass, pampas, willow, tree Lucerne).	Moderate
	Biotic	Terrestrial Ecology Exotic tree stands, and grassland predominate. Areas of mature kānuka and podocarp-broadleaved forest remnants occur and are in differing levels of modification resulting from land use impacts. The canopy composition of these indigenous forest areas is representative of pre-human land cover. Exotic and indigenous habitats exist for indigenous fauna. The most valuable habitat for fauna is the indigenous forest remnant at Ashhurst Domain. Natural pattern and process is moderate–high. Exotic habitats (riparian willows) also provide some habitat for species such as wetland and river birds. Due to habitat modifications some expected bird species are missing and the population structure is moderately modified. Indigenous river bed birds (e.g., dotterel) are likely to use the dry gravel substrates for seasonal nesting and feeding. The disturbance regime of the active bed means that populations of reptiles are unable to establish nor are terrestrial indigenous flora (e.g., cushion plants). Most expected species are absent. Remnant populations are low to absent	Moderate
Context	Abiotic and Biotic	The land use is dominated by grazed pasture farming on the hill country and the old river flood plains. The township of Ashhurst is located above a high river terrace which extends along the whole reach including the Ashhurst Domain. Ashhurst Domain is a popular destination for picnics, camping and walking. A significant lowland forest remnant (with totara, titoki, matai, kahikatea, maire) occupies the upper river terrace and the lower flood plain. The hill country on the true left bank supports areas of regenerating indigenous vegetation such as mānuka and kānuka. Terrestrial Ecology Including vegetation, animals, habitat	Moderate

River Component	Attribute groupings	Natural Character Attributes	Level of natural Character
		The indigenous forest ecosystems occurring in the river margins (kānuka forest, podocarp-broadleaved forest patches) extend landward and form part of the wider context. On the true right floodplain and terrace riser below Ashhurst, are areas of remnant treeland (kahikatea) and remnant forest with secondary regeneration. These areas are small but represent pre-human forest cover. The Ashhurst Domain has high habitat and potentially also fauna values. Other indigenous forest areas are degraded, and their habitat values and fauna values are diminished. Intervening areas are pastoral and urban with a predominant exotic vegetation and habitat status. These areas provide few habitat opportunities and their potential fauna values are limited.	
All (focus on active bed and margin)	Experiential	The Pohangina River reach retains a relatively high level of naturalness with the dynamic river processes highly evident on the island and gravel beds. The dense vegetation in the bed and the margins contribute to a remote and while experience from within the river bed.	Moderate High
		Overall level of natural character	**Moderate/High**

4.5. Generic Streams and Wetlands along the Designation (Figure 3, Appendix 4.B)

The route traverses the hill country north of the Manawatū Gorge and is primarily used for grazed pasture farming and the Te Āpiti Wind Farm. The route climbs steeply at its east and west extents and crosses flatter topography along the crest of the range. The hill country is characterised by numerous deeply incised gully and stream systems which drain localised catchments and run north to south eventually discharging to the Manawatū River. The east-west orientated corridor cuts across the drainage pattern of the hills and consequently intercepts many gullies, streams, and wetlands.

The waterbodies along the route include perennial, permanent and ephemeral streams, wetlands and constructed stock water ponds, most of which are accessible by stock. Most of the gullies support pasture and open scrub while some of the very steep sided gullies are densely covered in indigenous vegetation. There are five QEII open space covenants in the vicinity of the corridor, comprising densely vegetated gullies and slopes. The covenants are fenced.

The assessment below considers the generic condition of the collective waterbodies along the road corridor.

Table 9: Generic Streams – Existing Level of Natural Character

River Component	Attribute groupings	Natural Character Attributes	Level of natural Character
Active bed	Abiotic	Bed morphology/modification Stream base substrates vary depending on the location and stream gradient and include, rock, gravels, and muddy sediments. Structures such as culverts, stock water pond dams, fences and vehicle crossings modify the active bed at localised points. The stream beds in densely vegetated gullies are less modified or disturbed by stock than those in open pasture which suffer damage from cattle grazing. Pugging by grazing cattle has significantly modified wetland areas.	Moderate/High
		The flow regime remains natural with minor use for stock water and farm supply. The stream catchments are relatively small being limited to the surrounding hill country. Flows increase following rain events.	High
		Water quality in the smaller streams along the route is only moderately degraded. Concentrations of key nitrogen (NO3-N & NH4-N) and phosphorus species (DRP) are substantially higher than natural background levels in most streams which may be causing environmental impairment. However, water clarity and pathogen levels are generally at or near natural state. Stormwater contaminants, such as copper, zinc and hydrocarbons, are likely to be at or near natural state, as there is very little impervious surface cover in this area	Moderate
	Biotic	Aquatic Indigenous Taxa assemblages Macroinvertebrate samples collected from streams and gullies across the alignment were variable and reflective of land use within the catchment. Samples from streams within mostly forested catchments and fenced off from stock were generally reflective of macroinvertebrate communities, indicative of excellent water quality and diverse sensitive species. While some samples were affected by agricultural land use and lack of riparian margin, with abundant tolerant species and poor macroinvertebrate indices. Most streams assessed as part of the fish survey resulted in only one or two indigenous species present, despite there being a reasonable diversity within the Manawatū and Pohangina Rivers. It was noted at one site there was a perched culvert creating a partial fish barrier and likely reducing indigenous diversity. This is likely to be common, particularly within the gorge, where perched culverts are present beneath the railway line (and potentially SH3).	Moderate
		Ecosystem Functioning SEV values (excl. biotic function) varied across the assessed stream reaches and were often less than the reference sites (data provided by Horizons) which are >0.9. Functions of note which are reduced, include flood plain effectiveness, water temperature control, organic matter input, decontamination of pollutants, fish spawning habitat and habitat for aquatic fauna.	Moderate

		Many of these parameters stem from a lack (or reduced quality) of riparian margins.	
		Exotic aquatic Flora and Fauna There are numerous stream networks that feed into the Manawatū and Pohangina Rivers. The presence (and extent) of exotic aquatic macrophytes is variable depending on a range of factors within the catchment with some sites dominated by exotic species and other sites with no exotic species present. The fish survey across the sampled streams and gullies showed most waterways were dominated by indigenous species, although exotic species were found at one site.	Moderate
Margin	Abiotic	Some of the grazed steeper gully slopes are erosion prone with slips evident. Grazed areas generally lack riparian margins The steepest stream margins remain less modified by stock grazing due to difficulty of access, and these are generally more densely vegetated.	Moderate
	Biotic	The terrestrial ecology qualities vary among the streams in the generic grouping.	Moderate
Context	Abiotic and Biotic	Grazed farmland dominates the land use of the hill country, along with wind turbines and the associated access tracks.	Moderate
All (focus on active bed and margin)	Experiential	Rural working landscape dissected by the steep stream gullies, some of which support indigenous vegetation. The experience of naturalness varies greatly form high in the deep and densely vegetated gullies to highly modified in the upper parts of the stream gullies dominated by modified pasture.	Moderate /High
		Overall level of natural character	**Moderate**

DETAILED ASSESSMENT AREAS- Existing Natural Character

4.6. New Manawatū Bridge Crossing (Chainage 3600-4000)

Description of site: The margin on south bank of the river is dominated by the existing carpark and SH3 road environment. The north bank is less modified, but the railway embankment and line are a dominant feature in the river margin. The proposed bridge location is at the hinge point of the river where the gorge ends, and the river enters the wider bed, which include Parahaki Island and the confluence with the Pohangina River (**Figure 4, Appendix 4.B**).

Table 10: New Manawatū Bridge Crossing – Existing Level of Natural Character

River Component	Attribute groupings	Natural Character Attributes	Level of natural Character
Active bed	Abiotic	Morphology/modification The proposed bridge site is at the lower end of the gorge immediately upstream of Parahaki Island and the confluence with the Pohangina River. The rocky gorge gives way to wider gravel bed. Flood flows continuously shape the gravel bed and island margins. There are no structures in the bed.	High
		Flow regime Flow regime of the river is not managed and generally remains natural with seasonal floods, higher flows in the winter and low flows in the summer. Natural flow volumes have been assumed to be modified by water abstraction upstream.	High
		Water quality in this section of the Manawatū River is moderately degraded. Concentrations of key nitrogen (NO3-N & NH4-N) and phosphorus species (DRP) are substantially higher than natural background levels which may be causing environmental impairment. Water clarity is also moderately degraded from natural state. It is important to note that periphyton monitoring data collected at the Upper Gorge monitoring site suggests that, despite being increased above natural state, nutrients are not causing periphyton growth at levels that would affect the aesthetics of this section of the Manawatū River. Under normal conditions, pathogen concentrations are only slightly elevated above natural background levels. However, sporadic faecal contamination does occur, and this section of the river is unsuitable for swimming up to 30% of the time (based on the swimming maps on the MfE website). Stormwater contaminants, such as copper, zinc and hydrocarbons, are likely to be increased above natural levels due to run-off from SH3.	Moderate
	Biotic	Indigenous taxa assemblages	High

River Component	Attribute groupings	Natural Character Attributes	Level of natural Character
		Macroinvertebrate indices (MCI & QMCI) from 2017 sampling data (provided by Horizons) for the upper gorge area (values are likely to be similar for the identified proposed bridge crossing site) are slightly less compared to reference sites (data provided by Horizons). However, macroinvertebrate sampling is designed for wadeable streams as opposed to rivers. Greater stonefly diversity and abundance would have been expected within the sample. Fish diversity from the FFDB records show an array of indigenous species present within the Manawatū River and connecting waterways (near the proposed crossing). There are no downstream barriers to fish migration and, from a conservative approach, it could be assumed there is a natural assemblage of indigenous species using the Manawatū River as habitat or as a corridor.	
		Ecosystem Functioning A SEV assessment is inappropriate for a large river system, instead functions have been assessed qualitatively. The river bed, at the location of the proposed bridge crossing is unmodified and functions are likely to be similar to what was occurring historically. Modification on the surrounding banks (and Parahaki Island within the river) includes changes in vegetation type and a slight increase in impervious surfaces (adjacent road and railway corridor). Although this area is outside the active bed, it has an effect on the functions within the Manawatū River. These changes may have had an impact on functions such as organic matter input, decontamination of pollutants and habitat for aquatic fauna.	High
		Exotic aquatic Flora and Fauna No exotic aquatic macrophytes were observed although some species are likely to be present. FFDB records show perch have been recorded within the general area, while brown trout were also recorded during the fish survey within a gully system (and in FFDB records). A conservative approach assumes fish populations are dominated by indigenous species.	High
Margin	Abiotic	The river margin is quite modified and includes the railway line, SH3 and the Manawatū Gorge carpark. The railway is located on a fill embankment with a large box culvert through which a stream discharges. Parahaki Island is also part of the river margin and remains physically unmodified (human induced) with gravel beaches on its upstream shore. Flood flows frequently inundate the upstream parts of the island.	Moderate
	Biotic	Terrestrial Ecology The margins of the Manawatū River crossing reach are subjected to frequent disturbance resulting in those species present at the margin are adapted to a high frequency of disturbance. There is some secondary broadleaved regeneration on higher bank elevations. Forest communities present on banks do not represent pre-human forest cover.	Moderate

River Component	Attribute groupings	Natural Character Attributes	Level of natural Character
		Willow and other exotic tree species are common on the margins of the river and Parahaki Island. The exposed gravel beach and wetted margin habitats provide seasonal habitat for bird species of conservation concern and reliant on the gravel river beds for breeding (e.g., black-fronted and banded dotterel). Thus, the terrestrial values of the riverbed vary with season (highest September to February). The terrestrial portions of the river bed make an important contribution to the breeding migration patterns of river bed birds and thus pattern and process values are high. The disturbance regime is too high for the persistence of other significant terrestrial fauna (lizards) and terrestrial invertebrate communities High (seasonal).	
Context	Abiotic and Biotic	Parahaki Island is a dominant river landform that clearly exhibits the river's formative processes. The island is physically unmodified by human activity but is dominated by exotic trees and vegetation including rank grass, pampas, willow, tree lucerne. The hillslopes landward of the river margin are predominantly covered in exotic pasture (true left) and remnant areas of indigenous forest with intervening exotic pasture grass (true right). The true right assessment area contains old-growth forest and a raupō seepage (wetland), both of which are habitats representing pre-human conditions. A small stand of threatened swamp maire is present. The ecological condition of the forests and wetland are impacted by past and current stock access. Due to the proximity to the extensive forests of the Manawatū Gorge Scenic Reserve, the contribution of the indigenous ecosystems in this area to pattern and process is heightened. The true left area makes little contribution in terms of ecological features and function.	Moderate High
All (focus on active bed and margin)	Experiential	The gorge with its steep vegetated slopes and swift flowing river have high experiential values, albeit the road and rail modifications detract from the feeling of remoteness and pristine natural environment. From the river bed the sounds and smells of the river are evident.	Moderate High
		Overall level of natural Character	**Moderate High**

4.7. QE II West Stream - including QEII open space covenant and wetland at the northern approach to new bridge (Chainage 4000-6000)

Description of site: The upper part of the stream lies within a QEII open space covenant and consists of a very deep ravine which features high ecological value old-growth forest (mature tawa forest) with areas of younger, diverse broadleaved forests and scrub. From there, the stream descends through steep hill country which is well vegetated with regenerating broadleaf treelands and pasture grazed by cattle. At the lower end of the catchment, the gradient flattens, and wetlands are perched above the Manawatū River. The raupō wetland is fed by groundwater seeping from the toe of the hill slopes to the east (**Figures 4 and 5, Appendix 4.B)**

Table 5: QEII west stream – Existing Level of Natural Character

River Component	Attribute groupings	Natural Character Attributes	Level of natural Character
Active bed	Abiotic	Morphology/modification Upper part of the stream is deeply incised through rocky substrate, including ravines and bluffs and is unmodified and has a very high level of natural character. The middle and lower section of the stream flows through steep hill country and is more modified. Stock have access to the middle and lower parts of the stream and wetlands, where there is some disturbance of the steam/wetland bed by cattle. There are no structures in the stream.	High
		Flow regime The flow regime remains natural with minor use for stock water and farm supply. The stream catchments are relatively small being limited to the surrounding hill country. Flows increase following rain events.	High
		Overall, water quality in this stream is expected to be good. While phosphorus (DRP) concentrations are substantially higher than natural background levels, the risk of this causing environment impairment is low as concentrations of key nitrogen species (NO3-N & NH4-N) are near natural state. Water clarity and pathogen levels are also in near pristine condition. Stormwater contaminants, such as copper, zinc and hydrocarbons, are likely to be at natural state, as there is no impervious surface cover in this catchment.	High
	Biotic	Indigenous taxa assemblages Macroinvertebrate indices (MCI & QMCI) are similar to reference sites (data provided by HRC). Limited diversity of stoneflies and caddisflies recorded within sample compared to reference data. Fish diversity (from survey) included two species (incl. 1 at risk). Other species which could have thought to have been present (based on FFDB records and habitat conditions) include upland bully, common bully, redfin bully and torrent fish. A culvert (railway	Moderate

		crossing) near the confluence of the Manawatū River likely provides a partial barrier to fish passage (in two locations) and has likely affected fish diversity within the stream.	
		Ecosystem Functioning Two SEV assessments were conducted on this waterway reach (upstream and downstream) with approximate values (excl. biotic function) of 0.83 and 0.79 (out of 1), respectively. This is less than reference sites (data provided by Horizons) which are >0.9. Functions of note which are reduced include flood plain effectiveness and fish spawning habitat.	High
		Exotic aquatic Flora and Fauna No exotic aquatic macrophytes observed within assessed stream reach. No exotic fish recorded from survey.	Very High
Margin	Abiotic	The steep and near vertical margins of the upper part if the stream are unmodified and densely vegetated and are unmodified by structures. Some of the grazed steeper gully slopes are erosion prone with slips evident. The steepest stream margins remain less modified by stock grazing due to difficulty of access, and these are generally more densely vegetated.	High
	Biotic	Terrestrial Ecology – The margins of the crossings feature a range of successional stages and vary between the lower (chainage 4400) and upper (chainage 5600) extents. The stream margin in the lower extent is grazed and features both old growth swamp forest and secondary broadleaved forest. The stream margin in the upper reach is set within a deep ravine and is unvegetated due to heavy shading. This, however, represents the natural state thus the conditions present are high in terms of natural character.	High
Context	Abiotic and Biotic	The stream catchment is typical of the area where the steep side gullies are well vegetated with trees and shrubs and the hill tops and flatter areas with improved pastures. The wider context is modified by farming infrastructure (fences, access tracks, and stock water structures. Terrestrial Ecology Including vegetation, animals, habitat The terrestrial vegetation in the lower extent features a mosaic of age classes of indigenous forest and scrub. Old-growth forests are present. The ecological condition is impaired due to past and current stock access. The area provides important bird habitats and potential habitat for long-tailed bat. Collectively, the vegetation and habitats in the lower extent of Area 2 makes an important contribution to pattern and process. The upper extent features old-growth forest (mature tawa forest) with areas of younger, diverse broadleaved forests and scrub. The old-growth forests represent pre-human vegetation cover and not grazed. The forest is legally protected, presents good quality habitat for terrestrial invertebrates and connects with the Manawatū Gorge Scenic Reserve. Further landward are pastoral environments comprising exotic	Moderate High

		grass species which would present some edge influence on the remnant and regenerating forests.	
All (focus on active bed and margin)	Experiential	From within the gully system the stream catchment has a high level of naturalness and remoteness due mainly to the enclosed nature of the steep topography and dense vegetation and lack of obvious modification.	High
		Overall level of natural Character	**High**

4.8. East Stream Crossing QEII Open Space Covenant (Chainage 6100-6300)

Description of site: The head of the stream catchment over in the Project comprises three small, steep head gullies which coalesce into a single stream below the route alignment. The gullies lie within a recently registered QEII open space covenant and is fenced to exclude stock (**Figure 6, Appendix 4.B**)

The outer extent of the margin is at the QEII boundary (extent of treeline).

Table 6: QEII East Stream – Existing Level of Natural Character

River Component	Attribute groupings	Natural Character Attributes	Level of natural Character
Active bed	Abiotic	Morphology/modification The stream beds are unmodified by structures and their steep and vegetated nature will have restricted access by stock.	High
		Flow regime The flow regime at the head of the catchment, remains natural with minor use for stock water and farm supply. The stream catchments are relatively small being limited to the surrounding hill country. Flows increase following rain events.	High
		Overall, water quality in this stream is expected to be good. While phosphorus (DRP) concentrations are substantially higher than natural background levels, the risk of this causing environment impairment is low as nitrogen (NO3-N) concentrations are near natural state. Water clarity and pathogen levels are also in near pristine condition. Stormwater contaminants, such as copper, zinc and hydrocarbons, are likely to be at or near natural state, as there is no impervious surface cover in this catchment.	High
	Biotic	Indigenous taxa assemblages Macroinvertebrate indices (MCI & QMCI) are similar to reference sites (data provided by Horizons). Although limited diversity of stoneflies recorded within sample compared to reference data. Fish diversity (from two surveys) showed no fish	High

		species present. Fish passage may be affected by natural or artificial barriers. Conservative approach assumes a natural barrier due to steep topography which means no fish would likely be present.	
		Ecosystem Functioning SEV value (excl. biotic function) is approximately 0.93 (out of 1) although it must be noted that the SEV assessment was conducted downstream within the Manawatū Gorge Scenic Reserve and values are likely to be improved, relative to the upstream reach. SEV value is more likely to be reflective of value obtained for the western most QEII covenant (0.83) as the upstream reach is more incised, similar to the western most QEII covenant. This is less than reference sites (data provided by Horizons) which are >0.9. Functions of note which are reduced include flood plain effectiveness and fish spawning habitat.	High
		Exotic aquatic Flora and Fauna No exotic aquatic macrophytes observed within assessed stream reach. No exotic fish recorded from survey.	Very High
Margin	Abiotic	The steep margins of this upper part of the stream catchment are unmodified by structures or earthworks. Livestock are excluded by the perimeter fencing.	High
	Biotic	The area is generally free of exotic weed species. Terrestrial Ecology – The margin of the Area 3 crossing (chainage 6100–6300) is retired from stock grazing and is regenerating in secondary indigenous forest. Vegetation cover varies from exotic pasture grass to mature shrub-hardwood cover. The margin forms part of a legally protected area	High
Context	Abiotic and Biotic	The area landward of the margin is secondary broadleaved forest with mānuka/kānuka regeneration grading upslope into rank exotic grass Further beyond is grazed exotic pasture. The area connects with the Manawatū Gorge Scenic Reserve and provides a forest habitat corridor extending to the north, thus making an important contribution to pattern and process. Although several successional stages are present, the canopy species present do not represent pre-human forest compositions. The surrounding pastoral land use would contribute a degree of edge effect on the regenerating forest. Fences and access tracks and improved pastures reduce the natural character of the area	Moderate High
All (focus on active bed and margin)	Experiential	From within the gully system, the head of the stream catchment has a high level of naturalness and remoteness due mainly to the enclosure by steep topography and dense vegetation, together with lack of obvious modification.	High
		Overall level of natural Character	**High**

4.9. Stream Crossing - Construction access to Saddle Road at western end (Chainage 12800-13000)

Description of site: Stream catchment is approximately 3km long, extending from the farmed hill country to the Pohangina River. The stream is deeply incised with steep and very steep margins. The margins and upper catchment are well vegetated with predominantly indigenous vegetation and some exotic weeds. Small groups of mature pine trees are located in the upper parts of the catchment. The proposed crossing point is at the existing farm track ford just upstream of the confluence with the Pohangina River (**Figure 6, Appendix 4.B**).

Table 7: Saddle Road Access Crossing – Existing Level of Natural Character

River Component	Attribute groupings	Natural Character Attributes	Level of natural Character
Active bed	Abiotic	Morphology/modification Physical modification of the stream bed is limited to the locations which can be accessed by stock. The steep vegetated margins restrict stock access along many parts of the stream.	High
		Flow regime The flow regime within the catchment, remains relatively natural with minor use for stock water and farm supply. The stream catchments are relatively small being limited to the surrounding hill country. Flows increase following rain events	High
		Overall, water quality in this stream is expected to be very good. While phosphorus (DRP) concentrations are moderately elevated above natural background levels, the risk of this causing environment impairment is low as concentrations of key nitrogen species (NO3-N & NH4-N) are at or near natural state. Water clarity and pathogen levels are also in near pristine condition. Stormwater contaminants, such as copper, zinc and hydrocarbons, are likely to be at or near natural state, as there is very little impervious surface cover in this catchment	Very High
	Biotic	Indigenous taxa assemblages Macroinvertebrate assemblages and associated indices are likely to reflect reference conditions (or close to) in the upper catchment as there appears to be a high level of contiguous riparian cover and likely to be limited (if any) human modification or other factors affecting water quality. There is evidence of grazing to the stream edge and erosion in places. These factors are likely to alter the macroinvertebrate assemblage with the loss of sensitive taxa (or reduction in density) and an increase in species tolerant of poorer water and habitat quality. That said there is also a substantial tall native riparian litter and woody debris source. Fish diversity (from survey) includes two native species. Other species which could have thought to	High

		have been present (based on FFDB records and habitat conditions) include upland bully, redfin bully, torrent fish and longfin eel.	
		Ecosystem Functioning Ecosystem function is likely to be similar to the Western most QEII covenant (steep sided gully with contiguous riparian cover in upper reaches). Riparian cover is less contiguous downstream and there appears to be stock access to some sections, particularly the downstream section which is used as a stock crossing. Function is likely to be reduced for some components including floodplain effectiveness and fish spawning habitat as well as functions affected by reduced riparian cover.	High
		Exotic aquatic Flora and Fauna A conservative approach assumes no exotic macrophytes are present within the stream. Fish survey showed brown trout were present at similar levels as native fish within the stream	High Moderate
Margin	Abiotic	The steep margins of the stream catchment are generally unmodified by structures or earthworks, except for works to form the existing ford.	High
	Biotic	The area is generally free of exotic weed species. Terrestrial Ecology – Both native and exotic vegetation occurring in a mosaic, several successional stages with mature ecosystem components present	High
Context	Abiotic and Biotic	Beyond the stream margins the land is used for the wind farm and grazed exotic pasture, with relatively bare hill tops and ridges, and vegetated gullies. Fences, access tracks, turbines and improved pastures reduce the natural character of the wider area Prevalence of indigenous vegetation increases on the lower slopes where they descend to the Pohangina River, consisting of semi-mature kanuka, and small clusters of remnant forest.	Moderate High
All (focus on active bed and margin)	Experiential	From within the gully system, the stream catchment has a high level of naturalness and remoteness due mainly to the enclosure by steep topography and dense vegetation, together with lack of obvious modification.	High
		Overall level of natural Character	**High**

4.10. Stream Crossing at Eastern End (Chainage 12800-13000)

Description of site: The proposed crossing is situated in a modified rural environment on the flat land at the toe of the hill slopes. The area is dominated by improved pasture, shelter planting and farm infrastructure (**Figure 4, Appendix 4.B**).

Table 8: Stream Crossing Eastern End – Existing Level of Natural Character

River Component	Attribute groupings	Natural Character Attributes	Level of natural Character
Active bed	Abiotic	The stream bed appears to have been straightened and channelised through the flat productive farmland. The stream bed is tightly contained by the banks on either side and is comprised of rocks and gravels. (moderate) The stream tributaries in the hills are less modified than in the lowlands with some modification by stock grazing and culverts (high)	Moderate
		The stream is fed from a local catchment in the steep hill country. As such, the flow would be expected to be reasonably unmodified with higher flows in winter and following rain events. It is assumed that some abstraction occurs for farm operations given the stream's size and reliability.	Moderate High
		Water quality in the two streams in this area is expected to be moderately degraded. Concentrations of key nitrogen (NO3-N & NH4-N) and phosphorus species (DRP) are substantially higher than natural background levels which may be causing environmental impairment. However, pathogen levels are generally at or near natural state, and only the northern stream has (slightly) degraded water clarity. Stormwater contaminants, such as copper, zinc and hydrocarbons, are likely to be at or near natural state, as there is very little impervious surface cover in this catchment	Moderate
	Biotic	Indigenous taxa assemblages – Macroinvertebrate indices (MCI & QMCI) are less than reference sites (data provided by HRC). Limited diversity of stoneflies and mayflies (species present are generally more tolerant). Fish diversity (from survey) includes four indigenous species (incl. 2 at risk). Other species which could have thought to have been present (based on FFDB records and habitat conditions) include upland bully and torrent fish.	Moderate
		Ecosystem Functioning SEV value (excl. biotic function) is approximately 0.55 (out of 1). This is far less than reference sites (data provided by HRC) which are >0.9. Functions of note which are reduced include flood plain effectiveness, water temperature control, organic matter input, decontamination of pollutants, fish spawning habitat and habitat for aquatic fauna.	Moderate
		Exotic aquatic Flora and Fauna No exotic aquatic macrophytes observed within assessed stream reach. No exotic fish recorded from survey.	High
Margin	Abiotic	The stream margins on the lowland section consist of steeply cut banks which appear to be man-made. The hill country stream margins remain reasonably unmodified except for stock tracking.	Moderate
	Biotic	Terrestrial Ecology –	Moderate

		The margin of the Area 4 crossing (chainage12100–12700) are a mix of gorse/wild broom and regenerating secondary indigenous forest. The vegetation and habitats are relatively young and have resulted from recent human disturbance (i.e. scrub cutting). A plantation of exotic conifers form part of the margin around chainage 12500–12700. Between chainage12700–13000 the margin is high-producing exotic pasture grassland, with no vegetated margins.	
Context	Abiotic and Biotic	Between chainage12100–12700 the area landward of the margin is a cover of exotic weeds (gorse and wild broom) along with secondary broadleaved forest having recently regenerated from gorse and wild broom following scrub cutting. The area of indigenous vegetation cover is relatively large and would serve a role in stabilising the underlying hillside. The indigenous cover is at the eastern extent of a network of indigenous habitat patches loosely connecting to the Manawatū Gorge Scenic Reserve. Although several successional stages are present (exotic weeds and secondary broadleaved forest), the canopy species present do not represent pre-human forest compositions. The surrounding pastoral land use would contribute a degree of edge effect on the regenerating forest. Between chainage12700–13000 the context is high-producing exotic pasture grassland.	Moderate Low
All (focus on active bed and margin)	Experiential	The lowland section of stream has a low level of naturalness, it lacks meanders and riparian margin vegetation. The flowing water in the channel retains the movement and sounds of a stream albeit in a channelised bed.	Moderate
		Overall level of natural character	**Moderate**

5.0 EFFECTS ASSESSMENT

The assessment of natural character effects has been undertaken for the major stream crossings (i.e. detailed sites). The effects assessment (undertaken at a workshop by the contributing experts on 13 August 2018) has considered various design options that were discussed at the previous Project design option and mitigation workshops.

The assessments have considered the long-term effects of the Project. It is assumed that best practice stormwater management and erosion and sediment control measures will be implemented during construction to avoid or minimise short term adverse effects.

While mitigation measures have been suggested for each site, the assessment of change to the level of natural character has not included any mitigation.

5.1. West Stream - from QEII West Crossing to Raupō wetland (chainage 4000-6000)

Design Assumptions

Embankment- East Alignment (CH4000-4400):

(a) indicative footprint shown plus 17m-20m construction zone;

(b) 200m of stream under the embankment requiring either diversion or culverts;

(c) 200m stream diversion (assumed trapezoid armoured channel at base of embankment), potential ground improvements; and

(d) loss of raupō wetland and swamp maire, some old growth forest and all vegetation under footprint.

Embankment- West Alignment (CH4000-4400):

(a) footprint shown plus 17m-20m construction zone, plus ground improvements;

(b) 500m + 200m of stream affected under footprint to be diverted/culverted (assumed trapezoid armoured channel); and

(c) loss of some raupō wetland, changed hydrology due to ground improvements, loss of most of the old growth forest.

Viaduct-(CH4000-4400)

(a) long span steel, 3 piers at 90m centres;

(b) construction/crane access 29m wide access for length of viaduct (+) and 10m wide access to each pier- localised disturbance at each pier; and

(c) stream remains intact in long-term with armour protection for piers, no culvert long term, bridge spans raupō wetland, potential to retain swamp maire with pruning/modification.

QEII West crossing:

(a) alignment cut down into gully margins, artificially retained (MSE or similar);

(b) secondary broadleaf vegetation lost under bridge and culvert footprint;

(c) bridge or culvert at main gully and 60m-80m long culvert in eastern gully; and

(d) footprint will occupy large portion of upper catchment.

Possible mitigation in stream catchment: retire whole stream gully from grazing and protect as QEII covenant or amalgamate with Manawatū Gorge Scenic Reserve.

There are limitations to quantum of mitigation within this catchment to offset effects given its relatively small size. The gully is already well vegetated, the permanent footprints are relatively large in terms of the scale of the gully size and therefore this reduces the length of stream that can be enhanced. However, removal of stock would result in a relatively fast regeneration given the excellent local seed source of indigenous species.

Opportunity to extend the QEII covenant above the road to improve the values of the headwaters and upper catchment would have significant benefits to water quality.

Table 9: QEII West Stream – Change to Natural Character

West Stream (chainage 4000-6000) Stream from QEII West Crossing to Raupō Wetland, old growth forest							
Current state			**Future state at site/reach scale**			**Future state at stream catchment scale**	
River Component	**Existing** (whole catchment)		Site Embankment	Site Viaduct	Site QEII crossing (culvert & bridge)	**Whole Stream** embankment and QEII west crossing	**Whole Stream** viaduct and QEII west crossing
Active bed	Morphology/modification	H	L	MH	M	M	MH
	Flow regime	H	M	H	MH	H	H
	Water quality	H	M	M	M	M	M
	Aquatic (indigenous taxa assemblages)	M	L	M	M	ML	M
	Ecosystem functioning	H	L	H	M	M	MH
	Exotic aquatic flora and fauna (absence)	VH	M	VH	VH	H	VH
Margin	Morphology/physical modification	H	VL	H	M	ML	MH
	Terrestrial ecology	H	VL	M	M	L	M
Context	Land use /modification	MH	M	M	M	M	M
All	Experiential	H	M	M	M	MH	MH
	OVERALL LEVEL OF NATURAL CHARACTER *** Significantly Reduced**	**H**	**ML***	**MH**	**M***	**M***	**MH**

5.2. Stream Crossing Construction Access from Saddle Road

Design Assumptions

Either a single span bridge or box culverts will be required to cross the stream.

Table 10: Saddle Road Stream Crossing – Change to Natural Character

Stream Crossing- Construction Access to Saddle Road				
River Component		**Existing Whole Stream**	**Future Culvert at crossing**	**Future Whole Stream**
Active Bed	Active bed morphology/modification	H	M	H
	Flow regime	H	H	H
	Water quality	VH	VH	VH
	Aquatic (Indigenous taxa assemblages)	H	H	H
	Ecosystem Functioning	H	HM	H
	Exotic aquatic Flora and Fauna (absence)	HM	HM	HM
Margin	Morphology/Physical modification	H	M	H
	Terrestrial Ecology	H	H	H
Context	Land use /modification	MH	MH	MH
All	Experiential	H	MH	H
	Overall Level of Natural Character	**H**	**MH**	**H**

5.3. East QEII Crossing

Design Assumptions

Alignment cut down into stream gullies, culverts over the three stream gullies permanent loss of vegetation under footprint, and modification of stream banks.

Possible mitigation: retire/extend QEII covenant to reserve. Most beneficial option is to extend retirement/restoration upstream of the road to replace pastoral upper catchment with indigenous forest.

Table 11: QEII East – Change to Natural Character

East QEII Crossing Final alignment assessments 28.8.18		Crossing Site only		Whole Stream	
		Existing	Future crossing	Existing	Future with crossing
Active Bed	Active bed morphology/modification	H	ML	H-VH	MH
	Flow regime	H	MH	H-VH	H
	Water quality	H	M	H	M
	Aquatic (Indigenous taxa assemblages)	H	M	H-VH	H
	Ecosystem Functioning	H	M	H-VH	H
	Exotic aquatic Flora and Fauna (absence)	VH	VH	VH	VH
Margin	Morphology/Physical modification	H	L	VH	MH
	Terrestrial Ecology	H	L	H-VH	MH
Context	Land use /modification	MH	M	H-VH	H
All	Experiential	H	ML	H-VH	H
	Overall Level of Natural Character * Significantly Reduced	**H**	**M***	**H**	**H**

5.4. New Manawatū Bridge Crossing

Design Assumptions

300m-400m bridge, abutment located west of existing carpark, embankment/abutment on north side of river, assume one pier in river, riprap protection on north bank.

Possible mitigation: bridge alignment, design and materials to reflect and respect context. Attention to pier placement and treatment around pier and abutments and site rehabilitation.

Table 12: New Manawatū Bridge Crossing – Change to Natural Character

Manawatū River Crossing Final alignment assessments 28.8.18			
River Component		Existing	Bridge with Pier in River
Active Bed	Active bed morphology/modification	H	H
	Flow regime	H	H
	Water quality	M	M
	Aquatic (Indigenous taxa assemblages)	H	H
	Ecosystem Functioning	H	H

	Exotic aquatic Flora and Fauna (absence)	H	H
Margin	Morphology/Physical modification	M	ML
	Terrestrial Ecology	M	M
Context	Land use /modification	MH	M
All	Experiential	MH	M
	Overall Level of Natural Character	**MH**	**M**

5.5. East End (Woodville) Stream Crossing

Design assumptions

Bridge over stream, long ramps across flat farmland

Traverses approximately 350m of stream tributary in the hills

Table 13: East End Stream Crossing – Change to Natural Character

East End Stream Crossing (Woodville) Final alignment assessments 28.8.18			
River Component		**Existing**	**Crossing**
Active Bed	Active bed morphology/modification	M	ML
	Flow regime	MH	MH
	Water quality	M	M
	Aquatic (Indigenous taxa assemblages)	M	ML
	Ecosystem Functioning	M	ML
	Exotic aquatic Flora and Fauna (absence)	H	H
Margin	Morphology/Physical modification	M	L
	Terrestrial Ecology	M	M
Context	Land use /modification	ML	ML
All	Experiential	M	ML
	Overall Level of Natural Character	**M**	**ML**

6.0 DETAILED ASSESSMENT NOTES

This section of the report contains assessment notes, from the relevant expert contributor, for each of natural character attributes assessed.

6.1. Flow Regime

Flow regime assessment was based on desktop research and workshop discussions with the other specialist contributors' knowledge of the site conditions and local hydrological systems. Aspects of the flow regime considered were:

(a) The flow regime characteristics of a river/stream with a given catchment size and location

(b) Change to critical flow volumes and patterns relative to naturalised flow. Inflow/outflow controlled, texture and roughness of the river margin and catchments in relation to interception and infiltration and speeds of overland flow discharging into the waterway.

(c) Occurrence of impoundments or large diversions of flows, including flood harvesting. Proportion of flows diverted or impounded. Proportion of available allocation abstracted.

(d) Physical change and dynamics of river and water movement resulting from natural seasonal floods and flows- movement of alluvial loads, sediments, flushing of algae and weeds.

(e) Degree of stream catchment and wetland hydrology intactness.

The flow regime could be modified in the following ways, individually or cumulatively, by the Project.

(a) Relatively large embankment and culvert footprints in small gullies occupying a proportion of catchment space. These activities have the potential to change natural flow paths of main waterway stems (as well as associated perennial, intermittent and ephemeral tributaries) and volumes of streams such as creating barriers at the stream/groundwater interface.

(b) The road stormwater management system may divert flows away from a catchment or discharge more volumes into a catchment. Overall, the large areas of hard road surface will reduce the area of land available for infiltration and alter runoff during rain events.

(c) Removal of vegetation from the catchment reduces the interception of rain and alters overland flows, and interception of sediments on the slopes before they reach the stream.

(d) The net result is generally an increase in peak flows and reduction in base flows.

(e) Permanent stream diversions and straightening (assumed to be rock armoured) modify the speed and movement of water through the channels and interrupt the natural interaction of water flows with movement and deposition of silts and sediments.

(f) Ground improvements in or near wetlands and streams can modify the hydrological system of the area. These changes are difficult to accurately predict.

(g) Stream diversions and ground improvements can also change the degree of water movement through the hyporheic zone (i.e. from the stream to the underlying groundwater and vice-versa).

(h) Fragmentation and modification of the catchment hydrological system with the introduction of large structures (e.g. culverts) in catchments and stream beds, can constrict and modify the natural flow patterns.

6.2. Context

The context of streams, rivers and wetlands refers to the wider landscape context of the catchment adjacent to the waterbody. It considers the naturalness or modification of the land use, landform and vegetation cover that contributes to the overall character of the waterbody. The type of land use and extent of intensification or modification can impact on and be impacted on by the natural qualities of the waterbodies.

Aspects of the context considered in the assessment were:

(a) Nature and extent of modification of landforms and physical features of the wider area and catchment (such as stopbanks, gravel extraction, access roads, stock water dams.

(b) Extent and nature of intensification of agricultural land use.

(c) Land use and modification by structures, such as wind turbines, roads and state highways, buildings, urban areas, recreational facilities (carparks, campgrounds, toilets, mown grass, signage, cycleways and paths).

(d) Land cover or terrestrial ecology. Type and quality of vegetation cover and indigenous habitat including ecological links to the waterbody and connections to wider ecological networks

(e) Protected natural areas such as reserves, and parks.

The addition of a four-lane road into the predominantly rural landscape will reduce the naturalness of the context to the waterbodies crossed by the Project.

6.3. Experiential

Experiential/perceptual-_relates to how we experience naturalness the sense of untamed remoteness, the sounds and smells of a place and how natural it appears and feels. It is essentially underpinned by the biophysical attributes. This attribute was assessed at a stream/river corridor scale (including the steam/river bed and margins as well as the context).

Aspects of the experiential or sensory attribute considered for the assessment were:

(a) Experiential attributes such as the degree of remoteness, untamed, unmodified experience provided.

(b) Sensory attributes such as the sounds and silence (water, wildlife, wind noise from other activities such as wind turbines, farming and traffic noise).

(c) Transient values, including natural phenomenon such as flood flows and sounds, seasonal changes to vegetation and wildlife, sunlight through tree canopy.

(d) Other sensory experiences: smells, views, colours and light.

The addition of a four-lane road with associated structures, modifications and traffic noise will reduce the naturalness of the experiential and sensory qualities of the stream and river corridors.

6.4. Fresh water ecology assessment key notes

Author: Kieran Miller (Boffa Miskell)

West stream (QEII) crossings

Site	Component	Existing assessment	Future state (site/reach scale)			Future state (stream catchment scale)	
			Embankment (lower reach)	Viaduct	Upstream crossing	Embankment & upstream crossing	Viaduct & upstream crossing
West Stream (QEII)	Aquatic (indigenous taxa assemblages)	M	L High proportion of habitat loss & modification combined with reduced water quality (according to assessment) results in the presence of more tolerant macroinvertebrate species and less sensitive species. Fish diversity is unlikely to change however reduced habitat will decrease fish density.	M Reduced water quality (according to assessment) results in slight changes in macroinvertebrate species assemblages. However, modification to population structure remains moderate (some expected species absent).	M Culvert and reduced water quality results in slight changes in macroinvertebrate species assemblages. However, modification to population structure remains moderate (some expected species absent).	M / L High proportion of habitat loss & modification at two segments along the stream and reduced water quality. Results in changes to macroinvertebrate assemblages with some expected species absent and changes to population structure (lower densities in places). Fish diversity is unlikely to change but the development will reduce fish density.	M Culvert and reduced water quality results in slight changes in macroinvertebrate species assemblages. However, modification to population structure remains moderate (some expected species absent).

Site	Component	Existing assessment	Future state (site/reach scale)			Future state (stream catchment scale)	
			Embankment (lower reach)	Viaduct	Upstream crossing	Embankment & upstream crossing	Viaduct & upstream crossing
West Stream (QEII)	Ecosystem functioning	H	L Functions become reduced / modified including floodplain connectivity, connection to groundwater, water temp control, organic matter input, decontamination of pollutants, instream habitat and riparian vegetation.	H With minimal stream and riparian changes - functions remain largely unchanged.	M Some functions altered (approx. 25% of reach scale) including connectivity to groundwater, water temp control, organic matter input, decontamination of pollutants, instream habitat and riparian vegetation.	M Functions become reduced / modified including floodplain connectivity, connection to groundwater, water temp control, organic matter input, decontamination of pollutants, instream habitat and riparian vegetation.	M / H Some functions reduced, particularly at the upstream reach. Although over all, most ecosystem functions remain intact or have low levels of modification over the catchment scale.
	Exotic aquatic flora & fauna	VH	M Assumed channel will now have minimal riparian cover increasing the chances of large scale exotic macrophyte growth.	VH Minimal stream and riparian changes result in no changes to exotic species presence.	VH Culvert is unlikely to result in exotic species becoming established.	H Assumed channel at downstream end will now have minimal riparian cover increasing the chances of exotic macrophyte growth (potentially exotic species).	VH Culvert upstream and minimal changes downstream will not increase the habitat for exotic macrophyte species becoming established.

Embankment assumes 100m culvert and 200m stream diversion (highly engineered channel with extensive armouring and minimal riparian cover).

Viaduct assumes stream remains intact long-term.

Upstream crossing includes a bridge over the northern branch (vegetation loss) and a 60m culvert on the eastern branch (bridge over the ephemeral flow and culvert on the permanent flow).

Stream Crossing for Construction Access to Saddle Road

Site	Component	Existing (whole stream)	Future state	
			Culvert (Assessment at crossing)	Culvert (Assessment of whole stream)
Saddle Rd access road crossing	Aquatic (indigenous taxa assemblages)	H Macroinvertebrate assemblages and associated indices are likely to reflect reference conditions (or close to) in the upper catchment as there appears to be a high level of contiguous riparian cover and likely to be limited (if any) human modification or other factors affecting water quality. There is evidence of grazing to the stream edge and erosion in places. These factors are likely to alter the macroinvertebrate assemblage with the loss of sensitive taxa (or reduction in density) and an increase in species tolerant of poorer water and habitat quality. That said there is also a substantial tall indigenous riparian litter and woody debris source. Fish diversity (from survey) includes two indigenous species. Other species which could have thought to have been present (based on FFDB records and habitat conditions) include upland bully, redfin bully, torrent fish and longfin eel.	H A culvert at the downstream reach is unlikely to have large effect on macroinvertebrate or fish assemblages. A culvert may improve macroinvertebrate assemblages by providing an access for vehicles and stock to cross the stream without going into the waterway.	H A culvert at the downstream reach is unlikely to have large effects on macroinvertebrate or fish assemblages. A culvert may improve macroinvertebrate assemblages by providing an access for vehicles and stock to cross the stream without going into the waterway.

Site	Component	Existing (whole stream)	Future state	
Saddle Rd access road crossing	Ecosystem functioning	H Ecosystem function is likely to be similar to the Western most QEII covenant (steep sided gully with contiguous riparian cover in upper reaches). Riparian cover is less contiguous downstream and there appears to be stock access to some sections, particularly the downstream section which is used as a stock crossing. Function is likely to be reduced for some components including floodplain effectiveness and fish spawning habitat as well as functions affected by reduced riparian cover.	H/M Some functions might be reduced/ modified with the addition of a culvert (e.g. organic matter input, decontamination of pollutants, instream habitat and riparian vegetation), species passage (macroinvertebrates and fish) but these changes are likely to be relatively small. Ecosystem functions will largely remain intact (assuming culvert installation is undertaken appropriately).	H Some functions might be reduced/ modified with the addition of a culvert (e.g. organic matter input, decontamination of pollutants, instream habitat and riparian vegetation), and species passage (macroinvertebrates and fish) but these changes are, likely to be very small in the context of the wider gully and stream environment. Ecosystem functions will largely remain intact (assuming culvert installation is undertaken appropriately).
	Exotic aquatic flora & fauna	H/M A conservative approach assumes no exotic macrophytes are present within the stream. Fish survey showed brown trout were present at similar levels as indigenous fish within the stream.	H/M Culvert unlikely to have an effect on existing exotic aquatic flora and fauna provided passage parameters are maintained.	H/M Culvert unlikely to have an effect on existing exotic aquatic flora and fauna provided passage parameters are maintained.

East stream (QEII) crossings

Site	Component	Existing assessment (site/ reach scale)	Future state (site/reach scale)	Existing assessment (entire stream reach)	Future state (entire stream reach)
			Crossing		Upstream crossing
East Stream (QEII)	Aquatic (indigenous taxa assemblages)	H	M High proportion of local habitat loss & modification combined with reduced water quality (according to assessment) results in the presence of more tolerant macroinvertebrate species and less sensitive species. No fish species recorded during the surveys.	H / VH	H Lower part of the catchment remains unmodified. The development affects the stream reaches with lower values (relative to the downstream stream reach). Macroinvertebrate population likely to be modified upstream but downstream assemblages would likely remain intact.
	Ecosystem functioning	H	M Functions become reduced / modified including floodplain connectivity, connection to groundwater, water temp control, organic matter input, decontamination of pollutants, instream habitat and riparian vegetation.	H / VH	H Lower part of the catchment remains unmodified and functions remain largely intact. The development affects the stream reaches with lower values (relative to the downstream stream reach). Some functions altered in the upper reaches, however the functions across the entire reach are likely to remain intact.
	Exotic aquatic flora & fauna	VH	VH Culverts are unlikely to results in increased exotic species becoming established.	VH	VH Culverts are unlikely to results in increased exotic species becoming established.

Main stem and two tributaries affected (i.e. three crossings) all culverts.

Manawatū River bridge crossing

Site	Component	Existing assessment (site/ reach scale)	Future state (site/reach scale)
			Bridge
Manawatū River	Aquatic (indigenous taxa assemblages)	H	H The bridge is unlikely to change the population assemblages of aquatic fauna within the active bed.
	Ecosystem functioning	H	H Some functions might be reduced/ modified (e.g. organic matter input, decontamination of pollutants, instream habitat and riparian vegetation), but these changes are likely to be small. Ecosystem functions will largely remain intact.
	Exotic aquatic flora & fauna	H	H Bridge unlikely to have an effect on existing exotic aquatic flora and fauna.

300-400m bridge with 1 pier in the river. Abutments on both sides with some riprap protection on the northern bank.

Eastern end stream crossing (Woodville Gateway)

Bridge over main stem. Extensive culvert within the upper reaches of the tributary.

Site	Component	Existing assessment (site/ reach scale)	Future state (site/reach scale)
			Bridge
Eastern end	Aquatic (indigenous taxa assemblages)	M	M / L Macroinvertebrate and fish assemblages unlikely to change beyond existing state in non-impacted reaches. Extensive culvert will likely cause changes in macroinvertebrate assemblages (more tolerant species and changes to population densities) as well as reduced fish diversity and densities.

Site	Component	Existing assessment (site/ reach scale)	Future state (site/reach scale)
			Bridge
Eastern end	Ecosystem functioning	M	M / L Some functions will be further reduced/ modified particularly by the culvert (e.g. organic matter input, decontamination of pollutants, instream habitat and riparian vegetation). There will be reaches with almost all functions varying outside the natural range and reaches with functions that are more intact.
	Exotic aquatic flora & fauna	H	H Bridge and culvert unlikely to have an effect on existing exotic aquatic flora and fauna.

6.5. Terrestrial ecology key notes

Author: Dr Adam Forbes (Forbes Ecology)

Manawatū Bridge Crossing

River Component		Existing	Pier in River	Clear span
Margin	Terrestrial Ecology	M	M No differences in performance of the terrestrial ecology criteria	M No differences in performance of the terrestrial ecology criteria

West Stream - from QEII West Crossing to Raupō wetland. (chainage 4000-6000)

			Wetland/forest/stream			QE West	
Existing			Embankment	Viaduct	2 Culverts	1 culvert 1 Bridge	2 bridges & retaining wall
Margin	Terrestrial Ecology	H	VL Destruction of wetland, swamp maire, some of the old growth forest	M Moderate level of effect to old-growth forest, but permanent effects avoided. Effects to swamp maire and wetland avoided.	L Widespread old-growth forest loss for tracking, widespread loss of advanced secondary broadleaved regeneration	M Effect on old-growth much reduced and limited to bridge construction area, widespread impacts to secondary broadleaved forest.	H Terrestrial ecology effects largely contained due to structures used. Terrestrial ecology effects not warranting shift in score when wider gully area considered.

QEII East Crossing - Headwaters Down to Reserve (450m)

River Component		Existing	Current design	Alignment moves north (2&3)
Margin	Terrestrial Ecology	H Indigenous vegetation dominates with exotic grassland at fringes and in intervening areas	L Alignment cuts through middle of best quality forest and severs the protected forest, leaving an isolated remnant upstream/north of the alignment. Would be a relatively large proportion of the existing riparian vegetation what would be taken out.	M For both options, impacts to forest would be higher in vegetated area meaning no fragmentation and better quality part of the forest is avoided. Would be a relatively smaller proportion of the existing riparian vegetation what would be taken out.

East end Stream Crossing (Woodville Gateway)

River Component		Existing	Current design Option1	Option 2 moves south	Option 3 Further south
Margin	Terrestrial Ecology	M	M Terrestrial ecology effects similar among options.	M Terrestrial ecology effects similar among options.	M Terrestrial ecology effects similar among options.

6.6. Water quality methodology and results

(Dr Olivier Ausseil & Dr Michael Greer (Aquanet Consulting Ltd))

The commentary below describes the methodology and results of the water quality component of this Natural Character Assessment prepared for the Project.

CURRENT NATURAL CHARACTER

Methodology

The current natural character of the waterways in each assessment area was assessed by comparing modelled and measured water quality data for the relevant River Environment Classification[8] (REC) reaches with modelled estimates of natural state.

Data

The water quality model developed by Larned *et al.* (2017) was used to obtain estimates of existing median visual clarity and median dissolved reactive phosphorus, nitrate nitrogen, ammoniacal nitrogen and *E. coli* concentrations for the REC reaches within the assessment areas. Measured water quality data collected by Horizons at the Upper Gorge monitoring site on the Manawatū River were obtained from the Land Air Water Aotearoa website[9]. Periphyton data summaries from Kilroy (2016) were also used.

The REC categorises each river reach based on climate, topography and geology. For each REC category McDowell *et al.* (2013) modelled the following statistics for a range of water quality parameters:

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[8] The REC is a database of catchment spatial attributes, summarised for every segment in New Zealand's network of rivers.
[9] https://www.lawa.org.nz/.

(a) The median reference condition: reference conditions are defined as the chemical, physical or biological conditions that can be expected in streams and rivers with minimal or no anthropogenic influence.

(b) The trigger value: trigger values indicate the point at which water quality has degraded to the extent that there is a 'potential risk' of adverse effects at a site.

(c) The upper/lower bounds of the 95% confidence interval of the trigger value: the outer bounds of the confidence interval around the trigger value indicates the point at which water quality has degraded to the extent that resource-managers can be confident that there is a potential risk of adverse effects at a site.

Assessment approach - individual water quality parameters

The table below describes how the modelled water quality from Larned *et al.* (2017) and the LAWA website were compared with the McDowell *et al.* (2013) thresholds to grade the natural character of each water quality parameter in each REC reach.

A water quality parameter was only graded as "Very low" if the median value did not meet NPS-FM 2014 bottom lines or was found to be causing national bottom lines for periphyton to be breached. The full natural character assessment matrix for water quality is provided in the table below.

Natural character grading methodology for individual water quality parameters

Natural character	Assessment metrics (presented in McDowell *et al*. (2013)	Explanation
Very high	The median value for the parameter meets the median reference condition threshold	Water quality in the reach is within the expected natural range for the relevant REC category, and there is a 50% probability that water quality reflects natural state.
High	The median value for the parameter meets the trigger value threshold, but not the median reference condition threshold.	There is a 50% probability that water quality in the reach is degraded from its natural state, but this degradation is not sufficient to suggest that there is a potential risk of adverse effects
Moderate	The median value for the parameter does not meet the trigger value threshold but is within the 95% confidence interval.	Water quality in the reach is degraded to the extent that resource managers can be moderately confident that there is a potential risk of adverse effects.
Low	The median value for the parameter is outside the relevant boundary of the trigger value 95% confidence interval	Water quality in the reach is degraded to the extent that resource managers can be highly confident that there is a potential risk of adverse effects.

Natural character assessment matrix - Water quality component

Component	Very Low	Low	Moderate	High	Very High
Water and Habitat quality - Aquatic ecology Water quality and aquatic habitat quality; clarity, nutrient and bacterial levels etc. This should account for both the main channels of the river as well as lateral aquatic habitats if any (Including those outside of flood defenses). Habitat changes due to fine sediment, stock trampling or choking by exotic trees/shrubs	Very highly contaminated or permanently discoloured water displaying very high levels of human induced changes to the water quality with limited life supporting capacity (e.g. within polluted urban/industrialised areas or intensive farming); Lateral habitats drained, removed or separated from the active channel. Measured by: Contaminant concentrations do not meet NPS-FM 2014 bottom lines, are causing national bottom lines for periphyton to be breached or exceed ANZECC 2000 80% protection guidelines.	Water usually displaying high levels of contamination mainly from adjacent diffuse sources from land use activities (agricultural leaching etc); Lateral streams and wetlands are diminished in area, unnaturally silted and/or choked with exotic weeds. Lateral channels not exposed to lateral migration of flooding by the active surface Measured by: Median contaminant concentrations exceed the 95% confidence intervals (CIs) of the trigger values set out in McDowell et al. (2013).	Water displaying reasonable levels of naturalness although contains occasional high-moderate levels of human induced changes to part of the waterway or infrequent times; Some impact to habitat quality but lateral habitats generally intact and subject to active surface migration and flooding Measured by: Median contaminant concentrations are within the 95% CIs of the trigger values set out in McDowell et al. (2013) but exceed the trigger value thresholds.	Water displaying relatively high levels of water quality with small or rare amounts of impurities caused further upstream (e.g. by occasional stock crossing or forest harvesting); Lateral habitats in good condition despite occasional stock ingress or exotic vegetation. Lateral habitats subject to active channel migration and flooding Measured by: Median contaminant concentrations exceed the median reference conditions set out in McDowell et al. (2013) but are below the trigger value thresholds. Note – in many cases contaminant concentrations will be within the 95% CIs of the median reference conditions.	Highly natural water and lateral habitat quality. Displaying no human induced changes. Measured by: Median contaminant concentrations are at or below the median reference conditions set out in McDowell et al. (2013).

Periphyton growth is dependent on both nitrogen and phosphorus, and elevated concentrations of nitrate nitrogen (the main component of plant available nitrogen in streams not impacted by point source discharges) are unlikely to have an adverse effect unless dissolved reactive phosphorus is also elevated (and vice versa). Accordingly, both parameters were assigned the grade of the least degraded nutrient.

Assessment approach – individual REC reaches

For each REC reach, the overall natural character of water quality was assessed by averaging the grades of each water quality parameter.

Assessment approach –assessment areas

The gradings of all REC reaches in an assessment area were compiled and used to make a subjective decision on the overall grade. Measured data was given a greater weight than modelled data.

To support the grading assigned to each assessment area, a narrative assessment was also developed. This assessment describes the reasoning behind the grade and presents any additional supporting information. Specifically, periphyton data (presented in Kilroy (2016)) and modelled *E. coli* data (presented in Snelder *et al.* (2016)) are discussed, and a qualitative assessment of the expected level of contamination by typical stormwater-borne contaminants (copper, zinc and hydrocarbons) is provided.

Results

The results of the water quality component of the natural character assessment is provided in the table below.

Natural character assessment

Assessment scale	Assessment area	Narrative assessment	Natural Character
Broad-scale	Manawatū Gorge	Water quality in the Manawatū River through the gorge is moderately degraded. Concentrations of key nitrogen (NO_3-N) and phosphorus species (DRP) are substantially higher than natural background levels, The high nutrient concentrations and poor water clarity the Manawatū River means there is a risk of environmental impairment. It is important to note that periphyton monitoring data collected at the Upper Gorge monitoring site suggests that, despite being increased above natural state, nutrients are not causing periphyton growth at levels that would significantly affect the aesthetics of this section of the Manawatū River. Water clarity is sufficiently reduced compared to natural level that some impairment of aesthetic and possibly ecological values can be expected. Under normal conditions pathogen levels are only slightly elevated above natural state in the Manawatū River through the gorge. However, sporadic faecal contamination does occur, and this section of the river is unsuitable for swimming up to 30% of the time (based on the swimming maps on the MfE website). Ammoniacal-nitrogen (NH_4-N) concentrations are at or near natural state. Typical stormwater contaminants, such as copper, zinc and hydrocarbons, likely to be only very slightly elevated compared with natural state, as there is little impervious surface cover in the upstream catchment, noting however the historic stormwater inputs from the Manawatū Gorge Road.	Moderate
	Manawatū River Reach below SH3 Bridge	Below the SH3 bridge, water quality in the Manawatū River is moderately degraded. Concentrations of key nitrogen species (NO_3-N & NH_4-N) are substantially higher than natural background levels, but the potential for this to cause environment impairment is offset by the relatively low phosphorus concentrations in this section of the Manawatū River. That nutrients levels are not causing environmental impairment in this section of the Manawatū River is supported by the low level of periphyton growth observed at the Horizons Regional Council monitoring site at Upper Gorge. Water clarity is sufficiently reduced compared to natural level that some impairment of aesthetic and possibly ecological values can be expected. Under normal conditions pathogen levels are only slightly elevated above natural state in the Manawatū River downstream of the SH3 bridge. However, sporadic faecal contamination does occur, and this section of the river is unsuitable for swimming up to 30% of the time (based on the swimming maps on the MfE website). Typical stormwater contaminants, such as copper, zinc and hydrocarbons, likely to be only very slightly elevated compared with natural state, as there is little impervious surface cover in the upstream catchment, noting however the historic stormwater inputs from the Manawatū Gorge Road.	Moderate

Assessment scale	Assessment area	Narrative assessment	Natural Character
Broad-scale	Generic Streams and Wetlands along the route	Water quality in the smaller streams along the route is only moderately degraded. Concentrations of key nitrogen (NO_3-N & NH_4-N) and phosphorus species (DRP) are substantially higher than natural background levels in most streams which may be causing environmental impairment. However, water clarity and pathogen levels are generally at or near natural state. Stormwater contaminants, such as copper, zinc and hydrocarbons, are likely to be at or near natural state, as there is very little impervious surface cover in this area	Moderate
	Pohangina River Reach	Water quality in this section of the Pohangina River is generally degraded. Concentrations of key nitrogen (NO_3-N & NH_4-N) and phosphorus species (DRP) are substantially higher than natural background levels, and water clarity is significantly reduced. The high nutrient concentrations and poor water clarity the Pohangina River means there is a risk of environmental impairment. It is important to note that periphyton monitoring data collected at the Mais Reach monitoring site suggests that, despite being increased above natural state, nutrients are not causing periphyton growth at levels that would affect the aesthetic values of this section of the Pohangina River. While pathogen levels are elevated above natural state, this section of the Pohangina River is generally suitable for swimming (based on the swimming maps on the MfE website). Stormwater contaminants, such as copper, zinc and hydrocarbons, are likely to be at or near natural state, as there is very little impervious surface cover in this catchment	Moderate
Detailed	West stream from QE2 West Crossing to Raupō wetland	Overall, water quality in this stream is expected to be good. While phosphorus (DRP) concentrations are substantially higher than natural background levels, the risk of this causing environment impairment is low as concentrations of key nitrogen species (NO_3-N & NH_4-N) are near natural state. Water clarity and pathogen levels are also in near pristine condition. Stormwater contaminants, such as copper, zinc and hydrocarbons, are likely to be at natural state, as there is no impervious surface cover in this catchment.	High
	East QE2 Crossing	Overall, water quality in this stream is expected to be good. While phosphorus (DRP) concentrations are substantially higher than natural background levels, the risk of this causing environment impairment is low as nitrogen (NO_3-N) concentrations are near natural state. Water clarity and pathogen levels are also in near pristine condition. Stormwater contaminants, such as copper, zinc and hydrocarbons, are likely to be at or near natural state, as there is no impervious surface cover in this catchment.	High

Assessment scale	Assessment area	Narrative assessment	Natural Character
Detailed	Manawatū Bridge Crossing	Water quality in this section of the Manawatū River is moderately degraded. Concentrations of key nitrogen (NO_3-N & NH_4-N) and phosphorus species (DRP) are substantially higher than natural background levels which may be causing environmental impairment. Water clarity is also moderately degraded from natural state. It is important to note that periphyton monitoring data collected at the Upper Gorge monitoring site suggests that, despite being increased above natural state, nutrients are not causing periphyton growth at levels that would affect the aesthetics of this section of the Manawatū River. Under normal conditions, pathogen concentrations are only slightly elevated above natural background levels. However, sporadic faecal contamination does occur, and this section of the river is unsuitable for swimming up to 30% of the time (based on the swimming maps on the MfE website). Stormwater contaminants, such as copper, zinc and hydrocarbons, are likely to be increased above natural levels due to run-off from SH3.	Moderate
	East end (Woodville) Stream Crossing	Water quality in the two streams in this area is expected to be moderately degraded. Concentrations of key nitrogen (NO_3-N & NH_4-N) and phosphorus species (DRP) are substantially higher than natural background levels which may be causing environmental impairment. However, pathogen levels are generally at or near natural state, and only the northern stream has (slightly) degraded water clarity. Stormwater contaminants, such as copper, zinc and hydrocarbons, are likely to be at or near natural state, as there is very little impervious surface cover in this catchment	Moderate
	Saddle Road Access Road Crossing	Overall, water quality in this stream is expected to be very good. While phosphorus (DRP) concentrations are moderately elevated above natural background levels, the risk of this causing environment impairment is low as concentrations of key nitrogen species (NO_3-N & NH_4-N) are at or near natural state. Water clarity and pathogen levels are also in near pristine condition. Stormwater contaminants, such as copper, zinc and hydrocarbons, are likely to be at or near natural state, as there is very little impervious surface cover in this catchment	Very high

FUTURE NATURAL CHARACTER

Methodology

The potential effects of the proposed Manawatū Gorge Road have been assessed using the following assumptions:

(a) The assessment only considers the long-term effects of the operation of the road. Specifically, potential effects during construction (such as sediment inputs, short term disturbance etc.) have not been considered as part of the assessment.

(b) During the long-term operation of the road, the key potential effect(s) on water quality will therefore be associated with contaminants deposited on the road by passing vehicles and entrained by stormwater. These contaminants typically include metals (from tyres, brake pads, etc.), hydrocarbons (from fuel combustion, leaks, spills, etc.), sediment and microbial pathogens (from stock trucks, etc.).

(c) Stormwater runoff from the road will be intercepted by adequately designed devices/setups such as grassed swales, retention ponds and/or wetlands.

(d) Following interception (as above), stormwater runoff will be directed via gravity to the closest surface water body.

(e) The indicative alignment and options (e.g. bridges vs. culverts) were provided by Boffa Miskell from the Te Ahu a Turanga; Manawatū Tararua Highway Project team Mitigation Workshops.

The existing state of natural character was scored using the 5-point scale. Changes from the existing state were scored as a departure from the existing state, having regard to the following:

(a) The current natural state score: receiving environments with a higher score were considered more sensitive to change / stormwater inputs;

(b) The presence/absence of stormwater runoff into the stream under the current situation. For instance, the introduction of stormwater contaminants where there had been none before was considered a significant effect on the natural character of the water quality;

(c) The degree of dilution/ dispersion available, and the likeliness of causing detectable/measurable changes;

(d) The location of the crossing / stormwater discharge in the catchment and the proportion of catchment potentially affected by the discharge.

Results

Area/site	Option	Scores		Justification
		Current	Future	
Lower West QE2 Stream (Site scale)	Embankment	H	M	Introduction of stormwater-borne contaminants in a stream catchment of high natural character, justifying a full point reduction in score. The two options are expected to be equivalent in terms of long-term effects on stormwater-borne contaminant inputs/ concentrations
	Viaduct	H	M	
Upper West QE2 Stream (Site scale)	1 culvert, 1 bridge	H	M	Introduction of stormwater-borne contaminants in a stream catchment of high natural character, justifying a full point reduction in score
Lower West QE2Stream (Catchment scale)	Embankment (Lower reach) Culvert + bridge (upper reach)	H	M	Both the upper and lower reaches of the stream will be affected, and little further dilution is expected at the catchment scale compared with the site scale, justifying a full point reduction in score. The two options are expected to be equivalent in terms of long-term effects on stormwater-borne contaminant inputs/ concentrations
	Viaduct (Lower reach) Culvert + bridge (upper reach)			
East QE2 Stream (Site Scale)	Culvert	H	M	Introduction of stormwater-borne contaminants in a stream catchment of high natural character, justifying a full point reduction in score.
East QE2 Stream (Catchment Scale)	Culvert	H	M	Stormwater inputs are at the top of the catchment, and there are no significant side tributaries. Inputs are thus expected to affect the whole stream and only minimal dilution/dispersion, justifying a full point reduction in score.
Manawatū Bridge crossing	Bridge, 1 pier in river	M	M	No change due to (1) existing stormwater runoff in Manawatū River and (2) large dilution available, thus unlikely to be any measurable changes
East end (Woodville) Stream	Bridge + diversion	M	M	Existing water quality is already modified by rural land use/land cover and some (albeit limited) road runoff from Saddle Road higher in the catchment. Relatively large catchment, with significant dilution available. The additional road runoff inputs will likely result in only small changes.
Saddle Road Access Road Crossing	Culvert	VH	VH	The stream crossing is being installed to provide site access during construction of the new road. Traffic volumes in the catchment are not expected to increase in

(Site Scale)				the long-term. Therefore, stormwater-borne contaminant inputs are also unlikely to change.
Saddle Road Access Road Crossing **(Catchment Scale)**	Culvert	VH	VH	The stream crossing is being installed to provide site access during construction of the new road. Traffic volumes in the catchment are not expected to increase in the long-term. Therefore, stormwater-borne contaminant inputs are also unlikely to change.

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5 September 2018

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4.B
SUPPORTING PHOTOGRAPHS

Sector 1: Bridge to Bridge (existing SH3 bridge to new bridge)

View west over SH3 with the existing SH3 bridge in distance.

Looking across carpark on south bank of the Manawatū River. (New bridge location).

Carpark and location of the propsed south bridge abutment. The new bridge would link in to the terrace above the car-park.

Sector 2: New Manawatū River Bridge

Looking towards north bank and new bridge location lower end of Manawatū Gorge.

Parihaki Island at the lowere end of the gorge.

View across the river from existing carpark at the proposed new bridge site.

View downstream from the carpark to Parahaki Island.

Sector 3: Western Slope

New bridge location on north bank, old growth forest, raupo swamp, and kanuka forest.

Stream through old growth forest.

Raupo swamp and kanuka forest.

Looking along the Western Rise toward the Manawatū River, and a QEII open space covenant in foreground.

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Checked	Approved	Date

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Client	NZ TRANSPORT AGENCY
Project	TE AHU A TURANGA: MANAWATŪ TARARUA HIGHWAY
Title	CONTEXT PHOTOS

Original Size A3 | Project Number: 51-38113 | Drawing Number: FIG-01 | Rev:

Plot Date: 18 October 2018 - 7:53 AM   Cad File No: U:\2018\W18061_BEV_Manawatu_Gorge_LVA_for_NoR\TParty\GHD_data\20181002_drawings\NZ T A_A1_NZTA.dwg

Sector 4: Te Apiti Wind Farm

View over the flatter terrain on the ridge top from the Te Apiti Wind farm Lookout.

The wind farm infrastucture has altered the rural character of this area through the introduction of turbines and access roads.

The ridge top farmland is disected by steep vegetated gully systems.

Sector 5: Eastern Rise

View east from the ridge tops.

View towards Woodville, the steep hilly terrain, pine plantations and shelter belts.

A mix of native and exotic scrub regenerates in the steep gullies with open pasture on the ridges.

Towards the bottom of the Eastern Rise, the terrain becomes more broken and complex.

Sector 6: Woodville Gateway

View north were the Eastern Rise (left) meets the plains.

The plains at the aastern end of the designation are dominated by improved pasture.

View across the plains to the steep hill country of the eastern rise and Te Apiti Wind Farm beyond.

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Title: **CONTEXT PHOTOS**

Original Size **A3** Project Number: **51-38113** Drawing Number: **FIG-02** Rev:

Plot Date: 18 October 2018 - 7:53 AM Cad File No: U:\2018\W18061_BEV_Manawatu_Gorge_LVA_for_NoR\TParty\GHD_data\20181002_drawings\NZ T A_A1_NZTA.dwg

Manawatū Gorge

Manawatū River below SH3 Bridge

Pohangina River

Generic Streams (eastern end)

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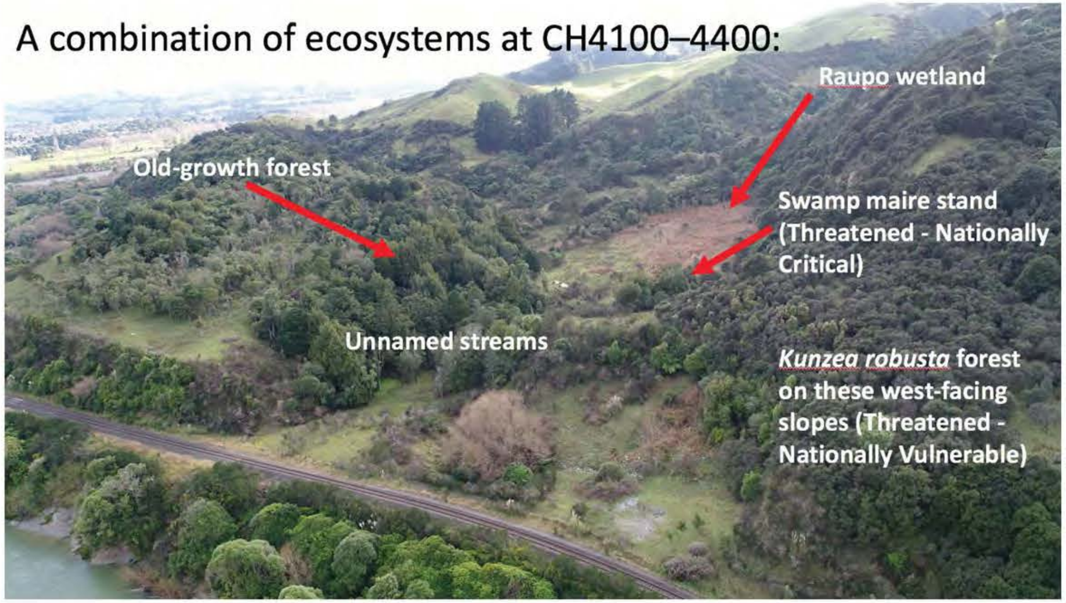
Title: **NATURAL CHARACTER ASSESSMENT BROADSCALE SITES**

Original Size: **A3** | Project Number: **51-38113** | Drawing Number: **FIG-03** | Rev:

Plot Date: 18 October 2018 - 7:53 AM Cad File No: U:\2018\W18061_BEV_Manawatu_Gorge_LVA_for_NoR\TParty\GHD_data\20181002_drawings\NZ T A_A1_NZTA.dwg

Manawatū River crossing

Manawatū River crossing



QEII west Stream lower catchment -Old growth forest, stream and Raupo wetland

Stream in old growth forest

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Scale	As Shown	This Drawing must not be used for Construction unless signed as Approved	

Client	NZ TRANSPORT AGENCY
Project	TE AHU A TURANGA: MANAWATŪ TARARUA HIGHWAY
Title	NATURAL CHARACTER ASSESSMENT DETAILED SITES
Original Size A3	Project Number: 51-38113 Drawing Number: FIG-04 Rev:

Plot Date: 18 October 2018 - 7:53 AM Cad File No: U:\2018\W18061_BEV_Manawatu_Gorge_LVA_for_NoR\TParty\GHD_data\20181002_drawings\NZ T A_A1_NZTA.dwg


Stream crossing_ Construction Road to Saddle Road


Stream crossing_ Construction Road to Saddle Road


QEII west stream crossing, vew down stream


QEII Stream, upper catchment.

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Checked	Approved	Date

NZ TRANSPORT AGENCY
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Title: NATURAL CHARACTER ASSESSMENT DETAILED SITES

Original Size: A3 | Project Number: 51-38113 | Drawing Number: FIG-05 | Rev:

Plot Date: 18 October 2018 - 7:53 AM   Cad File No: U:\2018\W18061_BEV_Manawatu_Gorge_LVA_for_NoR\TParty\GHD_data\20181002_drawings\NZ T A_A1_NZTA.dwg

QEII east stream crossing

QEII east stream crossing

East Streams _ Woodville Gateway

East Streams _ Woodville Gateway

No	Revision	Drawn	Checked	Approved	Date

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Client **NZ TRANSPORT AGENCY**
Project **TE AHU A TURANGA: MANAWATŪ TARARUA HIGHWAY**
Title **NATURAL CHARACTER ASSESSMENT DETAILED SITES**

Original Size **A3** Project Number: **51-38113** Drawing Number: **FIG-06** Rev:

Plot Date: 18 October 2018 - 7:53 AM Cad File No: U:\2018\W18061_BEV_Manawatu_Gorge_LVA_for_NoR\TParty\GHD_data\20181002_drawings\NZ T A_A1_NZTA.dwg

4.C

LANDSCAPE & VISUAL EFFECTS METHODOLOGY & ZTC METHODOLOGY

Boffa Miskell

Landscape and Visual Effects Assessment Methodology

5 April 2018

Introduction

The landscape and visual effects assessment process provides a framework for assessing and identifying the nature and level of likely effects that may result from a proposed development. Such effects can occur in relation to changes to physical elements, the existing character of the landscape and the experience of it. In addition, the landscape assessment method may include an iterative design development processes which includes stakeholder involvement. The outcome of any assessment approach should seek to avoid, remedy or mitigate adverse effects (see **Figure 1**). A separate assessment is required to assess changes in natural character in coastal areas and other waterbodies.

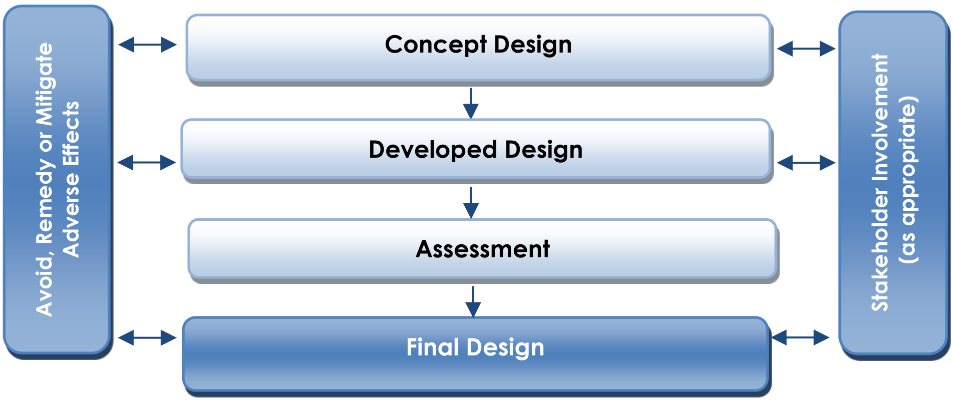

Figure 1: Design feedback loop

When undertaking landscape and visual effects assessments, it is important that a structured and consistent approach is used to ensure that findings are clear and objective. Judgement should always be based on skills and experience, and be supported by explicit evidence and reasoned argument.

While landscape and visual effects assessments are closely related, they form separate procedures. The assessment of the potential effect on the landscape forms the first step in this process and is carried out as an effect on an environmental resource (i.e. landscape elements, features and character). The assessment of visual effects considers how changes to the physical landscape affect the viewing audience. The types of effects can be summarised as follows:

> **Landscape effects**:
> *Change in the physical landscape, which may change its characteristics or qualities.*
>
> **Visual effects:**
> *Change to views which may change the visual amenity experienced by people.*

The policy context, existing landscape resource and locations from which a development or change is visible all inform the 'baseline' for landscape and visual effects assessments. To assess effects, the landscape must first be described, including an understanding of the key landscape characteristics and qualities. This process, known as landscape characterisation, is the basic tool for understanding landscape character and may involve subdividing the landscape into character areas or types. The condition of the landscape (i.e. the state of an individual area of landscape or landscape feature) should also be described alongside a judgement made on the value or importance of the potentially affected landscape.

This outline of the landscape and visual effects assessment methodology has been undertaken with reference to the Quality Planning Landscape Guidance Note[1] and its signposts to examples of best practice which include the UK guidelines for landscape and visual impact assessment[2] and the New Zealand Landscape Institute Guidelines for Landscape Assessment[3].

---

[1] http://www.qualityplanning.org.nz/index.php/planning-tools/land/landscape

[2] Landscape Institute and Institute of Environmental Management and Assessment (2013) Guidelines for Landscape and Visual Impact Assessment, 3rd Edition (GLVIA3)

[3] Best Practice Note Landscape Assessment and Sustainable Management 10.1, NZILA

Landscape Effects

Assessing landscape effects requires an understanding of the nature of the landscape resource and the magnitude of change which results from a proposed development to determine the overall level of landscape effects.

Nature of the landscape resource

Assessing the nature of the landscape resource considers both the susceptibility of an area of landscape to change and the value of the landscape. This will vary upon the following factors:

- Physical elements such as topography / hydrology / soils / vegetation;
- Existing land use;
- The pattern and scale of the landscape;
- Visual enclosure / openness of views and distribution of the viewing audience;
- The zoning of the land and its associated anticipated level of development;
- The value or importance placed on the landscape, particularly those confirmed in statutory documents; and
- The scope for mitigation, appropriate to the existing landscape.

The susceptibility to change takes account of both the attributes of the receiving environment and the characteristics of the proposed development. It considers the ability of a specific type of change occurring without generating adverse effects and/or achievement of landscape planning policies and strategies.

Landscape value derives from the importance that people and communities, including tangata whenua, attach to particular landscapes and landscape attributes. This may include the classification of Outstanding Natural Landscape (RMA s.6(b)) based on important biophysical, sensory/ aesthetic and associative landscape attributes, which have potential to be affected by a proposed development.

Magnitude of Landscape Change

The magnitude of landscape change judges the amount of change that is likely to occur to existing areas of landscape, landscape features, or key landscape attributes. In undertaking this assessment, it is important that the size or scale of the change is considered within the geographical extent of the area influenced and the duration of change, including whether the change is reversible. In some situations, the loss /change or enhancement to existing landscape elements such as vegetation or earthworks should also be quantified.

When assessing the level of landscape effects, it is important to be clear about what factors have been considered when making professional judgements. This can include consideration of any benefits which result from a proposed development. **Table 1** below helps to explain this process. The tabulating of effects is only intended to inform overall judgements.

Contributing Factors		Higher	Lower
Nature of Landscape Resource	**Susceptibility to change**	The landscape context has limited existing landscape detractors which make it highly vulnerable to the type of change which would result from the proposed development.	The landscape context has many detractors and can easily accommodate the proposed development without undue consequences to landscape character.
	The value of the landscape	The landscape includes important biophysical, sensory and associative attributes. The landscape requires protection as a matter of national importance (ONF/L).	The landscape lacks any important biophysical, sensory or associative attributes. The landscape is of low or local importance.
Magnitude of Change	**Size or scale**	Total loss or addition of key features or elements. Major changes in the key characteristics of the landscape, including significant aesthetic or perceptual elements.	The majority of key features or elements are retained. Key characteristics of the landscape remain intact with limited aesthetic or perceptual change apparent.
	Geographical extent	Wider landscape scale.	Site scale, immediate setting.
	Duration and reversibility	Permanent. Long term (over 10 years).	Reversible. Short Term (0-5 years).

Table 1: Determining the level of landscape effects

Visual Effects

To assess the visual effects of a proposed development on a landscape, a visual baseline must first be defined. The visual 'baseline' forms a technical exercise which identifies the area where the development may be visible, the potential viewing audience, and the key representative public viewpoints from which visual effects are assessed.

The viewing audience comprises the individuals or groups of people occupying or using the properties, roads, footpaths and public open spaces that lie within the visual envelope or 'zone of visual influence' of the site and proposal. Where possible, computer modelling can assist to determine the theoretical extent of visibility together with field work undertaken to confirm this. Where appropriate, key representative viewpoints should be agreed with the relevant local authority.

Nature of the viewing audience

The nature of the viewing audience is assessed in terms of the susceptibility of the viewing audience to change and the value attached to views. The susceptibility of the viewing audience is determined by assessing the occupation or activity of people experiencing the view at particular locations and the extent to which their interest or activity may be focussed on views of the surrounding landscape. This relies on a landscape architect's judgement in respect of visual amenity and reaction of people who may be affected by a proposal. This should also recognise that people more susceptible to change generally include: residents at home, people engaged in outdoor recreation whose attention or interest is likely to be focussed on the landscape and on particular views; visitors to heritage assets or other important visitor attractions; and communities where views contribute to the landscape setting.

The value or importance attached to particular views may be determined with respect to its popularity or numbers of people affected or reference to planning instruments such as viewshafts or view corridors. Important viewpoints are also likely to appear in guide books or tourist maps and may include facilities provided for its enjoyment. There may also be references to this in literature or art, which also acknowledge a level of recognition and importance.

Magnitude of Visual Change

The assessment of visual effects also considers the potential magnitude of change which will result from views of a proposed development. This takes account of the size or scale of the effect, the geographical extent of views and the duration of visual change which may distinguish between temporary (often associated with construction) and permanent effects where relevant. Preparation of any simulations of visual change to assist this process should be guided by best practice as identified by the NZILA[4].

When determining the overall level of visual effect, the nature of the viewing audience is considered together with the magnitude of change resulting from the proposed development. **Table 2** has been prepared to help guide this process:

Contributing Factors		Higher	Lower
Nature of the Viewing Audience	**Susceptibility to change**	Views from dwellings and recreation areas where attention is typically focussed on the landscape.	Views from places of employment and other places where the focus is typically incidental to its landscape context. Views from transport corridors.
	Value attached to views	Viewpoint is recognised by the community such as an important view shaft, identification on tourist maps or in art and literature. High visitor numbers.	Viewpoint is not typically recognised or valued by the community. Infrequent visitor numbers.
Magnitude of Change	**Size or scale**	Loss or addition of key features in the view. High degree of contrast with existing landscape elements (i.e. in terms of form scale, mass, line, height, colour and texture). Full view of the proposed development.	Most key features of view retained. Low degree of contrast with existing landscape elements (i.e. in terms of form scale, mass, line, height, colour and texture. Glimpse / no view of the proposed development.
	Geographical extent	Front on views. Near distance views; Change visible across a wide area.	Oblique views. Long distance views. Small portion of change visible.
	Duration and reversibility	Permanent. Long term (over 15 years).	Transient / temporary. Short Term (0-5 years).

Table 2: Determining the level of visual effects

[4] Best Practice Guide: Visual Simulations BPG 10.2, NZILA

Nature of Effects

In combination with assessing the level of effects, the landscape and visual effects assessment also considers the nature of effects in terms of whether this will be positive (beneficial) or negative (adverse) in the context within which it occurs. Neutral effects can also occur where landscape or visual change is benign.

It should also be noted that a change in a landscape does not, of itself, necessarily constitute an adverse landscape or visual effect. Landscape is dynamic and is constantly changing over time in both subtle and more dramatic transformational ways, these changes are both natural and human induced. What is important in managing landscape change is that adverse effects are avoided or sufficiently mitigated to ameliorate the effects of the change in land use. The aim is to provide a high amenity environment through appropriate design outcomes.

This assessment of the nature effects can be further guided by **Table 3** set out below:

Nature of effect	Use and Definition
Adverse (negative):	The proposed development would be out of scale with the landscape or at odds with the local pattern and landform which results in a reduction in landscape and / or visual amenity values
Neutral (benign):	The proposed development would complement (or blend in with) the scale, landform and pattern of the landscape maintaining existing landscape and / or visual amenity values
Beneficial (positive):	The proposed development would enhance the landscape and / or visual amenity through removal of restoration of existing degraded landscapes uses and / or addition of positive elements or features

Table 3: Determining the Nature of Effects

Cumulative Effects

During the scoping of an assessment, where appropriate, agreement should be reached with the relevant local authority as to the nature of cumulative effects to be assessed. This can include effects of the same type of development (e.g. wind farms) or the combined effect of all past, present and approved future development[5] of varying types, taking account of both the permitted baseline and receiving environment. Cumulative effects can also be positive, negative or benign.

Cumulative Landscape Effects

Cumulative landscape effects can include additional or combined changes in components of the landscape and changes in the overall landscape character. The extent within which cumulative landscape effects are assessed can cover the entire landscape character area within which the proposal is located, or alternatively, the zone of visual influence from which the proposal can be observed.

Cumulative Visual Effects

Cumulative visual effects can occur in combination (seen together in the same view), in succession (where the observer needs to turn their head) or sequentially (with a time lapse between instances where proposals are visible when moving through a landscape). Further visualisations may be required to indicate the change in view compared with the appearance of the project on its own.

Determining the nature and level of cumulative landscape and visual effects should adopt the same approach as the project assessment in describing both the nature of the viewing audience and magnitude of change leading to a final judgement. Mitigation may require broader consideration which may extend beyond the geographical extent of the project being assessed.

[5] The life of the statutory planning document or unimplemented resource consents.

Determining the Overall Level of Effects

The landscape and visual effects assessment concludes with an overall assessment of the likely level of landscape and visual effects. This step also takes account of the nature of effects and the effectiveness of any proposed mitigation.

This step informs an overall judgement identifying what level of effects are likely to be generated as indicated in **Table 4** below. This table which can be used to guide the level of landscape and visual effects uses an adapted seven-point scale derived from NZILA's Best Practice Note.

Effect Rating	Use and Definition
Very High:	Total loss of key elements / features / characteristics, i.e. amounts to a complete change of landscape character.
High:	Major modification or loss of most key elements / features / characteristics, i.e. little of the pre-development landscape character remains. *Concise Oxford English Dictionary Definition* *High: adjective- Great in amount, value, size, or intensity.*
Moderate- High:	Modifications of several key elements / features / characteristics of the baseline, i.e. the pre-development landscape character remains evident but materially changed.
Moderate:	Partial loss of or modification to key elements / features / characteristics of the baseline, i.e. new elements may be prominent but not necessarily uncharacteristic within the receiving landscape. *Concise Oxford English Dictionary Definition* *Moderate: adjective- average in amount, intensity, quality or degree*
Moderate - Low:	Minor loss of or modification to one or more key elements / features / characteristics, i.e. new elements are not prominent or uncharacteristic within the receiving landscape.
Low:	No material loss of or modification to key elements / features / characteristics. i.e. modification or change is not uncharacteristic and absorbed within the receiving landscape. *Concise Oxford English Dictionary Definition* *Low: adjective- **1.** Below average in amount, extent, or intensity.*
Very Low:	Little or no loss of or modification to key elements/ features/ characteristics of the baseline, i.e. approximating a 'no change' situation.

Table 4: Determining the overall level of landscape and visual effects

5. HISTORIC HERITAGE & ARCHAEOLOGY

IN THE MATTER OF	The Resource Management Act 1991
AND	
IN THE MATTER OF	Notices of requirement for designations under section 168 of the Act, in relation to Te Ahu a Turanga; Manawatū Tararua Highway Project
BY	**NZ TRANSPORT AGENCY** Requiring Authority

TE AHU A TURANGA; MANAWATŪ TARARUA HIGHWAY PROJECT

TECHNICAL ASSESSMENT #5

HISTORIC HERITAGE AND ARCHAEOLOGY

TABLE OF CONTENTS

INTRODUCTION

1. My name is **Rodney Edward Clough**. I am the Director of Clough & Associates Ltd, Heritage Consultants.

2. My evidence has been prepared in association with Kim Tatton[1] and Zarah Burnett.[2]

Qualifications and experience

3. I have the following qualifications, experience and professional affiliations relevant to this assessment:

   (a) I hold a Doctorate in Archaeology from the University of London and a Master of Arts in Anthropology from the University of Auckland;

   (b) I am a member of the New Zealand Archaeological Association ("**NZAA**") and served on its Council for several years, including as President (2009-2011);

   (c) I am a member of Heritage New Zealand Pouhere Taonga ("**HNZPT**") and the International Council on Monuments and Sites ("**ICOMOS**");

   (d) I have over 40 years' experience in the field of archaeology, including research, survey, investigation, analysis and report preparation, covering a variety of time periods and geographic locations. Over the last 26 years my work has largely focussed on New Zealand archaeology;

   (e) I lectured in archaeology at the University of Auckland for several years (1987-1994) prior to establishing my consultancy, and have continued to carry out joint research projects with the University; and

   (f) My practice carries out a range of work relating to cultural heritage management, and in particular, archaeological assessments relating to Resource Management Act 1991 ("**RMA**") and Heritage New Zealand Pouhere Taonga Act 2014 ("**HNZPTA**") requirements, conservation and management plans, survey, inventory and mitigation investigations. This has included hundreds of surveys and heritage assessments throughout New Zealand, but predominantly in the North Island.

[1] Senior Archaeologist (MA Hons).
[2] Archaeologist/Historian (MA Hons).

Code of conduct

4. I confirm that I have read the Code of Conduct for expert witnesses contained in the Environment Court Practice Note 2014. This assessment has been prepared in compliance with that Code, as if it were evidence being given in Environment Court proceedings. In particular, unless I state otherwise, this assessment is within my area of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

Purpose and scope of assessment

5. The New Zealand Transport Agency ("**NZ Transport Agency**") is proposing to construct a new section of State Highway 3 ("**SH3**") from Ashhurst to Woodville within the Manawatū District to replace the existing SH3 through the Manawatū Gorge (**Figure 1** - **Figure 3**). This is referred to as Te Ahu a Turanga; Manawatū Tararua Highway Project ("**the Project**").

6. The existing SH3 through the Manawatū Gorge is permanently closed due to geotechnical instability and the Project is to provide a new resilient, safe and efficient connection between the eastern and western sides of the Ruahine and Tararua Ranges. The new SH3 route was selected following a multi-criteria analysis ("**MCA**") of 18 route options. The process involved a consideration of the Project's investment objectives, environmental (including archaeological), social impacts and implementability.

7. This report forms part of a suite of technical reports prepared for the Project. The purpose of this report is to assess the actual and potential effects of the Project on archaeological and other historic heritage values. It has been prepared to inform the Assessment of Environmental Effects ("**AEE**") and to support the Notices of Requirement and designation required for the Project and to identify any relevant requirements under the HNZPTA. Recommendations are made in accordance with statutory requirements.

EXECUTIVE SUMMARY

8. The Project comprises a new section of two lane highway approximately 11.5km in length, with new bridge structures and intersection improvements, running from the existing SH3 western entry to the closed Manawatū Gorge route, across the Ruahine Ranges north of the Manawatū Gorge and south of Saddle Road, emerging near Woodville.

9. In the west, the Project route and new bridge over the Manawatū River and Palmerston North to Gisborne Railway Line at the mouth of the Manawatū Gorge will cross immediately south and east of Moutere Island[3] (also known as Parahaki Island - these names are used interchangeably throughout this report) and avoid the significant archaeological site T24/32 Parahaki Kāinga (village)/Burials. The design of the new bridge is yet to be confirmed, however, the design will consider the cultural significance of the area.

10. The existing SH3 Manawatū Gorge road and the Palmerston North to Gisborne Railway line were constructed in 1871 and 1891 respectively. Being of pre-1900 construction, the current road and railway are both archaeological sites within the definition provided in section 6 of the HNZPTA. The Project will not affect those sites.

11. No other archaeological or other historic heritage features were identified within the footprint of the Project route, either through historical information, previous investigations, or field survey. Therefore, there should be no major constraints on the proposed construction of the Project on archaeological and other historic heritage grounds, as no known archaeological or other historic heritage sites will be affected by the proposed construction of the Project.

12. In any area where archaeological sites have been recorded in the general vicinity, it is possible that unrecorded subsurface remains may be exposed during development. It is considered that there is potential for unrecorded sites relating to pre-European and historic Māori settlement to be located along the banks of the Pohangina and Manawatū Rivers within the Project area. Historical research supported by the archaeological record confirms that the river terraces were a favourable location by Māori for settlement and gardening. However, there is only a low potential of unrecorded sites through the steep and rugged Ruahine Hills of the Project area between Ashhurst and Woodville.

13. Conditions of consent are proposed to address the accidental discovery of archaeological sites and kōiwi tangata. The possibility of unrecorded archaeological sites can be provided for by putting in place procedures ensuring that the relevant Councils and HNZPT are contacted should this occur. However, it is also recommended that an application should be

[3] Note that on some early survey plans this island is spelt 'Motuere'. For consistency 'Moutere Island' is used in this report as this name is referenced in the Palmerston North District Plan and in other historical records.

made for an archaeological authority under section 44(a) of the HNZPTA to cover all works undertaken for the Project.

14. Further, since archaeological survey cannot always detect sites of traditional significance to Māori, such as wāhi tapu, tangata whenua are providing information separately in relation to these matters.

PROJECT DESCRIPTION

(See **Figure 2** and **Figure 3**)

15. The Project involves the construction and ongoing operation of a new section of SH3, generally between Ashhurst to the west and Woodville to the east. It is approximately 11.5km of new State highway which, as set out above, will run from the existing SH3 western entry to the closed Manawatū Gorge route, across the Ruahine Ranges north of the Manawatū Gorge and south of Saddle Road, emerging near Woodville. It will comprise a two-lane highway, new bridge structures, new roundabout connections and/or intersection improvements at SH57 and Woodlands Road, and potential reconfiguration of aspects of the Te Āpiti wind farm.

16. A full description of the Project including its design, construction and operation is provided in the AEE.

17. In summary, the Project route begins in the west at the southern embankment of the existing SH3 (Napier Road) Manawatū River Bridge and follows the alignment of the existing SH3 route for a short distance. From the intersection with SH57 the route curves to the east and north along a plateau to the south of the existing SH3. A new bridge approximately 300-400m long will cross the Manawatū River and Palmerston North to Gisborne Railway line at the mouth of the Manawatū Gorge, to the south of Moutere Island and to the north of the Manawatū Gorge Scenic Reserve.

18. North of the new bridge crossing, the alignment climbs to the north (and to the west of the Manawatū Gorge Scenic reserve) before curving to the east through an area of cut and crossing a gully and unnamed stream, traversed by either a box culvert or bridge structure.

19. The route then traverses the Ruahine Ranges approximately 1.2km north of the Manawatū Gorge and south of Saddle Road eastward through the Te Āpiti wind farm. Towards the east of the ridge top, the route traverses a property containing a closed Woodville Borough Council landfill.

20. From the ridge top, the route descends to the southeast through farmland towards Woodville. An unnamed stream at the foot of the Ruahine Ranges and to the west of Hope Road is traversed by an approximately 40-50m single span bridge. The route then connects with the existing SH3 (Napier Road/Vogel Street), Troup Road and Woodland Road via a large diameter, single-lane five-leg roundabout.

METHODOLOGY

21. The NZAA's site record database (ArchSite), District Plan schedules (Manawatū District Plan ("**MDP**"), Tararua Operative District Plan ("**TODP**"), Palmerston North District Plan ("**PNDP**")) and HNZPT's New Zealand Heritage List/Rārangi Kōrero were searched to determine whether any archaeological or other historic sites had been recorded on or in the immediate vicinity of the Project route. Literature and archaeological reports relevant to the area were consulted (see Bibliography). Aerial photographs including recent drone images[4] and LiDAR maps were examined for indications of archaeological features. Early survey plans were checked for information relating to past land use, and archival research was carried out to establish the history of the area.

22. A visual inspection of the western end of the Project route north of the Manawatū River was carried out on 6 and 11 July 2018.[5] The ground surface was examined for evidence of former occupation (in the form of shell midden, depressions, terracing or other unusual formations within the landscape, or indications of 19th century European settlement remains). Exposed and disturbed soils were examined where encountered for evidence of earlier modification, and an understanding of the local stratigraphy. Particular attention was paid to the spur and ridge lines/river banks and valleys (topographical features where archaeological sites are often found to be located). Photographs were taken to record the topography and features of interest/the area and its immediate surrounds.[6]

23. Further visits were carried out with local iwi regarding sites of significance, and to gain a broader understanding of the area's heritage. I undertook a field visit on 7 September with James Pitahi of Kahungunu on the Woodville side

[4] Courtesy of Adam Forbes (Project Ecologist).
[5] A more general inspection was carried out at the Options Phase.
[6] Archaeological inspection in accordance with the current framework of best practice for archaeological and heritage management in New Zealand, as espoused in International ICOMOS charters, national legislation, government heritage policy and codes of ethics for archaeological practice in New Zealand.

of the route, and on 19 October with Paul Horton of Rangitane[7] examining records and visiting significant sites along the Manawatū River at the Ashhurst end of the Manawatū Gorge.

[7] Te Ao Turoa Environmental Officer, Tainuiarangi Manawatu Inc.

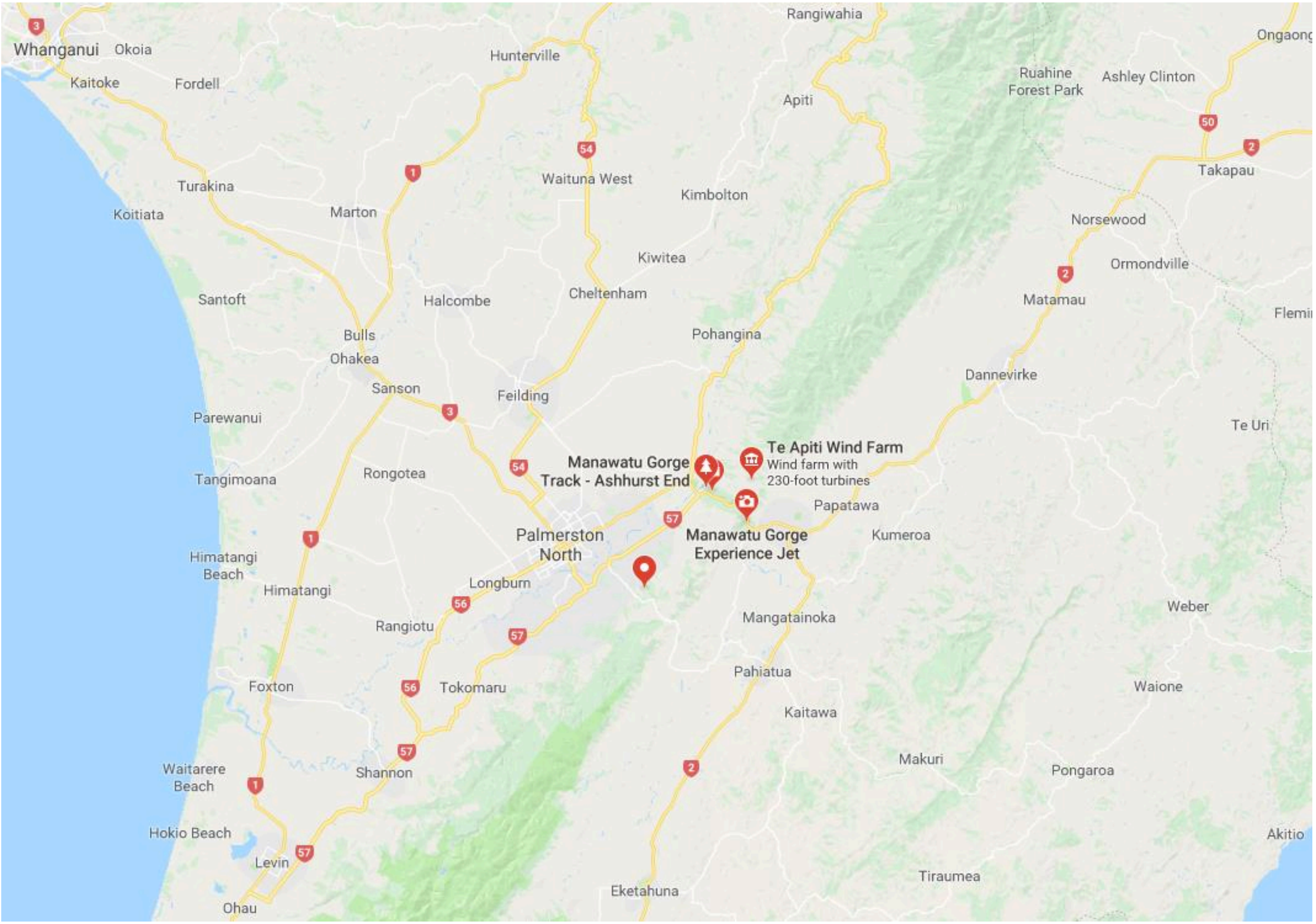

Figure 1. The location of the Manawatū Gorge and SH3, Manawatū (source: Google Maps 2018)

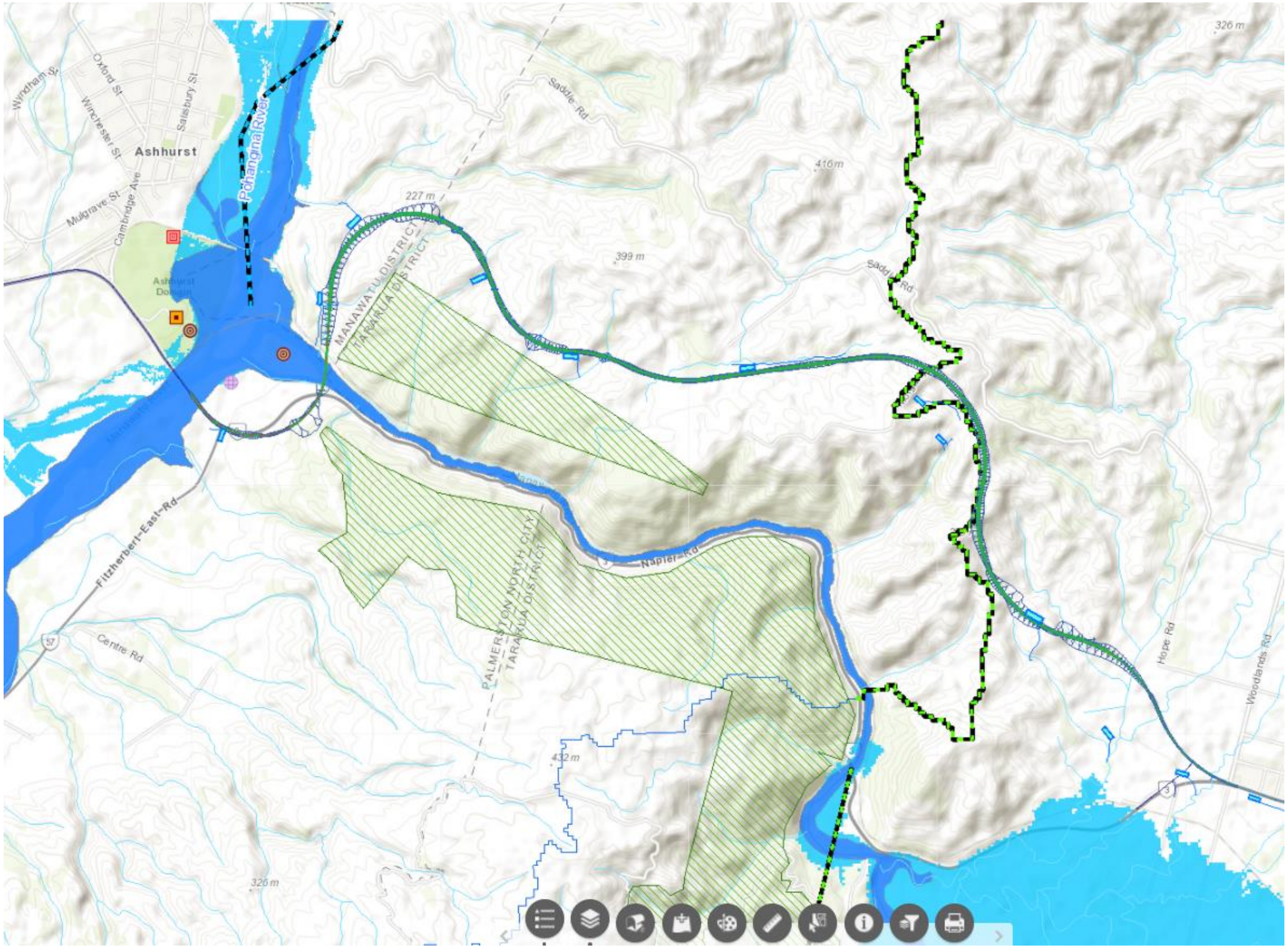

Figure 2. Te Ahu a Turanga Project proposed designation and indicative alignment (marked as a solid green line). The locations of recorded archaeological sites at the confluence of the Manawatū and Pohangina Rivers are also shown (squares and circles) (source: NZTA)

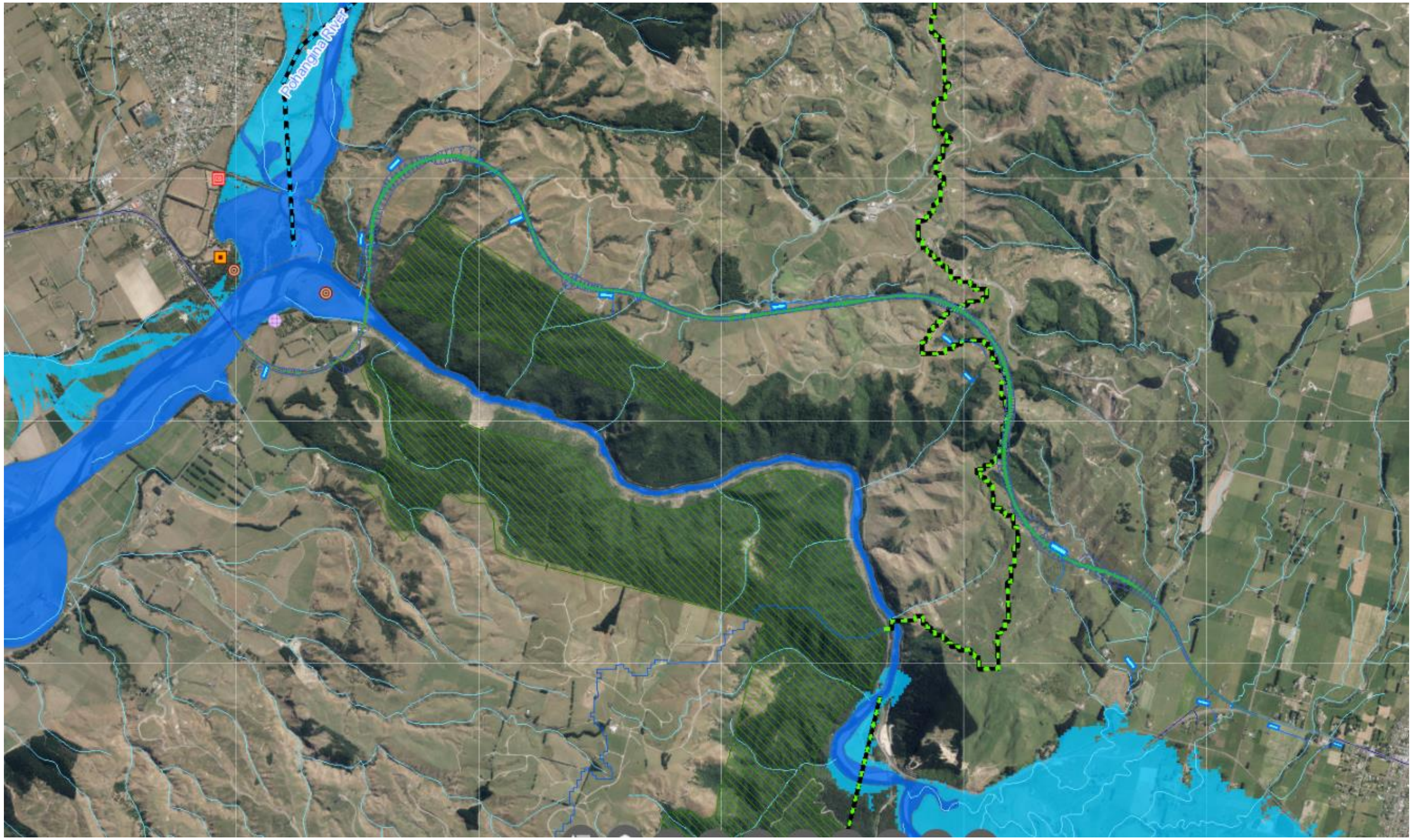

Figure 3. Aerial photograph of the Te Ahu a Turanga Project proposed designation and indicative alignment (marked as a solid green line). The locations of recorded archaeological sites at the confluence of the Manawatū and Pohangina Rivers are also shown (squares and circles) (source: NZTA)

STATUTORY REQUIREMENTS

RMA

24. Section 6 of the RMA recognises as matters of national importance: *"the relationship of Māori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga"* (s6(e)); and *"the protection of historic heritage from inappropriate subdivision, use, and development"* (s6(f)).

25. All persons exercising functions and powers under the RMA are required under section 6 to recognise and provide for these matters of national importance when *"managing the use, development and protection of natural and physical resources"*. There is a duty to avoid, remedy, or mitigate any adverse effects on the environment arising from an activity (s17), including historic heritage.

26. "Historic heritage" is defined (s2) as:

> *"those natural and physical resources that contribute to an understanding and appreciation of New Zealand's history and cultures, deriving from any of the following qualities:*
>
> *(i) archaeological;*
>
> *(ii) architectural;*
>
> *(iii) cultural;*
>
> *(iv) historic;*
>
> *(v) scientific;*
>
> *(vi) technological".*
>
> *"Historic heritage includes:*
>
> *(i) historic sites, structures, places, and areas;*
>
> *(ii) archaeological sites;*
>
> *(iii) sites of significance to Māori, including wāhi tapu;*
>
> *(iv) surroundings associated with the natural and physical resources".*

27. Regional, district and local plans contain sections that help to identify, protect and manage archaeological and other heritage sites. The plans are prepared under the provisions of the RMA. The MDP, TODP and PNDP are relevant to the proposed activity.

HNZPTA

28. In addition to any requirements under the RMA, the HNZPTA protects all archaeological sites whether recorded or not, and states that they may not be damaged or destroyed unless an Authority to modify an archaeological site has been issued by HNZPT (section 42).

29. An archaeological site is defined by the HNZPTA Section 6 as follows:

*"**archaeological site** means, subject to section 42(3), –*

(a) *any place in New Zealand, including any building or structure (or part of a building or structure) that –*

  (i) was associated with human activity that occurred before 1900 or is the site of the wreck of any vessel where the wreck occurred before 1900; and

  (ii) provides or may provide, through investigation by archaeological methods, evidence relating to the history of New Zealand; and

(b) *includes a site for which a declaration is made under section 43(1)".* [8]

HISTORICAL BACKGROUND

Māori settlement

30. While based on reliable documentary sources, this information should not be viewed as complete or without other context; there are a number of iwi historically associated with the Manawatū region, and many other histories known to tangata whenua.

31. Situated between the townships of Woodville and Ashhurst, the Manawatū Gorge (known to Māori as Te Āpiti'the narrowing') follows the course of the Manawatū River through the Ruahine and Tararua Ranges. According to

[8] Under Section 42(3) an Authority is not required to permit work on a pre-1900 building unless the building is to be demolished. Under Section 43(1) a place post-dating 1900 (including the site of a wreck that occurred after 1900) that could provide '*significant evidence relating to the historical and cultural heritage of New Zealand*' can be declared by Heritage NZ to be an archaeological site.

Māori tradition, the gorge was created when a giant totara tree, located on the slopes of the Puketoi mountain range, became possessed by the spirit Okatia and then pushed through the Ruahine and Tararua Ranges, forming the Gorge from its path.[9] The Manawatū River and its tributaries, such as the Pohangina, provided plentiful supplies of food sources (particularly eels) as well as easily navigable routes. Dense surrounding forest also supplied quantities of birds and berries which supported seasonal Māori occupation around the Manawatū Gorge area.[10]

32. The wider Manawatū district was settled by the Rangitāne tribe whose ancestor, Whatonga, came to New Zealand as one of three chiefs in command of the *Kurahaupō* canoe. The tribe established settlements in Wairarapa, Wellington, Wairau, Tamakinui-a-Rua (near present day Dannevirke), Horowhenua and Manawatū and claimed mana whenua or traditional authority over the land. The expansion of the tribe led to the formation of separate and distinct tribes such as Muaupoko; however, the majority of Rangitāne hapū remained part of the larger tribal consortium.[11]

33. Rangitāne exercises mana whenua over a large part of Manawatū and Tararua districts with Rangitāne being recognised as tangata whenua prior to European settlement. Even though Rangitāne interests extended to the catchment and drainage basin of the Manawatū River on both sides of the ranges, settlement was constrained to the margins of the Manawatū River. The river was the main route of travel and communication, as the plains were covered by dense forests and swamps that were impenetrable in places.[12]

34. Prior to the 19th century, Rangitāne lived in relative peace, apart from a few skirmishes with neighbouring tribes such as Ngāti Kahungunu and Ngāti Apa.[13] Around 1500AD, Māori began to construct defensive settlements, known as pā, which were sited on strategic areas such as headlands and volcanic cones. Many pā were located on prominent sites across the Manawatū, including at the entrance to the Manawatū Gorge (now part of the Ashhurst Domain) where occupants could maintain a guard over the

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[9] Malcolm McKinnon, 'Manawatū and Horowhenua places - Manawatū River and Gorge', Te Ara - the Encyclopedia of New Zealand, http://www.TeAra.govt.nz/en/Manawatū-and-horowhenua-places/page-6 (accessed 17 January 2018); Malcolm McKinnon, 'Manawatū and Horowhenua region - Culture and heritage to 1940', Te Ara - the Encyclopedia of New Zealand, http://www.TeAra.govt.nz/en/photograph/9512/the-story-of-the-Manawatū-river (accessed 17 January 2018).
[10] Malcolm McKinnon, 'Manawatū and Horowhenua region - Early Māori history', Te Ara - the Encyclopedia of New Zealand, http://www.TeAra.govt.nz/en/Manawatū-and-horowhenua-region/page-4 (accessed 17 January 2018).
[11] Mason Durie and Meihana Durie, 'Rangitāne', in Ministry of Culture and Heritage, *Māori Peoples of New Zealand, Nga Iwi O Aotearoa*, Auckland, 2006, pp.201-202.
[12] Rangitaane O Manawatu, Tanenuiarangi Manawatu Incorporated "Cultural Impact Assessment". To NZTA Cultural Assessment for the development of a temporary bypass around the Ashhurst township. n.d.
[13] Ibid.

important accessway.[14] According to historian T.L. Buick, the Rangitāne tribe maintained heavily defendable pā across their territory, along with smaller and less secure settlements suitable for seasonal food collection, and the 'Raukawa pā' near Ashhurst was often utilised when gathering hinau berries.[15] A kāinga (village), known as Parahaki, and burials are also known to be present on a small island at the mouth of the Manawatū Gorge (near Ashhurst). The island is said to have been retained by Rangitāne following the sale of the 250,000 acre Ahuaturanga Block (site of the present day Palmerston North) to the Crown in 1864.[16]

35. From the 1820s, Rangitāne faced significant threats when warring northern tribes, notably Ngāti Raukawa and Ngāti Toa, entered some areas of the Manawatū and Horowhenua armed with muskets. Led by Te Rauparaha, Ngāti Toa came into conflict with Muaupoko at Lake Papaitonga (near Levin) and later a series of revenge attacks were mounted along the Kāpiti Coast. Peace agreements were eventually negotiated, although it should be noted that:

> *"…while most of the coast was subjugated by Te Rauparaha the principal domain of the Rangitāne* … [according to McEwen] *"on the Dannevirke side of the Manawatū Gorge and further south, was not at any time invaded by Ngātitoa or their associated tribes and the Rangitāne sub-tribes of that district could not by any stretch of imagination be said to have been subjugated".*[17]

36. During the 19th century Māori occupation sites were frequent along the Manawatū and Pohangina Rivers. A plan of the Ahuaturanga block, dated 1864, indicates the Māori names of several small rivers and streams, particularly along the Pohangina, and identifies several occupied locations along the river including Raparuhe, Te Ponga, Te Wharau, and Parahaki kāinga established on a small island (Parahaki or Moutere Island) at the mouth of the Manawatū Gorge (**Figure 4 and 5**). Burials were also conducted at Parahaki. These place names represent former areas of Māori settlement along the Pohangina River, which tradition suggests were

[14] NZAA Site Record Form T24/28.
[15] T.L. Buick, Old Manawatū: or, The Wild Days of the West, Christchurch, 1975, p.33.
[16] NZAA Site Record Form T24/32.
[17] Victoria Fallas, 'Rangitikei/Manawatū Block' report commissioned for the Waitangi Tribunal, Wai #52, November 1993, p.3.

probably seasonal, taking advantage of the totara that grew in the area for the construction of waka, along with other resources such as flax and eels.[18]

37. Following the arrival of European colonists, Rangitāne chief Te Peeti Te Awe Awe (leader of the Ngāti Hineaute and Ngai Tamawahine hapū), who controlled large tracts of the lower Manawatū, sought alliances with the Crown by assisting with land purchases and lending support during the New Zealand Wars.[19] Significant blocks of Rangitāne land were acquired by the Crown on either side of the Manawatū Gorge during the 1860s and 1870s, and by 1880 Rangitāne's remaining lands were largely situated to the east of the Manawatū Gorge.[20] Justice was sought through the Māori Land Court; however, in order to retain their tribal traditions some 60 Rangitāne leaders had gathered at Puketotara in 1852 to compile genealogical records. The resulting notes taken by Te Rangiotu continue to be an important resource of tribal history to the present day.[21]

38. Claims to the title of Parahaki were heard by the Māori Land Court in 1879 and 1880. The site was later subdivided into two blocks and surveyed.

European settlement [22]

Ashhurst

39. The Ahuaturanga Block, or Upper Manawatū Block, was acquired by the Crown in July 1864 from the chiefs of Rangitāne, Ngāti Kauwhata and Ngātitumokai. It was a 250,000 acre parcel which included land on both sides of the Manawatū River (**Figures 4 and 6**).[23]

40. In the early 1870s, a portion of the Ahuaturanga Block (including what is now Ashhurst) was purchased from the Crown by Colonel William Feilding, for £75,000.[24] The section, named the Manchester Block, comprised 106,000 acres and was bought on behalf of the Emigrant and Colonists' Aid Corporation which had been established to assist the immigration of British working class people, particularly farm labourers, to New Zealand (**Figures 7**

[18] Paul Horton, Pers. Comm
[19] Palmerston North City Council website: https://www.pncc.govt.nz/news-events-and-culture/heritage-buildings/the-square-te-peeti-te-awe/.
[20] H. Hanson Turton, Plans of Land Purchases in the North Island of New Zealand. Volume Two: Provinces of Taranaki, Wellington and Hawke's Bay, Wellington, 1878, np; B.G.R. Saunders (ed.), The South of the North: Manawatū and its Neighbours, Palmerston North, 2000, p.21.
[21] Mason Durie and Meihana Durie, 'Rangitāne', in Ministry of Culture and Heritage, *Māori Peoples of New Zealand, Nga Iwi O Aotearoa*, Auckland, 2006, p.202.
[22] A summary of the historical background of European settlement within the Project area is provided here. A detailed historic background is provided in **Appendix A**.
[23] H. Hanson Turton, Māori Deeds of Land Purchases in the North Island of New Zealand: Volume Two, Wellington, 1878, p.179.
[24] M.H. Holcroft, The Line of the Road: A History of Manawatū County, 1876-1976, Dunedin, 1977, p.6.

and 8).[25] Ashhurst was surveyed at a clearing in the bush, known as Otangaki in 1877. Overall, the Manchester Block settlement scheme was an early success and by mid-1877 the block had attracted around 1600 settlers.[26]

41. The Ashhurst township served as the base for those involved in developing the fertile Pohangina Valley. Timber extraction was necessary to clear the nearby areas for farmland and Ashhurst became a depot for the trade. By 1879, the township of Ashhurst had increased significantly. Ashhurst lay on the main Coach road from Palmerston North to Napier and was near the main railway line between Whanganui and Napier (**Figure 9**).[27] Waterway access was also possible, with the proximity of the township to the Manawatū Gorge and the junction of the Pohangina and Manawatū Rivers.

42. During the 1880s and 1890s the land around Ashhurst was subdivided into both large and small holdings, and various businesses lining the main streets of the township and at the turn of the century the town continued to prosper. Farming (particularly dairying), forestry and tourism from the nearby Manawatū Gorge continued to sustain Ashhurst well into the 20th century.

[25] Ibid.
[26] Holcroft, p.7.
[27] *Wanganui Herald*, 24 February 1879, p.3.

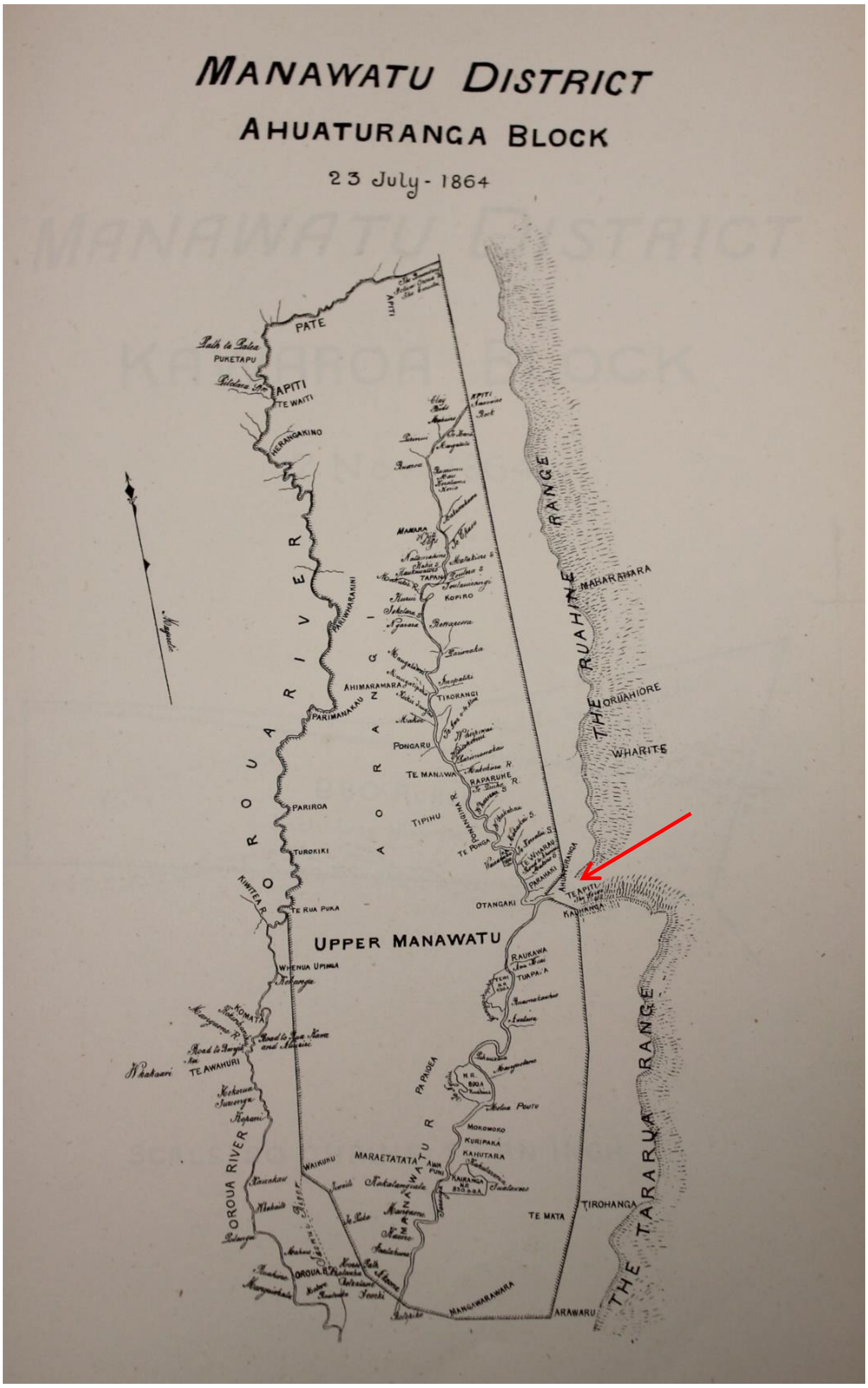

Figure 4. Plan of the Ahuaturanga Block, with the western entrance to the Manawatū Gorge arrowed in red, which was purchased by the Crown in 1864. It shows Māori place names at the confluence of the Manawatū and Pohangina Rivers.
Note: 'S' denotes stream and 'R' denotes river (source: H. Hanson Turton, *Plans of Land Purchases in the North Island of New Zealand. Volume Two: Provinces of Taranaki, Wellington and Hawke's Bay*, Wellington, 1878, np)

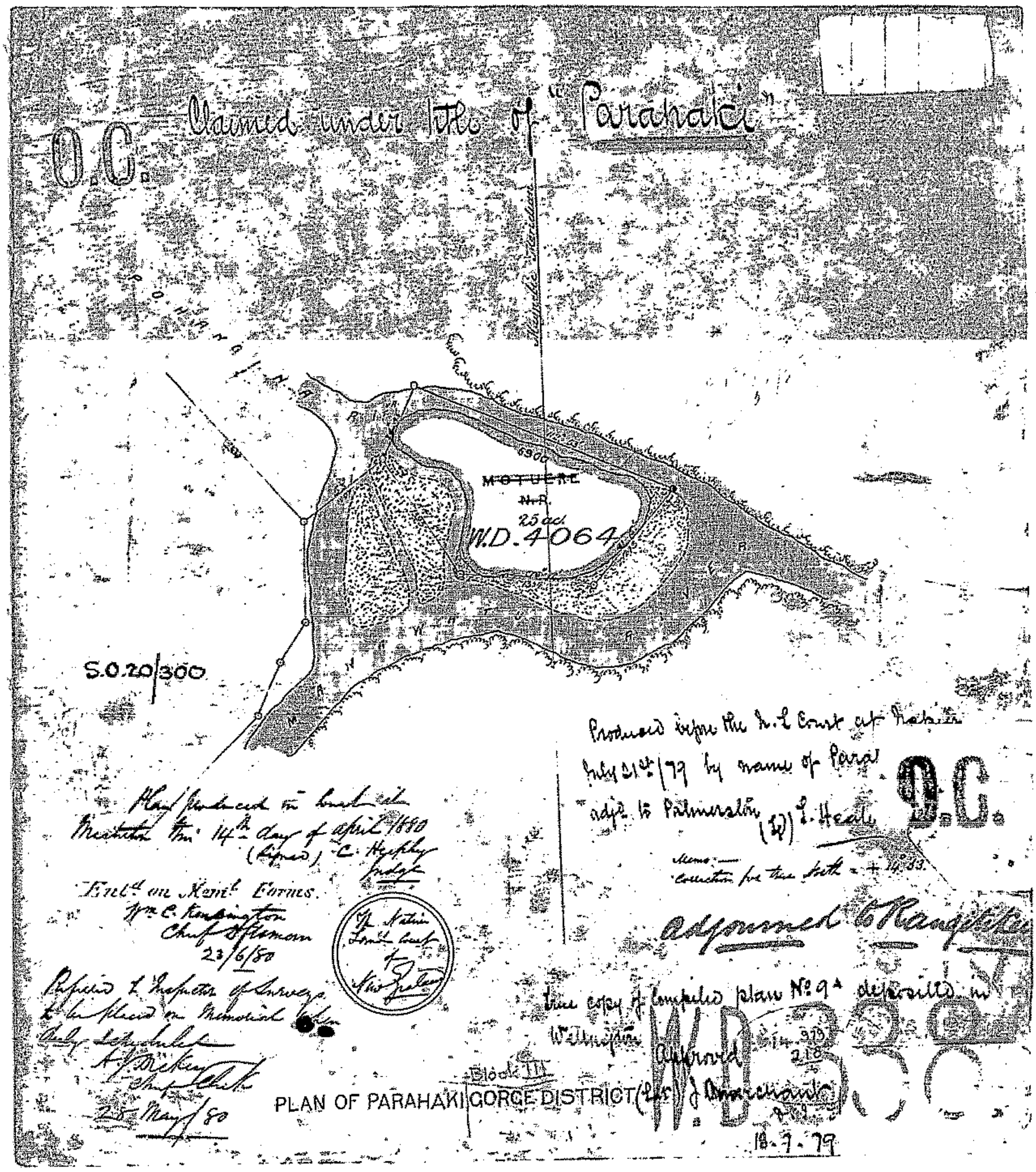

Figure 5. ML 338, dated ca.1879-1880, showing the island known to Māori as Parahaki at the confluence of the Manawatū and Pohangina Rivers. This plan was presented during the Māori Land Court hearings to determine the title to the land. (source: Quickmap)

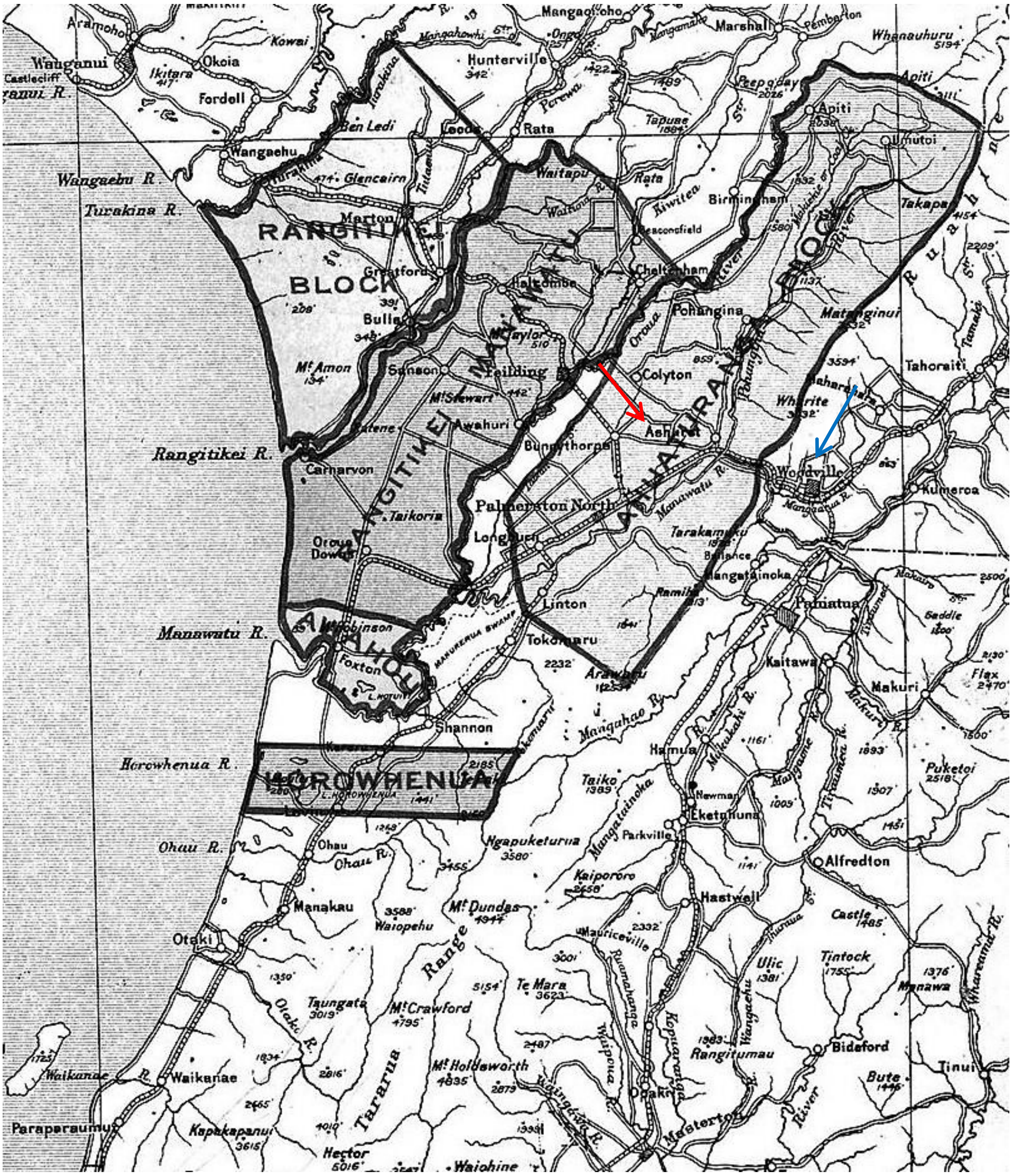

Figure 6. Close-up of map showing land blocks in the Manawatū and Horowhenua purchased by the Crown, including the Ahuaturanga Block. Ashhurst is arrowed in red and Woodville in blue. (source: T.L. Buick, *Old Manawatū: or, The Wild Days of the West*, Christchurch, 1975, np)

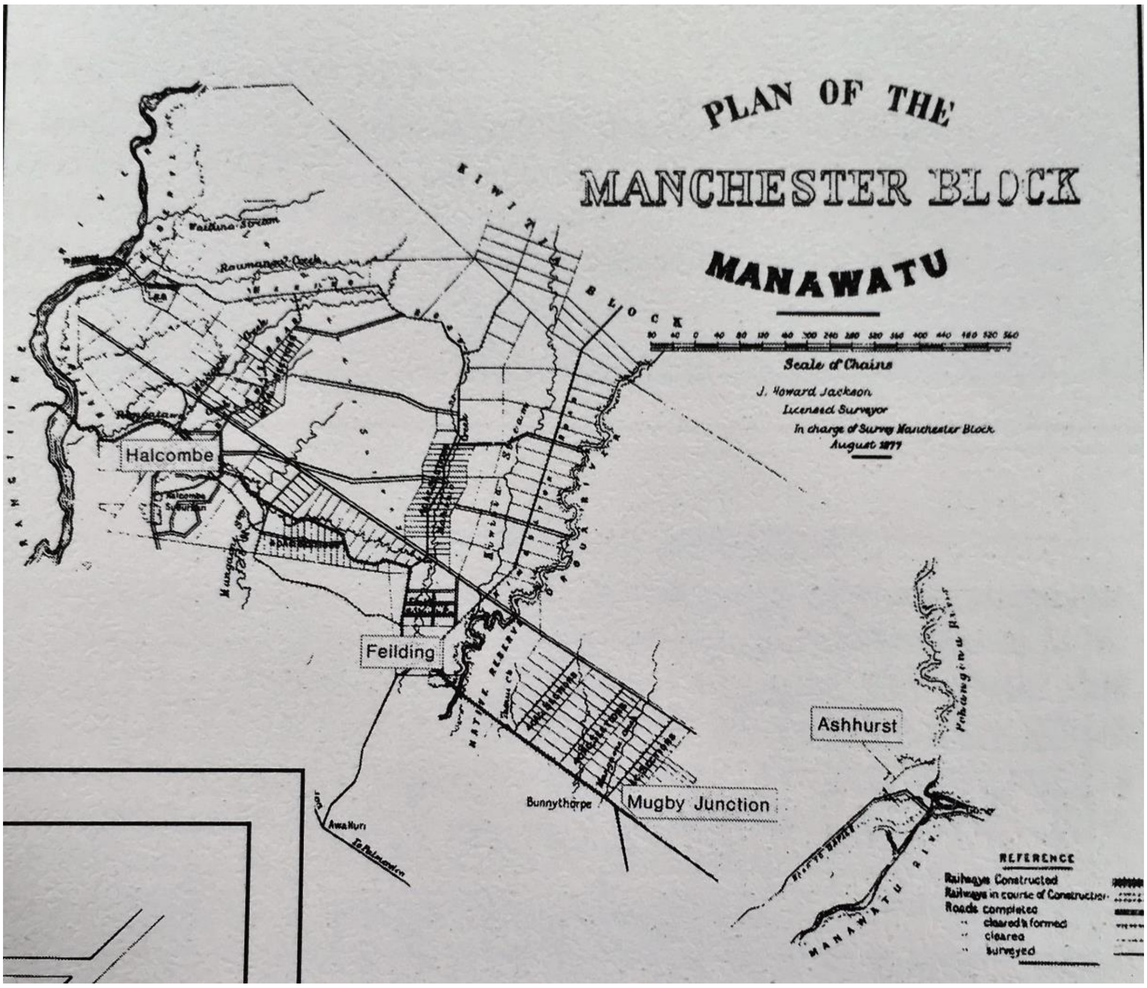

Figure 7. Plan of the Manchester Block, Manawatū, dated August 1877 with Ashhurst indicated. (source: B.G.R. Saunders (ed.), *The South of the North: Manawatū and its Neighbours*, Palmerston North, 2000, p.21)

Figure 8. Plan of the Manchester Block, dated 1878, with the township of Ashhurst arrowed in red. (source: MDC 00486 1-2, Archives Central, www.archivescentral.org.nz)

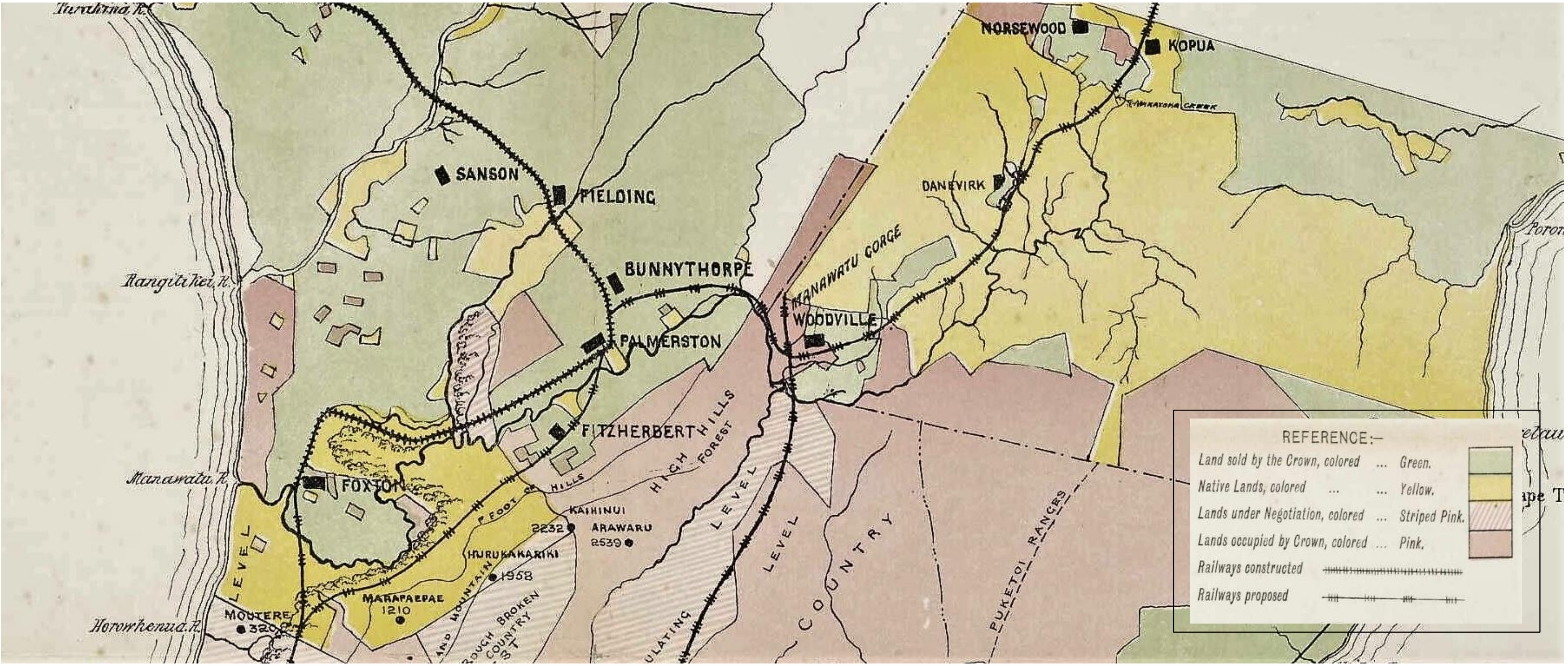

Figure 9. Close-up of map, dated 1880, showing lines of railway constructed, in course of construction, and proposed. (source: Printed as a supplement to "The New Zealand Times," Friday, April 2, 1880, Alexander Turnbull Library)

Area north-east of confluence of Manawatū and Pohangina Rivers

43. Following the purchase of the Ahuaturanga Block, and later the creation of the Manchester Block in the 1870s, further communication links in and around the Manawatū Gorge area were constructed to aid European settlement. After preliminary work bush felling, the formation of the Manawatū Gorge road was commenced in March 1871 and completed in 1872. The Upper Gorge Bridge was constructed in 1875 and provided coach communication to the Hawkes Bay.[28] Railway transport through the Manawatū Gorge was also planned in the late 19th century with the railway line from Napier through the Gorge finished in 1891.[29]

44. In order to facilitate these railway projects, various tracts of land were set aside under the Public Works Act, including an 83 acre parcel, located to the north east of the confluence of the Pohangina and Manawatū Rivers (north of Parahaki), which was gazetted for railway purposes in 1880 (**Figures 10 and 11**, and see **Figures 15 and 17**). Further land to the east was gazetted as Railway Reserve alongside the Gorge in 1890 (**Figure 12**, and see **Figure 17**).

45. Forest Reserve north and south of the Manawatū Gorge, along the line of the Tararua and Ruahine Ranges, was created by the Crown from the 1880s. On 13 August 1885, a Forest Reserve comprising 1,100 acres was gazetted under the Land Act, 1877.[30] The parcel was located to the north of the Manawatū Gorge and formed part of the Ahuaturanga Block. Neighbouring land to the east was also included in a large Crown Forest Reserve, set aside for the growth and preservation of timber, which was gazetted in 1881 (**Figure 12**).[31] By 1892 steps were taken to have portions of the Forest Reserve on the Ashhurst side of the Ruahine Range opened up for settlement.

46. In 1878, 3234 acres was granted to the Emigrant and Colonists' Aid Corporation Ltd (Section 2 of Subdivision X within the Manchester Block), to the north east of the confluence of the Manawatū and Pohangina Rivers (**Figure 15**).[32] A lease for the parcel was issued for a term of five years to Frederick, John and Alexander Whibley in 1885.[33] They retained the lease

[28] Ibid, pp.359-360; *Evening Post*, 28 August 1931, p.7.
[29] *Evening Post*, 28 August 1931, p.7.
[30] *New Zealand Gazette*, 6 August 1885, p.953.
[31] *New Zealand Herald*, 13 June 1881, p.4.
[32] The Pohangina River forms the western boundary of the parcel.
[33] WN29/91, LINZ.

until 1887 when it was transferred to William Akers, a sheep farmer.[34] According to the 1885 Public Works Statement, the Whibley Brothers of Ashhurst entered into a contract with the government to deliver 1,000 sawn totara sleepers, for railway purposes.[35] The brothers were also involved in sheep farming, and this was likely how the property was utilised by William Akers when he took over the lease in 1887.

47. Few other details are known about Akers' block throughout the later 19th century, although Akers became a leading figure in the Manawatū flax industry during the early 1900s. However, it is unclear whether he attempted any flax production on his Manchester Block property.[36] Akers transferred the leasehold on Lot 2, Section X, Manchester Block to Hugh Akers in 1907 and the land continued to be farmed by the family until well into the 20th century (**Figures 16 and 17**).[37]

[34] WN29/91, LINZ.
[35] Appendices to the Journals of the House of Representatives (AJHR), 1885 7-D-1, p.25.
[36] See: *Manawatū Herald*, 26 June 1900, p.3; *Wairarapa Daily Times* 16 April 1910, p.2; *Wairarapa Age*, 21 May 1910, p.6; *Manawatū Times*, 21 May 1910, p.7.
[37] WN29/91, LINZ.

Figure 10. SO 11605, dated 1880, showing Section 1, Subdivision X, Manchester Block, which was reserved for railway purposes. (source: Quickmap)

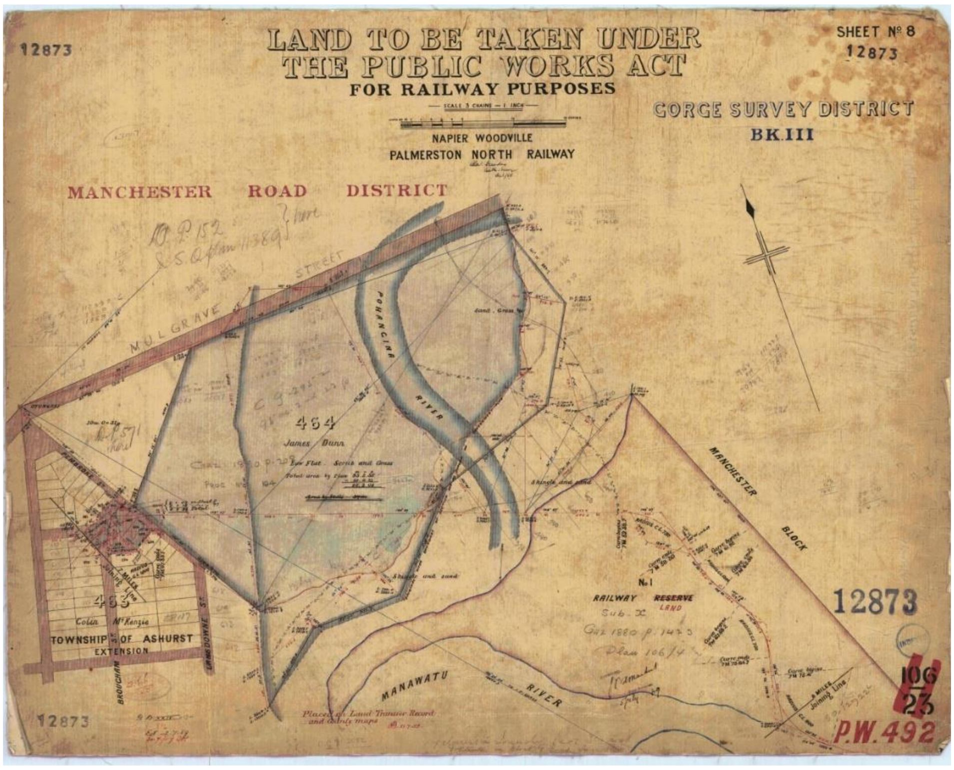

Figure 11. SO 12873, dated 1889, showing land to be taken under the Public Works Act for Railway Purposes adjacent to Railway Reserve Section 1, Subdivision X, Manchester Block. (source: Quickmap)

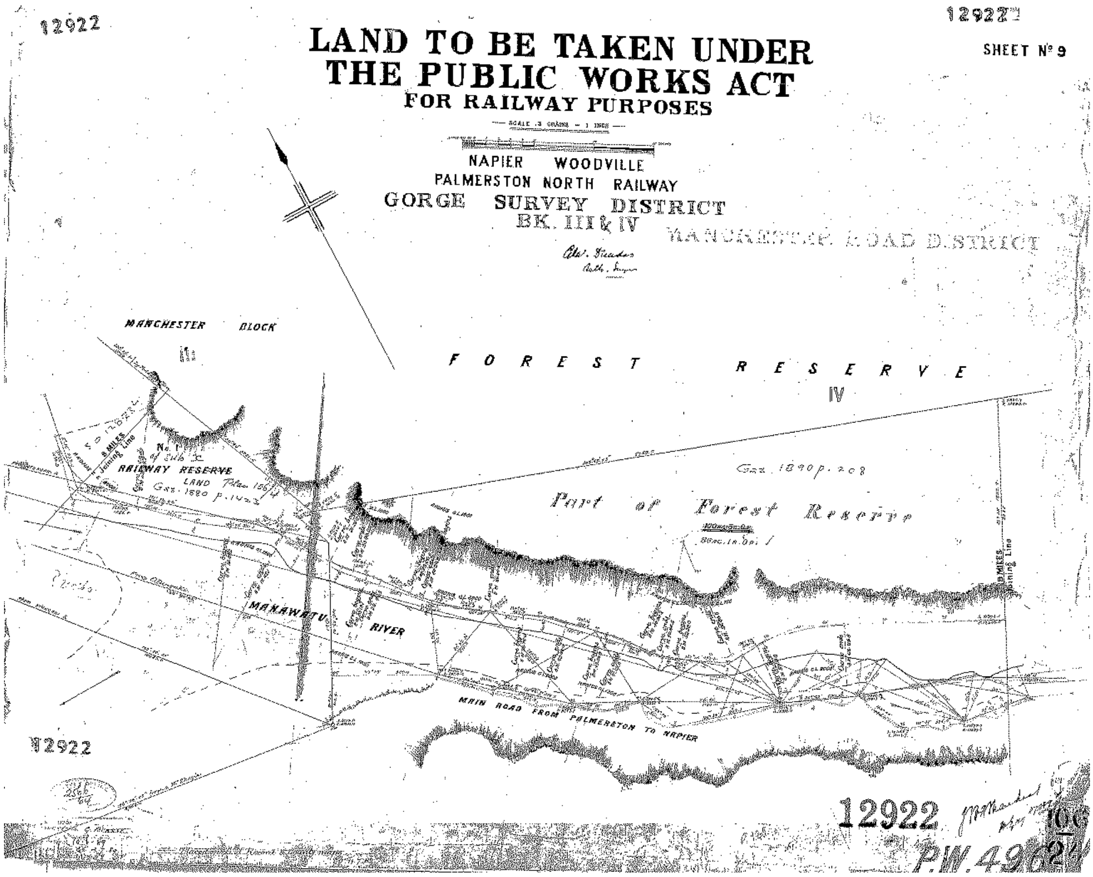

Figure 12. SO 12922, dated 1889, showing land to be taken under the Public Works Act for Railway Purposes alongside the Manawatū River and adjacent to Railway Reserve Section 1, Subdivision X, Manchester Block. (source: Quickmap)

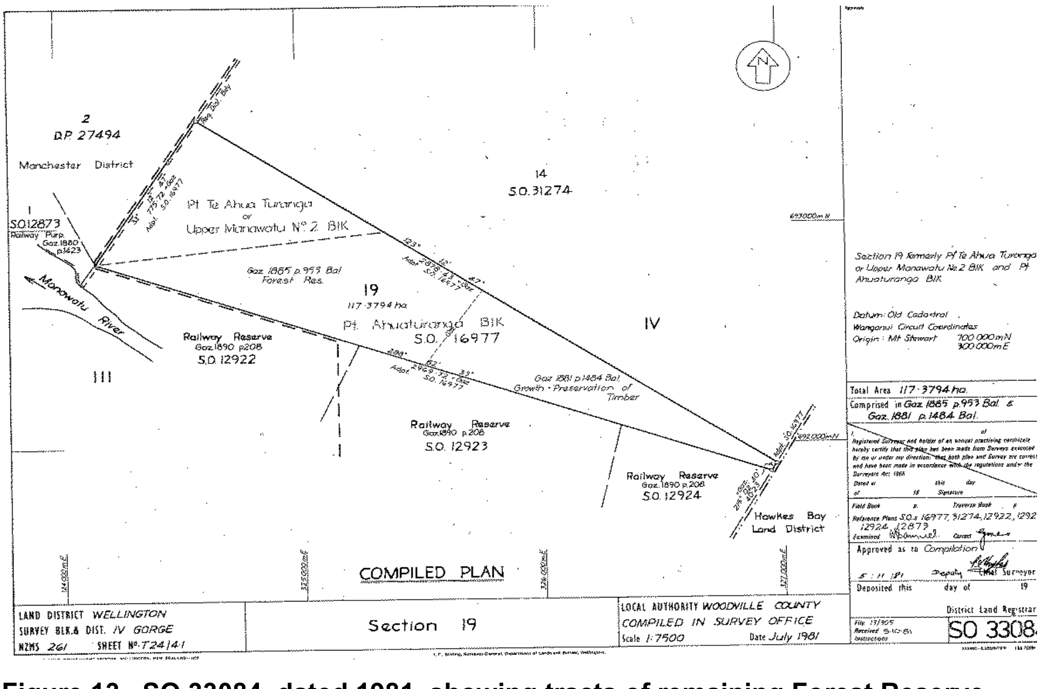

Figure 13. SO 33084, dated 1981, showing tracts of remaining Forest Reserve alongside the Manawatū Gorge (northern side). (source: Quickmap)

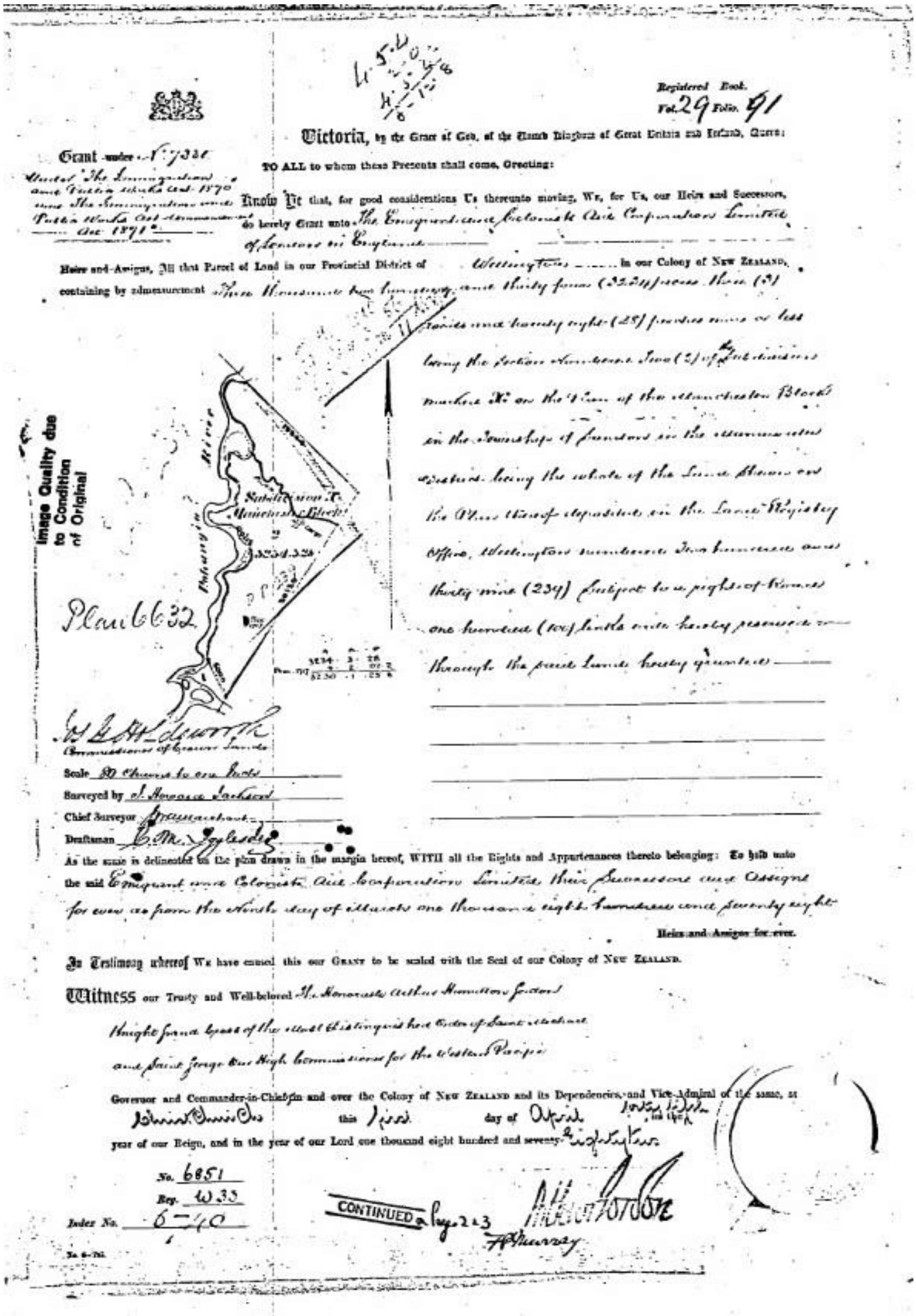

Figure 14. Certificate of Title (page 1 of 3) WN29/91, dated 1878, showing details of the grant for Section 2, Subdivision X, Manchester Block, alongside the Pohangina River and to the north-east of the confluence with the Manawatū River, issued to the Emigrant and Colonists' Aid Corporation Ltd under the Immigration and Public Works Act 1870 and the subsequent Amendment Act of 1871. (source: LINZ)

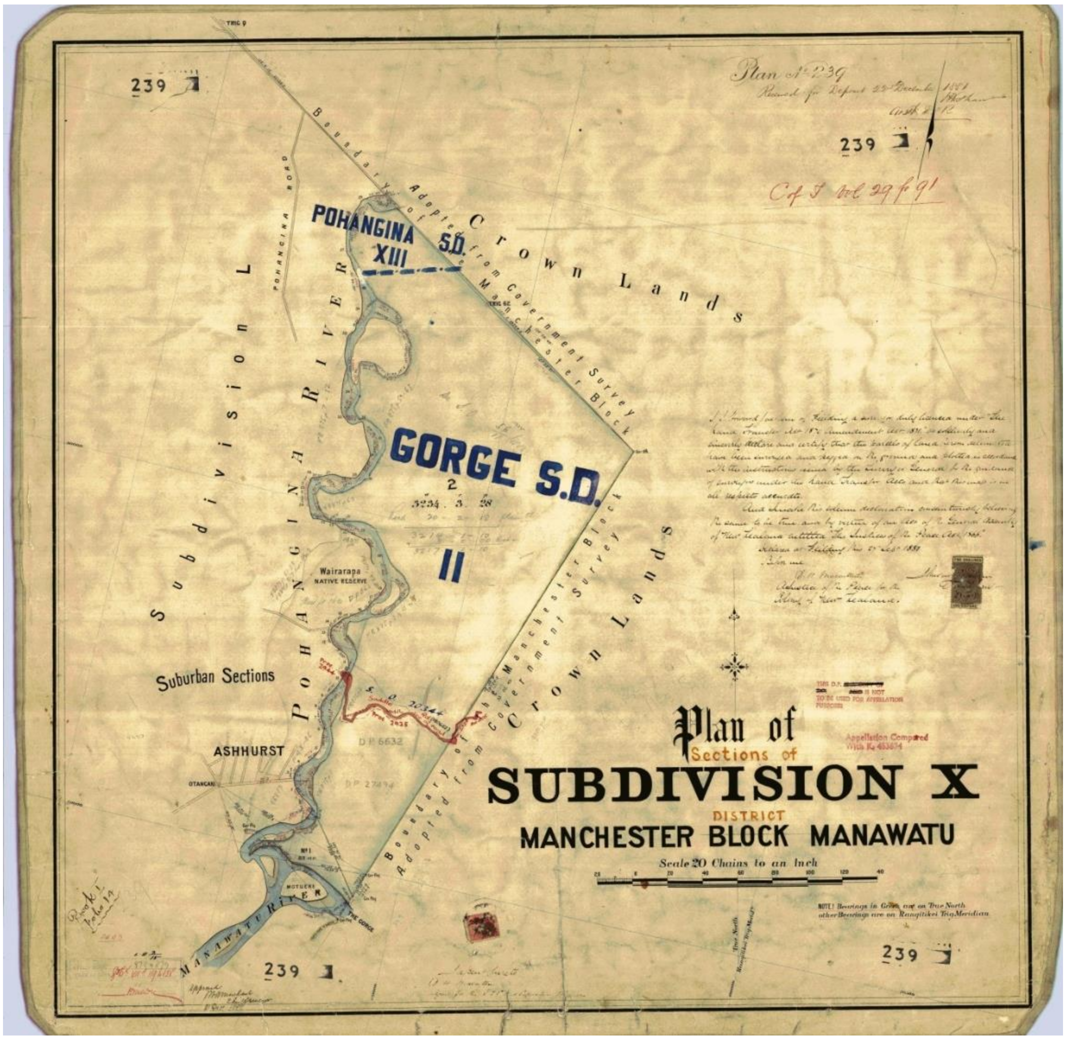

Figure 15. DP 239, dated ca.1881, showing Section 2, Subdivision X, Manchester Block alongside the Pohangina River and to the north-east of the confluence with the Manawatū River. (source: Quickmap)

Figure 16. DP 6632, dated December 1922, showing later subdivision of Section 2, Subdivision X, Manchester Block alongside the Pohangina River and to the north-east of the confluence with the Manawatū River. (source: Quickmap)

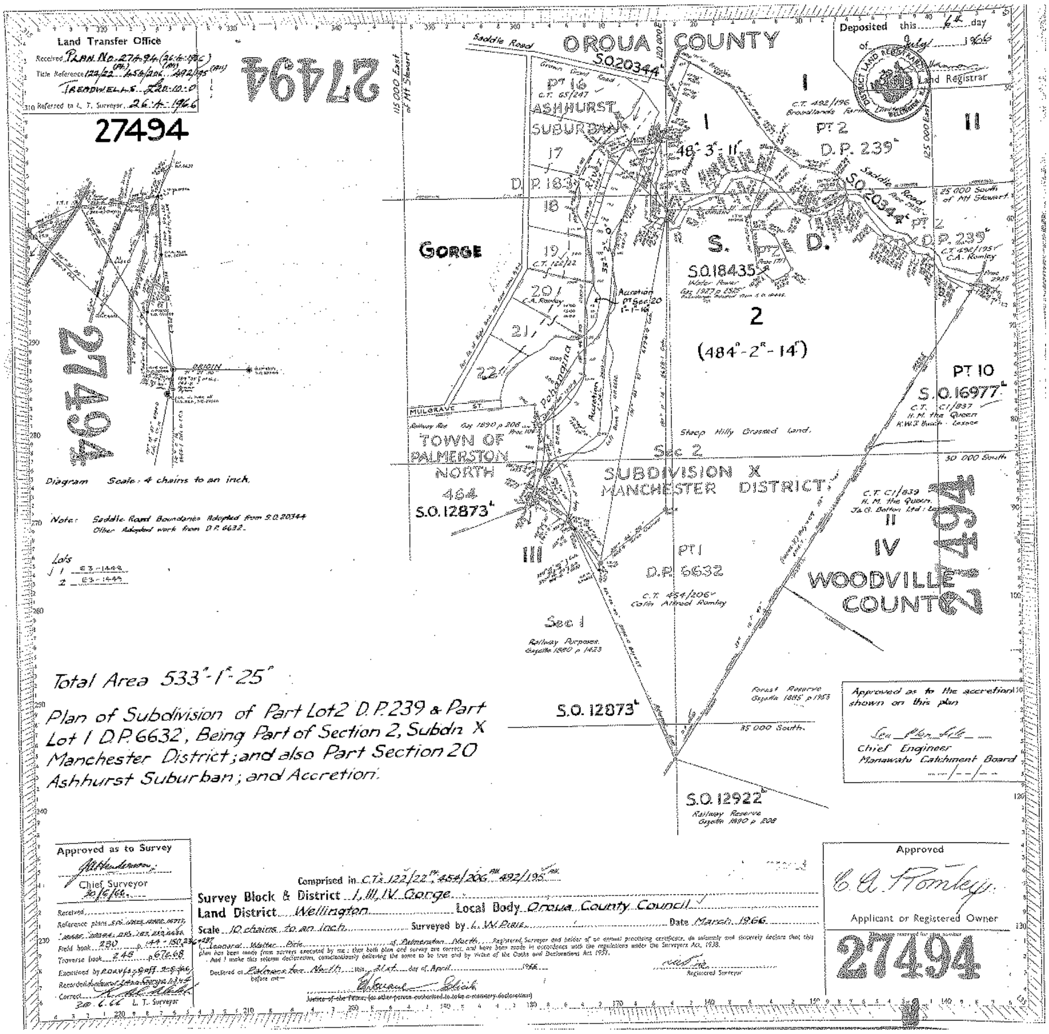

Figure 17. DP 27494, dated March 1966, showing later subdivision of Section 2, Subdivision X, Manchester Block alongside the Pohangina River and to the north-east of the confluence with the Manawatū River. (source: Quickmap)

Woodville

48. East of the Manawatū Gorge, the aptly named timber-milling township of Woodville was situated at the road and rail junction between the Wairarapa, Hawke's Bay, and Manawatū regions.[38] Its location provided the ideal place for settlement, and earned it the informal name: 'The Junction'.[39] In November 1874, suburban and rural sections at Woodville were offered for sale. The first of these lots sold in 1875 and many were taken up by road workers or those employed to construct the Hawke's Bay Railway.[40] Land sales continued throughout the 1870s and the establishment of dairy farms in and around the Woodville area helped to support growth (**Figure 18)**.

[38] Part of this was due to the close proximity of Woodville to the main accessway of the Manawatū Gorge, through which a road was completed in 1871, a bridge in 1875, and a railway in 1891. Malcolm McKinnon, 'Manawatū and Horowhenua places - Manawatū River and Gorge', Te Ara - the Encyclopaedia of New Zealand, http://www.TeAra.govt.nz/en/Manawatū-and-horowhenua-places/page-6 (accessed 19 January 2018).
[39] Kerryn Pollock, 'Hawke's Bay places - Southern Hawke's Bay', Te Ara - the Encyclopaedia of New Zealand, http://www.TeAra.govt.nz/en/hawkes-bay-places/page-5 (accessed 19 January 2018).
[40] Ibid; 'This is Woodville's History', accessed via: http://www.thisiswoodville.co.nz/pages/about-us/history.php.

49. Between 1895 and 1910 sawmills in and around the Woodville area produced significant quantities of firewood and sawn timber. Production was aided by the nearby rail lines, including from Napier, which reached Woodville in the 1880s, and the Palmerston North line, which was constructed in the 1890s.[41] Woodville's population growth remained slow but steady throughout the 20th century, with the surrounding rural hinterland continuing to provide the primary means of occupation and income). In recent years, Woodville has described itself as the wind farm capital of New Zealand.[42]

Figure 18. Photograph, possibly dated 1890s, showing the main street in Woodville. (source: O.002075, Museum of New Zealand Te Papa Tongarewa)

[41] Nancy Swarbrick, 'Logging native forests - Logging and sawmilling, 1840–1920', Te Ara - the Encyclopaedia of New Zealand, http://www.TeAra.govt.nz/en/logging-native-forests/page-4 (accessed 19 January 2018); Kerryn Pollock, 'Hawke's Bay places - Southern Hawke's Bay', Te Ara - the Encyclopaedia of New Zealand, http://www.TeAra.govt.nz/en/hawkes-bay-places/page-5 (accessed 19 January 2018).
[42] Kerryn Pollock, 'Hawke's Bay places - Southern Hawke's Bay', Te Ara - the Encyclopaedia of New Zealand, http://www.TeAra.govt.nz/en/hawkes-bay-places/page-5 (accessed 19 January 2018).

ARCHAEOLOGICAL BACKGROUND

Introduction

50. The Manawatū district has a rich and unique history. The first inhabitants of the land, or tangata whenua, were Māori whose occupation of the landscape can be traced back over centuries and is evidenced by the numerous NZAA-recorded archaeological sites and associated place names. [43]

51. No formal archaeological work had been conducted in the inland Palmerston North - Manawatū area prior to 1997, when an archaeological and wāhi tapu survey was undertaken at the request of Te Kaunihera Kaumatua o Rangitāne ki Manawatū to the Palmerston North City Council (Forbes 1997). This survey involved some field inspection as well as detailed archival research, including of Native/Māori Land Court Minute Books. It was prompted by the proposed building of the second bridge across the Manawatū River and the widening of the Fitzherbert Avenue Bridge.

52. As a result of this work, numerous archaeological sites have been recorded within the Palmerston North - Manawatū District. The location of sites clearly indicated Māori settlement was focused close to the rivers and creeks that provided access by canoe to the interior of the North Island (**Figure 19**). However, it was also noted by Forbes that intensive European development and flood control along the rivers, as well as the result of the type of soil in this area (stony loess with patches of clay), meant there was often a paucity of visible surface evidence of archaeological remains. Therefore, an absence of recorded archaeological sites in some areas does not necessarily mean that archaeological remains are not present. Also, sites that were once close to the river edge, may now be some distance away, and others eroded away due to changes in the river channels (Forbes 1997:15). Archaeological sites in this area continue to be seriously threatened by land practices, the long history of river and erosion control, and pressure from urban development.

53. Historic records indicate that settlement along the Manawatū River has long been associated with Rangitāne hapū and traditional and archaeological evidence points to Rangitāne occupation along the river for at least 650

[43] The national inventory of archaeological sites in New Zealand is the NZAA site recording scheme.Since its inception in 1958 the NZAA Site Recording Scheme records have been contributed by many different individuals and agencies and so can vary in quality and in level of detail. There are also limitations with the accuracy of the location information, in part attributable to the scale of the maps used (1:50,000). Some sites were recorded using early edition maps that have been converted to the metric version (NZMS 260), which has resulted in some alterations to grid references.

years. Early moa hunter sites have been identified in the Foxton area, and along trails in the Tararua Ranges but no sites of this age have been located in the Palmerston North area (Forbes 1997:9). As noted above, from around 1500AD Māori constructed defensive pā sites on strategic areas across the Manawatū, including at the entrance to the Manawatū Gorge (now part of the Ashhurst Domain) where occupants could maintain a guard over the important accessway.[44]

54. Numerous settlements sites, kāinga, pā and gardens, were established on almost every bend of the Manawatū River and along its fertile river banks and terraces. This is in contrast with the surrounding flats and forests between rivers where there are very few archaeological sites recorded. In 2003, an archaeological survey was carried out over the proposed Te Āpiti Wind Farm in the steep hill country of the Ruahine Ranges and within the proposed Project route (Arczoo Ltd May 2003). No archaeological sites were identified during that survey.

55. The archaeological record for the western side of the ranges is supplemented by the numerous Māori place names recorded on the 1864 Block Plan, which, together with the archaeological record, provides a more thorough understanding of early settlement patterns prior to European settlement in this area.

56. Key patterns of Māori settlement within this area have been identified as follows:

    (a) Precontact and contact period: small kāinga, pā and gardens on almost every river bend and on both sides from the Manawatū Gorge to the sea;

    (b) Contact period: continuation of settlement all along the river banks but with some later concentration in larger defended pā;

    (c) Post-contact period: pā and churches being focused closer to the road and rail which, in some instances resulted in moves away from the river banks (Forbes 1997).

[44] NZAA Site Record Form T24/28.

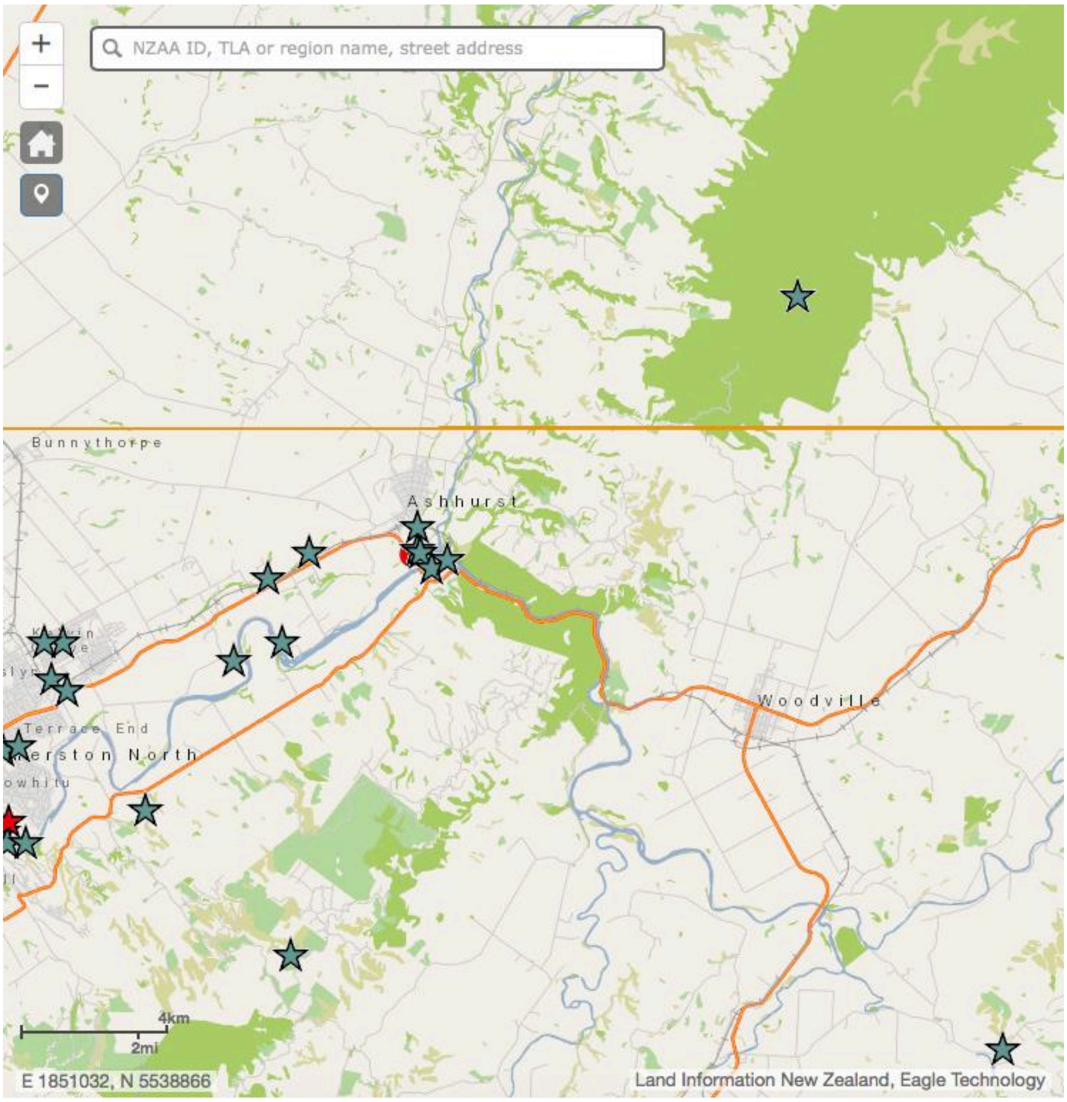

Figure 19. The location of recorded archaeological sites in the vicinity of the Project route (source: ArchSite)

57. The Manawatū River and its tributaries and the surrounding forests provided plentiful supplies of food sources, which supported Māori occupation around the Manawatū Gorge area. Prior to European flood control measures, periodic flooding of the river was an accepted part of the cycle of the river and needed for maintaining river and wetland health. Up until 1865 the plains on either side of the river were covered in totara and lowland forest with swamps and lakes, which provided close-at-hand and year-round sources of food. Swamps in particular are highly productive areas providing abundant supplies of birds, fish, eels and weaving plants. In the post-contact period there are reports of introduced fruit trees (such as peach) being grown on the river terraces (Forbes 1997:6, 24).

58. Ease of access to fertile river terraces is certain to have been exploited for gardens, and with kumara cultivation and storage, even the low intermediate

terraces (which would have been occasionally flooded) would have been gardened. This would explain the extensive settlement along both banks of the river.

Ashhurst

59. The area of the proposed Project route on the western side of the Ruahine Ranges lies with the Ahuaturanga Block, first surveyed for sale by Māori to the Crown in 1858 (Buick 1903:161). At this time the block was predominantly bush, with clearings and settlements on flats alongside the lower part of the Manawatū River before the Gorge.

60. At the western Ashhurst end of the Project route, there are several recorded archaeological sites associated with Māori settlement located along the river terraces of the Manawatū River, and near its confluence with the Pohangina River (**Figures 19, 20 and 21**; **Appendix B**):

    (a) Site T24/28 records a Pā within the Ashhurst Domain, said to be located strategically overlooking the confluence of the Pohangina and Manawatū Rivers.

    (b) Site T24/30 records burials located within the Ashhurst Domain. Known as 'Otangaki' this site is included in the Schedule of Objects and Sites of Cultural Heritage Significance to Tangata Whenua (Schedule 17B) in the PNDP. It is described as an old urupā containing six unmarked graves of Rangitāne people drowned when their canoe sank in the Manawatū River about 1850s or 1860s.

    (c) Garden soils are recorded as site T24/29 on the river terrace on the western side of the Pohangina River.

61. These sites are located to the west and well clear of the proposed Project route and will not be affected.

62. Other recorded sites are as follows:

    (a) Moutere Island is located in the middle of the confluence of the Manawatū and Pohangina Rivers and is also the recorded location of T24/32 Parahaki Kāinga (village)/Burials. This site is said to have been the home of Te Awe Awe (Rangitāne). Parahaki or Moutere Island is included in the Schedule of Objects and Sites of Cultural Heritage Significance to Tangata Whenua (Schedule 17B) in the PNDP. This site is the closest site located to the Project route being located immediately to the west of the proposed new bridge across the Manawatū River. The island has been affected by flooding over many years.

(b) Site T24/31 is a large grove of karaka trees along the Manawatū River terrace and slope above the river to the south of Moutere Island. Karaka trees were harvested by Māori for their berries and are often known to be associated with settlement sites. This site is located well clear of the proposed Project route and will not be affected.

(c) A Māori track (ara) and overland pathway through previously dense bush was recorded by Adkin (1948) over the Ahu(a)turanga Peak north of the Manawatū Gorge (**Figure 22**). The specific routes of such tracks are not currently known. Camps alongside tracks may have resulted in archaeological evidence of temporary occupation, such as fires and food preparation (Arczoo May 2003:4). To secure better communication, European settlers also cut a cattle track over the Ahuaturanga spur, which joined a similar work on the Hawke's Bay side, prior to 1867 when a track was formed along the precipitous, bush-covered sides of the Gorge.

63. In addition to those listed above, Ashhurst township, located on the western banks of the Pohangina River and to the west of the Project route, has a number of scheduled buildings and trees in the PNDP associated with early European settlement (**Figure 21**). However, none of these sites are affected by the Project route, which is located on the eastern side of the Pohangina River.

64. No Māori or early European sites are recorded on the eastern side of the Pohangina River and northern side of the Manawatū River. However, the possibility of other unrecorded archaeological evidence relating to Māori settlement and early European settlement and industry being present on the outskirts of Ashhurst cannot be discounted, particularly in light of the Māori place names on the 1864 Block Plan. The frequent paucity of visible surface evidence of Māori sites in the inland Manawatū area would indicate a potential for other unrecorded subsurface remains to be located along the banks of the Manawatū and Pohangina Rivers.

65. The existing SH3 Manawatū Gorge road was completed in 1871, with the Upper Gorge Bridge in 1875, and the Palmerston North to Gisborne Railway

line in 1891. Being of pre-1900 construction the current road and railway are both archaeological sites within the definition provided in section 6 of the HNZPTA.

Woodville

66. There are no recorded archaeological or other historic heritage sites located within the steep inland Ruahine Ranges and alluvial flats west of Woodville within the Project area (**Figure 19**). This is expected given our knowledge of the archaeological landscape where Māori sites are located close to the rivers rather than in the steep hill country and open flats and forests between rivers. Also, the landscape has been substantially altered over the last one hundred years, with a change in land use to predominantly pastoral farming, with some exotic forestry (Arczoo May 2003:4). Therefore, it is considered that there is only a low potential of unrecorded sites through this area.

67. The peak known as Te Ahu a Turanga is a significant place for Rangitāne and a number of historical events are known to have taken place there (Arczoo Ltd May 2003:3).

68. Near the existing SH3 eastern entrance to the Manawatū Gorge is the Woodville Old Gorge Cemetery (T24/42) (Figure 23). This historic cemetery contains the graves of many of the pioneers and early settlers of Woodville, including the notable early New Zealand artist Gottfried Lindauer. The location of the cemetery backing into the hillside high above the entrance to the Gorge and the confluence of three streams with significant Māori names – Mangamanaia, Mangapapa and Mangaatua - suggests that this was also a prime location for earlier Māori settlement.[45] (). The cemetery is terraced into the hill side and at least some of these terraces may predate the use of the area as a cemetery.

69. North east of the Woodville township on a ridge above the junction of the Manawatū and Tamaki Rivers is Raikapua Pā (U23/14) (Figure 23). This is a narrow, ridge-top pā, consisting of transverse terraces over approximately 100m. It has a commanding view across the fertile river flats back to the Manawatū Gorge and Ruahine Ranges. Raikapua Pā is located well east of the eastern end of the Project route and this site will not be affected.

70. Further settlement sites were pointed out by James Puatahi during the site visit, but as these were well removed from the preferred route, they have yet

[45] James Puatahi, Pers. Comm.

to be recorded. However, the site visit confirmed what would be expected: that there are numerous unrecorded archaeological sites indicating a similar pattern of settlement to that more evident on the western side of the Gorge.

71. Within Woodville township there are several scheduled buildings in the TODP. The eastern end of the Project route is located well to the west of Woodville and these sites will not be affected.

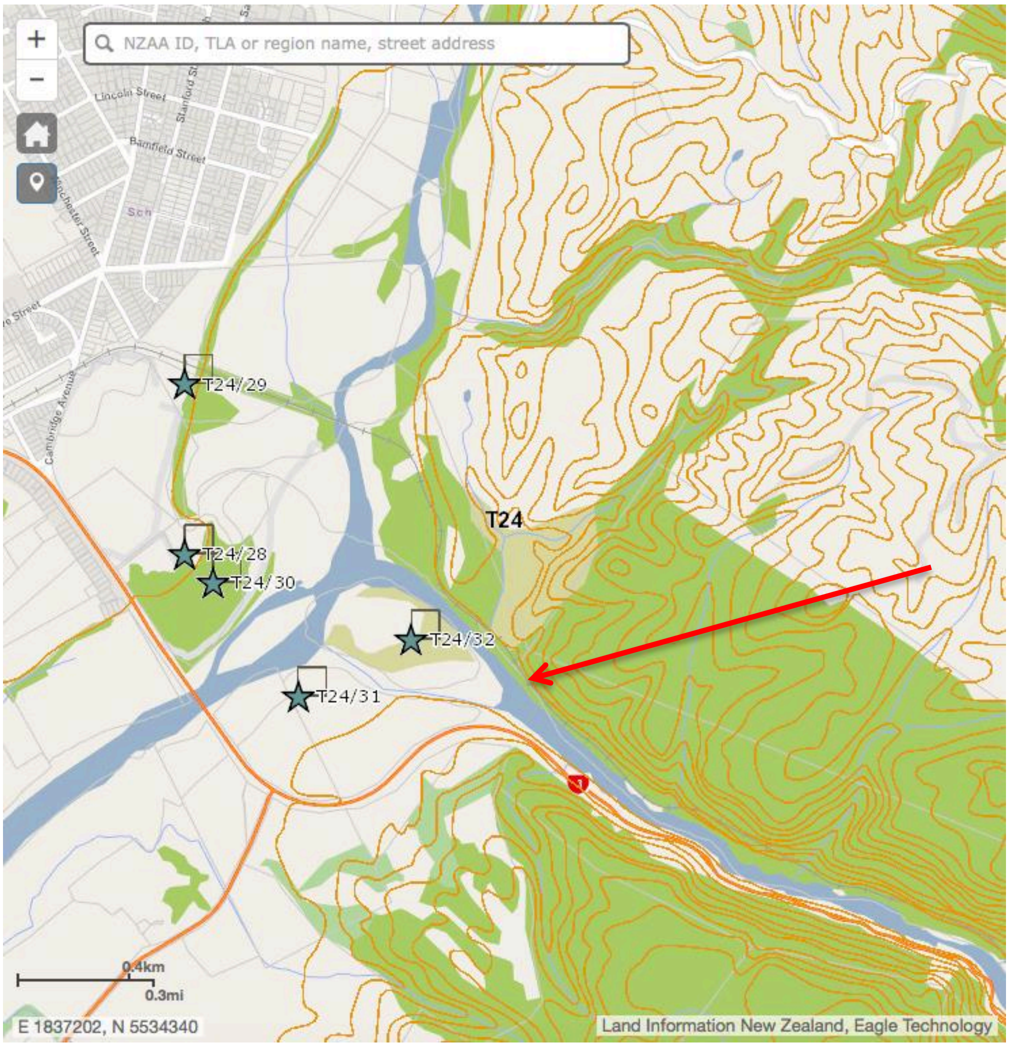

Figure 20. The location of recorded archaeological sites in the Ashhurst/Manawatū Gorge area at the western end of the Project. The arrow indicates the approximate location of the proposed new bridge across the Manawatū River as part of the Project route (source: ArchSite)

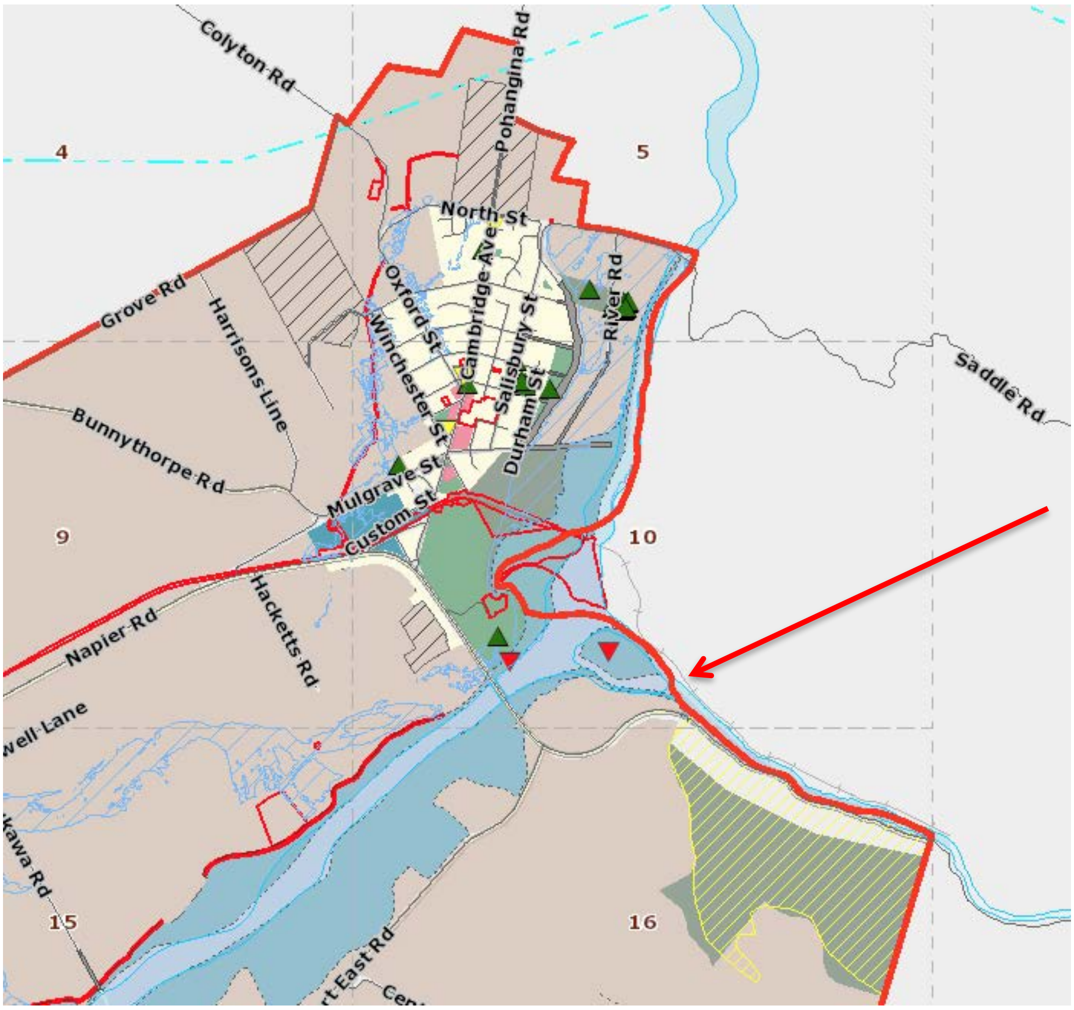

Figure 21. Detail from the Palmerston North District Plan (PNDP) of the Ashhurst area showing scheduled sites (red triangles) and trees (green triangles). The arrow indicates the approximate location of the proposed new bridge across the Manawatū River as part of the Project route (source: PNDP Maps)

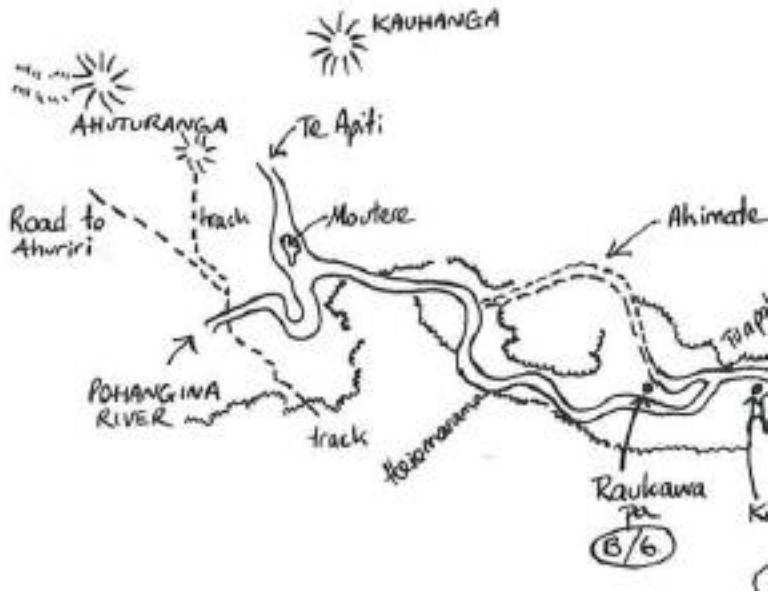

Figure 22. Detail from Adkin's compilation map in Forbes (1997) showing the confluence of the Manawatū and Pohangina Rivers with Te Āpiti (Manawatū Gorge), Moutere Island and a track that crosses the Pohangina River and the Ahu(a)turanga Saddle of the Ruahine Ranges north of the Manawatū River

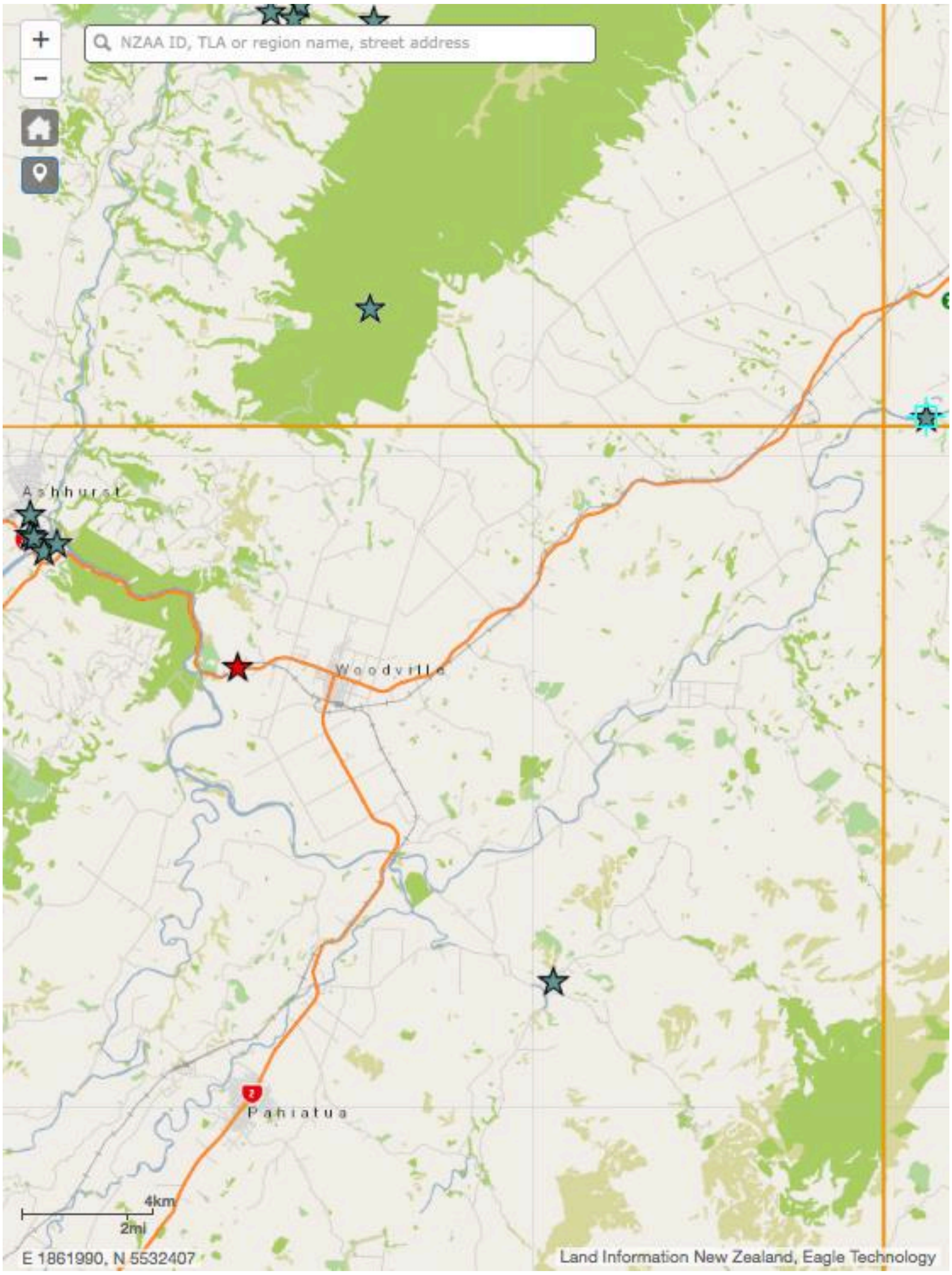

Figure 23. The location of recorded archaeological sites in the Woodville area near the eastern end of the Project. The red star marks the location of the Old Woodville Gorge Cemetery (T24/42) and the highlighted blue star the location of Raikapua Pa (U13/14) to the north east of Woodville township (source: ArchSite)

FIELD ASSESSMENT

Results

72. Field survey of the Project route was carried on 6 and 11 July 2018. The survey was focused primarily around the western end of the Project route, because of the identified potential for unrecorded archaeological remains along the river terraces of the Manawatū and Pohangina Rivers. The general area of the Te Āpiti Windfarm had been surveyed in 2003 (Arczoo) as part of the AEE for that development.

73. From the intersection with SH57 on the southern side of the Manawatū River, the Project route curves to the east and north along a plateau to the south of the existing SH3 (Figure 24). This area sits high above the confluence of the Manawatū and Pohangina Rivers and the lower Manawatū River terrace where T24/31 Karaka trees and T24/32 Parahaki Kāinga (village)/Burials on Moutere Island are located. No surface evidence of archaeological or other historic heritage sites were identified in this area during field survey. Inspection of LiDAR (Light Detection and Ranging) maps did not identify any surface features over this area that may indicate archaeological remains other than farm roads (e.g Figure 27). Nor were any features observed through detailed inspection of drone images taken along the route.[46]

74. The Project route alignment will cross the existing SH3, the Manawatū River and Palmerston North to Gisborne Railway line at the mouth of the Manawatū Gorge via a new bridge. The route alignment and bridge will be located immediately to the south of Moutere Island, and therefore, will avoid the scheduled site of T24/32 Parahaki Kāinga (village)/Burials (Figure 25).

75. At this western entrance to the Manawatū Gorge, the river narrows with steep sided river banks along both its northern and southern sides. North of the new bridge crossing, the Project route will cross the Palmerston North to Gisborne Railway line, which was cut away and modified the steep northern bank of the river (Figure 26). The route then enters a small gully and unnamed stream to the west of the Manawatū Gorge Scenic Reserve (Figure 28). This gully comprises low lying swampy ground with steep bush covered spurs and slopes on either side, including the rocky cliffs of the Manawatū Gorge Scenic Reserve (Figure 30 **and** Figure 31). While inspection of LiDAR images enabled easier inspection of the topography under vegetation, no

[46] Drone images provided by Adam Forbes (Ecologist).

surface features were observed over this area, although it did highlight a flat terrace above the stream that appeared to have archaeological potential (Figure 27). Drone images were taken of rock faces in this area (Figure 29), but there was no indication of any caves that might have been used in the past. In part, the valley walls were littered with exposed water rolled rocks, but there was no patterning or any indication that these had been used in garden or other structures.

76. The Project route then climbs north into the upper reaches of the gully and across the steep valleys and ridges on the western side of the Ruahine Ranges. This section of the Project route is through the steep hill country of the Ruahine Ranges in open pastoral farm land with bush remnants in the gullies (Figure 32).

77. The route then traverses the Ruahine Ranges approximately 1.2km north of the Manawatū Gorge through the Te Āpiti wind farm across the summit ridge (Figure 33). The Project may require the removal of at least one wind turbine and the reconfiguring of some turbine access tracks and existing electricity and fibre optic cables.

78. Towards the east of the ridge top, the route traverses a property containing a closed Woodville Borough Council landfill and descends to the southeast through farmland towards Woodville (Figure 34). An unnamed stream at the foot of the Ruahine Ranges and to the west of Hope Road is traversed by an approximately 40-50m single span bridge. The route then connects with the existing SH3 (Napier Road/Vogel Street), Troup Road and Woodland Road, indicatively via a large diameter, single lane five leg roundabout on the alluvial flats west of Woodville township (Figure 35).

79. No archaeological or other historic heritage sites were identified within the construction footprint of the Project route.

Figure 24. The plateau to the south of the existing SH3 and Manawatū River

Figure 25. Looking east into the Gorge at the confluence of the Manawatū and Pohangina Rivers. Moutere Island (Parahaki) is in the middle ground. The new Project bridge will cross the Manawatū River and Palmerston North to Gisborne Railway line at the mouth of the Manawatū Gorge, to the south of Moutere Island and to the north of the Manawatū Gorge Scenic Reserve (dashed line). Location of karaka trees (T24/31) arrowed.

Figure 26. Looking northwest along the approximate Project route (dashed line) into the gully on the northern side of the Manawatū River. The Palmerston North to Gisborne railway line runs along the river bank.

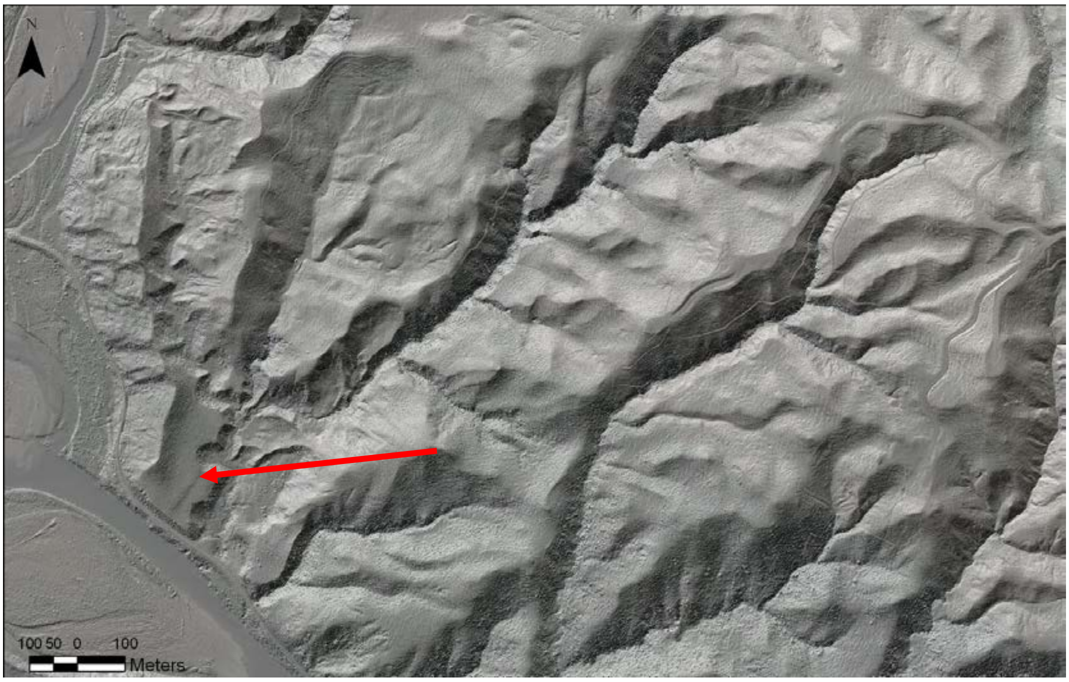

Figure 27. LiDAR image of the area north of the proposed Manawatū Bridge. The flat terrace arrowed was considered to have some archaeological potential but nothing was observed.

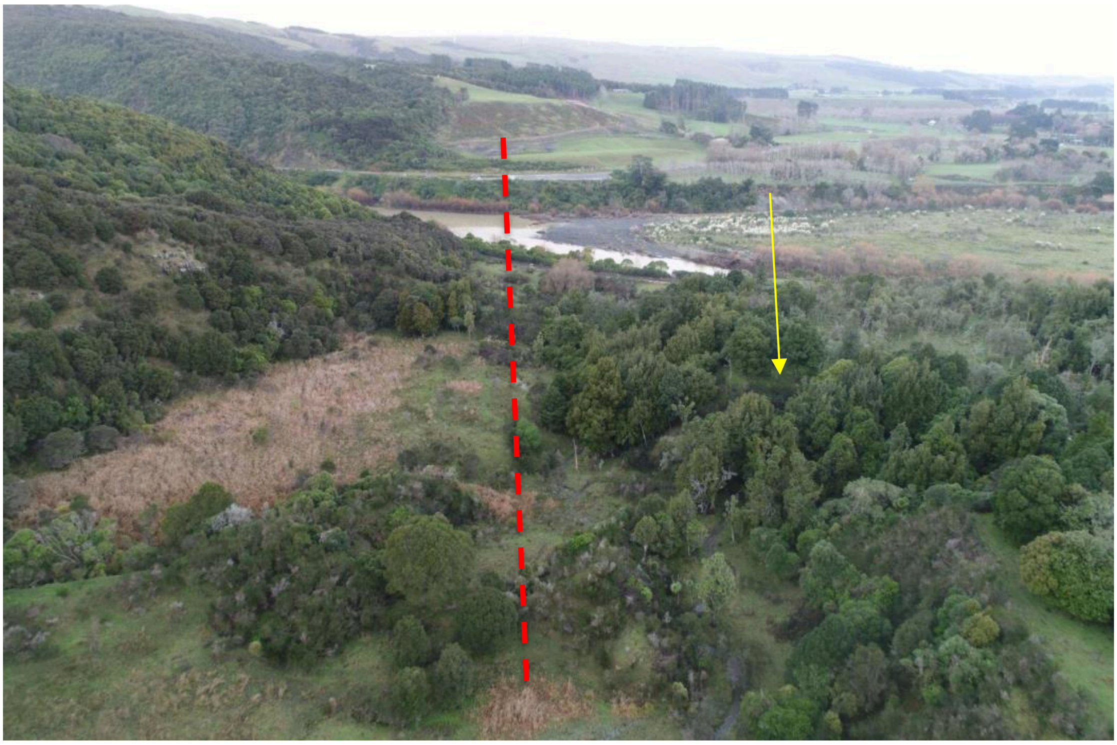

Figure 28. Looking south down the gully on the northern side of the Manawatū River to Moutuere Island and the proposed location of the new bridge across the Manawatū River (dashed line). Flat terrace marked on Figure 27arrowed here.

Figure 29. One of several rock faces in the small valley immediately north or the confluence

Figure 30. The gully within the Project route north of the Manawatū River and west of the Manawatū Gorge Scenic Reserve

Figure 31. The unnamed stream within the gully north of the Manawatū River

Figure 32. Looking south towards the confluence of the Manawatū and Pohangina Rivers along the Project route in the Ruahine Ranges

Figure 33. Looking west towards Ashhurst and the Pohangina River from the Te Āpiti Wind Farm

Figure 34. Looking west from the Woodville alluvial flats in the vicinity of the Project route on the eastern side of the Ruahine Ranges

Figure 35. Looking east across the alluvial flats from the base of the Ruahine Ranges towards Woodville township in the vicinity of the Project route

CONCLUSIONS

Effects of the project

80. This historic heritage assessment considers the actual and potential effects of the Project on archaeological and other historic heritage values. Historical sources were researched, the results of previous archaeological investigations were reviewed, and a field survey was carried out.

81. There should be no constraints on the proposed construction of the Project on archaeological or historic heritage grounds.

82. NZ Transport Agency conducted an MCA of 18 route options, which involved a consideration of the Project's investment objectives, environmental and social impacts and capability of being implemented. A number of recorded archaeological sites were identified, some of these significant, in the general area of the various options. The MCA process also identified areas where there was potential for unrecorded sites. As a result, route options were designed or modified so as to not affect recorded sites.

83. In the west, the location of the Project route and new bridge at the mouth of the Manawatū Gorge was designed so as to cross immediately south and east of Moutere Island, and avoid the significant archaeological site T24/32 Parahaki Kāinga (village)/Burials. The design of the new bridge is yet to be confirmed, and it will be important for the design to consider the cultural significance of the area.

84. The Project route alignment will cross the existing SH3, the Manawatū River and Palmerston North to Gisborne Railway line at the mouth of the Manawatū Gorge via a new bridge. Because they are of pre-1900 construction, the current road and railway are both archaeological sites under section 6 of the HNZPTA. However, the Project should have no direct effects on these structures.

85. No other archaeological or other historic heritage features were identified within the footprint of the Project route. Therefore, there are no effects of the Project on known archaeological and other historic heritage values.

86. In any area where archaeological sites have been recorded in the general vicinity, it is possible that unrecorded subsurface remains may be exposed during development. There is potential for other unrecorded sites relating to pre-European and historic Māori settlement to be located along the banks of

the Pohangina and Manawatū Rivers. Historical research supported by the archaeological record confirms that the river terraces were a favourable location by Māori for settlement and gardening. Therefore, it is recommended that an Heritage NZ Authority is applied for prior to the start of earthworks so that potential delays can be avoided should sites be exposed.

87. It is considered that there is only a low potential of unrecorded sites through the steep and rugged Ruahine Hills between Ashhurst and Woodville. However, given the large scale earthworks required for this Project and, taking Māori settlement patterns into consideration (which usually included a broad territory or rohe, usually focused along the major rivers and tributaries, but with access to numerous inland resources (mara)), there is some potential to encounter archaeological remains in this area of the Project footprint. However, these are unlikely to be archaeologically significant, given that this area was generally unsuitable for intensive Māori settlement.

88. Archaeological features and remains can take the form of burnt and fire cracked stones, charcoal, rubbish heaps including shell, bone and/or 19th century glass and crockery, ditches, banks, pits, old building foundations, artefacts of Māori and early European origin or human burials.

89. In the event of kōiwi tangata (human remains) being uncovered, work should cease immediately in the vicinity of the remains and the tangata whenua, HNZPT, the NZ Police and relevant District Council should be contacted so the appropriate arrangements can be made.

Māori cultural values

90. Again, as noted above, this is an assessment of effects on archaeological and other historic heritage values, and does not include an assessment of effects on Māori cultural values. Such assessments should only be made by the tangata whenua. Māori cultural concerns may encompass a wider range of values than those associated with archaeological sites.

91. The historical association of the general area with the tangata whenua is evident from the recorded sites, traditional histories and known Māori place names.

Archaeological value and significance

92. The archaeological value of sites relates mainly to their information potential, that is, the extent to which they can provide evidence relating to local,

regional and national history using archaeological investigation techniques, and the research questions to which the site could contribute. The surviving extent, complexity and condition of sites are the main factors in their ability to provide information through archaeological investigation. For example, generally pā are more complex sites and have higher information potential than small midden (unless of early date). Archaeological value also includes contextual (heritage landscape) value. Archaeological sites may also have other historic heritage values including historical, architectural, technological, cultural, aesthetic, scientific, social, spiritual, traditional and amenity values.

93. The Project area has no known archaeological value or significance as no sites were identified within the Project route, either through background research or field survey. However, the western end of the Project route is located near the confluence of the Manawatū and Pohangina Rivers, and within a significant archaeological landscape associated with intensive and continuous Māori settlement that was focused along these important rivers. There is potential for other unrecorded sites relating to pre-European and historic Māori settlement to be located along the banks of the Pohangina and Manawatū Rivers within the Project route. Historical research supported by archaeological research indicates that unrecorded sites could include Māori kāinga, pā and gardening sites.

94. The route alignment and bridge will be located immediately to the south and east of Moutere Island, and recorded archaeological site T24/32 Parahaki Kāinga (village)/Burials which is said to have been the home of Te Awe Awe (Rangitāne). This site has been evaluated according to the relevant statutory criteria and has been scheduled for protection on the PNDP (Schedule 17B).

95. The potential for unidentified subsurface remains in the steep inland hill country of the Ruahine Ranges is considered to be low but cannot be ruled out, although any remains are unlikely to be archaeologically significant given that this area was generally unsuitable for intensive Māori settlement.

96. The existing SH3 Manawatū Gorge road and the Palmerston North to Gisborne Railway line fall within the definition of an archaeological site in Section 6 of the HNZPTA. The current road through the Gorge has high heritage values (Historical, Social, Technological, Contextual, Amenity), however, its information or archaeological potential is limited (and it is not being affected by the Project).

RECOMMENDATIONS

97. There should be no major constraints on the proposed development on archaeological grounds, as no known archaeological or other historic heritage sites will be affected, and the possibility that archaeological remains may be present can be appropriately mitigated through the provisions of the HNZPTA.

98. In the west the Project route and new bridge over the Manawatū River and Palmerston North to Gisborne Railway Line at the mouth of the Manawatū Gorge will be located immediately to the south of Moutere Island and recorded site T24/32. It is recommended that the design of the new bridge (which is yet to be confirmed), should consider the archaeological and cultural significance of this area and ensure this area is avoided from any impact.

99. Conditions of consent are proposed to address the accidental discovery of archaeological sites and kōiwi tangata. The possibility of discovering archaeological remains can be provided for by putting procedures in place ensuring that the District Councils and HNZPT are contacted should this occur, in accordance with the NZ Transport Agency's Accidental Archaeological Discovery Specification (P45). P45 may be modified for the Project following consultation with tangata whenua, which is considered to be appropriate.

100. Because it is likely that subsurface archaeological features will be exposed during development, an Authority should be applied for under section 44(a) of the HNZPTA as a precaution prior to the start of earthworks. This would establish appropriate procedures for the management of any archaeological remains discovered, reducing the potential for delays during the development process. It should be noted that once an Authority from HNZPT is in place, the NZ Transport Agency's Accidental Archaeological Discovery Specification (P45) would no longer apply, as the conditions of the Authority would take precedence.

101. In the event of kōiwi tangata (human remains) being uncovered, work should cease immediately in the vicinity of the remains and the tangata whenua, HNZPT, NZ Police and the relevant Council should be contacted so that appropriate arrangements can be made.

102. While the future status of the Manawatū Gorge itself is not directly relevant to this Project, the significant heritage values of the existing SH3 road through the Manawatū Gorge should be recognised and these features should be retained as part of any revoking process of State Highway status. Options for heritage recognition and adaptive reuse of the road should be investigated.

103. Since archaeological survey cannot always detect sites of traditional significance to Māori, such as wāhi tapu, the tangata whenua should be consulted regarding the possible existence of such sites on the property.

Dr Rod Clough

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5.A
SITE HISTORIC BACKGROUND

APPENDIX 5.A: HISTORIC BACKGROUND

European settlement

Ashhurst

1. Situated west of the Manawatū Gorge, the area of Ashhurst was originally acquired by the Crown with the purchase of the Ahuaturanga Block, or Upper Manawatū Block, in July 1864 (**Figures 1 and 2**).[1] The Crown paid £12,000 to the chiefs of Rangitāne, Ngātikauwhata and Ngātitumokai for the 250,000 acre parcel which included land on both sides of the Manawatū River.[2] A number of Reserves were placed upon the deed and receipt of the Crown payment was received at Raukawa, near the western entrance to the Manawatū Gorge, by Te Hirawanu and Hoani Meihana in August 1864.[3]

2. In the early 1870s, a portion of the Ahuaturanga Block (including what is now Ashhurst) was purchased from the Crown (together with part of the neighbouring Rangitikei-Manawatū Block) by Colonel William Feilding, for £75,000.[4] The section, named the Manchester Block, comprised 106,000 acres and was bought on behalf of the Emigrant and Colonists' Aid Corporation which had been established to assist the immigration of British working class people, particularly farm labourers, to New Zealand (**Figures 3 and 4**).[5] The Corporation negotiated an agreement with the New Zealand Government whereby it committed to bring 2,000 immigrants to the new colony before 1 April 1877 in return for the cost of their passage, accommodation upon arrival, and the provision of one year's employment for 200 men.[6] Settlements within the Manchester Block included Feilding, Halcombe and Ashhurst (at the easternmost end), which was named after Henry George Ashhurst, a director of the Emigrant and Colonist's Aid Corporation (**Figure 5**).[7] Ashhurst was surveyed at a clearing in the bush, known as Otangaki in 1877, and the township was given several English street names (including Winchester Street, Wyndham Street, Worcester Street and Lincoln Street) which would have created some familiarity for new British immigrants.[8] Overall, the Manchester Block settlement scheme was

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[1] H. Hanson Turton, Māori Deeds of Land Purchases in the North Island of New Zealand: Volume Two, Wellington, 1878, p.179.
[2] Ibid.
[3] Ibid.
[4] M.H. Holcroft, The Line of the Road: A History of Manawatū County, 1876-1976, Dunedin, 1977, p.6.
[5] Ibid.
[6] Ibid.
[7] Ibid, p.7; Malcolm McKinnon, 'Manawatū and Horowhenua places - Halcombe to Ashhurst', Te Ara - the Encyclopedia of New Zealand, http://www.TeAra.govt.nz/en/Manawatū-and-horowhenua-places/page-3 (accessed 18 January 2018).
[8] Ibid.

an early success and by mid-1877 the block had attracted around 1600 settlers.[9]

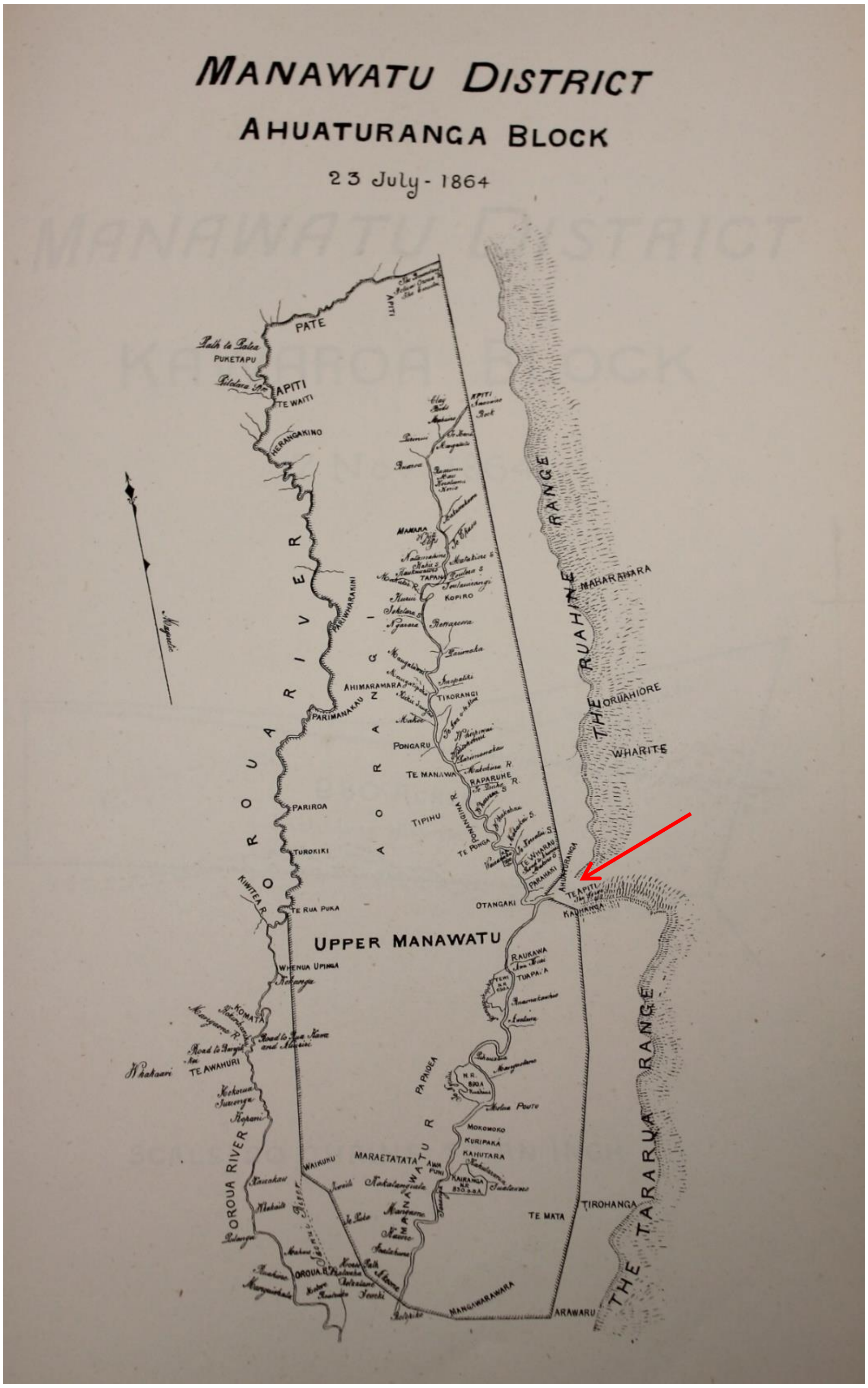

Figure 1. Plan of the Ahuaturanga Block, with the western entrance to the Manawatū Gorge arrowed in red, which was purchased by the Crown in 1864. (source: H. Hanson Turton, *Plans of Land Purchases in the North Island of New Zealand. Volume Two: Provinces of Taranaki, Wellington and Hawke's Bay*, Wellington, 1878, np)

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[9] Holcroft, p.7.

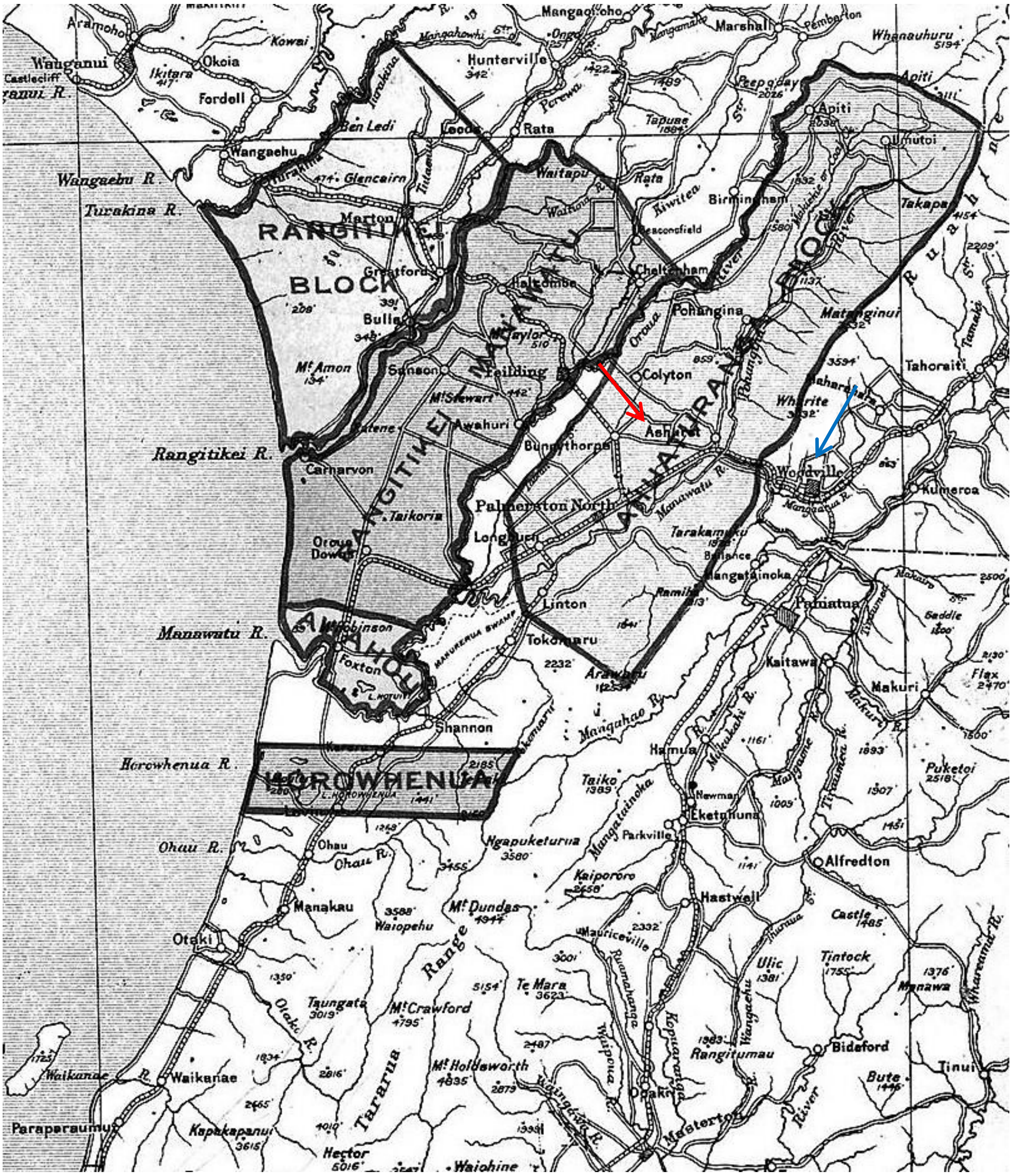

Figure 2. Close-up of map showing land blocks in the Manawatū and Horowhenua purchased by the Crown, including the Ahuaturanga Block. Ashhurst is arrowed in red and Woodville in blue. (source: T.L. Buick, *Old Manawatū: or, The Wild Days of the West*, Christchurch, 1975, np)

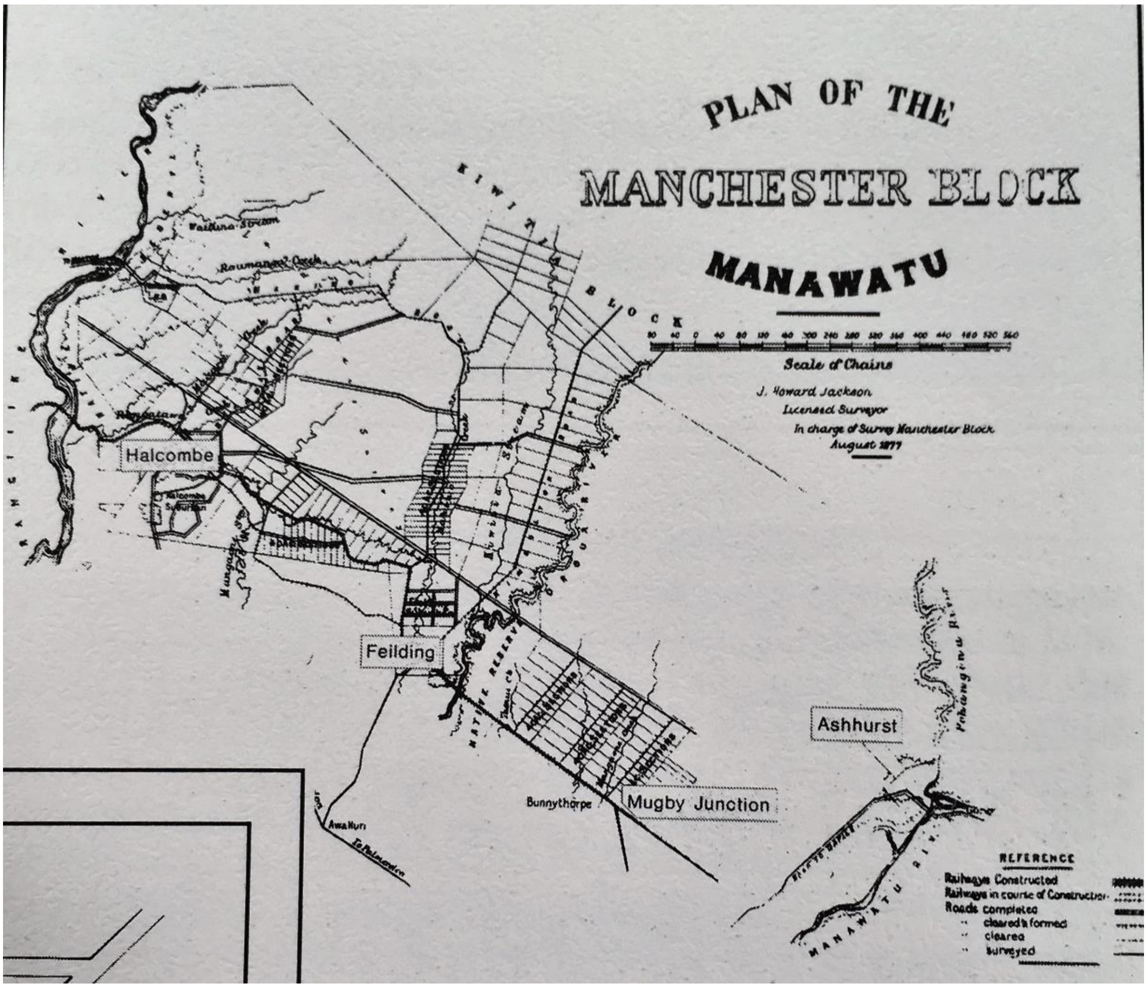

Figure 3. Plan of the Manchester Block, Manawatū, dated August 1877 with Ashhurst indicated. (source: B.G.R. Saunders (ed.), *The South of the North: Manawatū and its Neighbours*, Palmerston North, 2000, p.21)

Figure 4. Plan of the Manchester Block, dated 1878, with the township of Ashhurst arrowed in red. (source: MDC 00486 1-2, Archives Central, www.archivescentral.org.nz)

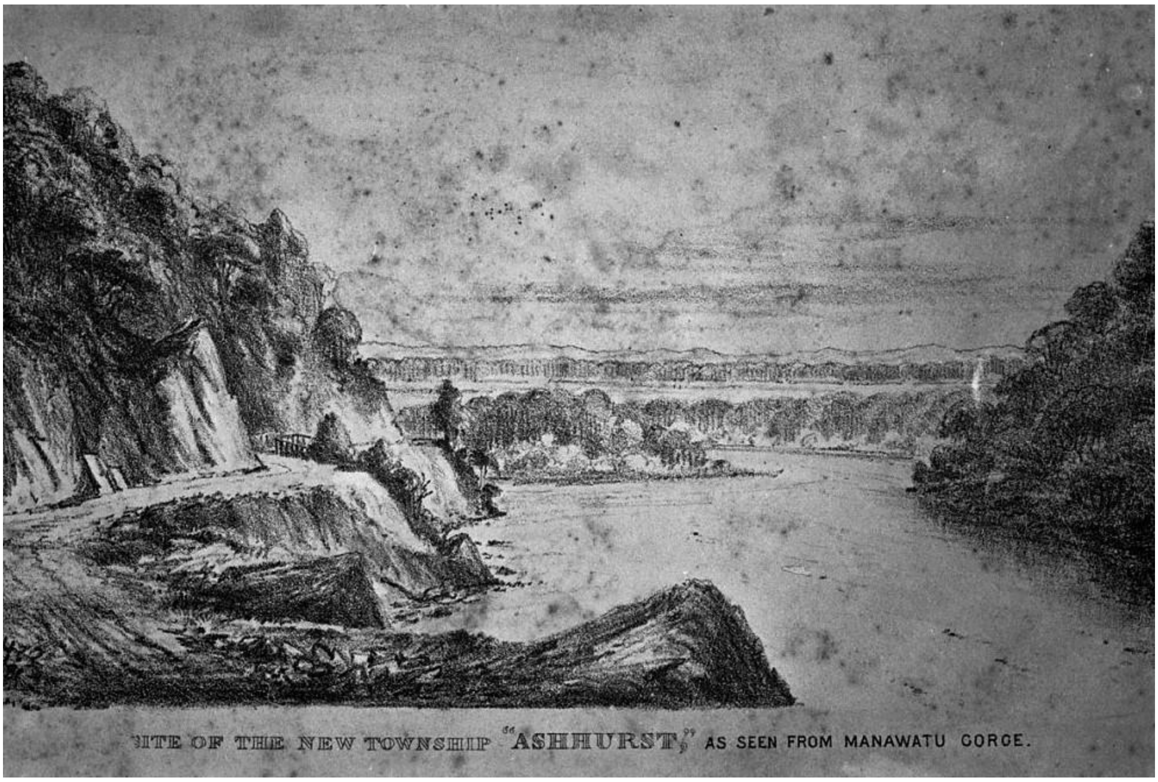

Figure 5. Sketch by Mrs Halcombe, dated ca. 1878, showing the site of the new township 'Ashhurst' as seen from the Manawatū Gorge. (source: PHOTO ASH:P, Feilding Library, Manawatū District Council)

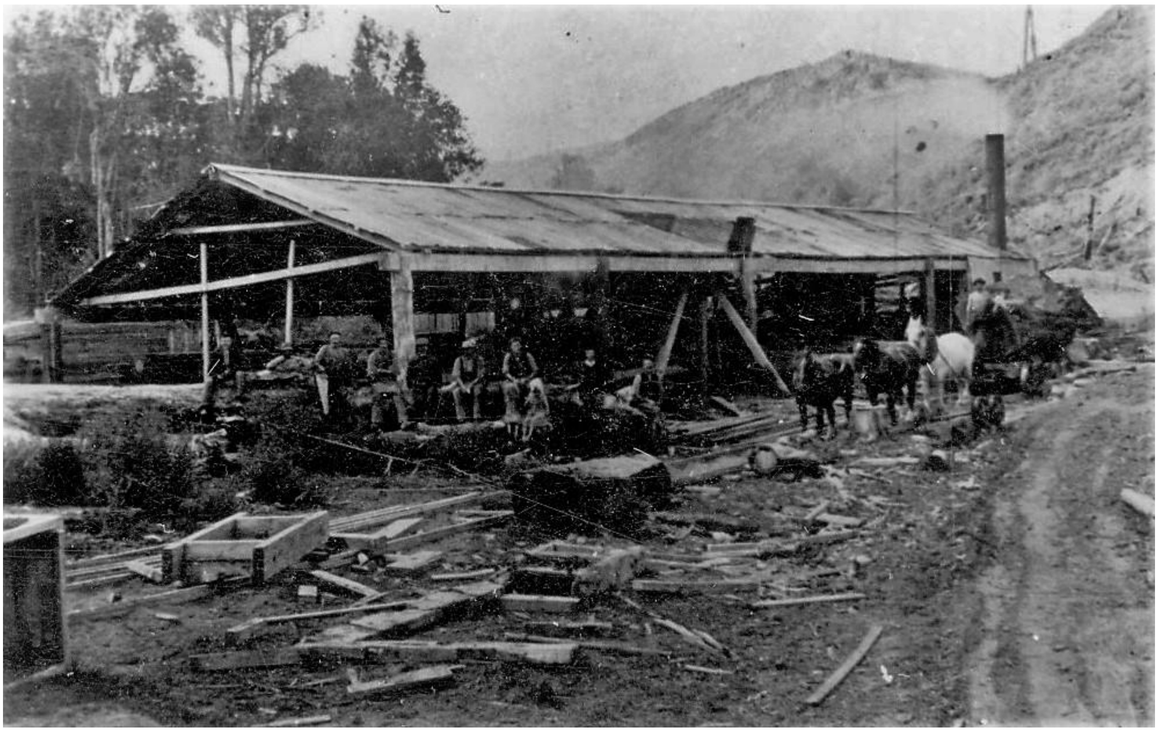

Figure 6. Photograph, dated ca.1890, showing a sawmill near Ashhurst. (source: PHOTO CLE76, Feilding Library, Manawatū District Council)

3. A number of the early British immigrants to settle in and around Ashhurst came from the counties of Buckinghamshire and Middlesex. Most had worked as farm labourers which was an advantage in a landscape where farming became the primary occupation.[10] The township served as the base for those involved in developing the fertile Pohangina Valley and D.A. Wills noted that *"the work of colonising progressed in this part of the block very rapidly"*.[11] Timber extraction was necessary to clear the nearby areas for farmland and Ashhurst became a depot for the trade (**Figure 6**), with the *Manawatū Times* reporting in October 1878:

> *"Mr Halcombe, the Agent of the Feilding Corporation, has made arrangements with Mr Bartholomew, for the erection of a saw mill at the new township of Ashhurst, and we also learn that it is his intention to erect cottages and settle two hundred immigrants upon the land in close proximity. The timber is in an almost inexhaustible supply in the vicinity, including totara and other kinds of the very best quality…"*[12]

4. By 1879, the township of Ashhurst had increased significantly, with houses numbering in the dozens and the metal road through to Feilding offering reliable transportation links as well as being 'one of the most picturesque in the country'.[13] Ashhurst also lay on the main Coach road from Palmerston North to Napier and was near the main railway line between Whanganui and Napier (**Figure 7**).[14] Waterway access was also possible, and the proximity of the township to the Manawatū Gorge and the junction of the Pohangina and Manawatū Rivers led passengers on the Napier coach to remark that *"it seems specially designed by nature for the site of an important town"*.[15]

5. In March 1879, 120 acres of land at Ashhurst were subdivided into quarter-acre sections and a coach was put on daily from Feilding so that prospective buyers 'might have the benefit of inspection'.[16] Mr McKenzie, of the Otangaki Hotel, intended to secure a corner section for the erection of a larger hotel to accommodate the increased numbers of travelling public.[17] Bartholomew's sawmill, on the Pohangina Road, likely attracted both permanent and itinerant

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[10] Douglas A. Wills, *Ashhurst School 85th Jubilee 1879-1965*, Palmerston North, 1965, p.30.
[11] Ibid, p.32.
[12] *Manawatū Times*, 16 October 1878, p.2.
[13] *Manawatū Times*, 15 February 1879, p.2.
[14] *Wanganui Herald*, 24 February 1879, p.3.
[15] Ibid.
[16] *Manawatū Times*, 19 March 1879, p.2.
[17] Ibid.

workers, with around 18 workers employed in 1879. Large logs, mainly of totara and matai, were hauled to the mill by a team of bullocks where an estimated 20,000 feet of timber were produced each week.[18] A two-room school was erected on Pohangina Road (now Cambridge Avenue) at Ashhurst in 1879 and that same year a Post Office was set up in Mr C. Crichton's local store (**Figure 8**).[19] The Ashhurst Railway Station was later opened in 1892 which serviced two trains daily each way. The timber industry was in slow decline by this date and goods through the station primarily comprised general merchandise and wool (**Figure 9**).[20] Entertainment for residents of Ashhurst and the surrounding area was also supplied with the erection of the Theatre Royal in 1893. The theatre and concert hall was built by Messrs Rimmer and Craven and comfortably accommodated 400 patrons.[21]

6. Maps and photographs from the late 1880s and 1890s indicate the pace of Ashhurst's growth during this time, with the land subdivided into both large and small holdings, and various businesses lining the main streets of the township (**Figures 11 to 14**). In 1896 the *Otago Witness* wrote:

> *"Arcadian Ashurst [sic] lies in a basin formed of the eastern slopes of Manawatū's western terraces and the western fall of the main, chain, intercepted a mile or so south by the celebrated Manawatū Gorge. It is situate on the Palmerston-Woodville railway, equidistant between Palmerston- North westward and the go-ahead agricultural township and district of Pohangina, nine miles to the north-east. Two decades ago, Ashurst was unknown, the locality being a wild, trackless forest of giant pines. Now, the country is open and the shades of the forest banished for the sunlit, smiling farms of the hardy settlers, who raise cattle and sheep and grow grain and prosper".*[22]

7. At the turn of the century Ashhurst continued to prosper. A summary of the township was provided in the *Cyclopaedia of New Zealand [Taranaki, Hawke's Bay and Wellington Provincial Districts]* in 1908 with the following:

> *"ASHHURST is a rising township in the centre of a saw-milling district, nine miles from Palmerston North and ninety-six miles north by rail from*

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[18] Ibid.
[19] Wills, pp.1 & 35.
[20] Ibid, p.35.
[21] Ibid.
[22] *Otago Witness*, 23 April 1896, p.17.

Wellington, in the county of Oroua. The land is mostly level, and is suitable for both grazing and cropping. The chief industries are dairying, agriculture, and saw-milling. The roads in the district are good, there is native and imported game in the neighbourhood, and trout fishing may be obtained. The Manawatū Gorge is in the vicinity, and is the attraction of numerous visitors to the town. The township has several churches, a public school, a post and telegraph office, a public hall, two hotels, a branch bank, besides several fine business houses. A coach runs daily to Pohangina from Ashhurst".[23]

8. New businesses in Ashhurst in the early 1900s included Purcell and Ovenden, tailors and costumiers, who established their shop along the Main Street in 1907, and Messrs. Ashcroft, Kirkham and Company, General Provision Merchants, who acquired an old established business located in the 'Corner Store' (an extensive two-storeyed wooden building) in 1906 (**Figure 15**).[24]

9. Farming (particularly dairying), forestry and tourism from the nearby Manawatū Gorge continued to sustain Ashhurst well into the 20th century and a further description of the town is given ca.1930:

"Ashhurst is a farming and dairying centre in the Oroua County, 8 ¾ miles north-east from Palmerston North. It is situated at the junction of the Pohangina and Manawatū Rivers, not far from the western entrance to the Manawatū Gorge. It may be reached by train or by good road from Palmerston North or Woodville. The town has a population of about 700, the main industries of the district being dairying, cropping and saw-milling. The Ashhurst Domain, prettily situated right on the banks of the Pohangina River, is a favourite picnic resort. It contains some pretty native bush. Swings, etc., have been provided for children. There is a Public Library at Ashhurst, also a State School, and two hotels. Good trout fishing may be had at the Pohangina and Manawatū Rivers …"[25]

[23] The Cyclopaedia Company Limited, The Cyclopaedia of New Zealand [Taranaki, Hawke's Bay and Wellington Provincial Districts], Christchurch, 1908, p.716.
[24] Ibid.
[25] Wills, p.36.

Figure 7. Photograph, dated ca.1890, showing the Ashhurst to Palmerston North passenger coach. (source: 2007N_Hor33_EPN_0274, Palmerston North Libraries and Community Services)

Figure 8 Photograph, dated ca.1895, showing Ashhurst School with teachers and pupils. (source: 2014P_Sc153_007747, Ian Matheson City Archives, Palmerston North Libraries and Community Services)

Figure 9. Photograph, dated 1981, showing the Ashhurst Railway Station which was opened in 1892. (source: 2007P_Ash13_ASH_0761, Palmerston North Libraries and Community Services)

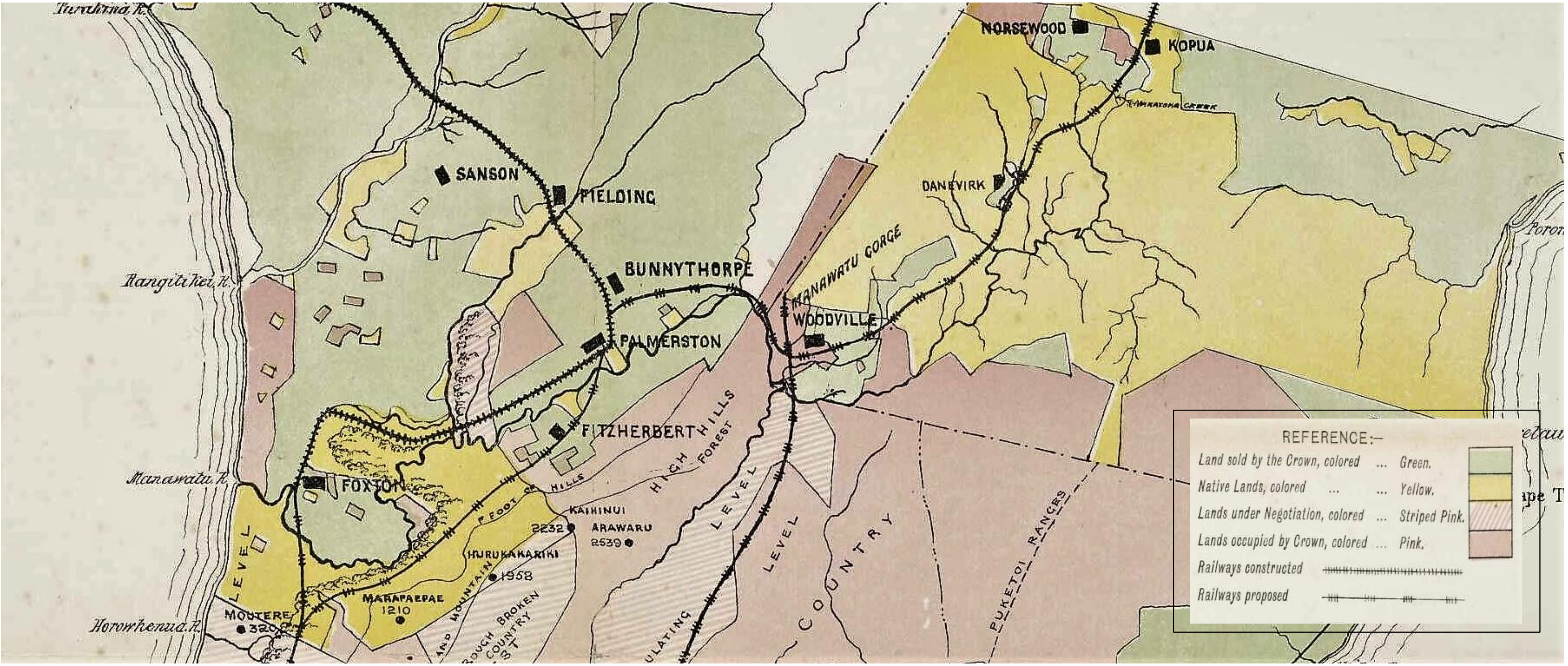

Figure 10. Close-up of map, dated 1880, showing lines of railway constructed, in course of construction, and proposed. (source: Printed as a supplement to "The New Zealand Times," Friday, April 2, 1880, Alexander Turnbull Library)

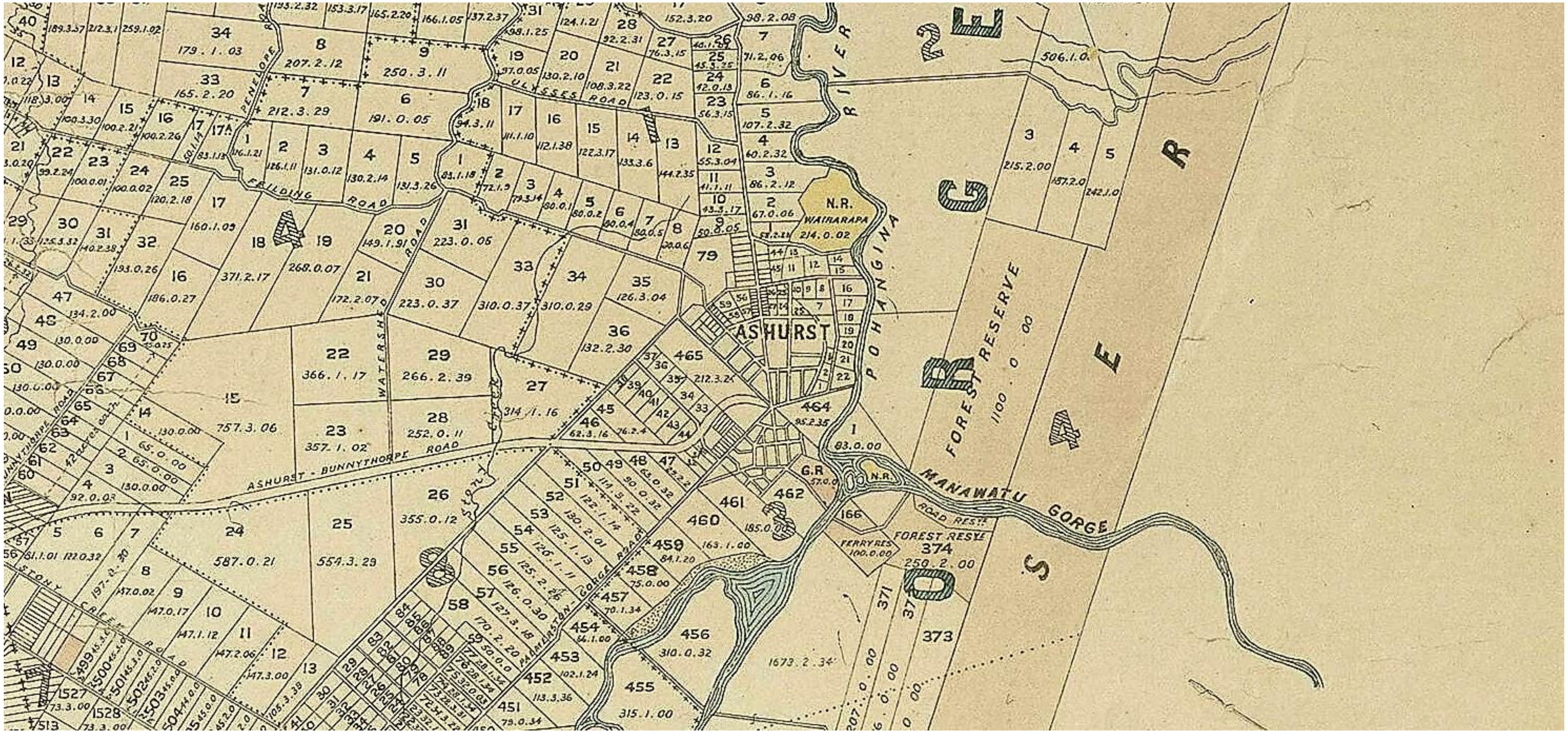

Figure 11. Close-up of map of the Manawatū-Rangitikei district, dated 1887, showing the township of Ashhurst and the Manawatū Gorge area. (source: Map of the Manawatū-Rangitikei district [cartographic material]: comprising the Manawatū, Oroua and part of the Horowhenua counties, provincial district of Wellington, New Zealand / compiled and published by F. Harold Tronson, Alexander Turnbull Library)

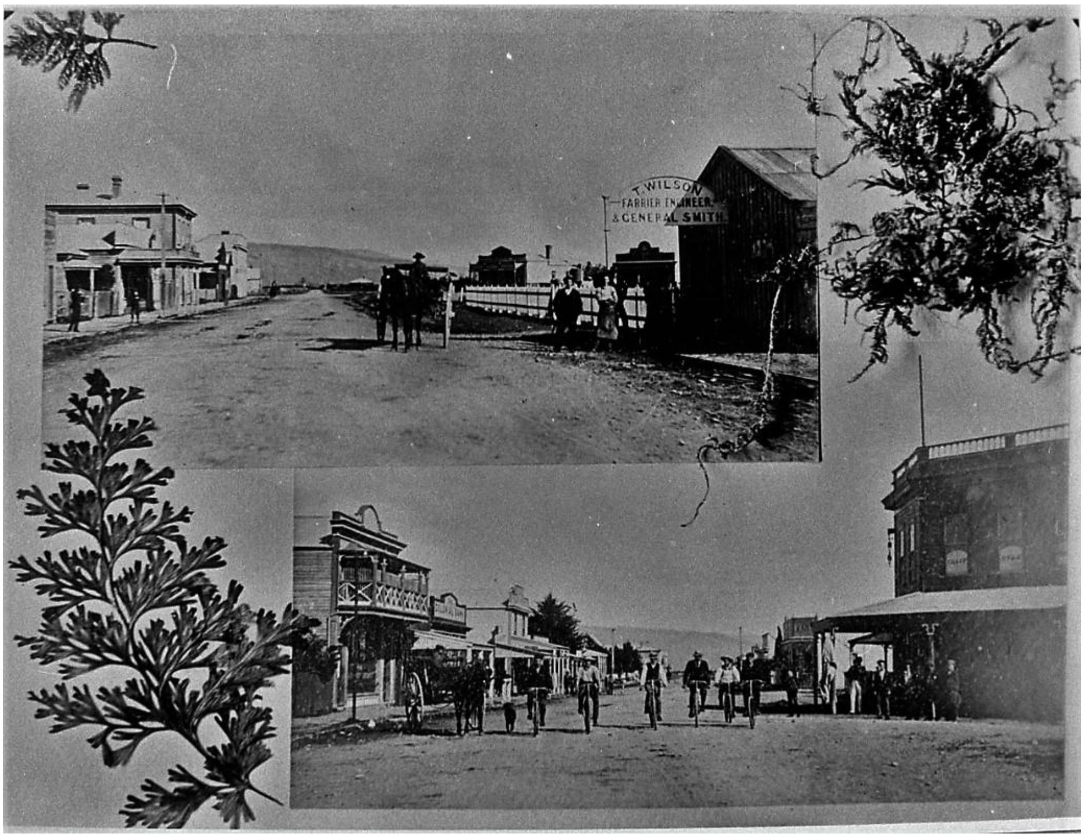

Figure 12. Photograph collection, dated ca.1895, showing views of Cambridge Avenue, Ashhurst. (source: 2007N_Ash1_ASH_0751, Palmerston North Libraries and Community Services)

Figure 13. Photograph, dated ca.1897, showing businesses along one of Ashhurst's main roads. (source: PHOTO ASH:2, Feilding Library, Manawatū District Council)

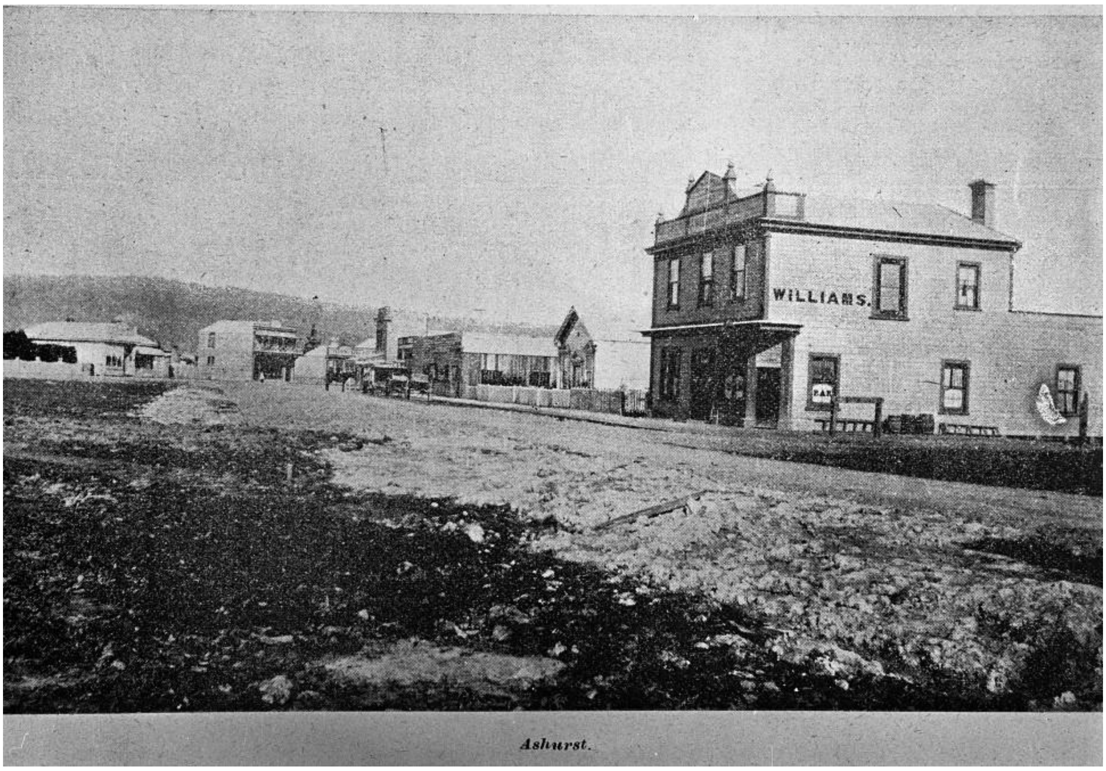

Figure 14. Undated photograph, showing businesses along one of Ashhurst's main roads. (source: PHOTO ASH:1, Feilding Library, Manawatū District Council)

MESSRS. A. J. KIRKHAM & CO.'S PREMISES.

Figure 15. Photograph, dated ca.1908, showing Messrs. Kirkham and Co.'s premises, General Provision Merchants, the Corner Store, Ashhurst. (source: The Cyclopaedia Company Limited, *The Cyclopaedia of New Zealand [Taranaki, Hawke's Bay and Wellington Provincial Districts]*, Christchurch, 1908, p.716)

Area north-east of confluence of Manawatū and Pohangina Rivers

10. During the 19th century Māori occupation sites were frequent along the Manawatū and Pohangina Rivers. The waterways were utilised as a means of transportation links and provided access to various food resources. A plan of the Ahuaturanga block, dated 1864, indicates the Māori names of several small rivers and streams, particularly along the Pohangina, and identifies several occupied locations along the river including Raparuhe, Te Ponga, Te Wharau, and Parahaki (**Figure 16** and see **Figure 1**). Few recorded details could be sourced relating to these areas; however, the Parahaki kainga is known to have been established on a small island (as set out above, the island named Parahaki is also known as Moutere Island) at the mouth of the Manawatū Gorge (at the confluence of the Manawatū and Pohangina Rivers). Burials were also conducted at Parahaki and the following account was recalled by Wi Duncan, who travelled down the Manawatū Gorge in 1872:

> *"On that occasion a party of about 20 of us, including my adopted father, Hemi Arama, and my mother, left Forty Mile Bush in three canoes to attend the Native Land Court at Foxton, and when we arrived at the entrance to the Gorge, the Europeans told us that the river was running very high in flood, and that any attempt to go through would assuredly end in disaster. However, my father decided to take the risk, so all the women and children were placed on shore to walk, and he, together with a Māori woman, paddled off. I wanted to go with my father, and sat [sic] in the stern of the canoe, but I had to get out with the others. The canoe had not gone very far when it was caught in the rapids and both the occupants drowned. We were told the news when we arrived at a spot between the two tunnels. As we had calculated upon getting right through to Jackey-town that day, we had no provisions with us, but gratefully accepted the hospitality of the Europeans, who gave us sufficient food to sustain us. On the following day we found the body of my father and buried him on Parahaki".*[26]

11. Claims to the title of Parahaki were heard by the Māori Land Court in 1879 and 1880, with an accompanying plan produced to illustrate the land formation (**Figure 17**). The site was later subdivided into two blocks and surveyed by W.G. Nelson in 1928 (**Figure 18**).

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[26] *Manawatū Times*, 26 August 1924, p.8.

12. Following the purchase of the Ahuaturanga Block, and later the creation of the Manchester Block in the 1870s, further communication links in and around the Manawatū Gorge area were constructed to aid European settlement. T.L. Buick notes:

> *"Ever since settlement had begun, the Tararua and Ruahine Ranges had formed a serious barrier to communication between the East and West Coasts. Although the Gorge divided them, the water-way was not always practicable, and for the overland journey only steep and tortuous native paths were available.[27] The first practical step towards securing better communication was the cutting of a cattle track over the Ahuaturanga spur, which joined a similar work on the Hawke's Bay side, but it was not until 1867 that an effort was made to form a track along the precipitous, bush-covered sides of the Gorge. In September of that year, Mr J.T. Stewart, who was in charge of the roads and surveys of the district, went through the Gorge in a canoe, and afterwards reported to Dr Featherston that it was possible to construct a road along the river bank without climbing the ranges, and thus secure almost level communication from east to west. With commendable promptitude he received instructions to put his scheme into execution, and he appointed a meeting with Mr Weber, who had charge of the road lines on the eastern side of the range, and together they fixed the level and the point of connection at the eastern entrance to the Gorge".*[28]

[27] One of these crossed the Tararuas a little to the south of the Gorge, starting from the Raukawa pā on the Manawatū side.
[28] Buick, 1975, pp.358-359.

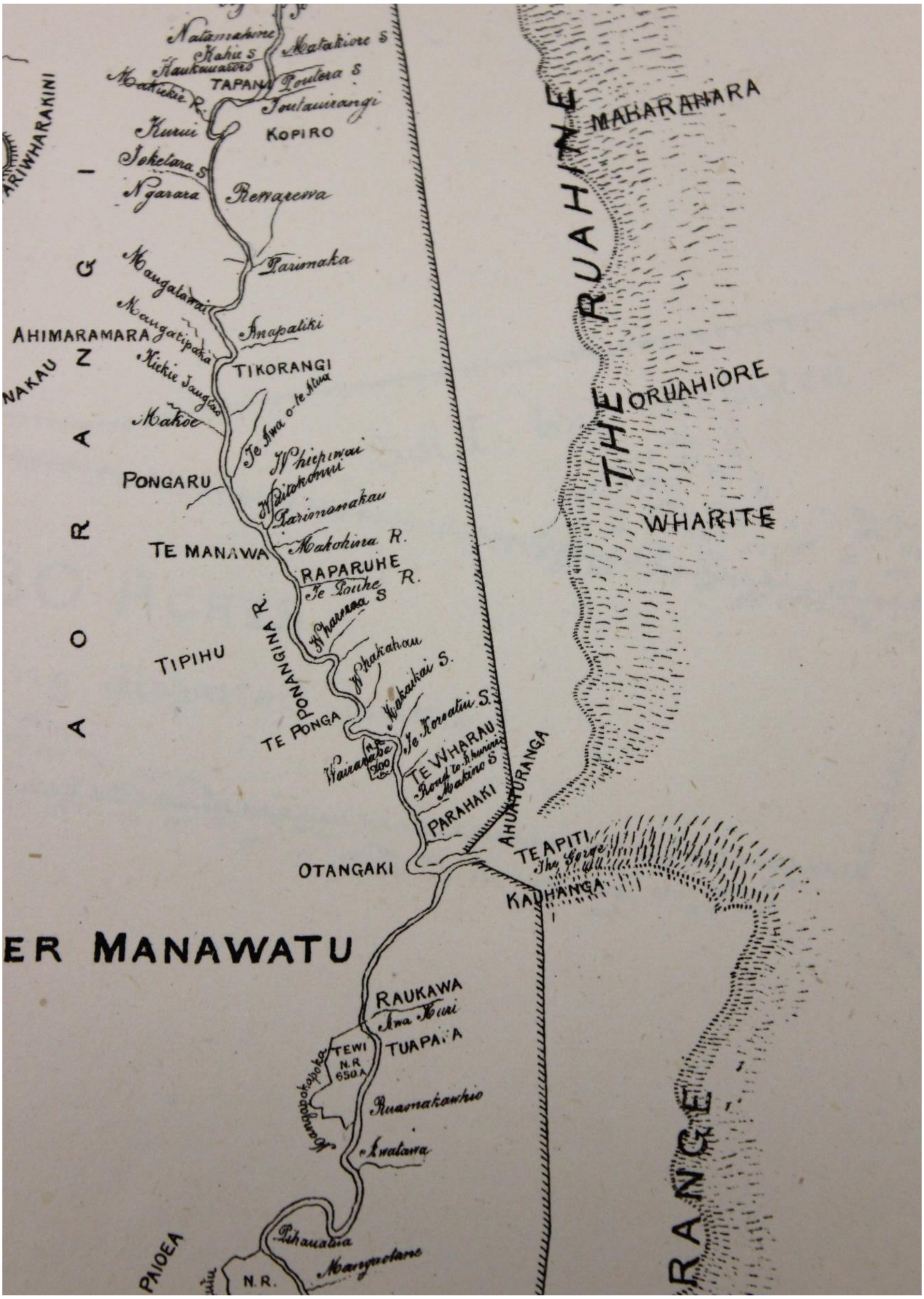

Figure 16. Close-up of the Ahuaturanga Block, which was purchased by the Crown in 1864, showing Māori place names at the confluence of the Manawatū and Pohangina Rivers. Note: 'S' denotes stream and 'R' denotes river. (source: H. Hanson Turton, *Plans of Land Purchases in the North Island of New Zealand. Volume Two: Provinces of Taranaki, Wellington and Hawke's Bay*, Wellington, 1878, np)

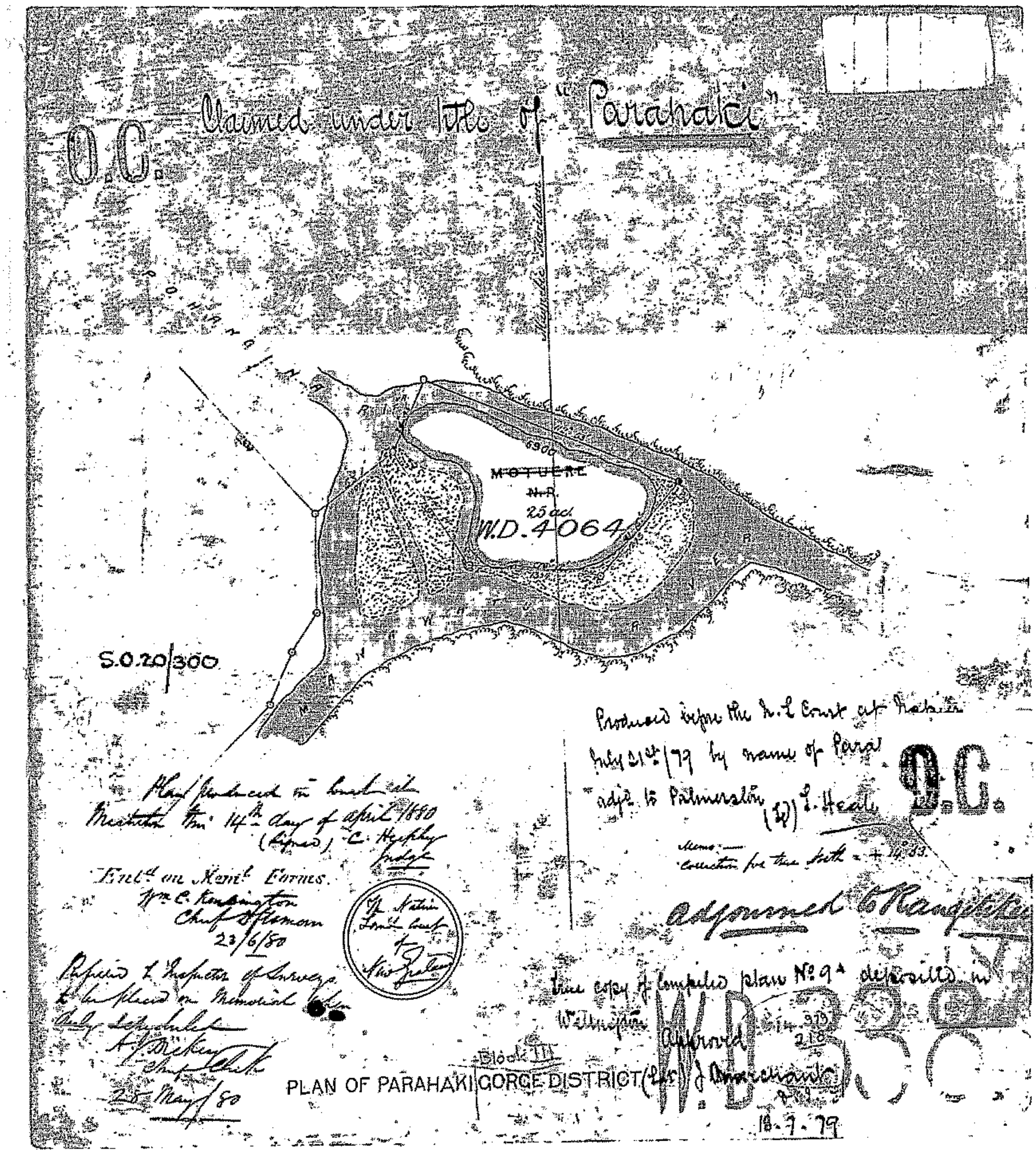

Figure 17. ML 338, dated ca.1879-1880, showing the island known to Māori as Parahaki at the confluence of the Manawatū and Pohangina Rivers. This plan was presented during the Māori Land Court hearings to determine the title to the land. (source: Quickmap)

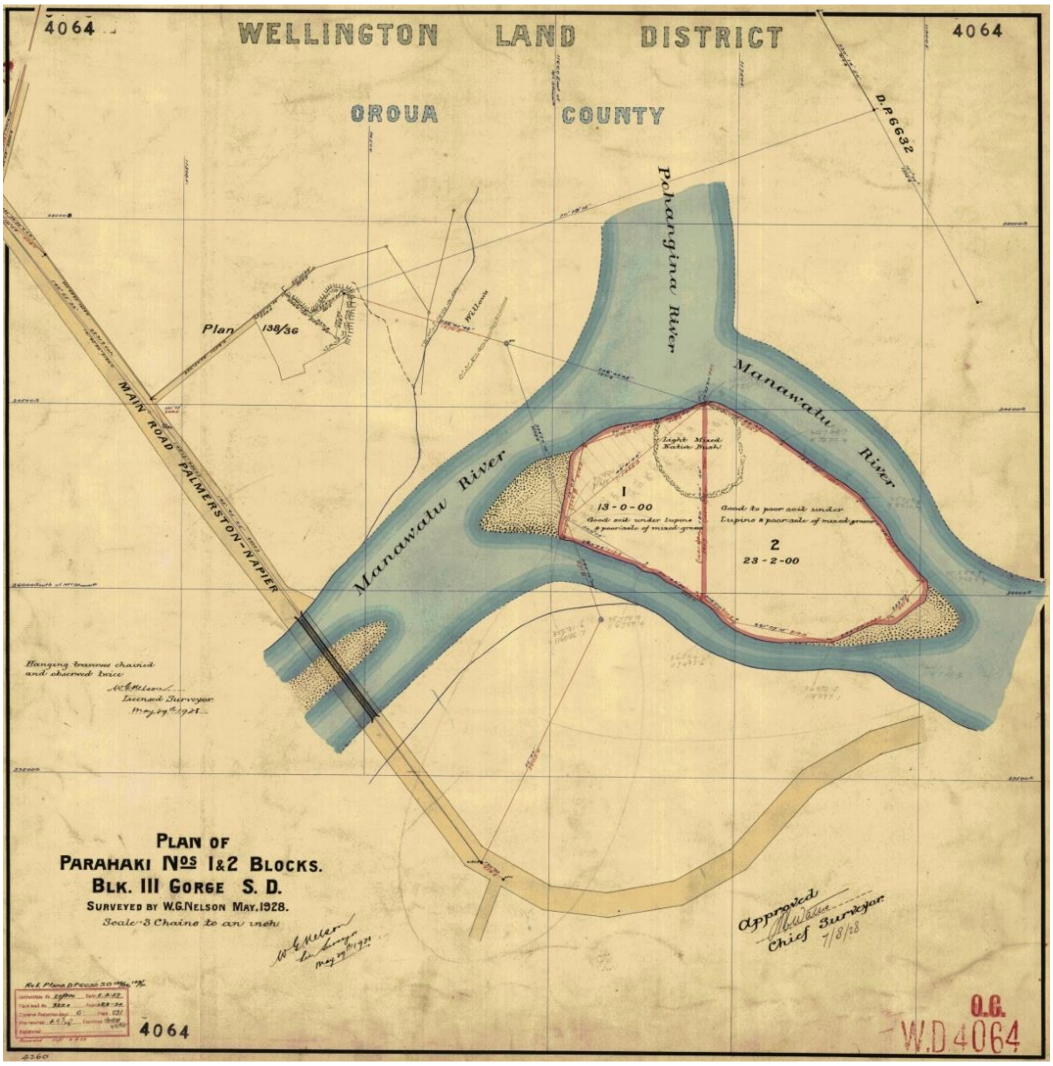

Figure 18. ML 4064, dated May 1928, showing the subdivision of Parahaki. (source: Quickmap)

13. After preliminary work bush felling, the formation of the Manawatū Gorge road was commenced in March 1871 and completed in 1872. The Upper Gorge Bridge was constructed in 1875 and provided coach communication to the Hawkes Bay.[29] Railway transport through the Manawatū Gorge was also planned in the late 19th century with the railway line from Napier through the Gorge finished in 1891. The link of railway between Eketahuna and Woodville was later completed in 1897, giving Palmerston North communication with Wellington via the East Coast.[30] The construction of the Gorge road is a story that involves both Māori and European labour, with Māori used to clear vegetation while gangs of Europeans worked on the road.

14. In order to facilitate these railway projects various tracts of land were set aside under the Public Works Act, including an 83 acre parcel, located to the

[29] Ibid, pp.359-360; *Evening Post*, 28 August 1931, p.7.
[30] *Evening Post*, 28 August 1931, p.7.

north east of the confluence of the Pohangina and Manawatū Rivers (north of Parahaki), which was gazetted for railway purposes in 1880 (**Figures 19 and 20**, and see **Figures 27 and 29**). Further land to the east was gazetted as Railway Reserve alongside the Gorge in 1890 (**Figure 21**, and see **Figure 29**).

15. Forest Reserve north and south of the Manawatū Gorge, along the line of the Tararua and Ruahine Ranges, was created by the Crown from the 1880s. On 13 August 1885, a Forest Reserve comprising 1,100 acres was gazetted under the Land Act, 1877.[31] The parcel was located to the north of the Manawatū Gorge and formed part of the Ahuaturanga Block. Neighbouring land to the east was also included in a large Crown Forest Reserve, set aside for the growth and preservation of timber, which was gazetted in 1881 (**Figure 22** and see **Figure 11**).[32] By 1892 steps were taken to have portions of the Forest Reserve on the Ashhurst side of the Ruahine Range opened up for settlement, and in August that same year the *Woodville Examiner* reported:

> *"Anyone would think that considering the quiet way in which the members of a Small Farm Association to be called the Ashurst [sic] Ruahine have acquired a block of land of 3000 acres, towering above Ashurst as it were, that the days of the Inquisition were returning. It's a matter of congratulation to think that there are in Ashurst a body of men, who, by exercising a certain amount of tact and reticence, have been enabled to acquire this block of land so prominent to Ashurst. I allude to the Forest Reserve adjoining Mr Akers back boundary, but immediately overlooking this township"*.[33]

16. In September 1892, it was further noted that the Minister of Lands had agreed to withdraw all restrictions from the Forest Reserve on the Pohangina side of the Ruahine Range *"to enable the block to be divided between Woodville and Ashurst [sic] Special Settlement Associations"*[34] Surveys of the land were carried out from 1897, although it remains unclear how the area was utilised during the late 1890s to early 1900s.[35] A later survey of Sections 1-11, Blocks 2 and 4, Gorge Survey District, was undertaken in

[31] *New Zealand Gazette*, 6 August 1885, p.953.
[32] *New Zealand Herald*, 13 June 1881, p.4.
[33] *Woodville Examiner*, 20 August 1892, p.2.
[34] *Woodville Examiner*, 1 September 1892, p.2.
[35] *Feilding Star*, 17 March 1897, p.2.

1915 and, in 1917, 66-year leases were issued by the Crown for Sections 8, 10 and 11 under the Soldiers Settlement Act, 1915 (**Figures 23 to 25**).[36]

17. In 1878, a sizeable area of more than 3234 acres was granted to the Emigrant and Colonists' Aid Corporation Ltd under the Immigration and Public Works Act 1870 and the subsequent amendment act of 1871 (**Figure 26**).[37] The land comprised Section 2 of Subdivision X within the Manchester Block, and its position to the north east of the confluence of the Manawatū and Pohangina Rivers is surveyed on DP 239 (**Figure 27**).[38] A lease for the parcel was issued for a term of five years to Frederick, John and Alexander Whibley in 1885.[39] The brothers were all settlers from nearby Ashhurst and they retained the lease until 1887 when it was transferred to William Akers, a sheep farmer.[40] Clearance of extant timber from the property may have been undertaken to facilitate farming by the Emigrants' and Colonists' Aid Corporation Ltd prior to the allocation of leaseholds, or by the lessees themselves. According to the 1885 Public Works Statement, the Whibley Brothers of Ashhurst entered into a contract with the government to deliver 1,000 sawn totara sleepers, for railway purposes, with a completion date of 4 March 1886.[41] The brothers were also involved in sheep farming, and this was likely how the property was utilised by William Akers when he took over the lease in 1887, although in 1888 the *Woodville Examiner* noted that "There is a good deal of bush being felled this season, and in the Pohangina district Mr W. Akers has had about 600 acres felled".[42] By 1891 the *Feilding Star* wrote:

> *"The agricultural returns will show a large increase in land under cultivation and grass at this end of the Manchester Block this year, but unfortunately the burns are bad. I notice two fires to-day. They must be bad too. Surely people ought to wait a few days to give it a chance of drying. Mr Akers, who has burnt 1100 acres on the subdivision X, commences sowing grass seed to-day. He has the whole of that fine block, consisting of 3300 acres, felled and grassed"*.[43]

18. Few other details are known about Akers' block throughout the later 19th century; however, he is reported to have released around 4000 trout 'in the

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[36] WNC1/837, LINZ; WNC1/839, LINZ.
[37] WN29/91, LINZ.
[38] The Pohangina River forms the western boundary of the parcel.
[39] WN29/91, LINZ.
[40] WN29/91, LINZ.
[41] Appendices to the Journals of the House of Representatives (AJHR), 1885 7-D-1, p.25.
[42] *Woodville Examiner*, 12 November 1888, p.4.
[43] *Feilding Star*, 2 April 1891, p.3.

four principal creeks running into the Pohangina river between Ashurst and the Manchester boundary'[44] in 1891 and, in 1888, the *Feilding Star* recounted the following:

> *"According to information given us by Mr Thomas Nelson, Ashhurst seems to be in luck's way. For some time past it has been noticed that in one spot the vegetation has been remarkably green and luxuriant. The locality is on Mr W. Akers land across the Pohangina river, opposite Mr Grammer's. Some Māoris investigated the matter recently and on opening out the ground a little found it so warm that the hand could not be kept there. It is surmised that a hot spring may be developed in the locality and should this be the case Ashhurst will possess a valuable additional attraction"*.[45]

19. Akers became a leading figure in the Manawatū flax industry during the early 1900s, although it is unclear whether he attempted any flax production on his Manchester Block property.[46] By May 1901, William Akers managed properties at Ashhurst, Linton and a section on Tokomaru Road, and a newspaper notice warned against those trespassing with 'dog or gun … flaxmill hands are specially included in this notice - W. Akers'.[47] Akers transferred the leasehold on Lot 2, Section X, Manchester Block to Hugh Akers in 1907 and the land continued to be farmed by the family until well into the 20th century (**Figures 28 and 29**).[48]

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[44] *Woodville Examiner*, 22 October 1891, p.3.
[45] *Feilding Star*, 12 July 1888, p.2
[46] See: *Manawatū Herald*, 26 June 1900, p.3; *Wairarapa Daily Times* 16 April 1910, p.2; *Wairarapa Age*, 21 May 1910, p.6; *Manawatū Times*, 21 May 1910, p.7.
[47] *Manawatū Times*, 9 May 1901, p.3.
[48] WN29/91, LINZ.

Figure 19. SO 11605, dated 1880, showing Section 1, Subdivision X, Manchester Block, which was reserved for railway purposes. (source: Quickmap)

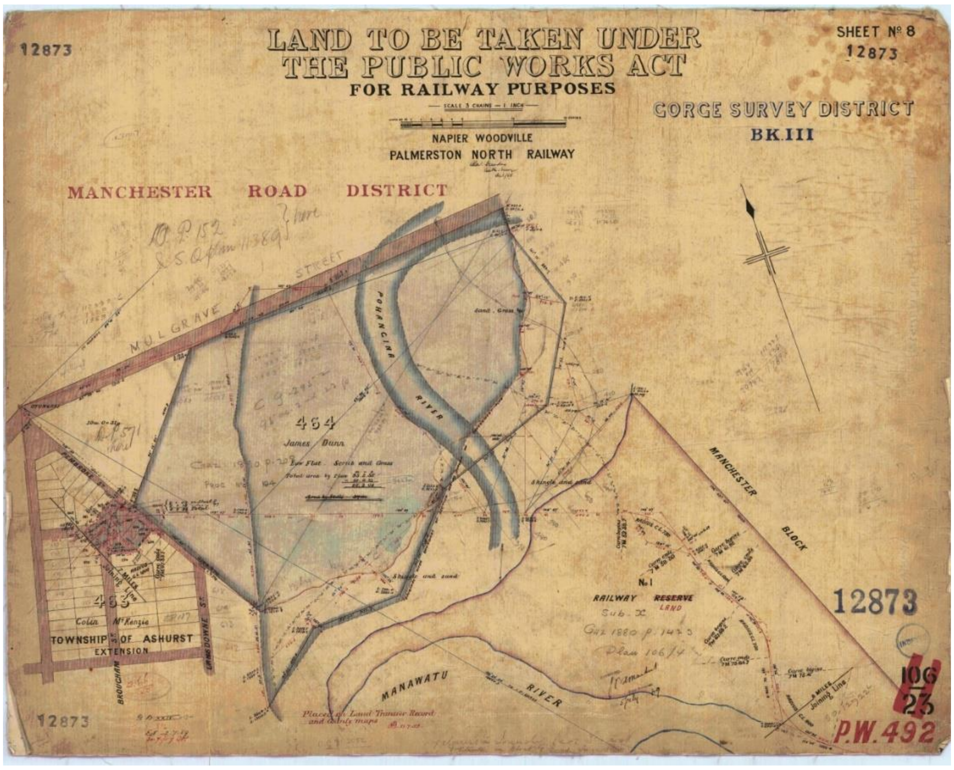


Figure 20. SO 12873, dated 1889, showing land to be taken under the Public Works Act for Railway Purposes adjacent to Railway Reserve Section 1, Subdivision X, Manchester Block. (source: Quickmap)

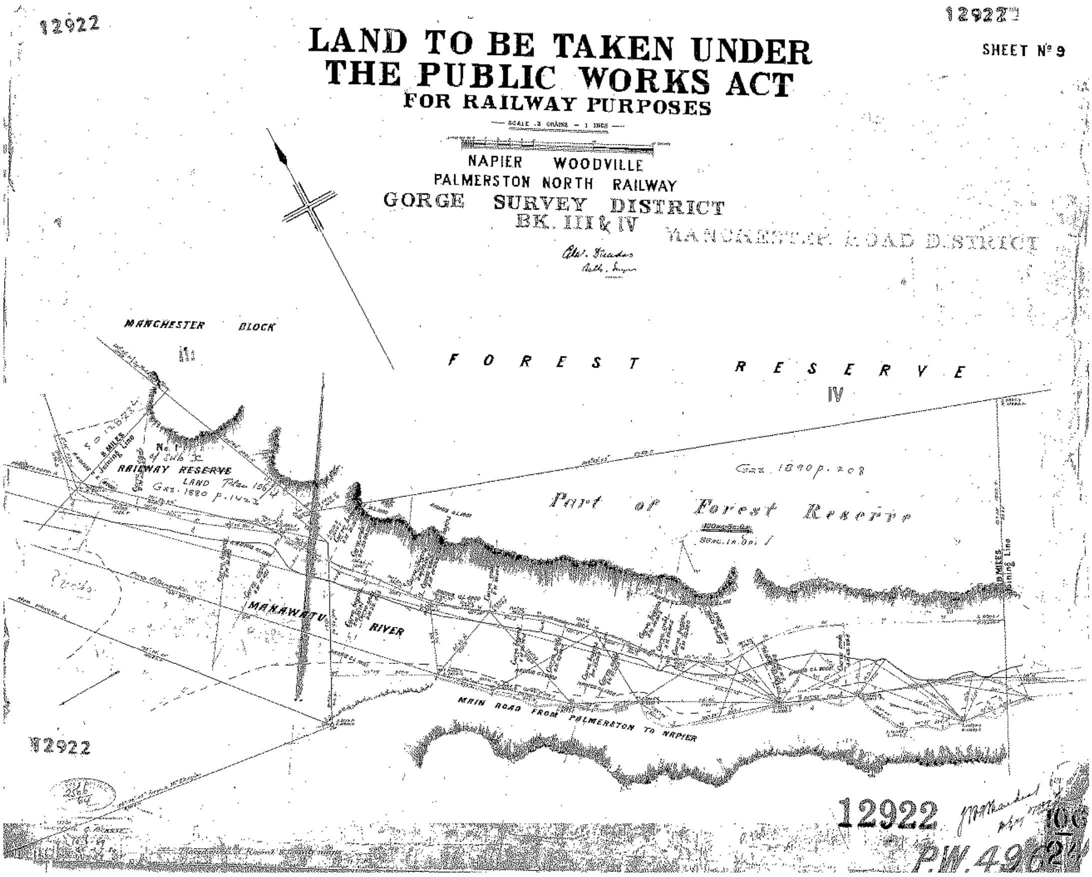


Figure 21. SO 12922, dated 1889, showing land to be taken under the Public Works Act for Railway Purposes alongside the Manawatū River and adjacent to Railway Reserve Section 1, Subdivision X, Manchester Block. (source: Quickmap)

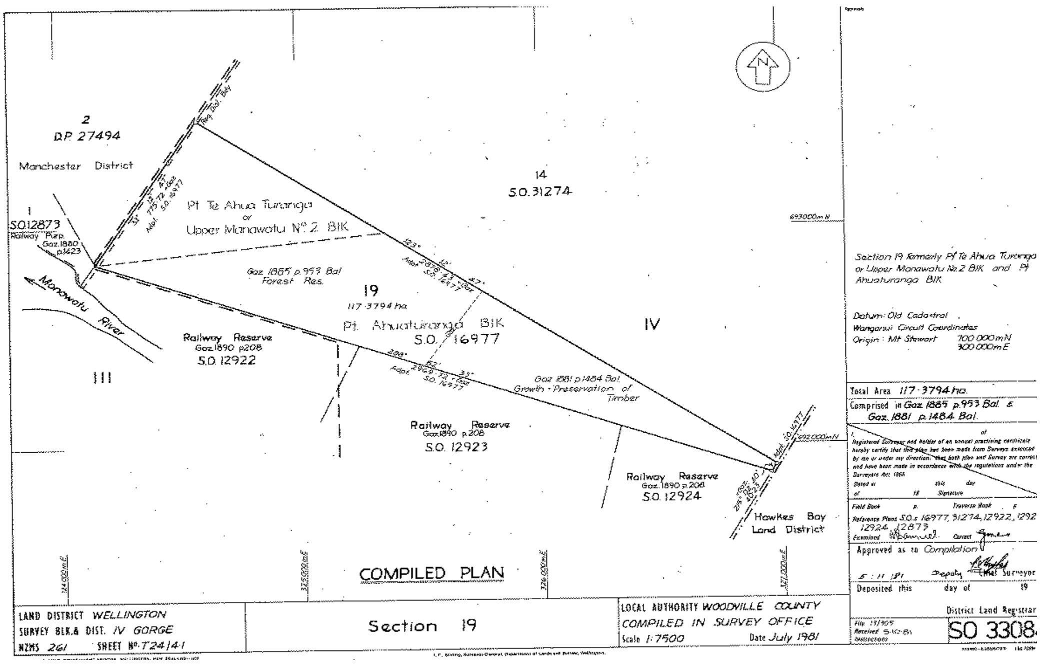


Figure 22. SO 33084, dated 1981, showing tracts of remaining Forest Reserve alongside the Manawatū Gorge (northern side). (source: Quickmap)

Figure 23. SO 16977, dated June 1915, showing Sections 1-11, Blocks 2 and 4, Gorge Survey District, to the north of Manawatū Gorge and east of Ashhurst. (source: Quickmap)

Reference:
Parent C/T.22A/175
N/C. Order No.
Lease No.
LOOSE LEAF CONVERSION

Land and Deeds 71

No. C1 / 839

REGISTER

CANCELLED

CERTIFICATE OF TITLE UNDER LAND TRANSFER ACT

LEASEHOLD

Registered Lease	Name of Lessor	Term of Lease	Lessor's Title:
No. 22A/175	Her Majesty The Queen under Section 4 of the Discharged Soldiers Settlement Act 1915. No.134.	66 years from 1.1.1917.	Vol. Folio

This Certificate dated the 10th day of February one thousand nine hundred and sixty-four under the seal of the District Land Registrar of the Land Registration District of WELLINGTON

WITNESSETH that J. & G. BOLTON LIMITED at Palmerston North

is seised of an estate of leasehold created by the lease particulars of which are set out above (subject to such reservations, restrictions, encumbrances, liens, and interests as are notified by memorials underwritten or endorsed hereon) in the land hereinafter described, delineated with bold black lines on the plan hereon, be the several admeasurements a little more or less, that is to say: All that parcel of land containing 632 ACRES 3 ROODS AND 1.7 PERCHES more or less being part of Section 11 Block IV of the Gorge Survey District

Assistant Land Registrar.

K. 474570 Compensation Certificate under Section 17 of the Public Works Amendment Act 1948 - 4.10.1960 at 1.46p.m.

A.L.R.

DISCHARGED
Mortgage 577880 to Edith May Honore, Elsie Maud Whiteman and Frederick Anders Niels Clausen in shares - 29.11.1963 at 9.59a.m.
A.L.R.

A.L.R.

Mortgage 651911 to The State Advances Corporation - 16.11.1965 at 10.30am

A.L.R.

Mortgage 676115 to National Mortgage and Agency Company of New Zealand Limited - 11.7.1966 at 11.20 a.m.

A.L.R.

Variation of Mortgage 651911 5.5.1969 at 11.58a.m.

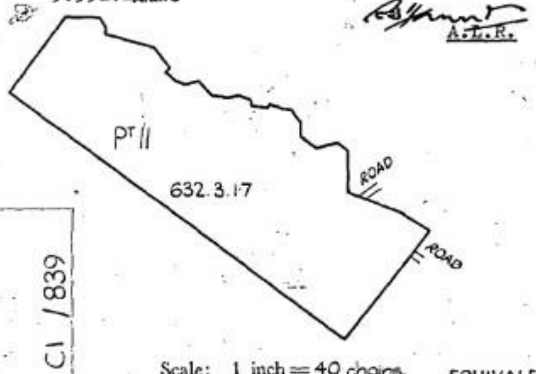
A.L.R.

Mortgage 123575.1 to Rural Banking and Finance Corporation - 23.7.1975 at 9.55 a.m.

L.R.

No. 216381.1 New Appellation, within land now known as Section 14 Block IV Gorge Survey District - 11.1.1977 at 1.40p.m.

A.L.R.



No. C1 / 839

Scale: 1 inch = 40 chains.

EQUIVALENT METRIC AREA IS 256.0691 ha

5,000/5/63—D9499 W

(OVER)

Figure 24. Certificate of Title (page 1 of 2) WNC1/839, dated 1917, showing details of the lease agreement for Section 11, Block 4, Gorge Survey District issued to J & G Bolton Ltd under the Soldiers Settlement Act 1915. (source: LINZ)

Reference:
Parent C/T. 22A/168
N/C. Order No.
Lease No.

Loose Leaf Conversion

Land and Deeds 71

REGISTER

No. C1 / 837

CERTIFICATE OF TITLE UNDER LAND TRANSFER ACT

LEASEHOLD

Registered Lease	Name of Lessor	Term of Lease	Lessor's Title:
No. 22A/168	Her Majesty The Queen under Section 4 of the Discharged Soldiers Settlement Act 1915 No. 137.	66 years from 1.1.1917.	Vol. Folio

This Certificate dated the 10th day of February one thousand nine hundred and sixty-four under the seal of the District Land Registrar of the Land Registration District of WELLINGTON

WITNESSETH that KENNETH WILLIAM JOHN BUSCH of Woodville Farmer

is seised of an estate of leasehold created by the lease particulars of which are set out above (subject to such reservations, restrictions, encumbrances, liens, and interests as are notified by memorials underwritten or endorsed hereon) in the land hereinafter described, delineated with bold black lines on the plan hereon, be the several admeasurements a little more or less, that is to say: All those parcels of land containing TOGETHER 772 ACRES 1 ROOD AND 27.1 PERCHES more or less being Section 8 and part of Section 10 Block IV of the Gorge Survey District

Assistant Land Registrar.

Proclamation 2559 defining the middle line of a road passing through the above described land - 10.6.1937 at 9.30a.m.

A.L.R.

EQUIVALENT METRIC AREA IS 312.5870ha

Scale: 1 inch = 40 chains.

Mortgage 345202 to The State Advances Corporation of New Zealand as varied by two memoranda of variation - 5.10.1955 at 11.9a.m.

A.L.R.

DISCHARGED
Mortgage 345203 to The State Advances Corporation of New Zealand - 5.10.1955 at 11
A.L.R.

A.L.R.

K 474569 Compensation Certificate under Section 17 of The Public Works Amendment Act 1948 - 4.10.1960 at 1.45p.m.

A.L.R.

Variation of Mortgage 345202 - 12.6.1967 at 2.00p.m.

A.L.R.

Variation of Mortgage 345202 - 18.6.1969 at 2.40 p.m.

A.L.R.

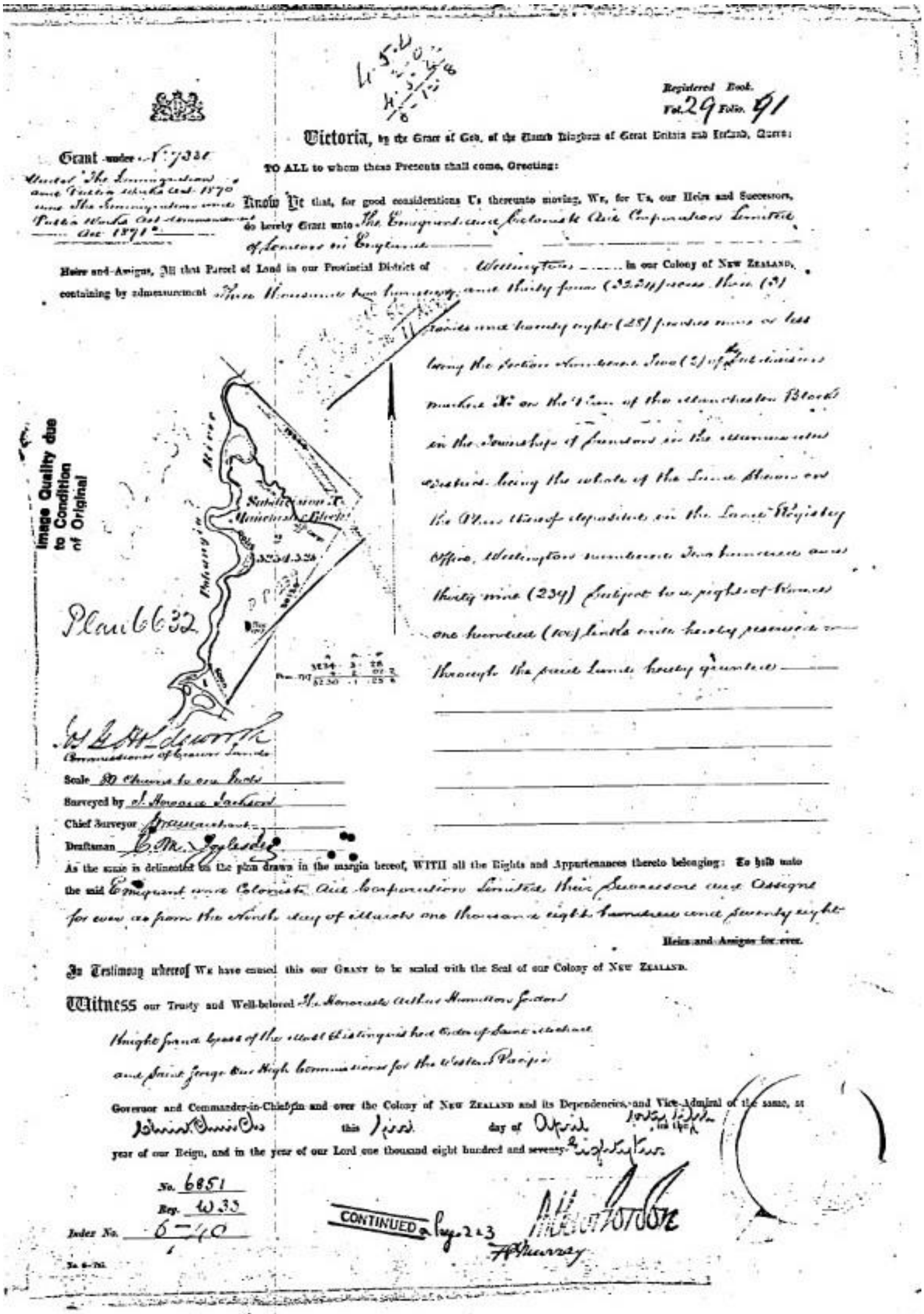
Variation of Mortgage 345202 - 6.12.1972 at 11.50 a.m.

A.L.R.

Register copy for L. & D. 69, 71, 72

No. C1 / 837

Figure 25. Certificate of Title (page 1 of 2) WNC1/837, dated 1917, showing details of the lease agreement for Sections 8 and 10, Block 4, Gorge Survey District issued to Kenneth W.J. Busch under the Soldiers Settlement Act 1915. (source: LINZ)


Registered Book.
Vol. 29 Folio. 91

Victoria, by the Grace of God, of the United Kingdom of Great Britain and Ireland, Queen:

Grant under N 7320
Under The Immigration and Public Works Act 1870 and The Immigration and Public Works Act Amendment Act 1871.

TO ALL to whom these Presents shall come, Greeting:

Know Ye that, for good considerations Us thereunto moving, We, for Us, our Heirs and Successors, do hereby Grant unto The Emigrant and Colonists Aid Corporation Limited of London in England

Heirs and Assigns, All that Parcel of Land in our Provincial District of Wellington in our Colony of New Zealand, containing by admeasurement Three thousand two hundred and thirty four (3234) acres three (3) roods and twenty eight (28) perches more or less being the Section numbered Two (2) of Subdivision marked X on the Plan of the Manchester Block in the Township of Feilding in the aforementioned District being the whole of the Land shown on the Plan thereof deposited in the Land Registry Office, Wellington numbered Two hundred and thirty nine (239) Subject to a right of way one hundred (100) links wide hereby reserved through the said land hereby granted

W S Haldsworth
Commissioner of Crown Lands

Scale 80 Chains to one Inch
Surveyed by J. Horace Jackson
Chief Surveyor
Draftsman C.M. Inglesbie

As the same is delineated on the plan drawn in the margin hereof, WITH all the Rights and Appurtenances thereto belonging: To hold unto the said Emigrant and Colonists Aid Corporation Limited their Successors and Assigns for ever as from the Ninth day of March one thousand eight hundred and seventy eight Heirs and Assigns for ever.

In Testimony whereof We have caused this our Grant to be sealed with the Seal of our Colony of New Zealand.

Witness our Trusty and Well-beloved The Honorable Arthur Hamilton Gordon Knight Grand Cross of the Most Distinguished Order of Saint Michael and Saint George Our High Commissioner for the Western Pacific

Governor and Commander-in-Chief in and over the Colony of New Zealand and its Dependencies, and Vice-Admiral of the same, at Christchurch this first day of April in the forty second year of our Reign, and in the year of our Lord one thousand eight hundred and seventy eight

No. 6851
Reg. W 33
Index No. 6-40

CONTINUED on Pages 2 & 3

A Gordon
A Murray

Figure 26. Certificate of Title (page 1 of 3) WN29/91, dated 1878, showing details of the grant for Section 2, Subdivision X, Manchester Block, alongside the Pohangina River and to the north-east of the confluence with the Manawatū River, issued to the Emigrant and Colonists' Aid Corporation Ltd under the Immigration and Public Works Act 1870 and the subsequent Amendment Act of 1871. (source: LINZ)

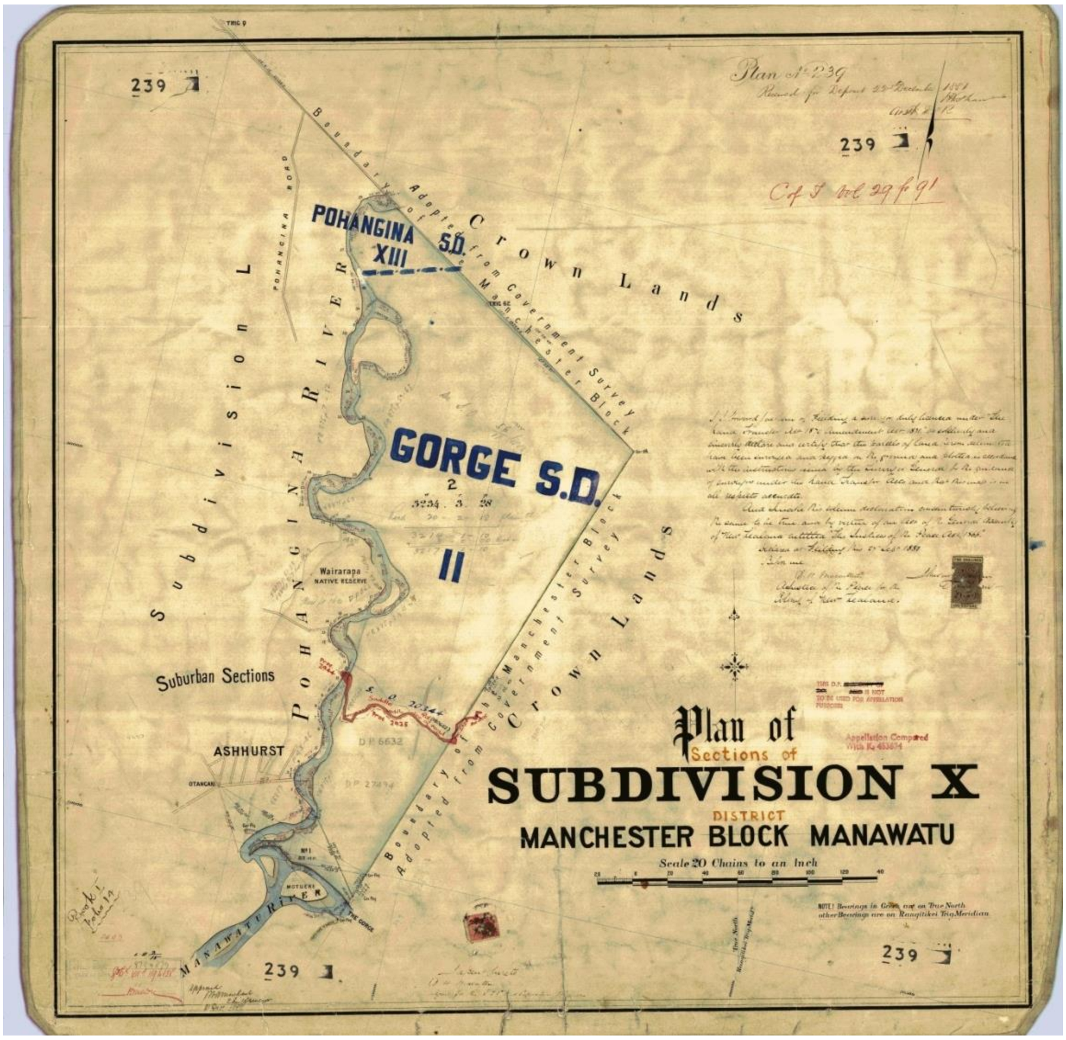


Figure 27. DP 239, dated ca.1881, showing Section 2, Subdivision X, Manchester Block alongside the Pohangina River and to the north-east of the confluence with the Manawatū River. (source: Quickmap)

Figure 28. DP 6632, dated December 1922, showing later subdivision of Section 2, Subdivision X, Manchester Block alongside the Pohangina River and to the north-east of the confluence with the Manawatū River. (source: Quickmap)

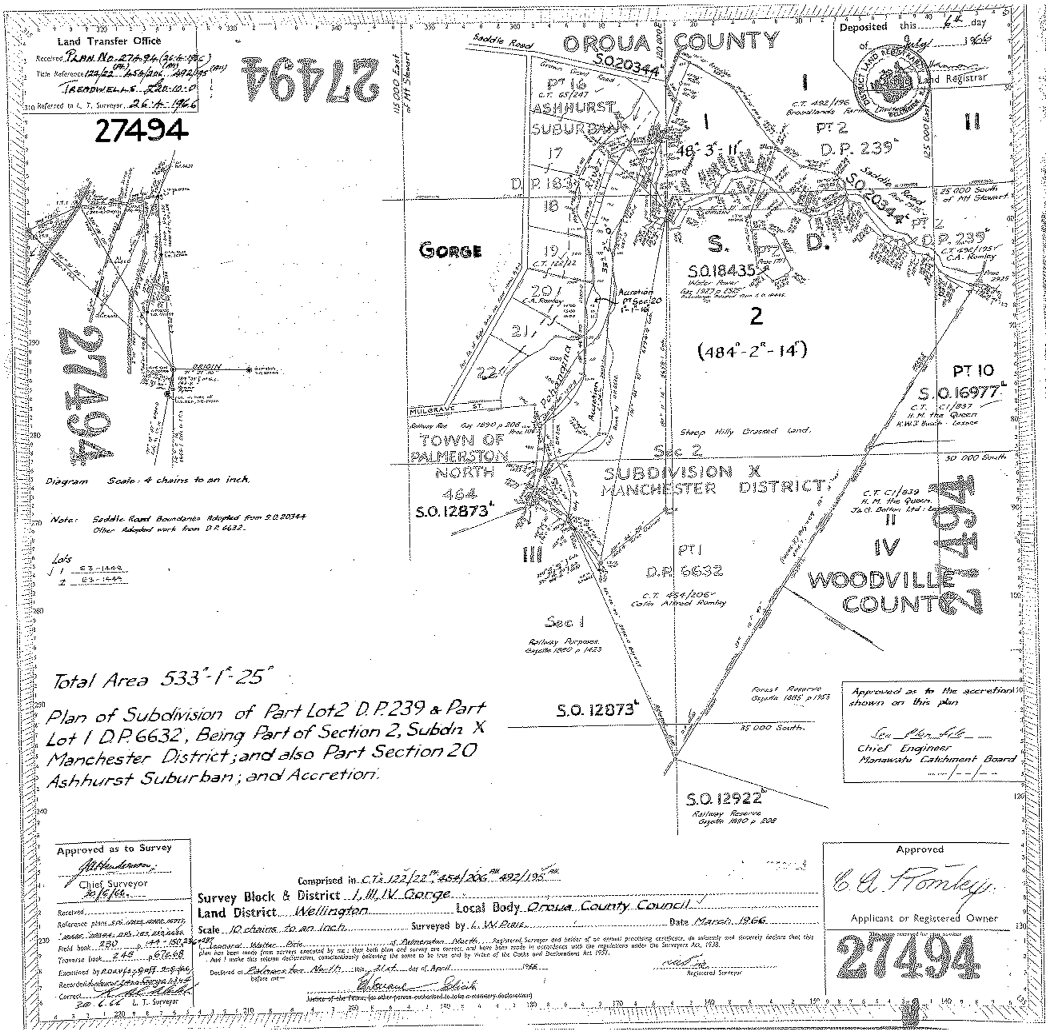


Figure 29. DP 27494, dated March 1966, showing later subdivision of Section 2, Subdivision X, Manchester Block alongside the Pohangina River and to the north-east of the confluence with the Manawatū River. (source: Quickmap)

Woodville

20. East of the Manawatū Gorge, the aptly named timber-milling township of Woodville was situated at the road and rail junction between the Wairarapa, Hawke's Bay, and Manawatū regions.[49] Its location provided the ideal place for settlement, and earned it the informal name: 'The Junction'.[50] In November 1874, suburban and rural sections at Woodville were offered for sale by the Napier Lands Office. The first of these lots sold in 1875 and many were taken up by road workers or those employed to construct the Hawke's Bay Railway.[51] Land sales continued throughout the 1870s,

[49] Part of this was due to the close proximity of Woodville to the main accessway of the Manawatū Gorge, through which a road was completed in 1871, a bridge in 1875, and a railway in 1891. Malcolm McKinnon, 'Manawatū and Horowhenua places - Manawatū River and Gorge', Te Ara - the Encyclopaedia of New Zealand, http://www.TeAra.govt.nz/en/Manawatū-and-horowhenua-places/page-6 (accessed 19 January 2018).
[50] Kerryn Pollock, 'Hawke's Bay places - Southern Hawke's Bay', Te Ara - the Encyclopaedia of New Zealand, http://www.TeAra.govt.nz/en/hawkes-bay-places/page-5 (accessed 19 January 2018).
[51] Ibid; 'This is Woodville's History', accessed via: http://www.thisiswoodville.co.nz/pages/about-us/history.php

promoted by the formation of the Woodville Small Farms Association.[52] The establishment of dairy farms in and around the Woodville area helped to support growth and by 1880 the township accommodated 11 houses, a hotel and stables, a butcher, bakery, bootmaker and a general store (founded by Monteith and Fountaine) (**Figure 30**).[53] A schoolroom had been erected in 1879 (which also served as a venue for community meetings), a branch of the Bank of New Zealand opened in 1882, and in 1883 print began on Woodville's first newspaper, known as 'The Woodville Examiner', which was published bi-weekly.[54]

21. Between 1895 and 1910 sawmills in and around the Woodville area produced significant quantities of firewood and sawn timber. Production was aided by the nearby rail lines, including from Napier, which reached Woodville in the 1880s, and the Palmerston North line, which was constructed in the 1890s.[55] A Town Board was established in 1885 under the chairmanship of Joseph Sowry, and he was later elected Woodville's first mayor when the township was constituted a borough in 1887 (**Figure 31**).[56]

22. By 1908 the Woodville Borough had a population of 1,100 residents and the features of the town were summarised in the *Encyclopaedia of New Zealand [Taranaki, Hawke's Bay and Wellington Provincial Districts]*:

> *"WOODVILLE is situated ninety-five miles from Napier, and 105 miles from Wellington, on the main line of railway, and is three miles distant from the Manawatū Gorge. It was formerly a part of the Seventy-mile Bush, but is now a prosperous dairying settlement, with thriving industries established. Woodville is also an important central railway junction, as it connects the East and West Coast railroads. The country south of Woodville is flat for some miles, but on all other sides the hills rise close to the town. The country, however, is of excellent quality, sheep and cattle farming, and dairying are carried on extensively, and a little cropping is also done. The town has a fine climate, a splendid water supply, and there is magnificent scenery in the district. Woodville has a number of industries that must help to assure its prosperity. It*

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[52] Ibid.
[53] Ibid; Woodville School Centenary 1877-1977 : Souvenir Programme, Woodville, 1977, np.
[54] *Hawkes Bay Herald*, 16 April 1879, p.3; *Daily Telegraph*, 2 December 1882, p.2; Woodville School Centenary 1877-1977 : Souvenir Programme, np.
[55] Nancy Swarbrick, 'Logging native forests - Logging and sawmilling, 1840–1920', Te Ara - the Encyclopaedia of New Zealand, http://www.TeAra.govt.nz/en/logging-native-forests/page-4 (accessed 19 January 2018); Kerryn Pollock, 'Hawke's Bay places - Southern Hawke's Bay', Te Ara - the Encyclopaedia of New Zealand, http://www.TeAra.govt.nz/en/hawkes-bay-places/page-5 (accessed 19 January 2018).
[56] 'This is Woodville's History', accessed via: http://www.thisiswoodville.co.nz/pages/about-us/history.php; *Wanganui Herald*, 20 July 1887, p.3.

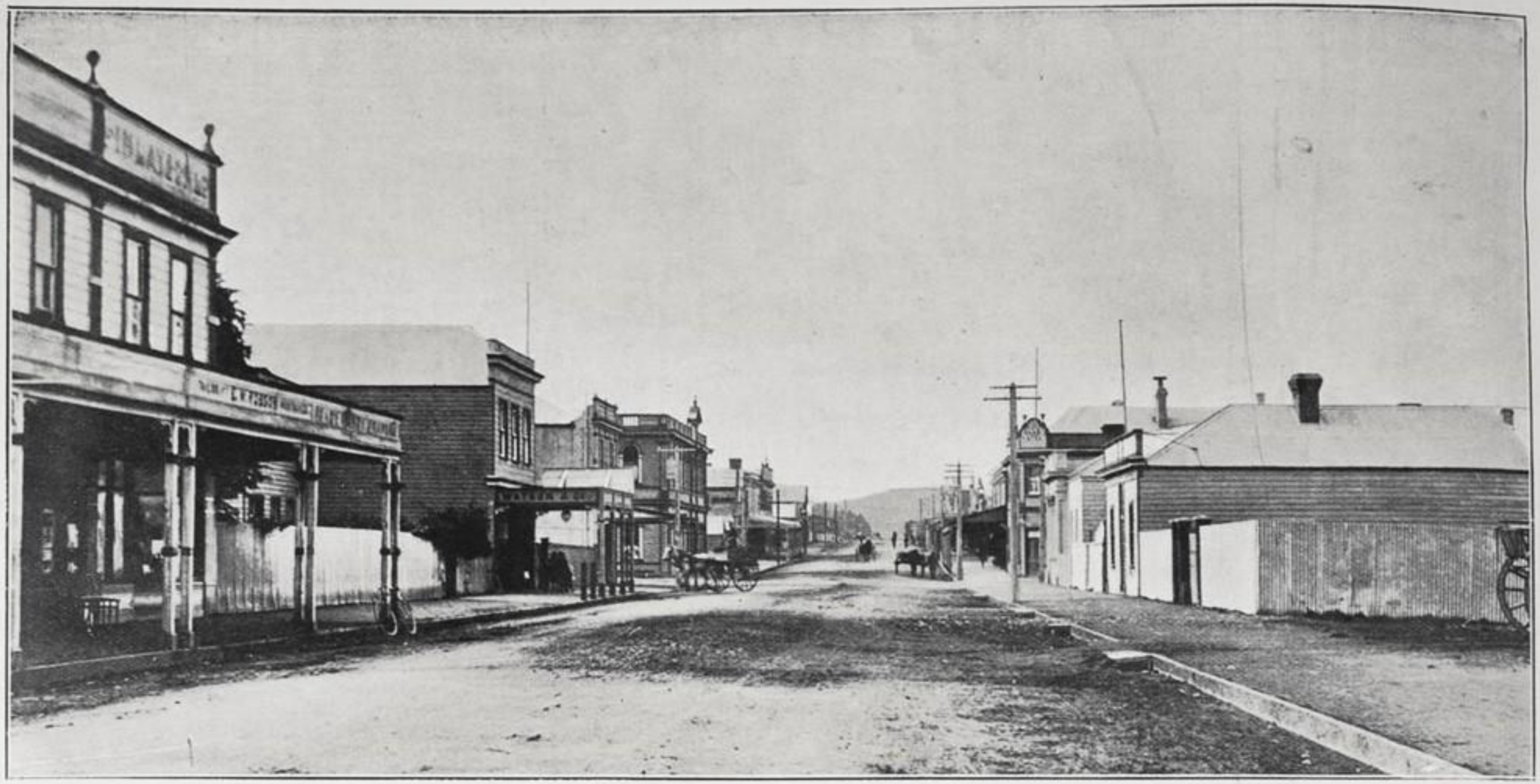
has freezing works, a bacon factory, a fellmonger, a dairy factory and creamery, a brewery, and there are also Government creosoting works. The town is well laid out, and its buildings include churches, public schools, Government offices, the railway station, the Borough Council Chambers, a Magistrate's Court, hotels, a branch bank, a newspaper office (with a tri-weekly issue) and numerous shops and stores. There is also a public swimming bath, and there are seventy acres of reserves, including a recreation ground, and a square with a band rotunda. The best trout fishing in the North Island is obtained at Woodville, and the roads in the district are good for cycling … There is a good fire brigade, equipped with a Shand-Mason manual engine, 1,200 feet of hose and four hydrants. In January, 1904, the Council took over the local library and reading room. The Alexandra Hall, a fine building erected as a memorial of the Coronation of King Edward VII, is also the property of the Council. Members of the council for the year 1907: Messrs Hubert Burnett (Mayor), F. Brook, T. Hartstone, H.P. Horne, A.E. Lawrence, D.G. McKibbin, J.Motley, J.A. Nicholas, G.H. Redwood, and R. Shaw (Councillors). The town clerk is Mr. W.G. Crawford".[57]

23. Woodville's population growth remained slow but steady throughout the 20th century, with the surrounding rural hinterland continuing to provide the primary means of occupation and income (**Figures 32 to 34**). In recent years, Woodville has described itself as the wind farm capital of New Zealand.[58]

[57] The Cyclopaedia Company Limited, The Cyclopaedia of New Zealand [Taranaki, Hawke's Bay and Wellington Provincial Districts], Christchurch, 1908, p.568.
[58] Kerryn Pollock, 'Hawke's Bay places - Southern Hawke's Bay', Te Ara - the Encyclopaedia of New Zealand, http://www.TeAra.govt.nz/en/hawkes-bay-places/page-5 (accessed 19 January 2018).

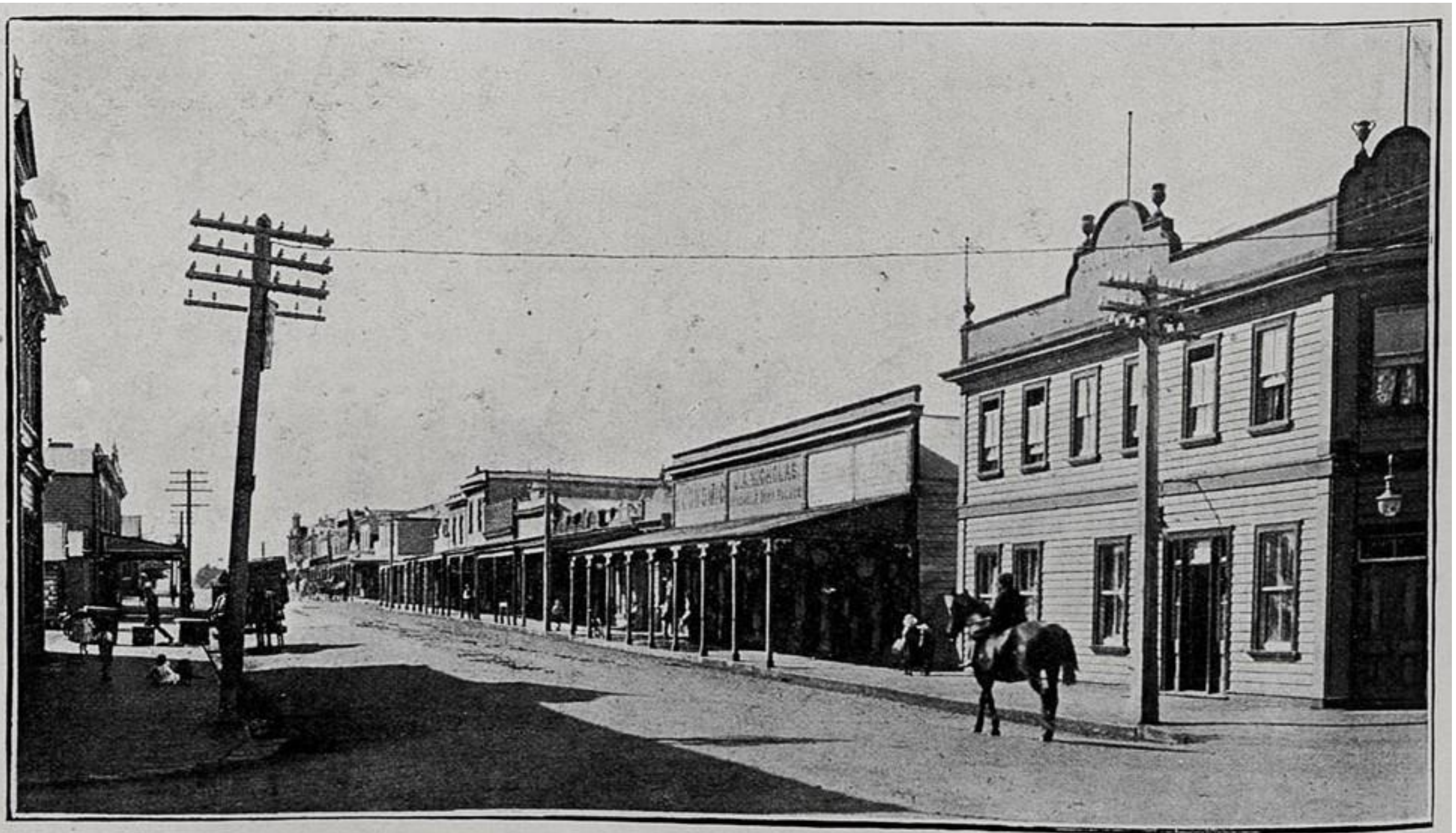
Figure 30. Photograph, dated 1878-1879, showing the Woodville Hotel on the corner of McLean and Vogel Streets. (source: 2007P_Wo1_RTL_0918, Palmerston North Libraries and Community Services)

Figure 31. Photograph, possibly dated 1890s, showing the main street in Woodville. (source: O.002075, Museum of New Zealand Te Papa Tongarewa)



A VIEW OF THE MAIN STREET, WOODVILLE, A THRIVING TOWNSHIP IN THE MANAWATU DISTRICT, WELLINGTON.

Figure 32. Photograph, dated 18 August 1904, showing the main street in Woodville. (source: Sir George Grey Special Collections, Auckland Libraries, AWNS-19040818-10-1)



AN IMPORTANT CENTRE ON THE WELLINGTON-NAPIER RAILWAY LINE: VOGEL STREET, WOODVILLE, NORTH ISLAND, N.Z.

Muir and Moodie, Photo.

Figure 33. Photograph, dated 8 July 1909, showing businesses along Vogel Street, Woodville. (source: Sir George Grey Special Collections, Auckland Libraries, AWNS-19090708-16-7)

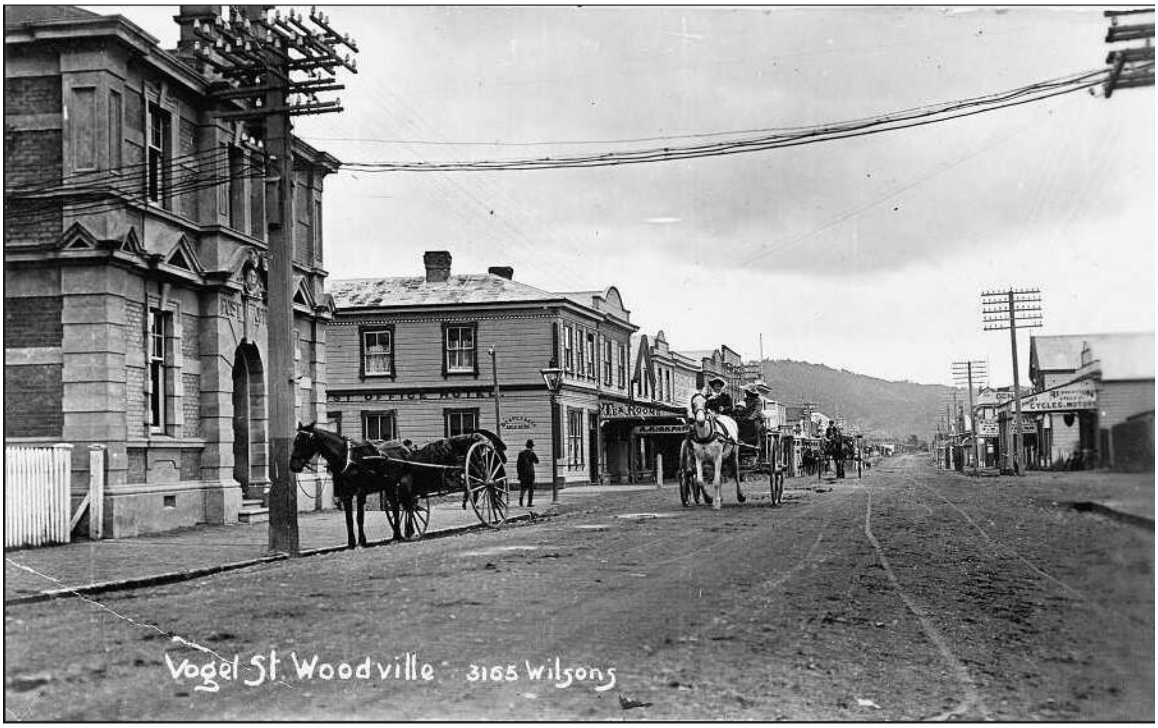


Figure 34. Photograph, dated ca.1910, showing businesses along Vogel Street, Woodville with the Post Office on far left (foreground). (source: Wilsons (Firm). Vogel Street, Woodville. Ref: 1/2-057395-F. Alexander Turnbull Library, Wellington, New Zealand. /records/23150590)

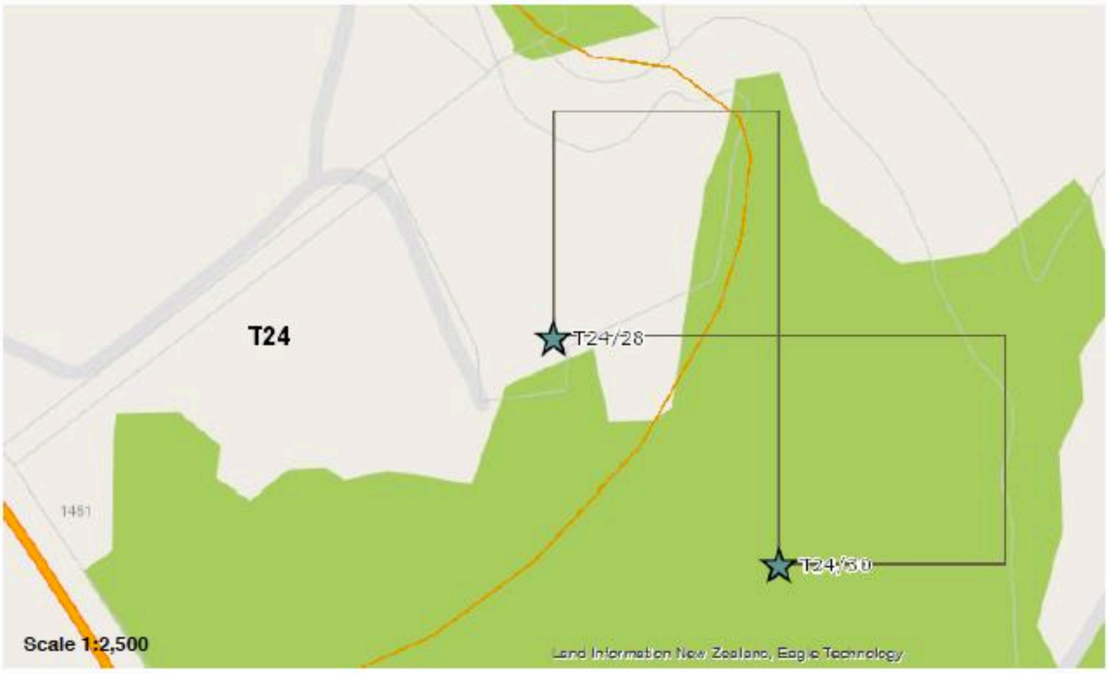
5.B
SITE RECORD FORMS

APPENDIX 5.B: SITE RECORD FORMS

ARCHSITE archaeological site recording scheme — **Site Record Form**	**NZAA SITE NUMBER:** T24/28 **SITE TYPE:** Pa **SITE NAME(s):** **DATE RECORDED:**

SITE COORDINATES (NZTM) Easting: 1834392 **Northing:** 5535099 **Source:** CINZAS

IMPERIAL SITE NUMBER: **METRIC SITE NUMBER:** T24/28



Finding aids to the location of the site

Brief description

PA

Recorded features

Other sites associated with this site

SITE RECORD INVENTORY	NZAA SITE NUMBER: T24/28

Supporting documentation held in ArchSite

NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION

SITE RECORD FORM (NZMS260)

NZMS 260 map number T24
NZMS 260 map name Palmerston North
NZMS 260 map edition Revised 1997

NZAA METRIC SITE NUMBER T24/28
DATE VISITED 2 July 1999
SITE TYPE Pa
SITE NAME: MAORI
OTHER

Grid References Easting 2744 Northing 60968

1. Aids to relocation of site *(attach a sketch map)* Palmerston North City, Ashhurst Domain, on a broad point in the Domain, on the edge of the terrace, behind the camping ground & old cottage. The location looks out up the Manawatu Gorge & over the newly developed wetlands beside the Pohangina River.

2. State of site and possible future damage In grass with scattered trees. Various exotic trees, some large pines, are growing around the terrace edge.

3. Description of site *(Supply full details, history, local environment, references, sketches, etc. If extra sheets are attached, include a summary here)*
Probable site location, ideal situation. Domain caretakers understand location was a pa site. No definite signs of archaeological remains. Possibly also the site of burials lifted in late 1950's.

Traditional history also points to a pa in the vicinity that guarded the entrance to the Manawatu Gorge. This would be the most likely situation.

A large karaka tree stands on the terrace edge stands on the eastern edge of the flat.

4. Owner Address Palmerston North City Council
Tenant/Manager Address

5. Nature of information *(hearsay, brief or extended visit, etc.)* Brief visit & historic records.
Photographs *(reference numbers, and where they are held)*
Aerial photographs *(reference numbers, and clarity of site)* Not visible

6. Reported by Michael Taylor
Address Archaeology North
P.O. Box 7294
Wanganui
Filekeeper
Date 6/12/99

7. Key words
Palmerston North City, pa, karaka, Maori

8. New Zealand Register of Archaeological Sites *(for office use)*
NZHPT Site Field Code

Latitude S		Longitude E	
AD	Type of site	XD	Present condition and future danger of destruction
	Local environment today		Security code
AH	Land classification	PE	Local body

ARCH SITE
archaeological site recording scheme

Site Record Form

NZAA SITE NUMBER: T24/29

SITE TYPE: Maori horticulture

SITE NAME(s):

DATE RECORDED:

SITE COORDINATES (NZTM) Easting: 1834392 **Northing:** 5535699 **Source:** CINZAS

IMPERIAL SITE NUMBER: **METRIC SITE NUMBER:** T24/29

Finding aids to the location of the site

Brief description

GARDEN SOIL

Recorded features

Soil - garden

Other sites associated with this site

SITE RECORD INVENTORY	NZAA SITE NUMBER: T24/29

Supporting documentation held in ArchSite

NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION

SITE RECORD FORM (NZMS260)

NZMS 260 map number T24
NZMS 260 map name Palmerston North
NZMS 260 map edition 1st, revised 1997

NZAA METRIC SITE NUMBER T24/29
DATE VISITED 2 July 1999
SITE TYPE Garden soil
SITE NAME: MAORI
OTHER
N149

Grid References Easting 2 7 4 4 4 Northing 6 0 9 7 4

1. Aids to relocation of site *(attach a sketch map)* Ashhurst Domain at northern end, on edge of high terrace, on walkway. Soil profile exposed in deep access cutting between river flat & terrace top. Just downriver from the railway line.

2. State of site and possible future damage Under grass and large, old pines.

3. Description of site *(Supply full details, history, local environment, references, sketches, etc. If extra sheets are attached, include a summary here)*

Soil profile exposed in track cutting. Very black soil with fine charcoal mixed through it, 30-35cm deep. Distinct sharp edge between black soil and dry gravelly brown subsoil. Extends at least 40-50m from terrace edge inland. Black soil is exposed on both sides of cutting and therefore predates it. Also pine trees which park staff say are at least 90years old are growing in in the soil and post-date it.
Possibly other black patches of soil back towards the cemetary in the Domain.

The black soil is most likely an old garden soil.

4. Owner Palmerston North
Address City Council
Tenant/Manager
Address

5. Nature of information *(hearsay, brief or extended visit, etc.)*
Brief visit by Annetta Sutton & Michael Taylor
Photographs *(reference numbers, and where they are held)*
Aerial photographs *(reference numbers, and clarity of site)*

6. Reported by Michael Taylor
Address Archaeology North
Box 7294, Wanganui
Filekeeper
Date 6/12/99

7. Key words

Maori, garden soil

8. New Zealand Register of Archaeological Sites *(for office use)*
NZHPT Site Field Code

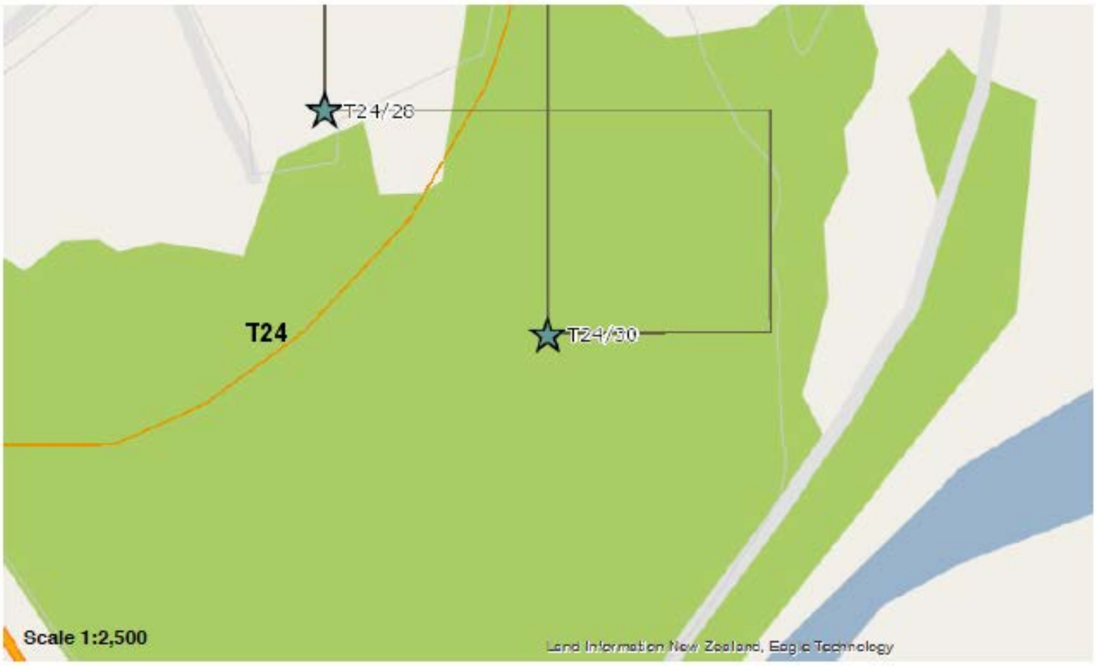
Latitude S
B H1 Type of site
Local environment today
A H Land classification

Longitude E
B D Present condition and future danger of destruction
Security code
P E Local body

ARCHSITE archaeological site recording scheme — **Site Record Form**	**NZAA SITE NUMBER:** T24/30 **SITE TYPE:** Burial/ cemetery **SITE NAME(s):** **DATE RECORDED:**

SITE COORDINATES (NZTM) Easting: 1834492 **Northing:** 5534999 **Source:** CINZAS

IMPERIAL SITE NUMBER: **METRIC SITE NUMBER:** T24/30



Finding aids to the location of the site

Brief description

BURIALS

Recorded features

Burial

Other sites associated with this site

SITE RECORD INVENTORY	NZAA SITE NUMBER: T24/30

Supporting documentation held in ArchSite

NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION

SITE RECORD FORM (NZMS260)

NZMS 260 map number T24
NZMS 260 map name Palmerston North
NZMS 260 map edition Revised 1997

NZAA METRIC SITE NUMBER T24/30
DATE VISITED 4 July 1999
SITE TYPE Burials
SITE NAME: MAORI
OTHER
N149

Grid References Easting 2 7 4 4 5 Northing 6 0 9 6 7

1. Aids to relocation of site *(attach a sketch map)* Palmerston North City, Ashhurst Domain on low rise, in bush between camping ground on upper terrace and bush covered flat. Concrete marker posts lead through the area of the burials. The Domain staff are aware of the exact location.

2. State of site and possible future damage Area clearing in light bush in Domain.

3. Description of site *(Supply full details, history, local environment, references, sketches, etc. If extra sheets are attached, include a summary here)*
Graves containing the remains of some Rangitane people who were drowned in the Manawatu River when their canoe capsized during a flood.
The individual graves are not visible.

4. Owner Address Palmerston North City Council
Tenant/Manager Address

5. Nature of information *(hearsay, brief or extended visit, etc.)*
Historic records, brief visit
Photographs *(reference numbers, and where they are held)*
Aerial photographs *(reference numbers, and clarity of site)*
Not visible

6. Reported by Address Michael Taylor
Archaeology North
P.O. Box 7294
Wanganui
Filekeeper Date 6/12/99

7. Key words
Palmerston North City, burials, Maori

8. New Zealand Register of Archaeological Sites *(for office use)*
NZHPT Site Field Code

Latitude S			Longitude E		
A	T	Type of site	D	D	Present condition and future danger of destruction
		Local environment today			Security code
A	H	Land classification	P	C	Local body

Site Record Form

ARCHSITE archaeological site recording scheme

NZAA SITE NUMBER: T24/31

SITE TYPE: Botanical evidence

SITE NAME(s):

DATE RECORDED:

SITE COORDINATES (NZTM) Easting: 1834792 **Northing:** 5534598 **Source:** CINZAS

IMPERIAL SITE NUMBER: **METRIC SITE NUMBER:** T24/31

Finding aids to the location of the site

Brief description

KARAKA GROVE

Recorded features

Karaka grove

Other sites associated with this site

SITE RECORD INVENTORY	NZAA SITE NUMBER: T24/31

Supporting documentation held in ArchSite

NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION

SITE RECORD FORM (NZMS260)

NZMS 260 map number T24
NZMS 260 map name Palmerston North
NZMS 260 map edition 1st, revised 1997

NZAA METRIC SITE NUMBER T24/31
DATE VISITED 7 July 1999
SITE TYPE Karaka Grove
SITE NAME: MAORI
OTHER
N149

Grid References Easting 2 7 4 4 8 Northing 6 0 9 6 3

1. Aids to relocation of site *(attach a sketch map)* Access from State Highway 3, gorge end of Manawatu River bridge. From carpark at end of bridge follow around the river terrace to the gorge mouth, 200-300m from bridge. Trees on river terrace and on slope to first level where there are more karaka. Not readily visible from State Highway.

2. State of site and possible future damage Area been grazed by sheep, in grass, limited regrowth of young trees.

3. Description of site *(Supply full details, history, local environment, references, sketches, etc. If extra sheets are attached, include a summary here)* A grove of over 55 large karaka trees.
On the lower terrace, about 30m from the river there are 14 large trees over an area of about 50x20m. Above this on the slope and near the edge of the first terrace level there are in excess of 20 large karaka trees over 60x25m. Further towards the gorge on this level are a spread of at least 20 medium to large trees, before the terrace turns towards the gorge. Three measured large trees with single trunks were 2.3m, 2.9m and 3.3m round at 1m above the ground. Many trees have multiple or split trunks.
There are a group of shallow holes amongst the trees on the lower terrace, largest 5x1.5 by 0.5m deep, but their origin is not clear.

4. Owner Tom Shannon
Address RD1
Palmerston North

Tenant/Manager
Address

5. Nature of information *(hearsay, brief or extended visit, etc.)*
Brief visit by Michael Taylor & Annetta Sutton
Photographs *(reference numbers, and where they are held)*

Aerial photographs *(reference numbers, and clarity of site)*

6. Reported by Michael Taylor
Address Archaeology North
Box 7294, Wanganui

Filekeeper [signature]
Date 6/12/99

7. Key words

8. New Zealand Register of Archaeological Sites *(for office use)*
NZHPT Site Field Code

Latitude S			Longitude E		
B	F	Type of site	B	B	Present condition and future danger of destruction
		Local environment today			Security code
A	E	Land classification	P	E	Local body

ARCHSITE archaeological site recording scheme

Site Record Form

NZAA SITE NUMBER: T24/32

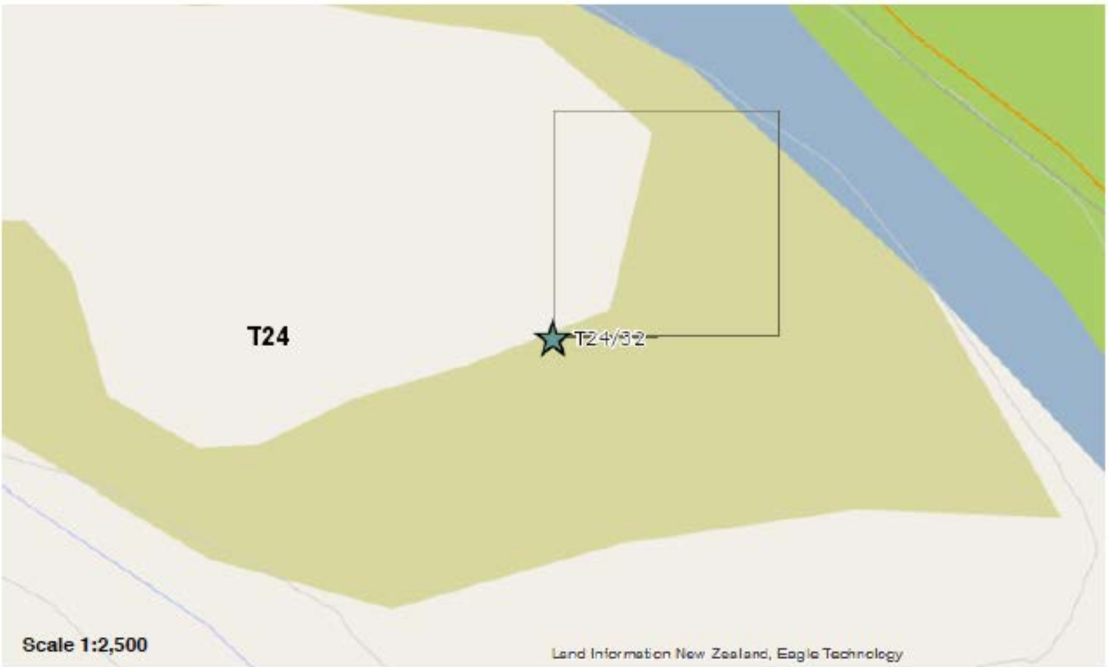
SITE TYPE: Burial/ cemetery

SITE NAME(s):

DATE RECORDED:

SITE COORDINATES (NZTM) Easting: 1835192 **Northing:** 5534799 **Source:** CINZAS

IMPERIAL SITE NUMBER: **METRIC SITE NUMBER:** T24/32



Finding aids to the location of the site

Brief description

KAINGA/BURIALS

Recorded features

Other sites associated with this site

SITE RECORD INVENTORY	NZAA SITE NUMBER: T24/32

Supporting documentation held in ArchSite

NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION

SITE RECORD FORM (NZMS260)

NZMS 260 map number T24
NZMS 260 map name Palmerston North
NZMS 260 map edition Revised 1997

NZAA METRIC SITE NUMBER T24/32
DATE VISITED 7 July 1999
SITE TYPE Kainga & burials
SITE NAME: MAORI Parahaki
OTHER
N149

Grid References Easting 2 7 4 5 2 Northing 6 0 9 6 5

1. Aids to relocation of site (attach a sketch map) Palmerston North City

Islnd at the mouth of the Manawatu Gorge in river.

2. State of site and possible future damage The island is under light scrub & grass.

3. Description of site (Supply full details, history, local environment, references, sketches, etc. If extra sheets are attached, include a summary here)

J.T. Stewart in his Fieldbook 1718, page 11, 11 November 1859, shows "Graves" marked with an "X".

Trevor Hosking told Archaeology North (pers. com. 2 July 1999) that in the 1950's when he visited the island that occupation layers were visible 4-5feet belwo the surface.

In tradition Te Awe Awe lived on the island.

The islnd was retained by Rangitane when the rest of the Ahuaturanga Block was purchased by the Crown in 1864.

4. Owner Multiple Maori ownership.
Address

Tenant/Manager
Address

5. Nature of information (hearsay, brief or extended visit, etc.) Historic records, discussion with Trevor Hosking, brief visit

Photographs (reference numbers, and where they are held)

Aerial photographs (reference numbers, and clarity of site)

6. Reported by Michael Taylor
Address Archaeology North
P.O. Box 7294
Wanganui

Filekeeper ewe
Date 6/12/99

7. Key words
Palmerston North City, kainga, burials, Maori

8. New Zealand Register of Archaeological Sites (for office use)
NZHPT Site Field Code

Latitude S Longitude E

A	T	Type of site	D	D	Present condition and future danger of destruction
		Local environment today			Security code
A	S	Land classification	P	E	Local body

NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION

ARCHSITE archaeological site recording scheme

Site Record Form

NZAA SITE NUMBER: T24/42

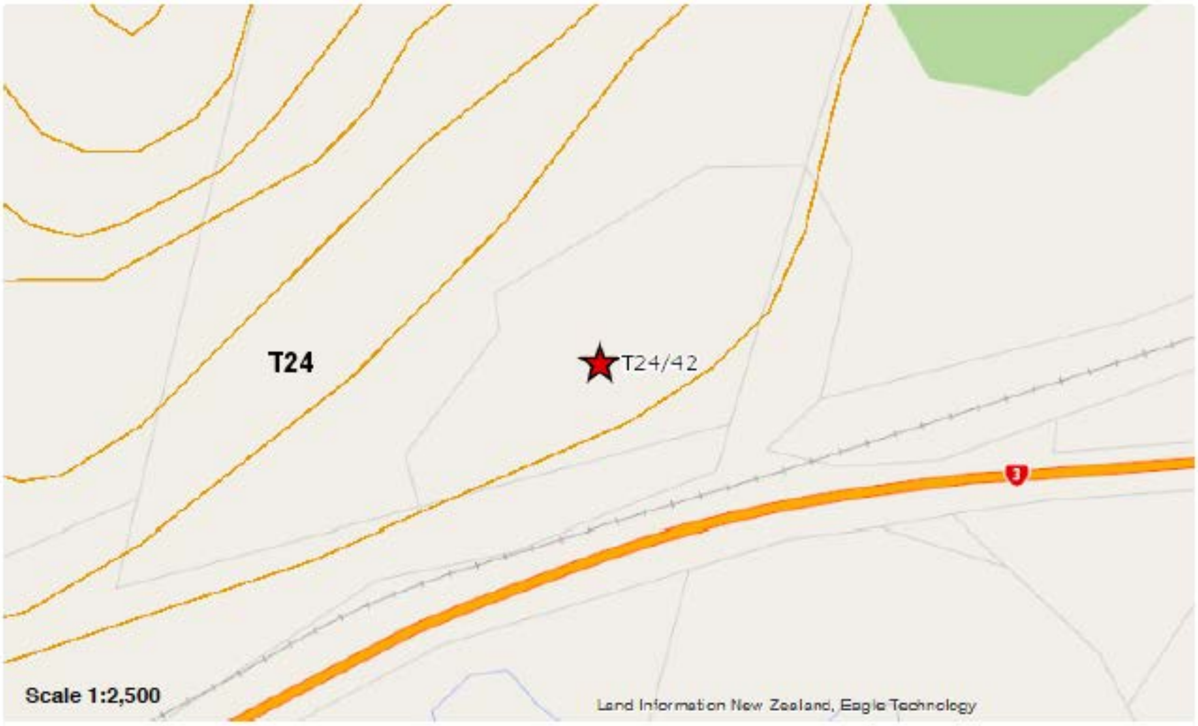
SITE TYPE: Burial/ cemetery

SITE NAME(s): Woodville Old Gorge Cemetery

DATE RECORDED:

SITE COORDINATES (NZTM) Easting: 1840607 **Northing:** 5531111 **Source:** On Screen

IMPERIAL SITE NUMBER: **METRIC SITE NUMBER:** T24/42



Finding aids to the location of the site

SH3 Napier Road Woodville. Located near the Woodville eastern entrance to the Manawatu Gorge

Brief description

Recorded features

Cemetery/ urupa, Grave with headstone, Terrace

Other sites associated with this site

SITE RECORD HISTORY	NZAA SITE NUMBER: T24/42

Site description

Updated 18/10/2018 (Field visit), submitted by rodclough , visited 07/09/2018 by Clough, Rod
Grid reference (E1840607 / N5531111)

Known as the Woodville Old Gorge Cemetery this historic cemetery contains the graves of pioneers, notable personalities and early settlers of Woodville. The grave of Gottfried Lindauer the artist is located in this cemetery.

The cemetery is located on a rise backing into the high hill behind with many oak trees.
Given its strategic location at the eastern entrance to the gorge high above the confluence of three rivers with clear views to the north and south this would have been a obvious location for prior Maori settlement also. The cemetery is terraced and some of these features may predate the use of this area as a cemetery.

Condition of the site

Statement of condition

Current land use:

Threats:

NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION

ARCHSITE archaeological site recording scheme

Site Record Form

NZAA SITE NUMBER: U23/14

SITE TYPE: Pit/Terrace

SITE NAME(s): Raikapua

DATE RECORDED:

SITE COORDINATES (NZTM) Easting: 1861300 **Northing:** 5538600 **Source:** On Screen

IMPERIAL SITE NUMBER: **METRIC SITE NUMBER:** U23/14

Finding aids to the location of the site

On ridge above the junction of the Manawatu and Tamaki Rivers.

Brief description

A series of transverse terraces (with several lateral ones) running along a high ridge.

Recorded features

Other sites associated with this site

NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION

SITE RECORD INVENTORY	NZAA SITE NUMBER: U23/14

Supporting documentation held in ArchSite

NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION
SITE RECORD FORM (NZMS260)
NZMS 260 map number U23
NZMS 260 map name
NZMS 260 map edition 1

NZAA METRIC SITE NUMBER U23/14
DATE VISITED 31.03.95
SITE TYPE Pa Terraces
SITE NAME: MAORI Raikapua
OTHER

Grid References Easting 2717113 Northing 6100103

1. Aids to relocation of site *(attach a sketch map)*

On a ridge above the junction of the Manawatu and Tamaki Rivers.

2. State of site and possible future damage
Some erosion and stock damage. Possible threat from future production forestry.

3. Description of site *(Supply full details, history, local environment, references, sketches, etc. If extra sheets are attached, include a summary here)*

This is a narrow, ridge-top pa, consisting of a series of transverse terraces (with several lateral ones) that run along a high ridge. The site is approximately 100m long, with steep natural defences on three sides (north, south, west). There is a narrow entry onto the pa from the eastern side and a small spur that runs from the south-western side. The Manawatu River lies below the site to the west and there are fertile river flats at the base of the pa. It is under rough pasture and there is some damage from erosion and ground slippage. There are flax plants and cabbage trees (ti) growing in the vicinity and the site has a commanding view of the surrounding countryside. There is no evidence of defensive architecture, such as ditches and banks.

4. Owner Knight Estate
Address

Tenant/Manager Garth Taylor
Address

5. Nature of information *(hearsay, brief or extnded visit, etc.)* Visited in the field and mapped.

Photographs *(reference numbers and where they are held)*

Aerial photographs *(reference numbers clarity of site)*

6. Reported by: Victoria Grouden
Address 2 Murdoch Road
Gisborne

Filekeeper E Nesting
Date 28.12.95

7. Key words Pa

8. New Zealand Register of Archaeological Sites (for office use)
NZHPT Site Field Code

Latitude S

Longitude E

AP Type of site

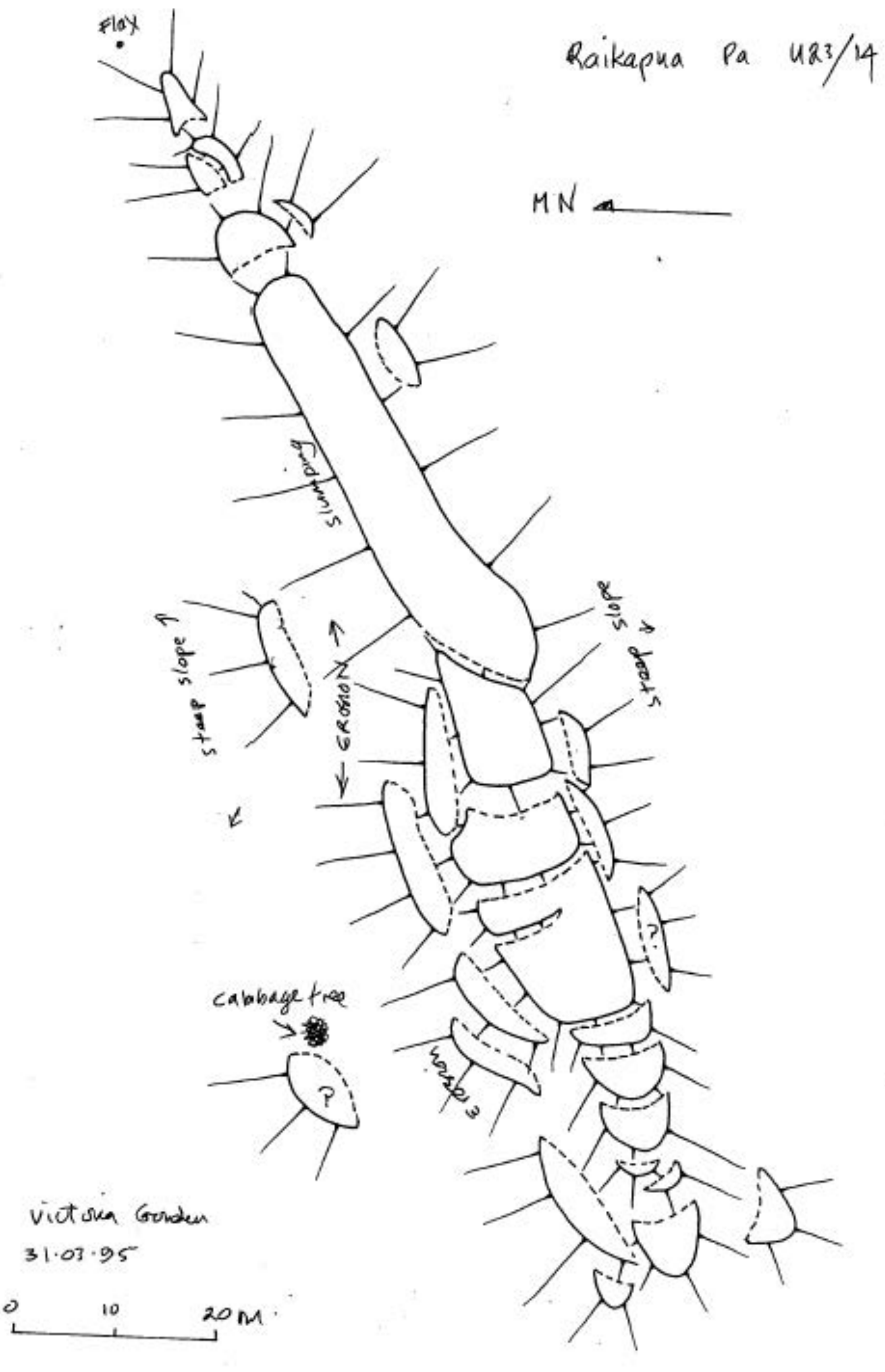
Local environment today

Land classification

BB Present condition & future danger of destruction

Security code

PF Local body Tararua


Raikapua Pa U23/14
MN
Flax
slumping
steep slope
slope
steep
EROSION
cabbage tree
P
P
erosion
Victoria Gordon
31.03.95
0
10
20M

6. TERRESTRIAL ECOLOGY

IN THE MATTER OF	The Resource Management Act 1991
AND	
IN THE MATTER OF	Notices of requirement for designations under section 168 of the Act, in relation to Te Ahu a Turanga; Manawatū Tararua Highway Project
BY	**NZ TRANSPORT AGENCY** Requiring Authority

TE AHU A TURANGA: TECHNICAL ASSESSMENT #6

TERRESTRIAL ECOLOGY

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INTRODUCTION

1. My name is **Dr Adam Forbes**. I am the founder and Principal Ecologist of Forbes Ecology, and I am the author of this report.

2. I have been advising the NZ Transport Agency since September 2017 on ecological matters in respect of its proposed Te Ahu a Turanga; Manawatū Tararua Highway project (the "**Project**").

3. My technical contributions have included:

   (a) informing the NZ Transport Agency's consideration of alternative routes for the Project;

   (b) inputting to 'Project shaping' in respect of the selected route option;

   (c) preparing an assessment of the Project's effects on indigenous vegetation and habitats (the "Terrestrial Vegetation and Habitats Assessment report", attached to this assessment as **Appendix 6.A**);

   (d) scoping, overseeing and reviewing aspects of the Terrestrial Fauna Ecology Assessment (attached to this assessment as **Appendix 6.B**)[1] and the Freshwater Ecology Assessment;[2] and

   (e) advising on how to manage the Project's adverse effects on ecological values.

Qualifications and experience

4. I have the following qualifications and experience relevant to this assessment:

   (a) I hold a PhD in Forestry from the University of Canterbury School of Forestry, and I am an Invited Research Associate with the School.

   (b) I have fourteen years' experience working as an ecological consultant. The last six years have been as independent self-employed consultant.

   (c) During my time as an ecological consultant I have undertaken a number of ecological assessments for Resource Management Act 1991 ("**RMA**") applications. These projects have included surveys and descriptions of ecological values, assessments of statutory ecological

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[1] The Terrestrial Fauna Ecology assessment was co-researched and co-authored by Andrew Blayney and Karin Sievwright who are terrestrial fauna ecologists employed by Boffa Miskell. I rely on information provided in their report.
[2] The Freshwater Ecology Assessment report is referred to here as (Miller, 2018) and this report is appended to the Landscape, Natural Character and Visual Effects Assessment report.

significance (including in terms of section 6(c) of the RMA) for both applicants and territorial authorities, assessments of effects and development of effects management and monitoring strategies.

(d) Since 2013 I have worked extensively on the Roads of National Significance projects in the Wellington and Manawatū-Whanganui ("**Horizons**") regions. This includes ongoing roles as Ecology Reviewer to Wellington Councils for Transmission Gully, Greater Wellington Regional Council Reviewer for both Mackays to Peka Peka and Peka Peka to Ōtaki, and I have assisted the NZ Transport Agency with the ecological aspects of the corridor options stages of the Ōtaki to north of Levin project. Through these projects I have developed a thorough understanding of the ecological effects and effects management aspects of large-scale roading developments.

Code of Conduct

5. I confirm that I have read the Code of Conduct for expert witnesses contained in the Environment Court Practice Note 2014. This assessment has been prepared in compliance with that Code, as if it were evidence being given in Environment Court proceedings. In particular, unless I state otherwise, this assessment is within my area of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

Purpose and scope of assessment

6. The purpose of this report is to provide an overview of the assessments carried out of the Project's effects on terrestrial ecology, which form part of the wider Assessment of Environmental Effects ("**AEE**") supporting the Notices of Requirement ("**NoR**") to be lodged for the Project. In this report I specifically cover:

(a) the existing environment in terms of terrestrial ecology features within the designation area;

(b) ecologically relevant aspects of the 'Project shaping' process;

(c) the Project's actual and potential effects on terrestrial ecology;

(d) the proposed ways in which the ecological effects of the Project will be managed; and

(e) recommended matters to be included as proposed NoR conditions.

Assumptions and exclusions in this assessment

7. Detailed design of the Project has not yet been undertaken, and the NZ Transport Agency is not yet seeking regional resource consents, or a waiver of the outline plan of works process, for the Project. At this stage, therefore, the Project to be assessed includes a designation corridor within which the road is proposed to be constructed. My assessment has taken into account that flexibility and the potential for effects on terrestrial ecology anywhere within the designation (subject to recommended constraints on detailed design to avoid or minimise particular effects, as I explain below).

EXECUTIVE SUMMARY

8. The NZ Transport Agency is seeking to designate land for the purposes of an alternative State Highway route across the Ruahine Range.

9. Of the proposed designation area, 38.5 ha (c. 10%) comprises terrestrial vegetation and habitats which are classified (based on composition, structure, and condition) into the following ten distinct ecosystem types and areas, ranging in ecological value from Very High to Low. Seven ecosystem types were assessed as significant, by reference to Horizons' One Plan Policy 13-5.

Ecosystem type	Area (ha)	Value level	RMA s6(c)
Old-Growth (OG) Forests (Alluvial)^	4.23	Very High	Yes
OG Forests (Hill Country)	1.78	Very High	Yes
Secondary Broadleaved Forests with OG Signatures	3.07	High	Yes
OG Treelands	0.41	High	Yes
Advanced Secondary Broadleaved Forests	2.93	High	No
Raupō Dominated Seepage Wetlands (High Value)	0.55	High	Yes
Secondary Broadleaved Forests and Scrublands	16.32	Moderate	No
Kānuka Forests	4.52	Moderate	Yes
Indigenous-Dominated Seepage Wetlands (Mod. Value)	0.56	Moderate	Yes
Mānuka, Kānuka and Divaricating Shrublands	4.12	Low	No

^This area calculation includes 0.05 ha of Very High value Threatened-Nationally Critical swamp maire forest. Areas are slope corrected using the project LiDAR dataset.

10. The proposed designation area contains potential populations of non-threatened and At-Risk lizard species, terrestrial invertebrate values ranging from Negligible to High, and Threatened and At-Risk bird species using shingle riverbed, wetland, forest and grassland habitats. Monitoring to date has not detected long-tailed bats, however further monitoring is scheduled for the summer of 2018-19 to determine the status of bat populations at the most likely habitats with the aim of clarifying the effects management pathway for bats.

11. Key actual or potential adverse effects of the Project include:

For terrestrial vegetation and habitats:

(a) clearance or modification of indigenous vegetation and habitats;

(b) habitat fragmentation and isolation; and

(c) edge effects on retained vegetation and habitats;

For terrestrial fauna:

(d) injury or mortality during vegetation clearance and earthworks;

(e) disturbance during critical nesting periods (birds);

(f) permanent loss of habitats; and

(g) modification of habitats in the form of:

(i) increased fragmentation and isolation due to reduced habitat connectivity;

(ii) creation of edge effects and consequential effects to composition, structure and food sources in retained habitats; and

(iii) invasions and corresponding impacts of non-native plant and animal species.[3]

12. A stepped approach is proposed for vegetation clearance. The proposed approach allows flexibility within the designation area for works to proceed without being constrained by lower value ecosystems that can be replaced in relatively short timeframes through replacement planting; and to manage

[3] Another potential effect of the Project relates to sedimentation, arising from construction of the Manawatū River crossing, of foraging areas along the riverbed, which in turn could impact dotterel foraging. This potential effect will be considered in the context of the regional resource consents required for the Project, in light of the precise bridge configuration and construction methodology proposed.

effects to higher value ecosystem types through avoidance and minimisation of effects, as defined by specific effects envelopes. Effects envelopes were developed to limit levels of effect on High and Very High value features to levels acceptable on ecological grounds,[4] given appropriate mitigation and offsetting measures. Measures are proposed to address adverse effects associated with increased fragmentation/isolation and edge effects.

13. Adverse effects on fauna from vegetation and habitat loss are directly addressed through the avoidance, replacement planting and offset measures discussed above. Disturbance of fauna (particularly lizards and birds), including during critical bird breeding seasons, will be addressed through provisions detailed in the Ecological Management Plan regarding effects management (e.g., preconstruction surveys and salvage) and scheduling of works outside of critical periods or, if not possible, through preconstruction surveys and constraints on works during specific time periods of high sensitivity.

14. Regarding terrestrial fauna, following full implementation of mitigation and offset measures, the level of adverse effect would be Very Low-Low, with net benefits to terrestrial fauna likely to be realised over time.

15. In broader terms, too, the proposed mitigation and offset package is likely to address adverse effects and offset residual adverse effects to a biodiversity net-gain position (and indeed, I understand that a condition will be proposed to ensure that outcome). Put another way, on the basis of the offset package proposed, in my view the Project will have net benefits in respect of terrestrial ecology values.

PROJECT DESCRIPTION

16. A Project description is provided in section C of the Assessment of Effects and Supporting Documents (volume 3). Details describing the Project are not repeated here, other than specific elements expanded on below.

17. **Figure 6.1** presents the configuration of indigenous ecosystems relative to the designation area and the indicative design. I refer to chainages (CH) throughout this report and these are shown on **Figure 6.1**.

18. In terms of the Project's effects (and the later detailed design process), several sites in particular have been key focal points for my assessment.

[4] Effects envelopes represent maximum allowable limits on species and ecosystems of very high conservation concern (i.e., swamp maire, old growth forests, high value seepage wetlands) and limit the magnitude of effect in specific locations (not designation wide) for other ecosystem types.

Works associated with the newly proposed bridge across the Manawatū River may affect, on the right (northern) bank of the River, an area containing a collection of High and Very High ecological values and levels of conservation concern (CH4000-4400). The Project also intersects with two areas subject to Queen Elizabeth II Trust ("**QEII**") covenants, including one at CH5600-5800. These areas, and other crossings of streams along the alignment, are important considerations for the detailed design phase of the Project, in that they present opportunities to minimise the extent of adverse effects to both terrestrial and freshwater ecosystems.

19. The Project description considered for this assessment does not provide particular design detail in relation to these areas. In my opinion, however, some design constraints are required in order to guide the detailed design process and ensure that the adverse effects of the Project on terrestrial ecology are acceptable, taking into account proposed mitigation and offsetting measures. These recommended constraints are discussed further below.

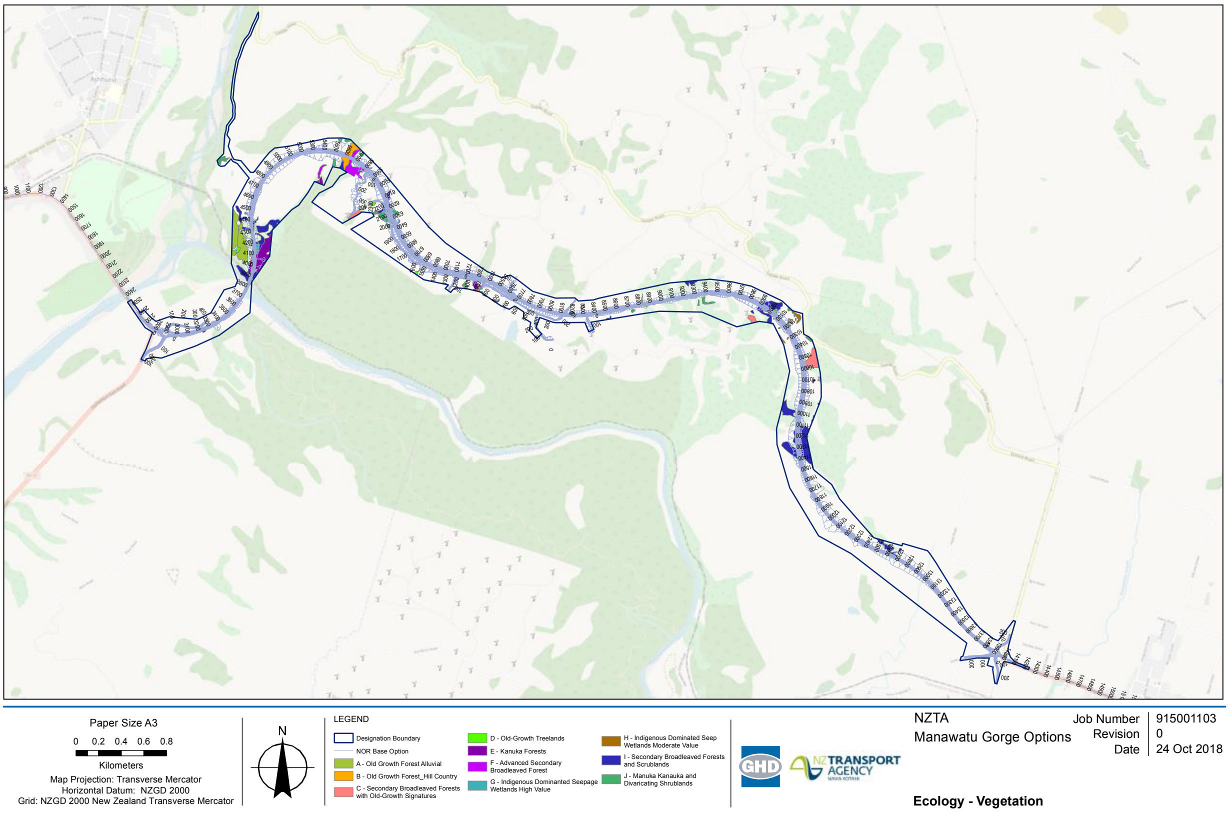

Figure 6.1. Distribution of indigenous ecosystem types within the proposed designation area including Chainage (CH) references.[5]

Note, ecosystems within the designation area but not mapped are within areas assumed to be clear of works (e.g., in mitigation areas) and thus are not included in the scope of effects/mitigation/offset. The plan does not show all access routes and the Project plans should be referred to for the location of site access alignments.

[5] Note that this figure and others in this assessment depict a previous iteration of the proposed designation area; three relatively small areas relating to unformed access tracks, in areas of pasture, have since been added.

EXISTING ENVIRONMENT

Landscape context

20. The designation area spans three ecological districts ("**ED**"), Manawatū Plains, Manawatū Gorge North, and Woodville ED. Rainfall and temperature are conducive to rapid regeneration of lowland native forest species. The Manawatū Gorge Scenic Reserve ("**MGSR**") is an important ecological feature, particularly so for this Project given its close proximity to the designation area. The MGSR comprises several large protected lowland forest remnants summing to approximately 1000 ha in total. A number of smaller native vegetation remnants exist in the surrounding landscape. Many of these are associated with gully systems and a number benefit from formal legal protection in the form of conservation covenants.

21. The predicted pre-human forest compositions (Leathwick, 2005) are shown in **Figure 6.2** below. These mainly comprised alluvial forest associations on the flats near both Ashhurst and Woodville and the intervening hill country featured rimu/tawa-kamahi forests (as represented by the MGSR today).

22. During times of human occupation indigenous vegetation has been extensively cleared and converted to agricultural and urban land uses. Clearance of indigenous cover has resulted in the contemporary land cover being of a predominantly exotic composition. The 'Land Environments', in terms of (Leathwick et al., 2003), traversed by the proposed designation area are classified as 'Chronically' or 'Acutely Threatened Environments', meaning that the combinations of landform and climate that are present in this landscape, at a national scale, contain less than 20% or 10% (respectively) of indigenous cover remaining (Walker et al., 2015).

23. While exotic vegetation communities within the alignment do present habitat opportunities for some fauna species, the ecosystem types of most value are the indigenous communities, particularly those that represent pre-human compositions, are threatened, or were rare prior to human occupation.

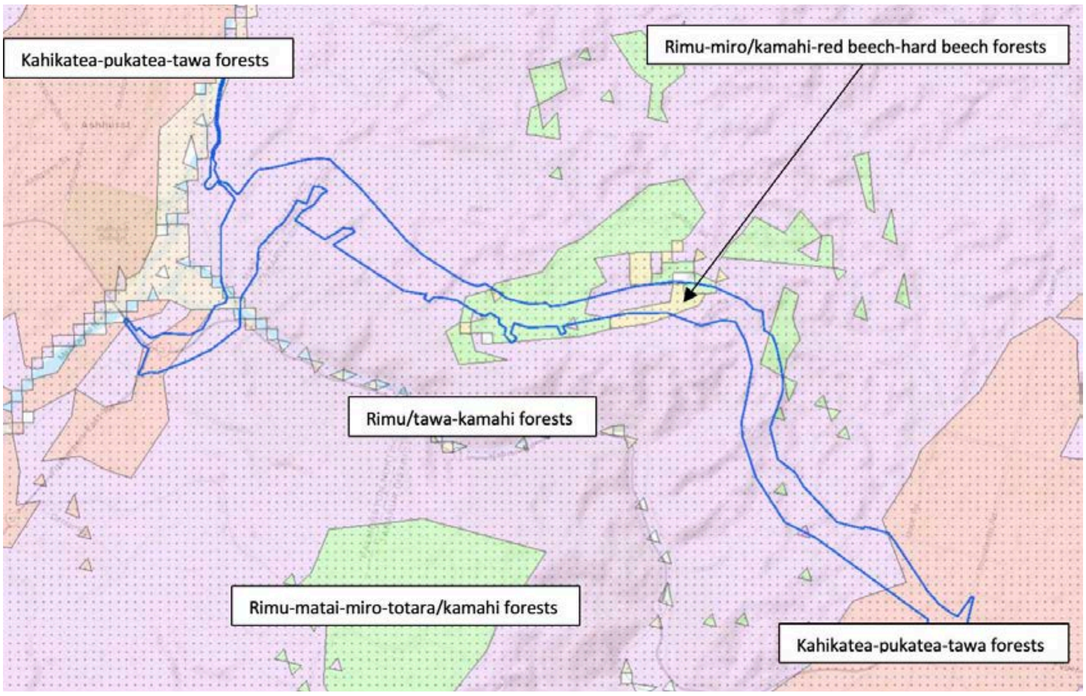

Figure 6.2. Predicted potential pre-human vegetation compositions (Leathwick, 2005) for the proposed designation area (outline shown) and surrounding landscape.

Terrestrial vegetation and habitats

24. Landcover within the designation area is predominantly exotic and these exotic communities are typically pastoral in origin. Exotic grasslands predominate. Exotic conifers occur as small plantations and as individual trees. Various exotic angiosperm species (e.g., Gorse, Willow) also occur.

25. Indigenous communities have been classified into 10 distinct terrestrial ecosystem types and these can be regarded as fauna habitats for policy purposes. The ten indigenous ecosystem types and their respective areas are listed in **Table 6.1** below.

26. The designation area covers 375.7 ha of land,[6] of which 38.5 ha (c.10%) comprises indigenous terrestrial ecosystems[7]. The land cover of the 337.2ha balance area within designation is predominantly exotic pasture with small areas of exotic plantation forest.

[6] The designation area calculation is to be updated as it omits three relatively small areas, in pasture, added recently.
[7] Note, this calculation and the vegetation cover figures in this paragraph excludes areas of indigenous ecosystems located within the designation area that are not mapped (due to those areas being within potential mitigation areas and thus not needing to be cleared, and thus not mapped).

Table 6.1. Ten ecosystem types located within the proposed designation boundaries.

Ref.	Ecosystem classification	Finalised area (ha)
1	Old-Growth Forests (Alluvial)^	4.23
2	Old-Growth Forests (Hill Country)	1.78
3	Secondary Broadleaved Forests with Old-Growth Signatures	3.07
4	Old-Growth Treelands	0.41
5	Advanced Secondary Broadleaved Forests	2.93
6	Raupō Dominated Seepage Wetlands (High Value)	0.55
7	Secondary Broadleaved Forests and Scrublands	16.32
8	Kānuka Forests	4.52
9	Indigenous-Dominated Seepage Wetlands (Moderate Value)	0.56
10	Mānuka, Kānuka and Divaricating Shrublands	4.12
	Total	38.49

^This area calculation includes 0.05 ha of Threatened-Nationally Critical (de Lange et al., 2018) swamp maire forest. Areas are slope-corrected using the Project LiDAR dataset.

27. The ecological values of the 10 ecosystem types are described in Tables 6.A.5-6.A.10 of the Terrestrial Vegetation and Habitats Assessment report. The levels of ecological value and corresponding One Plan Schedule F threat/rarity status can be summarised as follows:

Very High value:

1. Old-Growth Forests (Alluvial)[8]
2. Old-Growth Forests (Hill Country)[9]

High value:

3. Secondary Broadleaved Forests with Old-Growth Signatures[10]
4. Old-Growth Treelands[11]
5. Advanced Secondary Broadleaved Forests
6. Raupō-Dominated Seepage Wetlands[12]

Moderate value:

7. Secondary Broadleaved Forests and Scrublands

[8] Threatened (One Plan).
[9] Threatened (One Plan).
[10] Threatened (One Plan).
[11] Threatened (One Plan).
[12] Rare (One Plan).

8. Kānuka Forests[13]
9. Indigenous-Dominated Seepage Wetlands[14]

<u>Low value:</u>

10. Mānuka, Kānuka and Divaricating Shrublands

28. Horizons' One Plan Policy 13-5 provides criteria for assessing significance of vegetation and habitats. Section 4 of the Terrestrial Vegetation and Habitats Assessment report assesses statutory ecological significance, using the Policy 13-5 criteria, for the purposes of section 6(c) of the RMA. In summary, the following ecosystems have been determined as ecologically significant (numbered according to the list of ecosystems above):

    (a) Old-growth forests and treelands (1, 2, and 4);

    (b) Secondary forests with old-growth signatures (3);

    (c) Seepage wetlands (6, 9); and

    (d) Kānuka forests (8).

29. Items 5, 7, and 10 from the list above - i.e. the secondary broadleaved forests (both advanced and recent) and scrublands, and the native shrublands - are not considered significant when assessed against Policy 13-5 criteria. Those ecosystem types account for almost two-thirds of the potentially affected indigenous vegetation within the proposed designation - 23.37ha of 38.49ha. However, while these ecosystems do not qualify as significant in a statutory sense, the ecosystems do provide habitats for native fauna and represent an essential phase of forest regeneration. The effect on these ecosystems has been assessed and mitigation is recommended for their loss as a result of the Project.

Terrestrial fauna

30. Seven lizard species are potentially present within the designation area. New Zealand lizards are difficult to detect and, despite their non-detection within the daytime and nocturnal surveys carried out, it is very likely that At-Risk lizard species occur within the proposed designation area, particularly amongst either native or exotic vegetation where stock grazing does not occur; that is, between CH2500-12800. The presence of lizards (and High lizard values) is more likely in habitats connected to remnant

---

[13] Threatened (One Plan).
[14] Rare (One Plan).

habitats such as the gully systems and habitats with existing connections to the MGSR.

31. Based on inferences from habitat quality and configuration, the established trees, scrublands and seepage wetlands between CH4000 and 5800 (Western Rise) are expected to hold Moderate-Low terrestrial invertebrate values. The old-growth forest of the Western QEII area has direct connection with the MGSR and is likely to hold High invertebrate values. The relatively expansive areas of regenerating secondary broadleaved forests and scrublands between CH9900 and 12700 are likely to hold Moderate ecological value. Other areas of the alignment would be of Low to Negligible value for their terrestrial invertebrate assemblages.

32. The most important bird habitats and values occur on and near the Western Rise parts of the Project. These include the shingle riverbed habitat of the Manawatū River which supports a diversity of wetland and riverbed birds such as banded (Nat. Vul.)[15] and black-fronted dotterel, black- (Nat. Cri.) and red-billed (Dec.) gull, and Caspian tern (Nat. Vul.). The old-growth forests support a diversity of common forest bird species and potentially also Threatened and At-Risk species such as whitehead (Dec.), North Island rifleman (Dec.), and North Island kākā (Rec.). The seepage wetland at CH4100-4200 potentially supports swamp specialists such as marsh crake (Dec.) and Australasian bittern (Nat. Crit.). On the Eastern Rise, bush falcon (Rec.) was observed and can be assumed to range across the entire proposed designation area. Pipit (Dec.) is potentially present in exotic grasslands throughout the designation area.

33. Bioacoustics monitoring failed to detect long-tailed bats, and the experts who carried out the monitoring concluded that there is a low possibility of long-tailed bats being present in the Project area. However, there are trees within the designation area that have the attributes which provide roost cavities and also riparian and forest edge habitats in gullies with nearby mature forest providing potential roosting sites. Further work is scheduled in 2018-2019 to resolve current uncertainties regarding the presence/absence of long-tailed bat.

[15] These and all other threat classifications in this paragraph follow Robertson et al., (2017). Abbreviations used are: Nat. Crit. = Threatened-Nationally Critical; Nat. Vul. = Threatened-Nationally Vulnerable; Declining = At Risk-Dec.; Rec. = At Risk-Recovering.

METHODOLOGY

34. Detailed methodologies for both the Terrestrial Vegetation and Habitats and Terrestrial Fauna Assessments are contained in the respective reports, appended. Ecological values of terrestrial species and ecosystem types were assessed using current best practice methods (Environment Institute of Australia and New Zealand ("**EIANZ**"), 2018) for evaluating ecological values in the impact assessment framework. The assessment was based on the information available regarding species presence and the types of ecosystems present. Structured criteria to guide ecological values assessments are provided by EIANZ (2018; Table 4, p. 64) and these criteria formed the basis of the values assessment. They are:

    1. **Representativeness**:
        - Extent to which area is typical or characteristic; and
        - Size.
    2. **Rarity/distinctiveness**:
        - Amount of habitat or vegetation remaining;
        - Supporting nationally or locally Threatened, At Risk, or uncommon species;
        - Regional or national distribution limits;
        - Endemism;
        - Distinctive ecological features; and
        - Natural rarity.
    3. **Diversity and pattern**:
        - Level of natural diversity; and
        - Biodiversity reflecting underlying diversity.
    4. **Ecological context**:
        - Contribution to network, buffer, linkage, pathway;
        - Role in ecosystem functioning;
        - Important fauna habitat; and
        - Contribution to ecosystem service.

35. For the indigenous vegetation and habitats within the designation area, each of the four criteria was evaluated and given a categorical ranking of either High, Moderate, Low or Negligible. Overall value was then assessed using the following summation from the above criteria assessment:

- **Very High** value = Area[16] rates High for 3 or all of the four assessment matters. Likely to be nationally important and recognised as such.
- **High** value = Area rates High for 2 of the assessment criteria, Moderate and Low for the remainder, or Area rates High for 1 of the assessment matters, Moderate for the remainder. Likely to be regionally important and recognised as such.
- **Moderate** value = Area rates High for one matter, Moderate and Low for the remainder, or Area rates Moderate for 2 of more assessment matters Low or Very Low for the remainder. Likely to be important at the level of the Ecological District.
- **Low** value = Area rates Low or Very Low for majority of assessment matters and Moderate for one. Limited ecological value other than as local habitat for tolerant native species.
- **Negligible** value = Area rates Very Low for 3 matters and Moderate, Low or Very Low for remainder.

36. The assessment of ecological effects addressed the degree to which the proposed activity would diminish the attributes that made a given feature ecologically significant. The level of effect was determined through analysis of the level of ecological value and the magnitude of adverse effect (EIANZ, 2018). Both positive and adverse effects were considered. The assessment of magnitude and level of effect followed the EIANZ (2018) assessment criteria shown in **Table 6.2** and **Table 6.3** respectively.

[16] Of each ecosystem type/specific feature.

Table 6.2. Criteria for describing magnitude of effect (EIANZ, 2018).

Magnitude	Description
Very High	Total loss of, or very major alteration to, key elements/features/ of the existing baseline conditions, such that the post-development character, composition and/or attributes will be fundamentally changed and may be lost from the site altogether; AND/OR Loss of a very high proportion of the known population or range of the element/feature
High	Major loss or major alteration to key elements/features of the existing baseline conditions such that the post-development character, composition and/or attributes will be fundamentally changed; AND/OR Loss of a high proportion of the known population or range of the element/feature
Moderate	Loss or alteration to one or more key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be partially changed; AND/OR Loss of a moderate proportion of the known population or range of the element/feature
Low	Minor shift away from existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances or patterns; AND/OR Having a minor effect on the known population or range of the element/feature
Negligible	Very slight change from the existing baseline condition. Change barely distinguishable, approximating to the ‘no change’ situation; AND/OR Having negligible effect on the known population or range of the element/feature

Table 6.3. Criteria for describing level of effect based on matrix of ecological value and magnitude of effect (EIANZ, 2018).

Ecological value → Magnitude ↓	Very high	High	Moderate	Low	Negligible
Very High	Very high	Very high	High	Moderate	Low
High	Very high	Very high	Moderate	Low	Very low
Moderate	High	High	Moderate	Low	Very low
Low	Moderate	Low	Low	Very low	Very low
Negligible	Low	Very low	Very low	Very low	Very low
Positive	Net gain	Net gain	Net gain	Net gain	Net gain

37. Levels of effect were then considered further, in terms of national guidance regarding appropriate levels of ecological management response. National guidance on ecological management of effects was sourced from EIANZ (2018) and the Department of Conservation ("**DOC**") (2014; and references therein).

38. Regarding levels of effect, EIANZ (2018) recommends:

> **Very High adverse**: *Project effects in the 'Very High adverse' category are unlikely to be acceptable on ecological grounds alone (even with compensation proposals). Activities having very high adverse effects should be avoided. It is not the ecologist's role to make determinations with regard to project viability. The ecologist should present an objective and scientifically robust assessment of the effects of the project to assist the applicant in coming to an informed decision about project viability. Where very high adverse effects cannot be avoided, a net biodiversity gain would be appropriate.*
>
> **High and Moderate adverse**: *Options in the 'High and Moderate adverse' category represent a level of effect that requires careful assessment and analysis of the individual case. Such an effect could be managed through avoidance, design, or extensive offset or compensation actions. Wherever adverse effects cannot be avoided, no net loss of biodiversity values would be appropriate.*
>
> **Low and Very Low adverse**: *Should not normally be of concern, although normal design, construction and operational care should be exercised to minimise adverse effects. If effects are assessed taking impact management developed during project shaping into consideration, then it is essential that prescribed impact management is carried out to ensure Low or Very Low level effects.*

39. Offsetting principles contained in the DOC (2014) Guidance on Good Practice Biodiversity Offsetting in New Zealand were applied. In particular, ecological features of elevated conservation concern were assessed as to their status regarding the limits of offsetting.[17]

[17] See sections 6.2 and 6.3 of the Vegetation and Habitats Assessment report.

Statutory considerations, including national standards, regional and district plans and other relevant policies

40. The status of ecosystem types regarding statutory ecological significance was assessed using One Plan Policy 13-5 which sets out criteria regarding representativeness, rarity and distinctiveness, and ecological context. The criteria are provided in full in Table 6.A.11 of the Vegetation and Habitats Assessment report.

PROJECT SHAPING

Role in MCA process

41. I was involved as ecology advisor to the NZ Transport Agency on the previous project stage, the Manawatū Gorge Alternative - Detailed Business Case ("**DBC**"). Through the DBC phase, I assessed the ecological aspects and levels of ecological constraint of the 18 corridor options for the purposes of the multi-criteria analysis ("**MCA**") which helped inform the preferred corridor selection.

42. The ecological assessments of the 18 corridors (long-list options) was a valuable exercise (in terms of avoidance) in that a number of corridor options were able to be either ruled out, or scored unfavorably, due to the nature of some of the ecological risks associated with the lands they traversed. I considered a number of the options to be fatally flawed due to the ecological values potentially affected and the inability to avoid adverse effects to those values.

43. Even after careful amendments to the corridor boundaries to avoid important ecological sites, the resulting four short-listed options all presented substantial adverse ecological risks. At the conclusion of the shortlist stage, in ecological terms, there was no clearly preferable corridor alignment (although Option 3, which was developed as the basis for the Project, fared better than the other short-listed options in terms of freshwater ecology, with a 'moderate adverse' rather than 'significant adverse' rating). At the same time, it was clear there would be a requirement to carefully manage ecological constraints within discrete locations in any of the four corridor options.

44. As part of the DBC, I also assessed the ecological implications of six sub-options (i.e., A-F) for connections between the western end of Option 3 (at differing start points) and the existing SH3 southwest of Ashhurst.

Sub-options A and, to a lesser extent, B crossed similar terrain/terrestrial ecosystems to that of the Project and presented moderate adverse risks. Sub-options C to E traversed to the northwest and presented only minor adverse risks. Sub-option F commenced immediately to the north of the Manawatū River crossing and presented only minor adverse ecology risks.

Designation shaping

45. Vegetation and habitats were surveyed and mapped early in the Project timeline and this information was provided to the design team for use as a digital layer when considering design changes.

46. I attended the Project briefing and site visit and contributed to a number of design workshops and conference calls with other technical specialists. I presented information regarding ecological values, effects, and effects management at two mitigation workshops.

47. Regarding the designation extent, I highlighted opportunities to extend the designation to take in potential mitigation sites in a number of locations and these are described in the Design Philosophy Statement provided as an Appendix to the Assessment of Environmental Effects (volume 2). At around CH10400, I recommended that an earlier designation boundary that lay to the south, which took in a large area of regenerating forest, be contracted to the north to exclude the forested area from the designation.

Future shaping - constraints on detailed design

48. As noted above, the area of the Western Rise, immediately north of the Manawatū River (CH4000-4400) has the greatest ecological sensitivity and has high levels of constraint in terms of options to route a road in a manner that avoids features of High and Very High ecological value. Options for routing to the west are diminished by the culturally significant Parahaki Island, and options to the east by the MGSR. These fundamental constraints have made avoidance and minimisation of adverse ecological effects at CH4000-4400 very challenging. Other areas of particular ecological value at CH5600-5800 and CH6100-6400 also present constraints on future detailed design options. While these elements have not yet 'shaped' the Project that has been assessed by other specialists, a significant part of my work has involved assessing potential designs to identify recommended constraints on the future detailed design of the Project in these areas. This process and its outcomes are described further below.

ASSESSMENT OF EFFECTS

Adverse effects on terrestrial vegetation and habitats

General

49. The majority of the designation area is in exotic pasture and areas are of low sensitivity and are not discussed further here.

CH4000-4400 Northern Bridge Landing

50. In the highly constrained reach of the designation area between CH4000-4400, many of the ecological features potentially affected are of Very High ecological value.[18] These ecological features are described in detail in Vegetation and Habitats Assessment report, and can be summarised as:

    (a) Threatened alluvial old-growth forests, of which <2.5% of the vegetation type remains regionally.

    (b) A small remnant stand dominated by 14 mature swamp maire trees, which is a species classified as Threatened-Nationally Critical (de Lange et al., 2018).

    (c) A rare seepage wetland ecosystem.

    (d) A High value unnamed stream ecosystem.

51. As discussed in Sections 6.2 and 6.3 of the Vegetation and Habitats Assessment, the first three of the above ecosystems are both highly vulnerable (they contain highly threatened species or ecosystems) and highly irreplaceable (there are few options for replacing or conserving the potentially affected biodiversity components elsewhere).[19]

52. Analysis of an indicative embankment design through this area indicated that adverse effects on those species or ecosystems would be of Very High adverse level and would be incapable of appropriate mitigation or offsetting, and so that design would not have been supportable on ecological grounds. This led to a broader process, involving analysis of other potential designs, from which I have derived an 'effects envelope' of parameters within which I consider the Project must be designed and constructed, in order to be

[18] Following the EIANZ (2018) evaluation methodology.
[19] Norton (2008; Principle 3 therein) gave an example of <10% remaining as a threshold for habitats and nationally threatened as a threshold for species, below which clearance was inappropriate under any circumstances and specified the local context would set the level of limits to offsetting.

appropriate in terrestrial ecology terms (considering a recommended package of offset and other mitigation measures).

53. Four potential 3D road alignment designs (representing a range of alignments, to the east and west, between the constraints of Parahaki Island and the MGSR) were assessed. For each potential alignment, the likely impacts of an embankment (i.e., a shorter Manawatū River crossing bridge transitioning to an embankment immediately on the north river bank) and a longer viaduct, with a pier or piers constructed beneath, were assessed. Aspects of these analyses are presented in Section 5.2 of the Vegetation and Habitats Assessment report.

54. My analyses determined that each of the embankment options assessed would have Very High adverse effects on the ecosystems at CH4000-4400 (with permanent effects of a Very High magnitude). Following DOC (2014) and international (Pilgrim et al., 2013) good practice biodiversity offsetting guidance, the combined Very High levels of conservation concern (see Figure 6.A.7 of the Vegetation and Habitats Assessment report) plus permanent and severe residual impact magnitude (Appendix G of the Vegetation and Habitats assessment) indicates levels of effect that are inappropriate for biodiversity offsetting in that there is a lack of certainty that offsetting measures will be effective in appropriately addressing effects on biodiversity (i.e. these effects would be beyond the limits of offsetting).

55. After extensive assessment of design options, involving collaboration with various engineering disciplines within the Project team, I reached the conclusion that due to site constraints and the configuration of these critical ecosystems, there are unlikely to be any available options to construct an embankment within the proposed designation in a manner that could limit the level of effect to less than Very High adverse. This means that a principle of good practice offsetting (BBOP 2012), DOC (2014) and also One Plan Policy 13-4(c)(iv) is unlikely to be achieved with the level of effects that would result from an embankment.

56. A design that would be acceptable based on national ecological impact assessment and offsetting guidance would need to reduce the magnitude and duration of effect to achieve a level of effect less than Very High adverse. This is likely to involve the combination of an alignment that responds to the ecological values and elevates the structure in the form of a viaduct rather than an embankment, to minimise the impact magnitude and to

allow ecosystems to persist and be restored (i.e. not a permanent effect on their overall character).

57. That said, I have identified a recommended effects envelope based on my assessment of the various options - and guided in particular by the level of effects associated with two potential viaduct scenarios that I consider to be acceptable, as assessed in Section 5.2.1 of the Vegetation and Habitats Assessment report (annexed as Appendix 6.A). The parameters of this effects envelope allow for construction of the Project (likely a viaduct, unless another design and construction methodology can be devised to enable construction effects to remain within the envelope) in a manner that would reduce the magnitude and duration of adverse ecological effects on ecological features of Very High and High ecological value to an acceptable level, in my view (taking into account offsetting and mitigation measures).

58. Activities within the effects envelope will:

(a) cause no more than Moderate **magnitude** of adverse effect, on ecosystems with High or Very High **ecological value**, to ensure that the Very High adverse **effect** level is avoided; if so, effects are likely to be supportable on ecological grounds (with appropriate mitigation/offsetting); and

(b) cause effects on ecosystems of High or Very High ecological value that are not permanent,[20] in terms of the ecosystem's overall character. Effect duration should be long-term (c. 25 years) or less.

59. In practical terms, by way of illustration, the following effects on ecosystems of particular value (in the relevant part of the proposed designation) would come within the acceptable effects envelope, with appropriate offsetting and mitigation:

(a) **Threatened old-growth alluvial forests**: no more than 0.1 ha of Moderate magnitude/High level of effect, AND of no more than long-term (c. 25 years) duration, in terms of effects on the overall character of the ecosystem. In practice, this would cover the limited loss of canopy or emergent tiers, or loss of forest vegetation. Crucially, the effect would not be permanent in terms of overall character (notwithstanding that there may be some permanent effects, such as beneath the footprint of a viaduct pier); rather, the effects duration

[20] This and all other descriptions of effects duration follow EIANZ (2018) Table 8.

would be long-term or less in overall character and would be addressed through remediation plus restoration offsets.

(b) **Threatened-Nationally Critical swamp maire stand**: retention of all trees. Effects of canopy pruning to result in Low or Negligible magnitude of effect, and Moderate or Low level of effect. No permanent adverse effects on overall character of the stand (or indeed on any tree in it, apart from by way of canopy pruning).

(c) **Rare seepage wetland**: no more than 0.13 ha of Moderate magnitude/High level of effect, AND of no more than temporary (c. 15 years) duration. In practice this would allow for construction activities to directly modify no more than 0.13 ha of the seepage. The effects would be temporary in overall character and would be addressed through remediation plus restoration offsets.

(d) **Kānuka forest**: as an ecosystem of Moderate ecological value, even effects of a Very High magnitude could in theory be appropriately offset using the prescribed environmental compensation ratios ("**ECRs**"). That said, I understand that disturbance of the kānuka forest could likely be limited to an area of no more than 1 ha, which I would support as the retained kānuka forest would assist with the mitigation and offset treatments I discuss below (e.g., retirement, protection, and gap planting).

CH5600-5800 and CH6100-6400 - QEII areas

60. Two other areas of particular ecological sensitivity are the QEII protected sites located at CH5600-5800 ("**Western QEII**") and CH6100-6400 ("**Eastern QEII**").

61. The Western QEII, where it is crossed by the proposed designation at CH5600, contains Very High value old-growth forest,[21] and High value broadleaved forest in advanced stages of regeneration, as well as High value freshwater tributaries.

62. In respect of this area I went through a similar process to that described above. After extensive assessment of design options, involving collaboration with various engineering disciplines within the Project team, I reached the conclusion that due to site constraints and the configuration of the protected

[21] Representative of pre-human rimu/tawa-kamahi forests, 19.5% of this ecosystem type remains in the Horizons region.

forest, there were no available options to avoid Very High adverse effects. However, the old-growth forest at this location is of lesser vulnerability than the alluvial old-growth forest at CH4000-4400 and there are options immediately adjoining the affected forest for restorative replacement planting and pest control. In my opinion, the effect to the old-growth forest is able to be addressed by offsetting, but it is critical that detailed design is rigorous in application of measures to limit the effect duration (i.e., minimise permanent effects) and magnitude/severity (i.e. minimise the extent of clearance).

63. Likewise, the effect on the High value advanced secondary broadleaved forest would be Very High, as would the effect on the High value tributaries. Detailed design must take steps to limit the duration and magnitude of effect to these High value ecosystems.

64. Again, as with the CH4000-4400 section discussed above, in my view the detailed design process must be constrained by an envelope of effects in these areas.

65. As part of the process of identifying such an envelope, four differing alignments for crossing the gully containing the Western QEII were examined. Three of these were near the crossing point shown as the current indicative design on the NoR drawings (the indicative design is one of these options) and one option that crossed the gully close to the northwest corner of MGSR, where the vegetation and habitats crossed are of less value, was assessed.

66. Aspects that limited the potential to minimise impacts to vegetation and habitats were design limits on the grade, curve geometry and elevation of the alignments as they ascended the Western Rise. This combination of design parameters meant that the southernmost crossing near the MGSR could not be progressed as an option. Due to the grade restrictions on road design, where the alignment crosses the ridgeline (at CH5600), the alignment is low relative to the ridge. Further, the ridgeline ascends to the north meaning the further the alignment is to the north the greater the cut and consequential impact on the old-growth forest. I recommended the southern-most alignment for this reason and on the basis of the ecological value and conservation concern of the old-growth forest. Recommendations were made to bridge and use retaining walls at the crossing of the stream tributary at this site (CH5800) to minimise both forest and stream impacts.

67. Nonetheless, to reflect my view that other potential design options might have similarly acceptable effects, I have prescribed an effects envelope as specified in Table 6.A.15 of the Vegetation and Habitats Assessment report. Effects to the ecosystems beyond this envelope should not be permitted, in accordance with my recommendations. The effects envelope can be summarised as no more than 1 ha of old-growth (hill country) and 0.5 ha advanced secondary broadleaved forest (with retained forests in these ecosystem types to be protected).

68. At the Eastern QEII, three alignment options were assessed where the road crossed the forested (secondary broadleaved) gully. In all of these options the alignment crossed this area at a low elevation meaning there would be insufficient height to bridge the waterway and forest. Of the options, I recommended the northernmost on the basis that it minimised effects on the best quality forest, reduced the fragmentation effect (no longer would any forest be retained to the north of the road) and minimised the number of tributary streams that were crossed.

69. Nonetheless, for the crossing of the Eastern QEII site (CH6100-6400), I have prescribed an effects envelope (Section 5.3.3 of the Vegetation and Habitats Assessment) comprising limits on disturbance beyond the extent of cut and fill. Tracking and ancillary works should be minimised in indigenous vegetation (irrespective of composition) and stream ecosystems at this location.

Other valued areas within the proposed designation

70. Otherwise, there are a number of ecosystems within the designation where effects the Project's effects will need to be managed carefully. For example, the alignment makes perpendicular crossings of a number of waterways between CH6400-8600, and I recommend that retaining walls be used where possible to reduce the extent of fill in gullies as this would reduce the extent of impact on freshwater ecosystems.

71. Further, on the Eastern Rise, three options were investigated to reduce the length of interaction between the road and the stream around CH12100-12700. I recommend that the southernmost option be favoured, if possible, as this would avoid direct interactions with the stream.

72. That said, across the balance of the designation (i.e., other than in CH4000-4400 and the QEII areas), in my view it is acceptable, in ecological terms, for

construction activities to proceed with minimal constraint, provided recommended mitigation and offsetting measures are implemented. The sites discussed with regard to effects envelopes above contain High and Very High levels of ecological value, meaning that constraints are necessary to minimise the level of adverse effect. However, the lower value terrestrial ecosystems can be more readily replaced through restorative planting and adverse effects to fauna inhabiting these ecosystems can be mitigated by pre-clearance intensive surveys. On this basis, permission is sought to potentially clear all native shrublands (4.12 ha) and secondary broadleaved forests and scrublands (16.32 ha) that have been mapped (Figure 6.1) within the designation. The conditions and Ecological Management Plan will specify steps to be taken to minimise the disturbance and loss of native shrublands and secondary forests and scrubland. However, even the effects of complete clearance could effectively be offset through replacement restorative planting required through the proposed designation conditions.[22]

73. Effects of severance and fragmentation on existing forest habitats are difficult to remediate because the effect is permanent. These effects can be mitigated through delivering the configuration of restorative plantings (those required for both landscape and ecological mitigation purposes) in a manner that buffers existing sites and connects sites that are currently isolated.

74. Where partial clearance of forest stands is necessary, edge effects on a remaining forest stand are inevitable and could extend up to 50 m into the stand (Young & Mitchell, 1994). Restorative buffer planting would be required to seal, and where space allows, buffer, the newly created forest edge and thereby reduce the influence that the surrounding environment had on the microclimate and assemblages within the forest edge zone.

75. An overall summary of levels of adverse effect (including the recommended effects envelopes) on terrestrial vegetation and habitats is reproduced below in **Table 6.4** (from Table 6.A.16 of the Vegetation and Habitats Assessment report). This table represents a 'worst case' of effects in terrestrial ecology terms, in that it assumes clearance of all vegetation within the proposed designation, subject to the 'effects envelopes' and other constraints I have identified.

[22] Again, as noted above, those ecosystem types are not considered significant when assessed against Policy 13-5 criteria.

Table 6.4. Estimates of activities, their locations, and the resulting temporal scale, magnitude and level of adverse effects

Activities	Description	Location(s)	Temporal scale	Magnitude of effect	Level of effect
Vegetation clearance and modification of lower value (Moderate-Low value) ecosystem types	Potential designation-wide clearance of secondary broadleaved forest and scrublands and native shrublands	Designation wide	Temporary (medium term - *c.* 15 years)	Potentially Very High, as all of these ecosystem types could be cleared within the designation area. Likely to be Moderate with avoidance measures applied	High-Moderate
Vegetation clearance and modification of higher value (Moderate-Very High value) ecosystem types	Restricted clearance and modification of old-growth forests and treelands, secondary forests containing old-growth signatures, advanced broadleaved forest, kānuka and seepage wetlands	• 0.10 ha[23] of alluvial old-growth forest CH4000-4400	Long term (*c.* 25 years)	Moderate	High
		• 1 ha of hill country old-growth forest CH5650	Permanent (replacement not possible)	Very High (assuming the remaining area is avoided at CH5600)	Very High
		• 2.2 ha secondary forest containing old-growth signatures CH7300, 10500-10700	Long term (*c.* 25 yrs.)	High (assuming 0.41 ha avoided at CH6100)	Very High
		• 0.5 ha of advanced secondary broadleaved forest CH5700-5800	Long term (*c.* 25 yrs.)	High (assuming the remaining area is avoided at CH5750-5850)	Very High
		• 1 ha of kānuka forest (likely) at CH4200, minimise kānuka clearance elsewhere	Medium term (c. 15 years)	Moderate	Moderate
		• 0.13 ha of raupō seepage wetland CH4200[24]	Long term, (remediation possible)	Moderate, assuming direct effects avoided to remaining 0.42 ha	High
		• A remnant stand of 14 swamp maire CH4150	Long term (*c.* 25 yrs.)	Low or Negligible, assuming all swamp maire are retained, with some canopy pruning	Moderate or Low

[23] In addition, 0.05 ha has been allowed for minor old-growth forest clearance associated with the access track from Saddle Road across S. Bolton's land to the vicinity of CH4000.
[24] In addition, permanent loss of 0.39 ha of moderate value seepage wetland is assumed in the effects and offset calculation.

Activities	Description	Location(s)	Temporal scale	Magnitude of effect	Level of effect
Habitat fragmentation isolation	Severance of existing habitats resulting in one or more isolated habitat fragments	Dependent on final design	Permanent where replacement planting cannot remedy the severance or reconnect the fragment with an adjacent habitat	High, fragmentation and isolation would result in major loss and alteration of baseline conditions, attributes would be fundamentally changed	Very High-Low
Edge effects	Opening and exposing a forest edge to an open adjacent landscape	Dependent on final design	Temporary (medium term - 5-15 years)	Moderate, post-development character will be partially changed but minimised through buffer planting	Very High-Low

Adverse effects on terrestrial faunas

76. Effects on lizards, terrestrial invertebrates, avifauna and bats are discussed in Section 6 of the Terrestrial Fauna Assessment report (in **Appendix 6.B**). The drivers of the Project's adverse effects among the above fauna groups would be similar and can be summarised as:

    (a) injury or mortality during vegetation clearance and earthworks;

    (b) disturbance during critical nesting periods (birds);

    (c) permanent loss of habitats;

    (d) modification of habitats in the form of:

        (i) increased fragmentation and isolation due to reduced habitat connectivity;

        (ii) creation of edge effects and consequential effects to composition, structure and food sources in retained habitats; and

        (iii) invasions and corresponding impacts of non-native plant and animal species.

77. Further intensive survey work is required to confirm the status of long-tailed bat populations in the designation area and provide the ability to assess the effect on bats. Section 7.4 of the Terrestrial Fauna Assessment report provides an approach to address this current uncertainty.

78. The Terrestrial Fauna Report records the uncertainty in respect of which herpetofauna and invertebrate communities are present in the Project corridor. Taking a conservative approach, the Report records that non-grazed areas have a High value for herpetofauna and that parts of the corridor have value for invertebrates ranging from Moderate-Low to High, with the remainder of the corridor being of Negligible-Low value for invertebrates.

79. It has been determined that the alignment corridor is potentially utilised by 19 notable indigenous avifauna species for various activities (such as nesting, foraging and/or roosting), including four Threatened species and 15 At-Risk species. These species are considered to have Very High (Threatened species) or High ecological value (At-Risk species).

80. Summary ratings of adverse effects to fauna are given in the Terrestrial Fauna Assessment report for lizards, terrestrial invertebrates, and birds and are not repeated here.

MEASURES TO AVOID, REMEDY OR MITIGATE ACTUAL OR POTENTIAL ADVERSE (TERRESTRIAL ECOLOGY) EFFECTS

Terrestrial vegetation, habitats and fauna

81. Adverse effects to terrestrial vegetation and habitats will be addressed through avoidance and minimisation of effects to High and Very High value ecosystems through the effects envelopes approach discussed above. Of particular importance, this achieves avoidance of Very High magnitude adverse permanent effects to those features of Very High levels of conservation concern, for which clearance is inappropriate and offsetting not feasible.

82. For ecosystem types that can be replaced through restorative planting, replacement planting is proposed at the ECRs shown in **Table 6.5**. These ECRs are essentially multipliers by which the total affected area is multiplied to derive a replacement planting quantum. The ECRs are based on my expert judgement and their range of values considers the spatial area and quality (including considerations of scarcity) of the ecosystem types affected, and makes provision for time lag for delivery, risk of failure and uncertainty of outcome. In recommending these ECRs, I have also benchmarked the values to the extent I deem appropriate with the ECRs required for similar roading projects.[25] The mitigation/restoration ECRs for these ecosystem types range from 1:1 (native shrublands) to 5:1 (kānuka forests, old-growth treelands, and secondary broadleaved forests with old-growth signatures).

83. For the most threatened/rare/vulnerable and irreplaceable/complex ecosystems/features (old-growth forests, the seepage wetland and the nationally critical swamp maire), an approach of addressing adverse effects by replacement planting would not replace the full spectrum of biodiversity attributes lost. Instead, a package[26] of complementary, permanent, positive

[25] Table 11-50 of Transmission Gully Technical Report 11; Tables 6 and 8 of MacKays to Peka Peka EMP Attachments 1 and 5 respectively; Peka Peka to Otaki Draft Ecological Management Plan (Section 6); Table 4.1 of Mount Messenger Technical Report 7h.

[26] It should be noted that although I considered using the DOC's Microsoft Excel-based biodiversity offset calculator (Maseyk et al., 2015) to develop the offset package, my concerns over the ability of the model to adequately capture the complexity of biodiversity attributes present in this case meant that I instead have developed a bespoke package based on ecological science and principles, expert judgement and peer review, applied to the present context.

effects/restoration measures is needed to replace the lost biodiversity features to a level that a net biodiversity gain is achieved.

84. The net biodiversity gain outcome is important, both in terms of biodiversity offsetting (DOC, 2014) and ecological impact assessment (EIANZ, 2018) good practice guidance and the One Plan policy requirements. In particular, Policy 13-4 of the One Plan prescribes a net gain biodiversity outcome in response to a proposal's more than minor adverse effects in rare or threatened habitats.[27]

85. I understand that the NZ Transport Agency is to put forward a designation condition that requires offsetting to achieve a net indigenous biological diversity gain, with reference to the direction given by Policy 13-4.

86. It is my professional opinion that the restoration treatments in items (a) and (c) below would achieve and maintain a net biodiversity gain position. To achieve a net gain position, the lost habitat area must be replaced (i.e., habitat creation) in a like-for-like manner and with an additional area to address the time lag and uncertainties associated with establishing a native forest successional trajectory. Item (c) is relevant given the ongoing adverse effects that pests have on the forest and wetland biodiversity components that are subject to offset measures. Thus, the adverse effects of pests on like ecosystems must be addressed to achieve and maintain a net gain biodiversity position. Item (b) can also make an important contribution to biodiversity net gain as retiring, protecting and gap planting the existing forest ecosystems constitutes an enhancement of existing habitat immediately adjacent to a main area of impact (CH4000-4400) and restoration of these forests also makes a significant contribution in a landscape ecology sense, securing and strengthening an ecological corridor between MGSR and Ashhurst Domain. The precise scale of the biodiversity offset package would depend on the design and how that is constructed, and thus the end scale of effects.

[27] In this case, these are the old-growth forests and treelands, secondary forests with old-growth signatures, seepage wetlands, and kānuka forests. Policy 13-4 also envisages a net gain outcome in respect of more than minor adverse effects in at-risk habitats assessed to be significant in terms of Policy 13-5, and significant (residual) adverse effects in at-risk habitats not assessed to be significant - neither of these categories apply in this case.

87. In my assessment, based on the potential adverse effects of works within the designation corridor, a biodiversity offset package that achieves a biodiversity net gain would include the following components:

(a) Replacement planting using like-for-like composition and physiography to ensure there is a significant overall increase in the affected extent of affected ecosystems. Replacement planting is required following ECRs ranging from 4:1 to 12:1 listed in **Table 6.5** below and were developed taking into account the same considerations as for the mitigation ECRs described above. Particularly important are the like-for-like replacement planting sites for addressing impacts to old-growth forest ecosystem types. Initial discussions with Palmerston North City Council and Manawatū District Council officers have indicated approximately 14 ha of alluvial floodplain that is currently grazed could (in principle) be available at Ashhurst Domain for ecological planting to replace lost alluvial old-growth forests (the availability of this site is subject to Council confirmation). Potential sites for hill country old-growth forest replacement planting are numerous as indicated as areas 2, 3, 4 and 5 in Figure 6.A.9 of the Terrestrial Vegetation and Habitats Assessment report.

(b) Legal and physical protection (in perpetuity), including retirement from grazing, of existing forests located in close proximity to the location of effects. This action would require the NZ Transport Agency to secure a significant area of existing and degraded forests. One option for protection, retirement and gap planting is shown on Figure 6.A.9 of the Terrestrial Vegetation and Habitats Assessment report. Restorative planting is an important component of this treatment - through planting canopy gaps and clearings with suitable forest species the process of forest restoration is accelerated. The protection, retirement, and gap planting treatment would have the added benefit of securing landscape connectivity, effectively extending the boundary of the existing forest that is managed as MGSR and providing a habitat connection towards the Ashhurst Domain.

(c) Long-term (in perpetuity) integrated pest control is offered across all mitigation planting and offset replacement planting areas and also the existing forests that would be legally and physically protected, retired from stock grazing, and existing gaps/clearings planted with native tree species. Suitable pest control could cover possums and rats to achieve and maintain either a 5% residual trap catch/tracking index score or, if this monitoring method or target proves inappropriate for the configuration of control areas, an alternative outcome-related target (e.g., foliar browse) will be specified in the Ecological Management Plan. Further work is required to determine the optimal configuration for animal pest control, this might include for example a collaboration with DOC on a nearby project targeting animal pests specific to that project. Plant pest control will target pest species that threaten the regeneration and/or long-term maintenance of forest plants (e.g., shade tolerant species (e.g., barberry) or light demanding vines (e.g., old man's beard); not gorse or broom). This will enhance the terrestrial vegetation and habitats and associated biodiversity values of the mitigation and offset areas. Pest control will ensure that the permanent losses in biodiversity are permanently addressed, and that the net-gain position in biodiversity is maintained in the long term.

88. Potential sites and configuration of mitigation and offset treatments are discussed and mapped in Figure 6.A.9 of the Terrestrial Vegetation and Habitats Assessment report and are not discussed further here. Other potential sites on privately-owned hill country in the eastern study area and hill country and alluvial sites to the west of the study area are also being investigated at the time of writing.

89. Edge effects will be addressed through restorative buffer planting.

Table 6.5. Mitigation and offset quantities.

Mitigation quantities			
Ecosystem type	**Area actually/potentially affected (ha)**	**ECR**	**Replacement planting requirement (ha)**
Secondary Broadleaved Forests with Old-Growth Signatures	3.07	5	15.35
Old-Growth Treelands	0.41	5	2.05
Kānuka Forests	1.59	5	7.95
Advanced Secondary Broadleaved Forests	2.93	4	11.72
Secondary Broadleaved Forests and Scrublands	16.32	3	48.96
Manuka, Kānuka and Divaricating Shrublands	4.12	1	4.12
Mitigation replacement planting total area			90.15
Swamp maire mitigation planting are to be at the rates of 1:100 for damage (but retention); and 1:200 for unforeseen permanent loss			
Offset quantities			
Old-Growth Forests (Alluvial)^	0.15	12	1.8
Old-Growth Forests (Hill Country)^	1	10	10
Raupō Dominated Seepage Wetlands (High Value)	0.13	4	0.52
Indigenous-Dominated Seepage Wetlands (Moderate Value)	0.56	2	1.12
Offset replacement planting total area			13.44
Other treatments in the offset package			**Area required (ha)**
Retirement, protection and canopy gap planting			c. 32
Integrated pest control[28] in perpetuity over the entire replacement planting and retirement, protection and gap planting treatment areas, or a similar suitable alternative pest control project			135.59

[28] Animal pest control will address brushtail possums and rats and will maintain the density of those species below a 5% residual trap catch/tracking index. If this monitoring method or target proves inappropriate for the configuration of control areas, an alternative outcome-related target (e.g., foliar browse) will be specified in the Ecological Management Plan. Plant pest control will target pest species that threaten the regeneration and/or long-term maintenance of forest plants (e.g., shade tolerant species (e.g., barberry) or light demanding vines (e.g., old man's beard); not gorse or broom).

90. The Project's adverse effects on fauna from vegetation and habitat loss are directly addressed through the replacement planting and offset measures discussed above. It is also important that loss and disturbance of valuable fauna habitats will be avoided or otherwise minimised as far as practicable; the ECRs provide an incentive for constructors to achieve this.

91. Disturbance of fauna during critical breeding seasons will be addressed through provisions detailed in the Ecological Management Plan regarding the scheduling of works outside of critical periods or, if not possible, through preconstruction surveys and constraints on works during specific time periods of high sensitivity. Effects to birds will be addressed through:

    (a) a preclearance survey for cryptic bird species potentially inhabiting the raupō seepage, and for Whitehead in forests of the Western Rise, if works are required during their nesting season,

    (b) measures to address risks to Pipit in grassland habitats during their breeding season, and

    (c) seasonal management protocols to address potential effects to riverbirds associated with the Manawatū River crossing.

92. Effects to lizards will be addressed through intensive searches of impacted habitats for the purposes of salvage and relocation of resident lizards to suitable and secure habitats prior to disturbance.

93. Effects and mitigation required to address effects on long-tailed bats is to be addressed through further intensive bioacoustics bat surveys (which are programmed) and specific management plan provisions that respond to the survey results.

94. Regarding terrestrial fauna, I support the conclusion in Section 8 of the Terrestrial Fauna Assessment report that following full implementation of mitigation measures, the level of adverse effect would be Very Low-Low, with a net benefit being realised over time.

95. Indeed, with adherence to the effects envelopes recommended for areas of High and Very High ecological value/conservation concern, and with the mitigation and offset treatments described herein, it is my opinion that the effects management and positive effects proposed will result in a better configuration and level of ecological function of terrestrial vegetation and habitat than currently exists. Key aspects underpinning this position is that

all replacement plantings will be like-for-like, including restoration of highly threatened forest ecosystems (alluvial forest) and species (nationally critical swamp maire). Replacement plantings will be of an improved configuration in that the replacement plantings will be large and contiguous, joining existing fragmented sites where possible, and enhancing landscape scale connectivity, and significantly expanding the size of the (already large and high quality) MGSR.

96. Following full implementation of mitigation and offset proposals, it is my opinion that a net-gain position for terrestrial biodiversity would result from the Project (as will be required by the proposed designation condition, by reference to Policy 13-4).

97. Conditions are required to address the following aspects of terrestrial ecology:

(a) Preparation of an Ecological Management Plan, covering:

(i) Identification of ecological values (which would be based on the information present in this assessment and supporting documentation updated and expanded as necessary);

(ii) Objectives and methods to demonstrate how effects on terrestrial biodiversity will be monitored, managed, and mitigated, including but not limited to:

(1) Indigenous ecosystems/valued vegetation;

(2) Lizards;

(3) Bats;

(4) Terrestrial invertebrates; and

(5) Breeding bush, wetland, and riverbed birds;

(iii) Application of effects envelopes;

(iv) Staff training on ecological requirements;

(v) Use of ecosourced plant material, particularly regarding swamp maire, to ensure local genetic diversity is retained;

(vi) Measures to prevent plant pest introductions;

(vii) Salvage and transfer materials (soils, woody debris) for use in ecological mitigation areas;

(viii) Animal pest management; and

(ix) A plan for the delivery of mitigation and offset requirements including:

(1) Mitigation/offset principles;

(2) A programme for delivery;

(3) Species lists;

(4) Site locations and boundaries;

(5) Confirmation of restoration treatment components;

(6) Nature and duration of legal and physical protection;

(7) Proposed management and monitoring;

(8) Measures and thresholds of mitigation and offset success; and

(9) Procedures should mitigation and offset measures not be successful;

(b) Preparation of a Lizard Management Plan; and

(c) Preparation of an Avifauna and Bat Management Plan.

CONCLUSION AND RECOMMENDATIONS

98. The designation area within which the Project is proposed to be constructed contains 10 indigenous ecosystem types covering a combined area of 38.5 ha. The 10 terrestrial ecosystems can be regarded as habitats for policy purposes. Ecosystem/habitat values range from Very High (old-growth forests) to Low (native shrublands).

99. The proposed designation area contains fauna species representative of shingle riverbeds, native forest, and mixed pastoral landscapes. Highest avifauna values are associated with the Manawatū Riverbed, forest, wetland and scrubland ecosystems/habitats between CH4000 and 5800. Seven lizard species are potentially present and terrestrial invertebrate values are expected to be highest within intact old-growth forests connected to protected

areas. Further survey work is required to determine bat presence, following which effects and any necessary management response can be prescribed.

100. Measures are required to minimise effects to terrestrial ecosystems. Effects envelopes have been prescribed for specific areas of particular ecological value and conservation concern. These measures would include limiting clearance to agreed extents, buffer planting to address edge effects in retained vegetation, restoring damaged ecosystems to reduce the magnitude and duration of effect. In the area CH4000-4400, the use of a viaduct rather than an embankment is likely to be a design decision critical to achieving an acceptable level of adverse ecological effects.

101. Intensive pre-construction/clearance surveys for fauna species of conservation concern are required. This would include salvage and relocation of lizards, survey and avoidance/minimisation of works impacts on birds during critical nesting seasons, minimising impacts on indigenous ecosystems to minimise the impact on terrestrial invertebrates.

102. To ensure that adverse effects on ecology are appropriately managed, it is recommended that the approaches to effects management set out herein and, in the Vegetation, and Habitats Assessment and Terrestrial Fauna Assessment reports are implemented in full.

103. It is recommended that the mitigation and offset proposal specified in the Vegetation and Habitats Assessment report is implemented in full so as to demonstrate the attainment of a net-gain position in biodiversity in terms of Policy 13-4.

104. With adherence to the effects envelopes recommended for areas of High and Very High ecological value/conservation concern, with other effects management measures adopted, and with full implementation of mitigation and offset proposals, it is my opinion that a net-gain position for terrestrial biodiversity would result from the Project.

Dr Adam Forbes

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APPENDIX 6.1: TERRESTRIAL VEGETATION AND HABITATS ASSESSMENT REPORT

APPENDIX 6.2: TERRESTRIAL FAUNA ASSESSMENT REPORT

6.A
ASSESSMENT OF TERRESTRIAL VEGETATION & HABITATS

Te Ahu a Turanga – Manawatū Tararua Highway Project

Assessment of Terrestrial Vegetation and Habitats

Report prepared for the New Zealand Transport Agency

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Cover photograph:
Aerial view of the Manawatū Gorge showing the forests of the Manawatū Gorge Scenic Reserve, the Manawatū River, and the existing road (July 2018).

EXECUTIVE SUMMARY

The New Zealand Transport Agency (NZTA) is seeking planning approvals under the Resource Management Act (1991) to designate land for the purposes of an alternative State Highway route across the Ruahine Range. Forbes Ecology was engaged to provide an assessment of Terrestrial Vegetation and Habitats within the proposed designation, the associated actual and potential effects, and how those effects should be managed.

The composition, structure and condition of terrestrial vegetation and habitats were surveyed using both quantitative and qualitative survey techniques during August 2018. Ecological values and effects were assessed using current best practice methods (Environment Institute of Australia and New Zealand [EIANZ], 2018) for evaluating ecological values in the impact assessment framework. The ecological (statutory) significance of terrestrial vegetation and habitats was assessed using the criteria set out in Policy 13-5 of the Horizons One Plan. Effects management was structured around the mitigation hierarchy and good practice biodiversity offsetting guidelines (Business and Biodiversity Offsets Programme [BBOP], 2012; Department of Conservation [DOC], 2014). Terrestrial vegetation and habitats were assessed as to their status regarding the limits of offsetting (Pilgrim et al., 2013).

Of the proposed designation area, 38.5 ha (c. 10%) comprises terrestrial vegetation and habitats which are classified (based on composition, structure, and condition) into the following ten distinct ecosystem types and areas, ranging in ecological value from Very High to Low. Seven ecosystem types are assessed as significant regarding One Plan Policy 13-5.

Ecosystem type	Value level	RMA s6(c)	Area (ha)
Old-Growth (OG) Forests (Alluvial)^	Very High	Yes	4.23
OG Forests (Hill Country)	Very High	Yes	1.78
Secondary Broadleaved Forests with OG Signatures	High	Yes	3.07
OG Treelands	High	Yes	0.41
Advanced Secondary Broadleaved Forests	High	No	2.93
Raupō Dominated Seepage Wetlands (High Value)	High	Yes	0.55
Secondary Broadleaved Forests and Scrublands	Moderate	No	16.32
Kānuka Forests	Moderate	Yes	4.52
Indigenous-Dominated Seepage Wetlands (Mod. Value)	Moderate	Yes	0.56
Mānuka, Kānuka and Divaricating Shrublands	Low	No	4.12
			Sum = 38.49

^This area calculation includes 0.05 ha of Very High Value Threatened-Nationally Critical swamp maire forest. Areas are slope corrected using the project LiDAR dataset.

The majority of the designation features exotic pasture cover and the most common indigenous vegetation cover is Moderate value secondary broadleaved forests and scrublands. Several locations within the proposed designation feature habitats and species of Very High value and Very High levels of Conservation Concern (i.e., Vulnerability + Irreplaceability; Pilgrim et al., 2013).

Actual and potential adverse effects are identified as being clearance or modification of indigenous vegetation and habitats, habitat fragmentation and isolation, and edge effects on retained vegetation and habitats.

A stepped approach is proposed for vegetation clearance. The proposed approach allows flexibility within the designation area for works to proceed without being constrained by lower value ecosystems that can be replaced in relatively short timeframes through replacement planting; and to manage effects to higher value ecosystem types through avoidance and minimisation of effects, as defined by specific effects envelopes. Effects envelopes were developed that reduced levels of effect on High and Very High value features to levels acceptable on ecological grounds given appropriate mitigation and offsetting measures. Measures are proposed to address adverse effects associated with increased fragmentation/isolation and edge effects.

A mitigation and offset package is proposed to address adverse effects and to offset residual adverse effects to a biodiversity net-gain position. Key elements of the recommended mitigation and offset package are as follows (noting that the package will be updated to respond to the adverse effects of the project once detailed design has been undertaken, taking into account how effective the mechanisms intended to incentivise further avoidance of effects have been, and noting that retirement areas are subject to the NZTA acquiring the necessary land rights):

1. Up to 90.15 ha of like-for-like replacement indigenous restoration plantings (to account for the loss of up to 28.44 ha of habitat /ecosystem);
2. Replacement planting of swamp maire at ratios of 1:100 for damage/canopy pruning and 1:200 for unforeseen permanent loss/mortality;
3. Up to 13.44 ha of like-for-like replacement planting comprising (to account for the loss of up to 1.84 ha of habitat /ecosystem):
    a. Alluvial (1.8 ha) and hill country (10 ha) old-growth forests,
    b. Seepage wetlands (1.64 ha);
4. Retirement, protection and canopy gap planting of c. 32 ha of existing indigenous forests; and

5. Integrated pest control[1] in perpetuity over the entire replacement planting and retirement, protection and gap planting treatment areas (i.e., c. 135.59 ha), or an alternative pest control project, in collaboration with Iwi, DOC and Horizons.

Mitigation and offset areas are recommended (in priority order based on ecological principles). In combination and in conjunction with existing terrestrial vegetation and habitats, the mitigation and offset package would provide a significant extension to the regionally significant Manawatu Gorge Scenic Reserve (MGSR), connect and buffer existing remnants, and aim to provide landscape-scale ecological corridor between the MGSR and Ashhurst Domain.

[1] Animal pest control will address brushtail possums and rats and will maintain the density of those species below a 5% residual trap catch/tracking index. If this monitoring method or target proves inappropriate for the configuration of control areas, an alternative outcome-related target (e.g., foliar browse) will be specified in the Ecological Management Plan. Plant pest control will target pest species that threaten the regeneration and/or long-term maintenance of forest plants (e.g., shade tolerant species (e.g., barberry) or light demanding vines (e.g., old man's beard); not gorse or broom).

1.0 INTRODUCTION

1.1 Background

The existing State Highway 3 through the Manawatū Gorge has been permanently closed due to geotechnical instability. In response, the New Zealand Transport Agency (NZTA) is seeking planning approvals under the Resource Management Act 1991 to designate land for the purposes of an alternative State Highway route across the Ruahine Range. The corridor was identified from an earlier MCA process where 18 potential routes were assessed.

Forbes Ecology has been engaged by NZTA to provide a description of the vegetation and habitats within the proposed designation area, to assess the associated actual and potential effects, and how those effects should be managed. An overview of the proposed designation area is presented below in Figure 6.A.1. A copy of the project description is contained in the AEE report. This report informs the ecology assessment report.

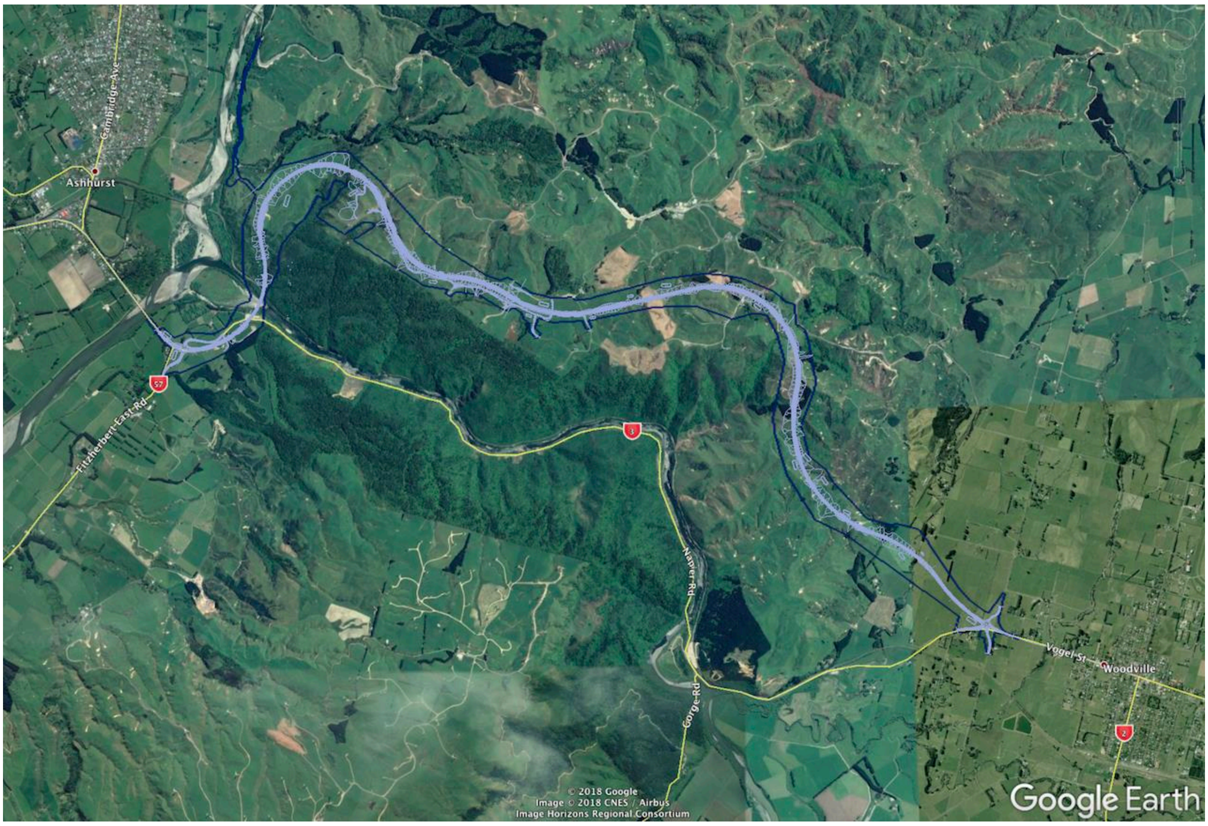

Figure 6.A.1. Overview of the proposed designation area. The proposed designation area and Notice of Requirement indicative design are shown in blue. Note that this figure and others in this assessment depict a previous iteration of the proposed designation area; three relatively small areas relating to unformed access tracks, in areas of pasture, have since been added.

1.2 Report Objectives

In relation to terrestrial indigenous vegetation and habitats within the proposed designation area, this report addresses the following objectives:

1. Classify and quantify the extent of indigenous vegetation and habitats.
2. Describe the nature and level of ecological values of vegetation and habitats.
3. Assess the ecological significance in terms of RMA S6(c) criteria.
4. Assess the levels of effect from the project to vegetation and habitats.
5. Based on levels of ecological value and the project requirements, prescribe approaches to effects management including recommendations for mitigation and biodiversity[2] offsetting.

[2] Biodiversity has three components: species, genetic and ecosystem diversity (Swingland, 2001). This report addresses all three components but with an emphasis on ecosystem and habitat diversity.

2.0 METHODS

2.1 Vegetation and Habitat Descriptions and Mapping

All indigenous vegetation and terrestrial habitats located within the proposed designation area were classified according to vegetation structure and species composition, and their spatial extent within the corridor was mapped. This process was informed by data collected from the proposed designation area using the following methods.

Point-centred quarter (P-C Q) vegetation survey (Mueller-Dombois & Ellenberg, 2002) followed randomly defined transect start points in predetermined vegetation strata. The P-C Q survey provided quantitative data on tree species composition, density, basal area, and frequency, and these data provided a main basis for quantitative forest descriptions. The P-C Q was deployed in the two largest indigenous forest areas within the designation (CH4000 & CH5600)[3]. Survey points were located at 20 m intervals along transects and a minimum of 20 points were surveyed in each forest areas.

Recce survey (Hurst & Allen, 2007) using 10 × 10 m plots located on a stratified-random basis. Recce survey augmented P-C Q survey and provided quantitative data on the species composition and vertical structure of the forests surveyed. A Recce plot was randomly located in the old-growth alluvial forest at CH4000.

Ecological condition was assessed for each vegetation area covered by the P-C Q survey using the Forest Monitoring Assessment Kit (FORMAK) Site Assessment Form (Handford, 2004) in part. This provided a comprehensive assessment of ecosystem health for each vegetation area surveyed.

Walk-through surveys were conducted in an opportunistic manner within wetlands and other areas of vegetation within the proposed designation area, with notes kept on vegetation and habitats. Walk-though surveys were combined with observations against the wetland indicator species list (Clarkson, 2013) to delineate wetland boundaries.

High-resolution orthophotography and oblique photography was collected from a drone to assist with survey design, area measurements, and to support the quantitative data collected from the above methods on vegetation composition.

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[3] CH refers to Chainage, which is a standard measure in metres from one end of the corridor to the other. Refer to Figure 6.A.2 for CH references.

The above data was used, in combination, to provide detailed descriptions of the distribution, composition, and condition of vegetation and habitats within the designation area.

2.2 Ecological Values Assessment

Ecological values of terrestrial ecosystem types were assessed using current best practice methods (Environment Institute of Australia and New Zealand [EIANZ], 2018) for evaluating ecological values in the impact assessment framework. The assessment was based on the detailed information available for each ecosystem type as described by the previous section. Structured criteria to guide ecological values assessments are provided by EIANZ (2018; Table 4, p. 64) and these criteria formed the basis of the values assessment:

1. Representativeness:
    - Extent to which area is typical or characteristic,
    - Size.
2. Rarity/distinctiveness:
    - Amount of habitat or vegetation remaining,
    - Supporting nationally or locally Threatened, At Risk, or uncommon species,
    - Regional or national distribution limits,
    - Endemism,
    - Distinctive ecological features,
    - Natural rarity.
3. Diversity and pattern:
    - Level of natural diversity,
    - Biodiversity reflecting underlying diversity.
4. Ecological context:
    - Contribution to network, buffer, linkage, pathway,
    - Role in ecosystem functioning,
    - Important fauna habitat,
    - Contribution to ecosystem service.

For the indigenous vegetation and habitats within the designation area, each of the four criteria were evaluated and given a categorical ranking of either High, Moderate, Low, or Negligible. Overall value was then assessed using the following summation from the above criteria assessment:

- Very High value = Area rates High for 3 or all of the four assessment matters – likely to be nationally important and recognised as such.
- High value = Area rates High for 2 of the assessment criteria, Moderate and Low for the remainder, or Area rates High for 1 of the assessment matters, Moderate for the remainder – Likely to be regionally important and recognised as such.

- Moderate = Area rates High for one matter, Moderate and Low for the remainder, or Area rates Moderate for 2 of more assessment matters Low or Very Low for the remainder. Likely to be important at the level of the Ecological District.
- Low = Area rates Low or Very Low for majority of assessment matters and Moderate for one. Limited ecological value other than as local habitat for tolerant native species.
- Negligible = Area rates Very Low for 3 matters and Moderate, Low or Very Low for remainder.

The ecological values assessment was informed by data from the following sources:

- Project-related survey data (e.g., for flora, habitats/ecosystems, avifauna & herpetofauna).
- Regional and District Planning documents and supporting technical reports.
- National level databases such as Potential Predicted Vegetation (Leathwick et al. 2004), Threatened Environments Classification (Walker et al. 2012), Singers and Rogers (2014), Land Cover Database (Terralink 2004).
- Central Government's Protecting our Places (MfE, 2007), the four national priorities for biodiversity protection.

2.3 Ecological Significance Assessment

The Horizons Regional Council ("One Plan", Horizons Regional Council 2017) sets out policies and rules for the management of natural resources including indigenous habitats. Policy 13-5 sets out criteria for assessing the significance of, and the effects of activities on, an area of habitat. Accordingly, indigenous habitats within the designation area were assessed against the ecological significance assessment criteria regarding representativeness, rarity and distinctiveness, and ecological context, contained in One Plan Policy 13-5. While there are apparent overlaps between the assessment criteria for ecological values and ecological significance, the ecological values assessment is (compared to significance assessment) a more nuanced assessment, considering a wider range of sub-criteria that contribute to the overall score of each criterion. Effectively, the ecological values assessment provides a ranked non-statutory assessment. In contrast, the significance assessment process is binary (either significant or not) and needing only one positive response to trigger statutory significance under RMA s6(c).

The ecological significance assessment was guided by the following criteria:

1. Representativeness:

    Habitat that:

a. Comprises indigenous habitat type that is under-represented (20% or less of known or likely former cover), or
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 of the same habitat type in the Ecological District or Ecological Region or has functioning ecosystem processes.

2. 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
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. pre-human) uncommon within New Zealand and supports an indigenous species or community of indigenous species.

3. Ecological Context:

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.

2.4 Ecological Effects Assessment

Fundamentally, the assessment of ecological effects addressed the degree to which the proposed activity would diminish the attributes that made a given feature ecologically significant. The level of effect was determined through analysis of the level of ecological value and the magnitude of adverse effect (EIANZ, 2018). Both positive and adverse effects were considered.

The assessment of magnitude and level of effect followed the EIANZ (2018) assessment criteria shown in Table 6.A.1 and Table 6.A.2 respectively. When considering the magnitude of effect, the timescale of potential effects must be considered and EIANZ (2018, Table 9) provides recommended timescales for effect duration categories.

Table 6.A.1. Criteria for describing magnitude of effect (EIANZ, 2018).

Magnitude	Description
Very High	Total loss of, or very major alteration to, key elements/features/ of the existing baseline conditions, such that the post-development character, composition and/or attributes will be fundamentally changed and may be lost from the site altogether; AND/OR Loss of a very high proportion of the known population or range of the element/feature
High	Major loss or major alteration to key elements/features of the existing baseline conditions such that the post-development character, composition and/or attributes will be fundamentally changed; AND/OR Loss of a high proportion of the known population or range of the element/feature
Moderate	Loss or alteration to one or more key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be partially changed; AND/OR Loss of a moderate proportion of the known population or range of the element/feature
Low	Minor shift away from existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances or patterns; AND/OR Having a minor effect on the known population or range of the element/feature
Negligible	Very slight change from the existing baseline condition. Change barely distinguishable, approximating to the ‘no change’ situation; AND/OR Having negligible effect on the known population or range of the element/feature

Table 6.A.2. Criteria for describing level of effect (EIANZ, 2018).

Ecological value → Magnitude ↓	Very high	High	Moderate	Low	Negligible
Very High	Very high	Very high	High	Moderate	Low
High	Very high	Very high	Moderate	Low	Very low
Moderate	High	High	Moderate	Low	Very low
Low	Moderate	Low	Low	Very low	Very low
Negligible	Low	Very low	Very low	Very low	Very low
Positive	Net gain	Net gain	Net gain	Net gain	Net gain

Table 6.A.3. Timescales for duration of effects (EIANZ, 2018).

Permanent	Effects continuing for an undefined time beyond the span of one human generation (taken as approximately 25 years)
Long term	Where there is likely to be substantial improvement after a 25-year period (e.g., the replacement of mature trees by young trees that need >25 years to reach maturity, or restoration of ground after removal of a development) the effect can be termed ‘long term’
Temporary	Long term (15-25 years or longer – see above)
	Medium term (5-15 years)
	Short term (up to 5 years)
	Construction phase (days or months)

2.4.1 Ecological management response

Levels of effect were viewed in terms of national guidance regarding appropriate levels of ecological management response. National guidance on ecological management of effects was sourced from EIANZ (2018) and DoC (2014; and references therein[4]).

Regarding levels of effect, EIANZ (2018) recommends:

Very High adverse: *Project effects in the 'Very High adverse' category are unlikely to be acceptable on ecological grounds alone (even with compensation proposals). Activities having very high adverse effects should be avoided. It is not the ecologist's role to make determinations with regard to project viability. The ecologist should present an objective and scientifically robust assessment of the effects of the project to assist the applicant in coming to an informed decision about project viability. Where very high adverse effects cannot be avoided, a net biodiversity gain would be appropriate.*

High and Moderate adverse: *Options in the 'High and Moderate adverse' category represent a level of effect that requires careful assessment and analysis of the individual case. Such an effect could be managed through avoidance, design, or extensive offset or compensation actions. Wherever adverse effects cannot be avoided, no net loss of biodiversity values would be appropriate.*

Low and Very Low adverse: *Should not normally be of concern, although normal design, construction and operational care should be exercised to minimise adverse effects. If effects are assessed taking impact management developed during project shaping into consideration, then it is essential that prescribed impact management is carried out to ensure Low or Very Low level effects.*

Offsetting principles contained in the DoC (2014) Guidance on Good Practice Biodiversity Offsetting in New Zealand were applied. In particular, ecological features of elevated conservation concern were assessed as to their status regarding the limits of offsetting.

[4] Includes BBOP (2012) good practice biodiversity offsetting principles.

3.0 INDIGENOUS VEGETATION AND HABITATS

3.1 Ecological Values

Indigenous terrestrial vegetation communities and terrestrial habitats were classified into ten distinct ecosystem types according to their composition, structure, and in the case of seepage wetlands, ecological condition/habitat potential. The designation area has a total area of 375.7 ha[5] and terrestrial indigenous ecosystems occupy 38.5 ha (i.e., c. 10% indigenous) of the designation area. The quantities and distribution of terrestrial ecosystems within the proposed designation area are summarised in Figure 6.A.2 and Table 6.A.4. below. Photographs of examples of each ecosystem type are provided in Appendix A.

Table 6.A.4. Ten ecosystem types located within the proposed designation boundaries.

Ref.	Ecosystem classification	Finalised area (ha)
1	Old-Growth Forests (Alluvial)^	4.23
2	Old-Growth Forests (Hill Country)	1.78
3	Secondary Broadleaved Forests with Old-Growth Signatures	3.07
4	Old-Growth Treelands	0.41
5	Advanced Secondary Broadleaved Forests	2.93
6	Raupō Dominated Seepage Wetlands (High Value)	0.55
7	Secondary Broadleaved Forests and Scrublands	16.32
8	Kānuka Forests	4.52
9	Indigenous-Dominated Seepage Wetlands (Moderate Value)	0.56
10	Mānuka, Kānuka and Divaricating Shrublands	4.12
	Total	38.49

^This area calculation includes 0.05 ha of Threatened-Nationally Critical swamp maire forest.
Areas are slope corrected using the project LiDAR dataset.

3.2 Levels of Ecological Value

The levels of ecological value of the ten identified ecosystem types are summarised below and described in detail in the tables that follow:

Very High value:

1. Old-Growth Forests (Alluvial)
2. Old-Growth Forests (Hill Country)

[5] Slope corrected measurement. The designation area calculation is to be updated as it omits three relatively small areas, in pasture, added recently.

High value:

3. Secondary Broadleaved Forests with Old-Growth Signatures
4. Old-Growth Treelands
5. Advanced Secondary Broadleaved Forests
6. Raupō-Dominated Seepage Wetlands

Moderate value:

7. Secondary Broadleaved Forests and Scrublands
8. Kānuka Forests
9. Indigenous-Dominated Seepage Wetlands

Low value:

10. Mānuka, Kānuka and Divaricating Shrublands

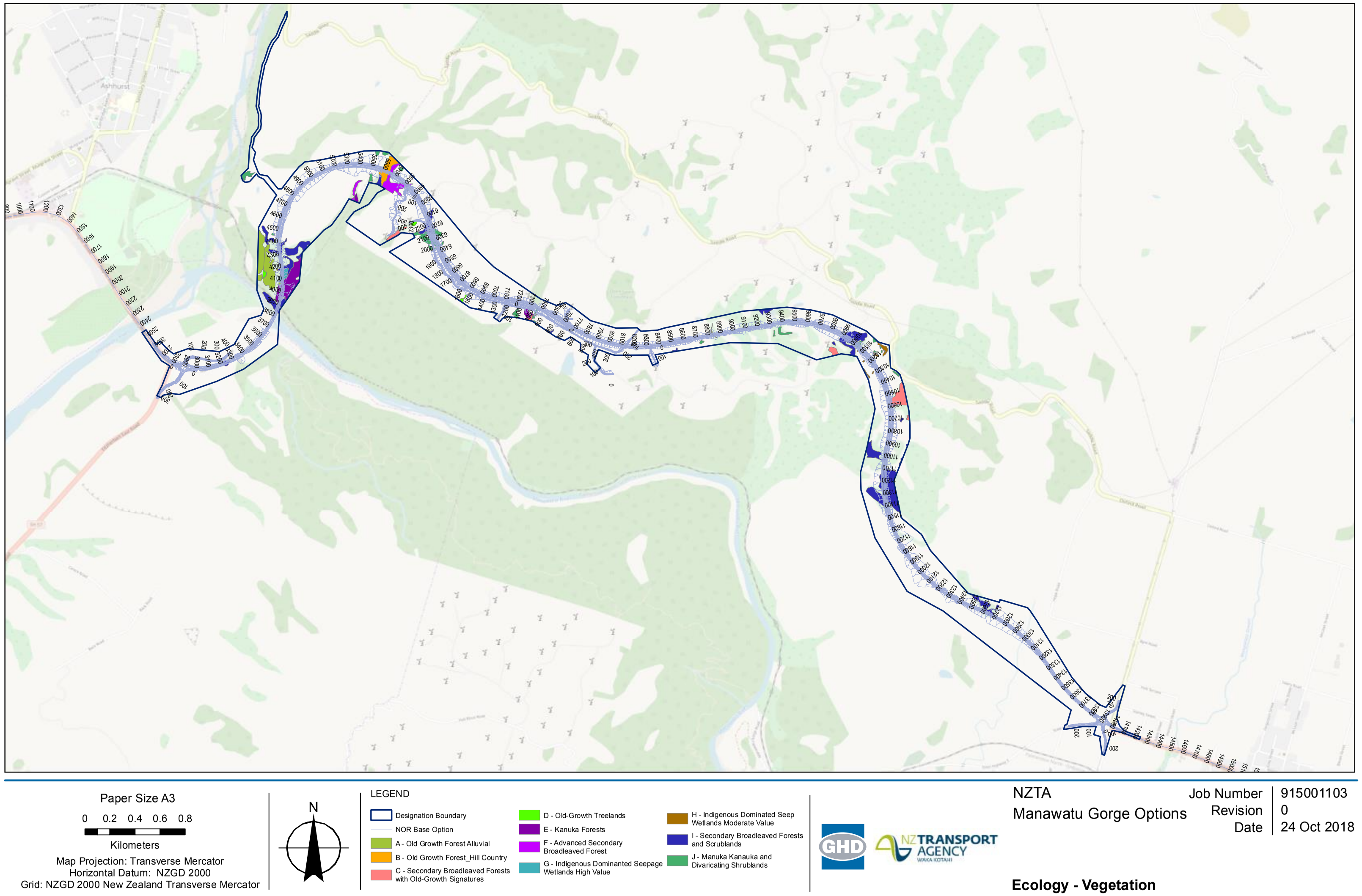

Figure 6.A.2. Distribution of indigenous ecosystem types within the proposed designation area. Note, ecosystems within the designation but not mapped are within areas assumed to be clear of works (e.g., in mitigation areas) and thus are not included in the scope of effects/mitigation/offset.

Table 6.A.5. Ecological values assessment of old-growth forests and treelands within the proposed designation area.

Ecological feature	Matters	Attributes to be considered	Assessment	Value level[6] (H, M, L, VL)
Old-Growth Forests (Alluvial) Old-Growth Forests (Hill Country) Old-Growth Treelands[7] (Types 1, 2, & 4)	Representativeness	Vegetation habitats:		
		▪ Typical structure and composition ▪ Indigenous species dominate ▪ Expected species and tiers are present	*The OG alluvial forests (CH4000–4100) are of a typical structure (noting stock understorey impacts[8]) and composition and are dominated by indigenous species. Expected species are present. The ground cover and subcanopy tiers are impacted by long-term stock access. There are charred wood remains within the existing forest, indicating previous burning of the forest.* *The OG hill country forest (Western Queen Elizabeth II National Trust Covenant (QEII); c. CH5600) has some representative canopy species missing, such as rimu – which would once have been emergent (as seen at the adjacent Manawatū Gorge Scenic Reserve). Indigenous species dominate, and most expected species are present.*	**High**
		Species:		
		▪ Species assemblages that are typical of the habitat ▪ Indigenous species that occur in most of the guilds expected for the habitat type	*Species assemblages are typical of lowland forests in this area of the Ecological District.*	
	Rarity/distinctiveness	Criteria for rare/distinctive vegetation and habitats:		
		▪ Naturally uncommon, or induced scarcity ▪ Amount of habitat or vegetation remaining ▪ Distinctive ecological features ▪ National priority for protection	*The alluvial OG forests (CH4000–4400) represent communities that occur in productive lowland positions (e.g., floodplains and low elevation sites), thus across the region, most of these ecosystems have historically been cleared for agriculture and development. Hill country OG forests are also much reduced in extent, and as a result, these OG forests are amongst the most threatened forest compositions in the Horizons Region. The induced scarcity of both the alluvial and hill country OG forests means the*	**High**

[6] Refer Table 6 of EIANZ (2018).

[7] Treelands in this category comprise mature forest canopy species but are grazed and sparse in canopy cover. Forest survey canopy dominance data from CH4000–4400 and CH5600 are contained in Appendix B.

[8] Refer forest condition assessment in Appendix D.

			forests are recognised as Threatened ecosystem types (i.e., <20% of former ecosystem extent remaining). *The OG forest remnants at CH4000–4400 are characteristic of alluvial landforms being located on stream terraces and terrace risers. These forests most closely represent podocarp/tawa–mahoe and kahikatea-pukatea-tawa forests and are the two most Threatened forest ecosystems in the Manawatū Region (only approx. 2.5% of each ecosystem type remains).* *The OG forest at CH5600 most closely represents rimu/tawa-kamahi forest (this is also the predicted pre-human forest composition for the area (Leathwick et al. 2005)). Rimu is missing from this forest and kamahi is scarce. Approximately 19.5% of this forest type remains in the Manawatū Region, making this forest a Threatened ecosystem.* *The land environments in which the OG forests remain are the least protected and most reduced (i.e., Acutely Threatened Environments; Walker et al., 2015), containing <10% nationally; meaning that their protection is Priority 1 of central Government's four national priorities for biodiversity protection (MfE, 2007).*	
		Criteria for rare/distinctive species or species assemblages:		
		▪ Habitat supporting Nationally-Threatened or At-Risk species, or locally uncommon species ▪ Regional or national distribution limits of species or communities ▪ Unusual species or assemblages ▪ Endemism	*The old-growth forests are not confirmed as supporting Threatened, At Risk, or locally uncommon species, nor species at distribution limits, unusual species or assemblages or unusual levels of endemism. However, Threatened or At Risk fauna species may be present.*	
	Diversity and pattern	▪ Level of natural diversity, abundance and distribution ▪ Biodiversity reflecting underlying diversity ▪ Biogeographical considerations – pattern, complexity ▪ Temporal considerations, considerations of lifecycles, daily or seasonal cycles of habitat availability and utilisation	*The alluvial OG forests have a natural diversity of canopy compositions which are expressions of the variation in underlying landform pattern. Pukatea and kahikatea dominate wet valley-floor positions whereas matai and titoki increase in dominance on dryer sites such as terrace risers. The abundance (e.g., basal area among canopy species) and distribution (microsite locations) of species is natural.* *The hill country OG forest is missing characteristic species of the emergent forest canopy tier. The forest is positioned in a sheltered location relative to the predominant westerly wind direction.* *All OG forests contribute seasonal resources in terms of fruit and nectar which have become scarce at the landscape scale due to widespread lowland forest clearance. The OG forests all have other areas of native forest within 1 km and form part of a landscape-scale habitat matrix amongst other forest remnants north of the Manawatū Gorge.*	**Forest = High; Treeland = Low**
	Ecological context	▪ Site history, and local environmental conditions which have influenced the	*The OG forests are structurally advanced and intact regarding forest stature and are of sufficient size and shape to support interior forest microclimate conditions. All OG*	**Medium**

		development of habitats and communities ▪ The essential characteristics that determine an ecosystem's integrity, form, functioning, and resilience (from "intrinsic value" as defined in RMA) ▪ Size, shape and buffering ▪ Condition and sensitivity to change ▪ Contribution of the site to ecological networks, linkages, pathways and the protection and exchange of genetic material ▪ Species role in ecosystem functioning – high level, key species identification, habitat as proxy	*forests present occur in discrete patches and are thus influenced by edge effects from the surrounding pastoral landscape. Where stock access occurs (e.g., alluvial forests), forest regeneration is impaired, thus affecting integrity, form, functioning and ultimately the resilience of the forest site. If retired, the biotic and abiotic conditions prevailing would conceivably lead to a rapid recovery of forest regeneration and thus understorey integrity. In the absence of browsers, the forest ecosystems are viable in terms of regeneration processes.* *Perturbations resulting from fires and logging have, over time, shaped the contemporary forest structure and composition. The forest canopy species perform crucial functional roles in supporting communities of birds and insects.*	
			Overall ecological value of OG forest[9]	**orest = Very High; Treeland = High**

Table 6.A.6. Ecological values assessment of secondary broadleaved forests with old-growth signatures within the proposed designation area.

Ecological feature	Matters	Attributes to be considered	Assessment	Value level[10] (H, M, L, VL)
Secondary Broadleaved Forests with Old-Growth Signatures (Type 3)	Representativeness	Vegetation habitats:		
		▪ Typical structure and composition ▪ Indigenous species dominate ▪ Expected species and tiers are present	*The secondary forests have a forest structure and composition of dominant species representing mid-successional species, such as mahoe, five finger, hangehange, rangiora, ribbonwood, lancewood, and lemonwood. Manuka or kānuka may also be present. Mature forest canopy species are conspicuous, either as old trees remnant from past forest or in advanced stages of secondary succession following clearance. Although dominated by secondary broadleaved species, the signature of OG species means that these forests have either retained or attained a canopy composition comparable in representativeness to that of pre-human forest compositions.*	**Moderate**

[9] Refer Table 6 of EIANZ (2018).
[10] Refer Table 4 of EIANZ (2018).

		Species:		
		▪ Species assemblages that are typical of the habitat ▪ Indigenous species that occur in most of the guilds expected for the habitat type	*Species assemblages (e.g., forest birds) are typical of secondary lowland forests in this area of the Ecological District. The native OG components to some extent resemble the pre-human forest canopy composition, although the full range of mature forest canopy species are not represented.*	
	Rarity/distinctiveness	Criteria for rare/distinctive vegetation and habitats:		
		▪ Naturally uncommon, or induced scarcity ▪ Amount of habitat or vegetation remaining ▪ Distinctive ecological features ▪ National priority for protection	*Lowland forests that are representative of pre-human compositions have an induced scarcity and thus are recognised as Threatened ecosystem types (i.e., <20% of former ecosystem extent remaining).* *The land environments in which the secondary forests with OG signatures remain are poorly protected and are reduced in extent nationally (i.e., Acutely and Chronically Threatened Environments; Walker et al., 2015), meaning that their protection is Priority 1 of Central Government's four national priorities for biodiversity protection (MfE, 2007).*	**High**
		Criteria for rare/distinctive species or species assemblages:		
		▪ Habitat supporting Nationally-Threatened or At-Risk species, or locally uncommon species ▪ Regional or national distribution limits of species or communities ▪ Unusual species or assemblages ▪ Endemism	*The secondary forests with OG signatures are not known to support Threatened, At-Risk, or locally uncommon species, nor species at distribution limits, unusual species or assemblages or unusual levels of endemism. However, Threatened or At Risk fauna species may be present.*	
	Diversity and pattern	▪ Level of natural diversity, abundance and distribution ▪ Biodiversity reflecting underlying diversity ▪ Biogeographical considerations – pattern, complexity ▪ Temporal considerations, considerations of lifecycles, daily or seasonal cycles of habitat availability and utilisation	*The secondary forests with OG signatures have natural levels of floristic diversity, although at any site the full complement of potential mature forest canopy species (e.g., tawa, hinau or podocarps) and OG forest indicators (e.g., kiekie) are not present. The diversity of seral species is high in some cases. The biodiversity of these ecosystems responds to the underlying diversity of landform and abiotic variables. The forests have other areas of native forest within 1 km and form part of a fragmented landscape-scale habitat network amongst other forest remnants north of the Manawatū Gorge.*	**High**
	Ecological context	▪ Site history, and local environmental conditions which have influenced the development of habitats and communities	*The secondary forests with OG signatures are communities that have assembled following partial or complete forest clearance. These forests are often in gullies or on steep topography where stock browsing and other disturbance has been less, thus forest regeneration has advanced. The forests comprise mainly fast-growing,*	**Moderate**

		▪ The essential characteristics that determine an ecosystem's integrity, form, functioning, and resilience (from "intrinsic value" as defined in RMA)	*relatively light-demanding species. The forests are spatially configured in a range of sizes and shapes, and the ecological condition varies depending on stand age and the history of stock access.* *The OG signature forms an important functional component (e.g., a potential seed source, provision of resources to attract frugivorous seed dispersers) for further natural diversification of the secondary forest.*	
		▪ Size, shape and buffering		
		▪ Condition and sensitivity to change		
		▪ Contribution of the site to ecological networks, linkages, pathways and the protection and exchange of genetic material		
		▪ Species role in ecosystem functioning – high level, key species identification, habitat as proxy		
			Overall ecological value of secondary forest with OG signatures	**High**

Table 6.A.7. Ecological values assessment of advanced secondary broadleaved forests and secondary broadleaved forests and scrublands within the proposed designation area.

Ecological feature	Matters	Attributes to be considered	Assessment	Value level[11] (H, M, L, VL)
Advanced Secondary Broadleaved Forests; Secondary Broadleaved Forests and Scrublands (Types 5 & 7)	Representativeness	Vegetation habitats:		**Advanced Secondary = Moderate; Secondary and Scrubland = Low**
		▪ Typical structure and composition	*These secondary broadleaved forests are indigenous dominated but do not clearly represent pre-human compositions (i.e., absence of long-lived canopy species) or statures (e.g., no emergent tier). The advanced secondary forest (CH5600–5800) has a forest structure and composition representing a later phase of development. Mid-successional species, such as lancewood have attained greater representation in the canopy. Kānuka may also be present.*	
		▪ Indigenous species dominate		
		▪ Expected species and tiers are present		
		Species:		
		▪ Species assemblages that are typical of the habitat	*Species assemblages are typical of older secondary lowland forests in this area of the Ecological District.*	
		▪ Indigenous species that occur in most of the guilds expected for the habitat type		

[11] Refer Table 6 of EIANZ (2018).

	Rarity/distinctiveness	Criteria for rare/distinctive vegetation and habitats:		
		▪ Naturally uncommon, or induced scarcity ▪ Amount of habitat or vegetation remaining ▪ Distinctive ecological features ▪ National priority for protection	*The land environments in which the advanced secondary broadleaved forest exist are poorly protected and are reduced in extent nationally (i.e., Acutely and Chronically Threatened Environments; Walker et al., 2015), meaning that their protection is Priority 1 of Central Government's four national priorities for biodiversity protection (MfE, 2007).*	**Moderate**
		Criteria for rare/distinctive species or species assemblages:		
		▪ Habitat supporting Nationally-Threatened or At-Risk species, or locally uncommon species ▪ Regional or national distribution limits of species or communities ▪ Unusual species or assemblages ▪ Endemism	*The secondary broadleaved forests are not known to support Threatened, At-Risk, or locally uncommon species, nor species at distribution limits, unusual species or assemblages or unusual levels of endemism. However, Threatened or At Risk fauna species may be present.*	
	Diversity and pattern	▪ Level of natural diversity, abundance and distribution ▪ Biodiversity reflecting underlying diversity ▪ Biogeographical considerations – pattern, complexity ▪ Temporal considerations, considerations of lifecycles, daily or seasonal cycles of habitat availability and utilisation	*The advanced secondary broadleaved forest has high levels of natural diversity. Secondary broadleaved forests and scrublands have natural levels of floristic diversity for seral forest. Both categories of secondary broadleaved forest are missing the mature forest canopy species (e.g., tawa, hinau or podocarps) and OG forest indicators (e.g., kiekie) in advanced stages of development (i.e., mature forest canopy species are not conspicuous). The diversity of seral species can be high. The biodiversity of these ecosystems responds to the underlying diversity of landform and abiotic variables. The forests have other areas of native forest within 1 km and form part of a fragmented landscape scale habitat network amongst other forest remnants north of the Manawatū Gorge.*	**Moderate**
	Ecological context	▪ Site history, and local environmental conditions which have influenced the development of habitats and communities ▪ The essential characteristics that determine an ecosystem's integrity, form, functioning, and resilience (from "intrinsic value" as defined in RMA) ▪ Size, shape and buffering ▪ Condition and sensitivity to change ▪ Contribution of the site to ecological networks, linkages,	*The secondary forests are communities that have assembled following forest clearance. These forests are often in gullies or on steep topography where stock browsing and other disturbance has been less and thus forest regeneration has advanced. The forests comprise mainly fast-growing, relatively light-demanding species. The forests are spatially configured in a range of sizes and shapes, and the ecological condition varies depending on stand age and the history of stock access. The site of advanced broadleaved regeneration is legally protected and has a history of stock exclusion. The secondary broadleaved forests form an important functional component (e.g., a potential seed source, provision of resources to attract frugivorous seed dispersers) and provide nursery conditions and potential for further successional development to forest compositions that incorporate mature forest canopy species representative of pre-human times.*	**Advanced Secondary = High; Secondary and Scrublands = Moderate**

		pathways and the protection and exchange of genetic material ▪ Species role in ecosystem functioning – high level, key species identification, habitat as proxy	*Some large areas of secondary broadleaved forest and scrub exist in on the slopes of the eastern rise and these areas stand out as having the highest values relating to ecological context (e.g., size, networks, linkages).*	
			Overall ecological value of advanced secondary broadleaved forest and broadleaved forest and scrublands	**Advanced Secondary = High Secondary and Scrublands = Moderate**

Table 6.A.8. Ecological values assessment of mature kānuka forest within the proposed designation area.

Ecological feature	Matters	Attributes to be considered	Assessment	Value level[12] (H, M, L, VL)
Kānuka forests (Type 8)	Representativeness	Vegetation habitats:		
		▪ Typical structure and composition ▪ Indigenous species dominate ▪ Expected species and tiers are present	*These secondary forests are kānuka dominant and have few broadleaved species in the understorey. Broadleaved species such as mahoe may be present in the canopy and rewarewa may be emergent.*	**Moderate**
		Species:		
		▪ Species assemblages that are typical of the habitat ▪ Indigenous species that occur in most of the guilds expected for the habitat type	*Species assemblages are typical of secondary lowland forests in this area of the Ecological District. Some species are missing (e.g., emergent rimu).*	
	Rarity/distinctiveness	Criteria for rare/distinctive vegetation and habitats:		
		▪ Naturally uncommon, or induced scarcity ▪ Amount of habitat or vegetation remaining ▪ Distinctive ecological features	*Mature kānuka forests have an induced scarcity and thus are recognised as regionally Threatened ecosystem type.* *The land environments in which the kānuka forests remain are poorly protected and are reduced in extent nationally (i.e., Acutely and Chronically Threatened Environments;*	**High**

[12] Refer Table 6 of EIANZ (2018).

		▪ National priority for protection	*Walker et al., 2015), meaning that their protection is Priority 1 of Central Government's four national priorities for biodiversity protection (MfE, 2007).*	
		Criteria for rare/distinctive species or species assemblages:		
		▪ Habitat supporting Nationally-Threatened or At-Risk species, or locally uncommon species	*The kānuka forests are not known to support Threatened, At-Risk, or locally uncommon species, nor species at distribution limits, unusual species or assemblages or unusual levels of endemism. However, Threatened or At Risk fauna species may be present.*	
		▪ Regional or national distribution limits of species or communities		
		▪ Unusual species or assemblages		
		▪ Endemism		
	Diversity and pattern	▪ Level of natural diversity, abundance and distribution	*The kānuka forests have reduced levels of floristic diversity due to past and current land use impacts on forest regeneration processes. The forests have other areas of native forest within 1 km and form part of a fragmented landscape scale habitat network amongst other forest remnants north of the Manawatū Gorge.*	**Moderate**
		▪ Biodiversity reflecting underlying diversity		
		▪ Biogeographical considerations – pattern, complexity		
		▪ Temporal considerations, considerations of lifecycles, daily or seasonal cycles of habitat availability and utilisation		
	Ecological context	▪ Site history, and local environmental conditions which have influenced the development of habitats and communities	*The kānuka forests are communities that have assembled following partial or complete forest clearance. These forests are in gullies or on faces which are today still grazed. Forest condition is reduced by grazing and limited regeneration means that resilience and potential for successional development is impaired. The kānuka forests provide an important nursery for the development of future forests but the existing kānuka stands would need to be retired for this potential to be realised.*	**Moderate**
		▪ The essential characteristics that determine an ecosystem's integrity, form, functioning, and resilience (from "intrinsic value" as defined in RMA)		
		▪ Size, shape and buffering		
		▪ Condition and sensitivity to change		
		▪ Contribution of the site to ecological networks, linkages, pathways and the protection and exchange of genetic material		
		▪ Species role in ecosystem functioning – high level, key species identification, habitat as proxy		
			Overall ecological value of kānuka forest	**Moderate**

Table 6.A.9. Ecological values assessment of native shrublands within the proposed designation area.

Ecological feature	Matters	Attributes to be considered	Assessment	Value level[13] (H, M, L, VL)
Mānuka, Kānuka and Divaricating Shrublands (Type 10)	Representativeness	Vegetation habitats:		
		▪ Typical structure and composition ▪ Indigenous species dominate ▪ Expected species and tiers are present	*Shrublands of manuka, kānuka, and small-leaved divaricates within an exotic grassland matrix. Species composition and dominance varies among sites. Often mixed with a minority of exotic woody species such as gorse or having invaded exotic grassland.*	**Low**
		Species:		
		▪ Species assemblages that are typical of the habitat ▪ Indigenous species that occur in most of the guilds expected for the habitat type	*Species assemblages result from recent disturbance and are not representative of pre-human mature forest compositions. Of limited stature and cover.*	
	Rarity/distinctiveness	Criteria for rare/distinctive vegetation and habitats:		
		▪ Naturally uncommon, or induced scarcity ▪ Amount of habitat or vegetation remaining ▪ Distinctive ecological features ▪ National priority for protection	*The land environments in which the native shrublands remain are poorly protected and are reduced in extent nationally (i.e., Acutely and Chronically Threatened Environments; Walker et al., 2015), meaning that where indigenous cover is >50%, the protection of these areas is Priority 1 of Central Government's four national priorities for biodiversity protection (MfE, 2007).*	**Moderate**
		Criteria for rare/distinctive species or species assemblages:		
		▪ Habitat supporting Nationally-Threatened or At-Risk species, or locally uncommon species ▪ Regional or national distribution limits of species or communities ▪ Unusual species or assemblages	*The native shrublands are not known to support Threatened, At-Risk, or locally uncommon species, nor species at distribution limits, unusual species or assemblages or unusual levels of endemism. However, Threatened or At Risk fauna species may be present.*	

[13] Refer Table 6 of EIANZ (2018).

		▪ Endemism		
	Diversity and pattern	▪ Level of natural diversity, abundance and distribution ▪ Biodiversity reflecting underlying diversity ▪ Biogeographical considerations – pattern, complexity ▪ Temporal considerations, considerations of lifecycles, daily or seasonal cycles of habitat availability and utilisation	*The shrublands have low levels of floristic diversity. The biodiversity of these ecosystems is limited by their relatively young age or the disturbance regime that prevents succession to more advanced and diverse states.*	**Low**
	Ecological context	▪ Site history, and local environmental conditions which have influenced the development of habitats and communities ▪ The essential characteristics that determine an ecosystem's integrity, form, functioning, and resilience (from "intrinsic value" as defined in RMA) ▪ Size, shape and buffering ▪ Condition and sensitivity to change ▪ Contribution of the site to ecological networks, linkages, pathways and the protection and exchange of genetic material ▪ Species role in ecosystem functioning – high level, key species identification, habitat as proxy	*The shrublands are communities that have assembled following recent vegetation clearance. These communities are on steep topography where stock browsing and other disturbance has been less and also amongst paddocks containing stock. The shrublands comprise mainly fast-growing, relatively light demanding species. Where shrublands can be retired they make an important contribution to the development of future forests, thus when sustainably managed form an important habitat and successional phase.*	**Low**
			Overall ecological value of native shrublands	**Low**

Table 6.A.10. Ecological values assessment of indigenous–dominated wetlands within the proposed designation area.

Ecological feature	Matters	Attributes to be considered	Assessment	Value level[14] (H, M, L, VL)
Raupō Dominated Seepage Wetlands (High Value); Indigenous-Dominated Seepage Wetlands (Moderate Value) (Types 6 & 9)	Representativeness	Vegetation habitats:		
		▪ Typical structure and composition ▪ Indigenous species dominate ▪ Expected species and tiers are present	*In these locations, the seepage wetlands would once have supported tall swamp-forest species, thus the current herbaceous (e.g., raupō & carex) and woody (e.g., manuka) compositions do not clearly represent pre-human composition and structure. The exception to this is the raupō dominated seepage at CH4200 which features a remnant stand of swamp maire (Threatened-Nationally Critical) on its southern margin.*	**Raupō seepage (CH4200) = Moderate; remaining seepages = Low**
		Species:		
		▪ Species assemblages that are typical of the habitat ▪ Indigenous species that occur in most of the guilds expected for the habitat type	*The species present are typical of seepage wetlands where swamp forest has been cleared and stock have had unrestricted access over prolonged periods. All seepage wetlands have a history of grazing which has simplified the species composition. The raupō seepage at CH4200 presents the greatest opportunity to support swamp birds (crake, Australasian bittern).*	
	Rarity/distinctiveness	Criteria for rare/distinctive vegetation and habitats:		
		▪ Naturally uncommon, or induced scarcity ▪ Amount of habitat or vegetation remaining ▪ Distinctive ecological features ▪ National priority for protection	*Seepage wetlands are a rare ecosystem type (One Plan Schedule F) within the Horizons region.* *The raupō dominated seepage at CH4200 features Threatened swamp maire.* *The protection of native vegetation associated with wetlands is Priority 2 of Central Government's four national priorities for biodiversity protection (MfE, 2007).*	**High**
		Criteria for rare/distinctive species or species assemblages:		
		▪ Habitat supporting Nationally-Threatened or At-Risk species, or locally uncommon species ▪ Regional or national distribution limits of species or communities ▪ Unusual species or assemblages ▪ Endemism	*Those seepages embedded within pastoral surroundings are unlikely to support species of conservation concern. The raupō seepage at CH4200–4300 supports Threatened Swamp Maire and provides potential habitat for Threatened and At-Risk swamp bird species.*	

[14] Refer Table 6 of EIANZ (2018).

	Diversity and pattern	▪ Level of natural diversity, abundance and distribution ▪ Biodiversity reflecting underlying diversity ▪ Biogeographical considerations – pattern, complexity ▪ Temporal considerations, considerations of lifecycles, daily or seasonal cycles of habitat availability and utilisation	*The seepage wetlands are degraded by stock access and this has reduced the diversity, abundance and distribution of species.* *The raupō seepage at CH4200 provides potential habitat for Threatened and At-Risk swamp birds. All other seepage wetlands are of low value regarding their contribution to diversity and pattern.*	**Raupō seepage (CH4200) = High** **Other seepages = Low**
	Ecological context	▪ Site history, and local environmental conditions which have influenced the development of habitats and communities ▪ The essential characteristics that determine an ecosystem's integrity, form, functioning, and resilience (from "intrinsic value" as defined in RMA) ▪ Size, shape and buffering ▪ Condition and sensitivity to change ▪ Contribution of the site to ecological networks, linkages, pathways and the protection and exchange of genetic material ▪ Species role in ecosystem functioning – high level, key species identification, habitat as proxy	All seepage wetlands have been modified and had their condition degraded by ongoing stock access. Hydrosystems are intact. Seepages are small and lack buffering from adjacent pastoral land uses.	**Low**
			Overall ecological value of seepage wetlands	**Raupō seepage (CH4200) = High** **All other seepage wetlands = Moderate**

4.0 ECOLOGICAL SIGNIFICANCE ASSESSMENT

4.1 Assessment of One Plan Criteria

One Plan Policy 13–5 provides criteria for assessing the significance of, and the effects of activities on, an area of habitat. Policy 13–5 prescribes the following approach for classifying significant indigenous vegetation or significant habitats of indigenous fauna:

- *Rare habitats* are those that were originally (i.e., pre-human) uncommon within New Zealand, and supports an indigenous species or community of indigenous species (criterion (ii)(E))
- *Threatened habitats* are those indigenous habitat types that are under-represented (20% or less of known or likely former cover; criterion (i)(A)).
- *At Risk* habitats are those that have been reduced to 50% or less of their former extent.

Rare or threatened habitats may also be ecologically significant under one or more further criteria contained in Policy 13–5. The ten ecosystem types described in Table 6.A.4. follow the ecosystem types described in One Plan schedule F with some additions to account for seral or regenerating communities that do not represent pre-human forest compositions but still contribute to the level of current natural diversity. The ten ecosystem types can be regarded as habitats in terms of Policy 13-5, and their statutory significance is assessed as follows.

The alluvial and hill country old-growth forests, secondary forests containing conspicuous old-growth signatures, and kānuka forest represent compositions that occurred during pre-human times but are now underrepresented (<20% remaining) in the contemporary landscape. Thus, these ecosystem types are significant under Policy 13–5 (a) (i) (A).

The raupō seepage wetland is significant as at its southern margin it supports a remnant stand of swamp maire (Threatened–Nationally Critical) and as seepage wetlands were rare even before humans modified New Zealand's ecosystem pattern. Thus, the raupō seepage wetland at CH4200 is significant under both Policy 13–5 (a) (ii) (A) and (E). Other indigenous-dominated seepage wetlands are significant as they are rare ecosystem types (Policy 13–5 (a) (ii) (E).

The advanced secondary broadleaved forest at CH5700–5800, the secondary broadleaved forests and scrublands, and the native shrublands are not significant in terms of the criteria contained in Policy 13–5 (a).

Table 6.A.11. Ecological significance assessment (applying One Plan criteria) of indigenous ecosystem types located within the designation area.

Policy 13–5 (a)	Criteria Description	OG forests (A & H-C)	OG treeland	Secondary forest with OG signatures	Advanced secondary broadleaved forest	Raupō seepage wetland	Secondary broadleaved forest and scrublands	Kānuka forest	Other indigenous seepages	Native shrublands
Representativeness (i)	Habitat that:									
	(A) Comprises indigenous habitat type that is underrepresented (20% or less of known or likely former cover), or	Significant[15]	Significant	Significant				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 Distin	Habitat that supports an indigenous species or community that:									

[15] Significance as defined by the One Plan Schedule F.

	(A) Is classed as threatened (as determined by the New Zealand Threat Classification System and Lists), or					Significant[16]				
	(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.					Significant			Significant	
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									

[16] Relates to the seepage wetland containing a stand of Threatened-Nationally Critical swamp maire at c. CH4120.

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	**Significant**	**Significant**	**Significant**	Not significant	**Significant**	Not significant	**Significant**	**Significant**	Not significant

5.0 VEGETATATION CLEARANCE/MODIFICATION ACTIVITIES AND EFFECTS

5.1 Clearance or Modification of Indigenous Vegetation and Habitats

Permission is sought for the clearance of a subset of ecosystem types (Table 6.A.12.). The full extent of each class within the designation area could potentially be entirely cleared; while such an outcome may be unlikely, mitigation has been recommended to address the level of adverse effect that would result from their complete loss. The purpose of this approach is to allow flexibility within the designation area for works to proceed without being constrained by lower value ecosystems that can be replaced in relatively short timeframes through replacement planting. The replacement planting would be at the environmental compensation ratios (ECR) specified in Table 6.A.19. If, as part of the detailed design process, opportunities are identified to reduce the extent of effects from these assumed maxima, the replacement planting area required would reduce accordingly, through application of the respective ECRs to slope-corrected measures of affected vegetation. As such, further avoidance will be incentivised. Any such changes would need to respond to and be up to/within the level of effects specified in Table 6.A.19. A management regime is defined through the conditions that directs the management plan framework to take steps to avoid effects to animals inhabiting ecosystem types subject to this management regime.

For the other ecosystem types (Table 6.A.12) permission is sought for a discrete envelope of effects based on the preliminary design[17], including a provision for flexibility beyond the project footprint to allow for construction access. This aspect of the approach emphasises the importance of avoiding adverse effects to higher value ecosystem types and the conditions and management plan framework specify steps and measures to identify, demarcate, and physically protect these higher value ecosystem types.

Table 6.A.12. Ecosystem types for which full clearance is sought versus clearance constrained.

Full clearance	Constrained clearance
Full clearance allowed following pre-clearance fauna surveys. Replacement planting to be provided for the full area (Table 6.A.4.) of these	Clearance constrained by either an agreed effects envelope or condition and management plan provisions for minimisation of clearance. Agreed effects envelopes are specified in Section 5.3. Replacement planting and

[17] In this report, both the “preliminary design” and “preliminary indicative design” are terms that refer to the preliminary 3D road design shown on the designation plans as lodged.

ecosystems occurring within the designation area. • Secondary broadleaved forests and scrublands, • Native shrublands.	offset measures are required for all ecosystems not constrained by one of the three effects envelopes. • Old-growth forests and treelands, • Secondary forests containing old-growth signatures, • Advanced broadleaved forest, • Kānuka forest, • Indigenous dominated seepage wetlands.

5.1.1 *Habitat fragmentation and isolation*

Efforts have been made in the designation and preliminary design to minimise the extent to which existing habitats are severed or left isolated from adjacent habitat areas (i.e., fragmented). Although a level of fragmentation is unavoidable, bridges assist with the maintenance of ecological connectivity, and a principle of landscape and ecological replacement planting and the ecological offset is to enlarge and connect remaining vegetation areas where the configuration of the project allows.

5.1.2 *Edge effects*

Where forest communities are partly cleared, the creation of a new forest edge exposes the forest habitat to climatic influences (Young & Mitchell, 1994) from the surrounding landscape (e.g., increased wind and solar radiation, reduced humidity) and these changes can lead to modification of the floristic composition and structure, including increased threats from light-demanding weed species. These changes can also alter the suitability of the edge habitat zone to animals inhabiting the forest habitat (Ewers & Didham, 2008). These effects will be addressed through buffer planting treatments at the patch edge to effectively seal and buffer the habitat patch from the surrounding landscape influences.

5.2 Magnitudes and Levels of Adverse Effects

Magnitudes and levels of adverse effects are described below for specific key areas. Refer Table 6.A.2. for specification of overall level of effect (EIANZ, 2018).

For the first of these areas, four potential 3D road alignment designs (representing a range of alignments, to the east and west, between the constraints of Parahaki Island and the MGSR) were assessed. For each potential alignment, the likely impacts of an embankment (i.e., a shorter Manawatū River crossing bridge transitioning to an embankment immediately on the north river bank) and a longer viaduct, with a pier or piers constructed beneath, were assessed. The options were proposed and examined in response to the Very High adverse levels of effects potentially arising at this site to multiple ecosystems (Figure

6.A.3 & Figure 6.A.4). Aspects of these analyses are presented in 5.2.1 below. These analyses of options provided the basis for the corresponding effects envelope.

5.2.1 Immediately north of the Manawatū River crossing (CH4000–4400)

Eastern (preliminary indicative design centreline) Embankment Option

The embankment option would result in the complete and permanent destruction of the remnant stand of swamp maire located at approximate CH4130. This stand is the only known remnant of swamp maire forest within proximity of the project, meaning that the embankment would result in total loss of swamp maire from the designation area and wider landscape. Swamp maire holds the threat classification Threatened-Nationally Critical, with the national population estimated to be undergoing a very high ongoing or predicted decline of >70% (de Lange et al. (2018); p. 24). The magnitude of effect resulting from the destruction of the swamp maire stand is Very High. The swamp maire stand is of Very High ecological value and is ecologically significant in terms of RMA (1991, s6(c)). This combination of Very High magnitude of effect to a Very High value feature would result in a permanent Very High adverse level of ecological effect. Following EIANZ (2018) best practice guidance, project activities resulting in Very High adverse levels of effect are not acceptable on ecological grounds alone and measures would be required to avoid or otherwise reduce the magnitude of adverse effects to the swamp maire stand.

The embankment option would result in the complete and permanent destruction of the 0.55 ha raupō dominated seepage wetland located at CH4200. Complete and permanent loss of the seepage wetland would result in a Very High magnitude of adverse effect. The seepage wetland is a regionally rare ecosystem, supporting a stand of threatened swamp maire and providing potential habitat for nationally Threatened and At-Risk swamp birds such as Australian bittern. The seepage wetland is ecologically significant in terms of RMA (1991, s6(c)). Central Government's non-statutory guidance identifies the protection of indigenous vegetation associated with wetlands to be a national priority (MfE, 2007), and is applicable to the seepage. The seepage is of Very High vulnerability (i.e., holding high rarity attributes) and irreplaceability (i.e., there are no options to recreate the seepage), meaning the seepage is of a Very High level of conservation concern[18]. The seepage is valued as High ecological value. The combination of Very High magnitude effects to a High value seepage ecosystem would result in a permanent Very High adverse level of effect. The seepage hydro system is fundamental to the formation and sustainability of the seepage wetland

[18] In this context, Conservation Concern is defined as the combined levels of irreplacability and vulnerablity, after Pilgrim et al. (2013).

class, the hydro system cannot be recreated elsewhere, and thus the embankment would result in a permanent and irreplaceable loss of this type of wetland habitat from the region.

Embankment construction would potentially require up to a 20 m-wide[19] disturbance area extending laterally from the toe of the embankment. Together with the embankment footprint, this disturbance zone would result in permanent modification of the High value waterway between CH4100–4350. The assessed level of effect from this interaction is High–Very High, based on the linear length of waterway affected within the catchment (Miller, 2018).

On the western side of the embankment, the 20 m disturbance zone would extend into the alluvial old-growth forest resulting in 0.28 ha of direct forest clearance plus edge effects within the forest beyond the extent of disturbance. The alluvial old-growth forest represents forest types of which <2.5% remains regionally and exhibits high degrees of the structural development (e.g., emergent canopy tier) which take centuries to develop. The alluvial old-growth forest is of Very High ecological value and conservation concern (see Figure 6.A.7). Permanent clearance of the ecosystem over 0.28 ha would equate to a Very High magnitude of effect and a Very High adverse level of effect. This level of effect would be unacceptable on ecological grounds and signals that measures would be required to reduce the magnitude and duration of effects.

Approximately 1.5 ha of kānuka forest would be lost beneath the footprint between CH4000–4100. The magnitude of effect from the impact to kānuka forest would be Very High. A Very High magnitude effect to a Moderate Value feature would equate to a High level of effect.

In combination, the embankment option between CH4000–4400 would permanently destroy a Very High value (nationally threatened) swamp maire stand, 0.55 ha of rare High value seepage wetland, and 0.28 ha of Very High value alluvial swamp forest. An undefined quantity of High value stream habitat (depending on final construction footprint) would be permanently modified (Miller, 2018) and 1.5 ha of kānuka forest would be lost. The levels of effects on Very High and High Value ecosystems from the embankment option between CH4000–4400 are all Very High adverse. Permanent loss of vulnerable and irreplaceable seepage and alluvial old-growth ecosystems would result in adverse effects that fall beyond the bounds of offsetting in this landscape (see Section 6.3).

In summary, these levels of effect for the embankment option at this site are unsupportable on ecological grounds and alternative approaches (e.g., a viaduct) would be required to

[19] A minimim of 17 m disturbance zone is required for vehicle access to enable embankment construction (Appendix E).

reduce the magnitude and duration of effects to levels that are acceptable on ecological grounds.

Western (Detailed Business Case (DBC) centreline) Embankment Option

An embankment along the DBC centreline would result in extensive impact on the alluvial old-growth forest, destroying all of the pukatea-kahikatea-tawa forest composition that exists on wet soils adjacent to the toe of the slope, and also the matai-tawa-titoki forest on the drier soils of the terrace riser and beyond to the west. Including provision for access, the embankment would result in 1.42 ha of permanent loss of Very High value old-growth forest. This impact would result in a Very High magnitude of effect to a Very High value forest ecosystem, with the outcome being a Very High adverse level of effect.

Given the unfavourable geotechnical conditions in the valley floor area, and to address the risk of lateral spread associated with the embankment option, extensive ground improvement works are likely to be required both beneath and beyond the embankment footprint (personal communication: Debbie Fellows (Geotechnical Engineer)) and this disturbance would extend to the east into the rare raupō seepage wetland. These works, in combination with embankment and construction access, would be widespread and destructive to ecosystems located on the valley floor. The embankment and construction access would result in direct loss to the raupō seepage and to the remnant swamp maire stand. There would also potentially be groundwater hydrology effects to any remnants of the wetland and the threatened swamp maire stand. Taking these activities into account, the worst-case scenario is that the entire raupō wetland and swamp maire stand would be permanently lost. On this basis, the adverse effects to the wetland and swamp maire would be of a Very High magnitude and the effect would be on features of High and Very High ecological value. This combination of effect magnitude and ecological value would result in a Very High adverse level of effects and effects would be of a permanent duration.

Given the inability to avoid or minimise the effect on the High value stream, an approximate length of 400 m would be directly and permanently affected. The affected stream reach would likely be subjected to a Very High magnitude of effect and this would result in a Very High adverse level of effect.

Overall, and compared to an embankment on the preliminary indicative design alignment, the effect of an embankment following the DBC alignment would result in greater amount of loss of old-growth alluvial forest, and the same effect (i.e., complete loss) to the seepage wetland and swamp maire. The effect on the High value stream would likely be of a Very High magnitude (Miller, 2018). Similar to an embankment following the preliminary indicative design centreline, the western embankment would result in Very High adverse effects on the old-growth forest, the rare seepage wetland and the Threatened – Nationally Critical remnant swamp maire (as well as the High value stream). The forest and seepage ecosystems are vulnerable and irreplaceable, and effects resulting from the severe, permanent loss of these ecosystems would be beyond the bounds of offsetting. This level of effect would be unacceptable on ecological grounds and signals that measures would be required to reduce the magnitude and duration of effects (e.g., elevate or reroute the structure).

Eastern (preliminary indicative design centreline) Viaduct Option

Provision of a viaduct structure located along the centreline of the preliminary indicative design alignment between CH4000–4400 would limit the effects on the threatened old-growth forest and the threatened swamp maire. If the viaduct alignment could be moved c. 15 m to the east of the centreline, the swamp maire would stand clear and to the west of the viaduct. This would mean natural patterns of lighting and precipitation could be maintained for the forest stand. A viaduct on the current alignment would result in the eastern half of the stand being located beneath the viaduct. In this scenario, the swamp maire stand might require some canopy pruning to provide adequate clearance for viaduct construction and maintenance – the extent and detail of this would be subject to detailed viaduct design. This would equate to a Low magnitude of effect to a Very High value feature, resulting in a Moderate level of effect. Restorative planting of swamp maire seedlings using seeds sourced from the affected stand would be a means of addressing the effects that are unable to be addressed (avoidance) through viaduct design and construction methodology.

The effect on the seepage wetland would be largely dependent on the need to install any supporting piers and foundations within the wetland. The road centreline runs approximately 90 m across the wetland, meaning that a pier within the centre of the wetland body could be avoided by adopting a 90 m viaduct span. Piers would need to be located near the edges of the wetland and may require substantial foundations depending on the ground conditions; however, any associated effects on the wetland could be minimised through design and suitable construction methodologies. This would mean that direct effects from construction to the rare seepage wetland ecosystem could be minimised aside from a small (0.02 ha) area along the seepage' western margin where access activities might encroach into wetland vegetation. This western fringe is transitional to wet pasture and is the least sensitive area of the wetland.

Effects of the viaduct from overhead shading could be reduced through design and restorative planting could be applied to incorporate wetland species adapted to the levels of partial shade that would occur beneath the viaduct. The effect of reduced precipitation is not considered a significant issue for long-term wetland health as the soils are permanently waterlogged across the wetland from groundwater sources (the wetland soil hydrology is not dependent on rainfall).

On the basis that the wetland could be largely spanned, that areas disturbed for access could be remediated and restorative planting could address shading effects to ensure a sustainable wetland vegetation cover, a Moderate magnitude of effect to the High value seepage wetland would result in a High level of effect. The High level of effect could be readily addressed through proximal high value wetland restoration treatments.

Effects to the Very High value alluvial old-growth forest would be avoided as the forest would be set back laterally more than 30 m[20] from the edge of the viaduct.

Based on the proximity of the viaduct and associated work area to the High value stream, it appears there would be a good possibility of avoiding permanent effects to the High value stream. Any permanent effects (e.g., diversion) would likely be localised to stream segments, and there is a better chance of stream values being restored to previous levels (or higher) after construction is complete (Miller, 2018).

The kānuka forest at CH4000–4100 would be impacted by pier installation and by the overhead cover of the viaduct. The magnitude of effect to kānuka forest would be High. A High magnitude effect to a Moderate value ecosystem would result in a Moderate level of effect. Although of a threatened status, the effects to the kānuka forest could be mitigated with a high degree of certainty.

In summary, with the eastern viaduct option, the effect to High and Very High value ecosystems would range from High to Low. Impacts to the kānuka forest would be Moderate, and this effect can be readily mitigated.

Western (DBC centreline) Viaduct Option

A western viaduct, assuming access from the eastern side of the structure, would encroach into the old-growth forest by approximately 0.06 ha along the forest's eastern edge. This interaction would likely require some loss of the emergent or canopy forest tiers for both construction and maintenance. This could be managed with expert arborist skills, and the sub-canopy and understorey components could be largely retained. Most disturbance would result from access for, and installation of, bridge piers. A strip with a maximum width of 20 m would need to be cleared for each pile, and a 30 m deep working platform would be required to the east to allow for crane and heavy vehicle access, orientated parallel to the viaduct structure. Assuming 90 m pier spans, a minimum of 70 m of forest could be retained between piers, and as no permanent structure is associated with the access strips to each pier, these areas could be remediated to allow a long-term regeneration to alluvial forest composition. Importantly, permanent and Very High magnitude effects could be avoided. The magnitude of effect from localised disturbance/loss of structural features would be Moderate (partial change in attributes compared to baseline). The duration would be long term (c. 25 years). A Moderate effect magnitude to a Very High value ecosystem equates to

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[20] A minimim of a 29 m setback from the viaduct would be required for crane and vehicle access (Appendix E).

a High level of effect. The effect would be concentrated along the forest margin, thus avoiding permanent effects associated with fragmentation and severance of the wider forest. The High level of effect would be within the limits of offsetting and could reasonably be addressed.

The effect of shading and reduced precipitation on the retained forest is somewhat uncertain. It is likely that the zone beneath the viaduct could be supplemented with seedlings of shade-tolerant species, and that the soils are naturally waterlogged and would still receive runoff from surrounding areas. The worst-case scenario would suppress some forest regeneration. Even in the case of repressed regeneration, ecological connectivity would be maintained and the magnitude of effect on the forest would be no more than Moderate.

Approximately 0.13 ha of the seepage wetland would be encroached upon for construction access platforms to the east of the structure. The effect on the wetland would be of Moderate magnitude. Following completion of works, the affected seepage area could be remediated, meaning the duration of effect would be medium term (c. 15 years). The resulting level of effect would be High. The swamp maire would fall within the 30 m construction platform, but it is feasible that this small forest stand could be avoided through a combination of detailed design and sympathetic construction access configuration.

It is likely that localised permanent works in the stream would be required to protect viaduct piers from erosion. The effect of these localised permanent works would be of Moderate or less magnitude, resulting in no greater than a High level of effect.

Some encroachment into the kānuka would likely be required. Allowing 0.1 ha of clearance would equate to a Low magnitude of effect and a Low level of effect.

In summary, with the western viaduct option, the effect to High and Very High value ecosystems would range from High to Low.

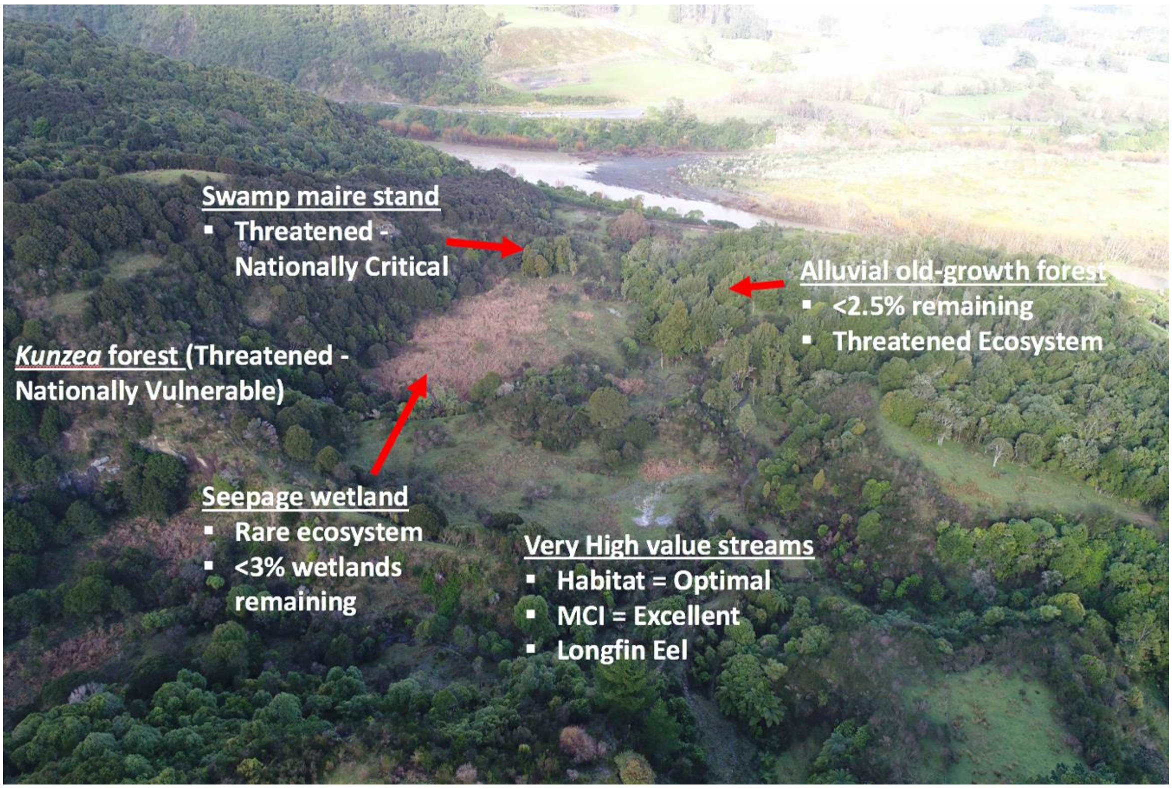

Figure 6.A.3. Key features of High and Very High ecological value located within the CH4000–4400 reach. Note, kānuka is the common name for a number of species in the genus *Kunzea*.

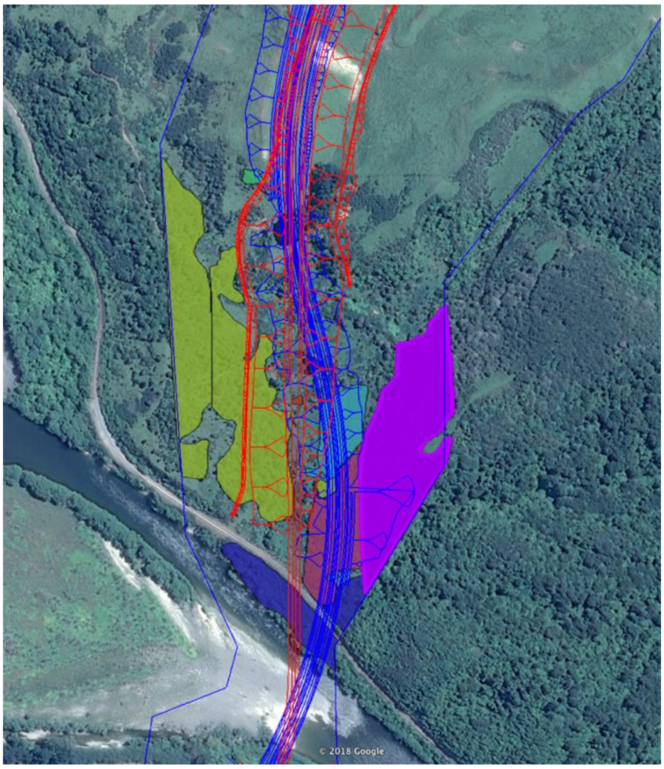

Figure 6.A.4. Embankment design options from preliminary indicative design (blue/easternmost) and detailed business case (DBC; red/westernmost) used for effects envelope predictions. The relevant vegetation polygons shown are green = old-growth forest (inc. swamp maire stand), blue = seepage, purple/red shades = kānuka.

Table 6.A.13. Summary of effects scenarios for embankment and viaduct options over CH4000–4400.

Ecosystem types	Embankment options (both preliminary indicative design & DBC alignments)	Eastern viaduct option – NoR preliminary indicative design alignment	Western viaduct option – DBC alignment
Old-Growth Forests	Option not supported on ecological grounds due to Very High levels of adverse effect to multiple High and Very High value ecosystems/species	▪ 0 ha (avoided).	▪ 0.06 ha of modification including localised permanent loss for pier footprint. ▪ Edge effects beyond forest edge. ▪ Moderate magnitude of effect, High level of effect. ▪ Long-term effect duration.
Swamp Maire Stand		▪ Retention of all swamp maire trees, some canopy pruning potentially required. ▪ Low magnitude of effect, Moderate level of effect.	▪ Retention of all swamp maire trees. ▪ Low-Negligible magnitude of effect, Moderate-Low level of effect.
Seepage Wetland		▪ 0.02 ha disturbance, all areas to be remediated other than areas affected by permanent structures (e.g., piers). ▪ Moderate magnitude of effect, High level of effect. ▪ Temporary duration (c. 15 yrs).	▪ 0.13 ha disturbance, all areas to be remediated other than areas affected by permanent structures (e.g., piers). ▪ Moderate magnitude of effect, High level of effect. ▪ Temporary duration (c. 15 yrs).
Kānuka Forest (*Kunzea* Forest)		▪ 1 ha clearance. ▪ High magnitude of effect, Moderate level of effect.	▪ 0.1 ha clearance. ▪ Low magnitude of effect, Low level of effect.
Stream		▪ To be confirmed on detailed design.	▪ To be confirmed on detailed design.

5.3 Effects envelopes

5.3.1 North of Manawatu River Crossing (CH4000–4400)

Within CH4000–4400 there are ecological grounds to avoid or otherwise minimise adverse effects to threatened and rare ecosystems/species and also to allow adequate flexibility for consideration of options and the development of an optimal detailed design solution. The approach taken here is to utilise the predicted effects from the above four scenarios to prescribe, for each ecological feature of importance, maximum allowable levels and durations of adverse effect (as assessed by EIANZ (2018) criteria), and a maximum physical extent of effect (also see summary in Table 6.A.16.).

Based on the level of value and conservation concern of ecosystems/species listed below, two essential requirements for any activities within this area would be to:

1. Cause no more than Moderate magnitude of adverse effect. This ensures that the Very High adverse effect level is avoided, and that the effects are likely to be supportable on ecological grounds with an appropriate mitigation/offsetting proposal, and
2. Cause effects that are not permanent in overall character. Effect duration should be long term (c. 25 years) or less.

Conforming to these requirements would imply the following envelope of acceptable ecological effects:

- **Threatened old-growth alluvial forests**: no more than 0.1 ha of Moderate effect magnitude/High level of effect, AND of no more than long-term (c. 25 years) duration. In practice, this would cover the limited loss of canopy or emergent tiers, or loss of forest vegetation. Crucially, the effect would not be permanent in overall character. The effects duration would be long-term or less in overall character and would be addressed through remediation plus restoration offsets.
- **Threatened Nationally – Critical swamp maire stand**: retention of all trees. Effects of canopy pruning to result in Low or Negligible magnitude of effect, and Moderate or Low level of effect. No permanent adverse effects.
- **Rare seepage wetland**: no more than 0.13 ha of Moderate effect magnitude/High level of effect, AND of no more than temporary (c. 15 years) duration. In practice this would allow for construction activities to directly modify no more than 0.13 ha of the seepage. The effects would be temporary in overall character and would be addressed through remediation plus restoration offsets.
- **Kānuka forest (Kunzea Forest)**: no more than 1 ha of clearance, with effects to be addressed through mitigation using the prescribed ECRs.

5.3.2 *Western QEII covenant (CH5600–5800)*

A bridge crossing the Western QEII covenant would result in no more than (i.e., maximum allowable) 1 ha of clearance of old-growth hill country forest and no more than 0.5 ha of advanced secondary broadleaved forest. Given the legal protected status of this vegetation area, and its level of value, clearance of any indigenous vegetation should be limited to 20 m beyond the extent of fill and 5 m beyond the extent of cut. With these minimisation measures applied, the impact on the old-growth forest would be of an extent that most of the old trees would be destroyed and the trees retained would be small fragments on either side of the alignment. The sites would be exposed to edge effects which would compromise the ecological integrity of the remaining old-growth forest stands. This would result in a major alteration to the form and function of the old-growth forest stand. The level of effect on the old-growth forest would be Very High, resulting from a Very High magnitude of effect to a Very High value ecosystem.

The magnitude of effect on the High Value Advanced Secondary Broadleaved Forest would be High, resulting in a Very High adverse effect. These levels of effect suggest that further measures are required at this location during detailed design to minimise the level of effect. Such measures could include use of retaining walls or further use/optimisation of bridges to reduce the extent of vegetation clearance required.

Table 6.A.14. Level of effect description (EIANZ, 2018) for Western QEII crossing.

Ecosystem types	Levels of value	Magnitudes of adverse effect					
		Very High	**High**	**Moderate**	**Low**	**Negligible**	**Avoided**
Old-Growth Forest	Very High	V. High	V. High	High	Moderate	Low	Nil
Advanced Secondary Broadleaved Forest	High	V. High	V. High	Moderate	Low	V. Low	Nil
Streams	High	V. High	V. High	Moderate	Low	V. Low	Nil

Table 6.A.15. Effects envelopes for Western QEII crossing CH5600–5800.

Ecosystem types	Northern & eastern tributaries
Old-Growth Forests	1 ha, with the retained forest to be protected
Advanced Secondary Broadleaved Forest	0.5 ha, with the retained forest to be protected

5.3.3 Eastern QEII covenant (CH6100–6400)

The combination of cut and fill through the Eastern QEII would result in loss of secondary broadleaved forest. Given the legally protected status of this vegetation area, clearance of indigenous vegetation should be limited to 20 m beyond the extent of fill and 5 m beyond the extent of cut. These limitations on clearance would mean that the High level of effect resulting from Very High effect magnitude on the Moderate value secondary broadleaved forest is limited in extent. At CH6100–6400 the effects envelope is the preliminary design footprint (NoR stage) plus the 20 m and 5 m buffer areas described above.

5.4 Designation wide (excluding mitigation and protected vegetation areas)

Activities that would occur across the designation area, along with their location, the temporal scale, magnitude and level of effect are described in Table 6.A.16. below. The fauna aspects of these effects are directly addressed in the Terrestrial Fauna Ecological Effects Assessment (Blayney & Sievwright, 2018).

It is assumed that 8–10 m wide corridors would be required to access the designation area in number of locations along the alignment. The sensitivities of access corridors would need to be considered and good practice measures to avoid or otherwise minimise effects would be undertaken. Where clearance of fauna habitats and vegetation cannot be avoided, the approach for addressing fauna and vegetation effects would follow the procedures and methods prescribed for effects management within the designation area. These procedures and methods will be detailed in the project's Ecological Management Plan.

Specific access is to be designated from the Saddle Road along the alluvial flats on S. Bolton's land and along an existing farm track to the CH4000–4400 area[21]. This activity would result in the upgrade of an existing farm track. It has been assumed there would be some minor additional forest clearance required to achieve the widened track.

The forest in this location represents the drier alluvial composition (podocarp/tawa-mahoe) and the forest is heavily impacted from grazing. A total of 0.05 ha of old-growth alluvial forest has been allowed for in the mitigation/offset calculations to address the effects of upgrading the existing track. To reduce the duration of effect, the track should be retired and remediated as far as practical on completion of works. The surrounding area is the retire, protect and gap plant treatment and this proximal restoration would assist in addressing adverse effects to this area.

[21] Refer plan: 51-38113-C-902.

Table 6.A.16. Estimates of activities, their locations, and the resulting temporal scale, magnitude and level of adverse effects

Activities	Description	Location(s)	Temporal scale	Magnitude of effect	Level of effect[22]
Vegetation clearance and modification of lower value (Moderate–Low value) ecosystem types	Potential designation-wide clearance of secondary broadleaved forest and scrublands and native shrublands	Designation wide	Temporary (medium term – *c.* 15 years)	Potentially Very High, as all of these ecosystem types could be cleared within the designation area. Likely to be Moderate with avoidance measures applied.	High–Moderate
Vegetation clearance and modification of higher value (Moderate–Very High value) ecosystem types	Restricted clearance and modification of old-growth forests and treelands, secondary forests containing old-growth signatures, advanced broadleaved forest, kānuka and seepage wetlands	▪ 0.10 ha[23] of alluvial old-growth forest CH4000–4400[24],	Long term (*c.* 25 years)	Moderate	High
		▪ 1 ha of hill country old-growth forest CH5650,	Permanent (replacement not possible)	Very High (assuming the remaining area is avoided at CH5600)	Very High
		▪ 2.2 ha secondary forest containing old-growth signatures 7300, 10500–10700,	Long term (*c.* 25 yrs.)	High (assuming 0.41 ha avoided at CH6100)	Very High

[22] Assessed prior to mitigation/offsetting.
[23] In addition, 0.05 ha has been allowed for minor old-growth forest clearance associated with the access track from Saddle Road across S. Bolton's land to the vicinity of CH4000.
[24] This quantity includes 0.05 ha of alluvial old-growth forest clearance for access track upgrading in the forest to the west of CH4000–4400 area.

Activities	Description	Location(s)	Temporal scale	Magnitude of effect	Level of effect[22]
		▪ 0.5 ha of advanced secondary broadleaved forest CH5700–5800,	Long term (*c.* 25 yrs.)	High (assuming the remaining area is avoided at CH5750–5850)	Very High
		▪ 1 ha of kānuka forest CH4200, 0.39 ha CH7300	Medium term (c. 15 years)	Moderate	Moderate
		▪ 0.13 ha of raupō seepage wetland CH4200[25],	Long term, (remediation possible)	Moderate, assuming direct effects avoided to remaining 0.42 ha	High
		▪ A remnant stand of 14 swamp maire CH4150	Long term (*c.* 25 yrs.)	Low or Negligible, assuming all swamp maire are retained, with some canopy pruning	Moderate or Low
Habitat fragmentation isolation	Severance of existing habitats resulting in one or more isolated habitat fragments	Dependent on final design	Permanent where replacement planting cannot remedy the severance or reconnect the fragment with an adjacent habitat	High, fragmentation and isolation would result in major loss and alteration of baseline conditions, attributes would be fundamentally changed	Very High–Low

[25] In addition, permanent loss of 0.39 ha of moderate value seepage wetland is assumed in the effects and offset calculation.

Activities	Description	Location(s)	Temporal scale	Magnitude of effect	Level of effect[22]
Edge effects	Opening and exposing a forest edge to an open adjacent landscape	Dependent on final design	Temporary (medium term – 5–15 years)	Moderate, post-development character will be partially changed but minimised through buffer planting	Very High–Low

6.0 EFFECTS MANAGEMENT

6.1 Mitigation and Offsetting Principles and Frameworks

6.1.1 The mitigation hierarchy

Good practice effects management directs for practical steps to be taken to manage effects using the mitigation hierarchy.

As such, good practice (Business and Biodiversity Offsets Programme [BBOP], (2012)) specifies that practical measures must be taken as follows:

Avoidance: avoid creating impacts from the outset, such as careful spatial or temporal placement of elements of infrastructure, in order to completely avoid impacts on certain components of biodiversity.

Minimisation: reduce the duration, intensity and/or extent of impacts (including direct, indirect and cumulative impacts, as appropriate) that cannot be completely avoided, as far as practically feasible.

Rehabilitation/restoration: rehabilitate degraded ecosystems or restore cleared ecosystems following exposure to impacts that cannot be completely avoided and/or minimised.

Offset: compensate for any residual significant, adverse impacts that cannot be avoided, minimised and/or rehabilitated or restored, in order to achieve no net loss or a net gain of biodiversity. Offsets can take the form of positive management interventions such as restoration of degraded habitat, arrested degradation or averted risk, protecting areas where there is imminent or projected loss of biodiversity.

In the event that residual significant adverse effects cannot be addressed through rigorous and exhaustive application of the mitigation hierarchy, a biodiversity offset may be an appropriate method of addressing residual effects. An offset is the last resort after all reasonable measures have been taken first to avoid and minimise the impact of a development project and then to restore biodiversity on-site (BBOP, 2012). The following principles and regional policy direct the parameters and acceptability of a biodiversity offset.

6.1.2 *BBOP (2012) biodiversity offsetting principles*

The BBOP (2012) principles establish a framework for designing and implementing biodiversity offset and verifying their success. The ten BBOP (2012) principles[26] are as follows:

1. **Adherence to the mitigation hierarchy**: A biodiversity offset is a commitment to compensate for significant residual adverse impacts on biodiversity identified after appropriate AVOIDANCE, minimisation and on-site rehabilitation measures have been taken according to the mitigation hierarchy.

2. **Limits to what can be offset**: There are situations where residual impacts cannot be fully compensated for by a biodiversity offset because of the irreplaceability or vulnerability of the biodiversity affected.

3. **Landscape context**: A biodiversity offset should be designed and implemented in a landscape context to achieve the expected measurable conservation outcomes taking into account available information on the full range of biological, social and cultural values of biodiversity and supporting an ecosystem approach.

4. **No net loss**: A biodiversity offset should be designed and implemented to achieve in situ, measurable conservation outcomes that can reasonably be expected to result in no net loss and preferably a net gain of biodiversity.

5. **Additional conservation outcomes**: A biodiversity offset should achieve conservation outcomes above and beyond results that would have occurred if the offset had not taken place. Offset design and implementation should avoid displacing activities harmful to biodiversity to other locations.

6. **Stakeholder participation**: In areas affected by the project and by the biodiversity offset, the effective participation of stakeholders should be ensured in decision-making about biodiversity offsets, including their evaluation, selection, design, implementation and monitoring.

7. **Equity**: A biodiversity offset should be designed and implemented in an equitable manner, which means the sharing among stakeholders of the rights and responsibilities, risks and rewards associated with a project and offset in a fair and balanced way, respecting legal and customary arrangements. Special consideration

[26] Where capitilisation occurs below, it is as per the source.

should be given to respecting both internationally and nationally recognised rights of indigenous peoples and local communities.

8. **Long-term outcomes**: The design and implementation of a biodiversity offset should be based on an ADAPTIVE MANAGEMENT approach, incorporating MONITORING AND EVALUATION, with the objective of securing outcomes that last at least as long as the project's impacts and preferably in PERPETUITY.

9. **Transparency**: The design and implementation of a biodiversity offset, and communication of its results to the public, should be undertaken in a transparent and timely manner.

10. **Science and traditional knowledge**: The design and implementation of a biodiversity offset should be a documented process informed by sound science, including an appropriate consideration of traditional knowledge.

6.1.3 One Plan biodiversity offset policy direction

One Plan Policy 13–4 directs for the mitigation hierarchy to be applied in relation to effects management of rare, threatened or at-risk habitats or significant indigenous vegetation or habitats. In the case that a biodiversity offset is required to address adverse effects that are residual following application of the mitigation hierarchy, Policy 13–4(i)(d) requires that a biodiversity offset must:

(i) Provide for a net indigenous biological diversity gain within the same habitat type, or where that habitat is not an area of significant indigenous vegetation or a significant habitat of indigenous fauna, provide for that gain in a rare habitat or threatened habitat type, and

(ii) Reasonably demonstrate that a net indigenous biological diversity gain has been achieved using methodology that is appropriate and commensurate to the scale and intensity of the residual adverse effect, and

(iii) Generally be in the same ecologically relevant locality as the affected habitat, and

(iv) Not be allowed where inappropriate for the ecosystem or habitat type by reason of its rarity, vulnerability or irreplaceability, and

(v) Have a significant likelihood of being achieved and maintained in the long term and preferably in perpetuity, and

(vi) Achieve conservation outcomes above and beyond that which would have been achieved if the offset had not taken place.

While an offset is a last resort option for addressing residual adverse effects, BBOP (2012) principle 2 (above) specifies there are limits to what can be offset, specifically where the residual adverse effects relate to biodiversity components of very high irreplaceability and vulnerability. Further, One Plan Policy 13–4(d)(iv) specifies that offsetting should not be allowed where inappropriate for the ecosystem or habitat type by reason of its rarity, vulnerability, or irreplaceability.

6.2 Assessment of Offsetability of Affected Ecosystem Types

An impartial process for assessing the offsetability of biodiversity impacts (Pilgrim *et al*., 2013) was used to check, for the ecosystem types present within the designation area, whether there was biodiversity of a nature that extended beyond the limits of biodiversity offsetting. This is an important step given the intent of BBOP (2012) Principle 2 and One Plan Policy 13-4(d)(iv).

The Pilgrim et al. (2013) framework is referenced by DoC (2014) as the accepted method for assessing offsetability. An assessment of the offsetability of biodiversity impacts addresses the appropriateness of risks to biodiversity and the achievability of offsets. Key issues affecting offsetability are biodiversity conservation concern, residual impact magnitude, theoretical offset opportunity and practical offset feasibility (Pilgrim et al., 2013). The framework comprises the following components (also see Figure 6.A.5):

1. Assess levels of conservation concern for affected biodiversity.
2. Determine the residual impact magnitude.
3. Assess opportunities to offset.
4. Assess offset feasibility.
5. Combine residual impacts (2), offset opportunity (3) and offset feasibility (4) to categorise likelihood of offset success.
6. Combine biodiversity conservation concern (1) and likelihood of offset success (5) to determine offsetability.

Offsetability of biodiversity impacts J. D. Pilgrim *et al.*

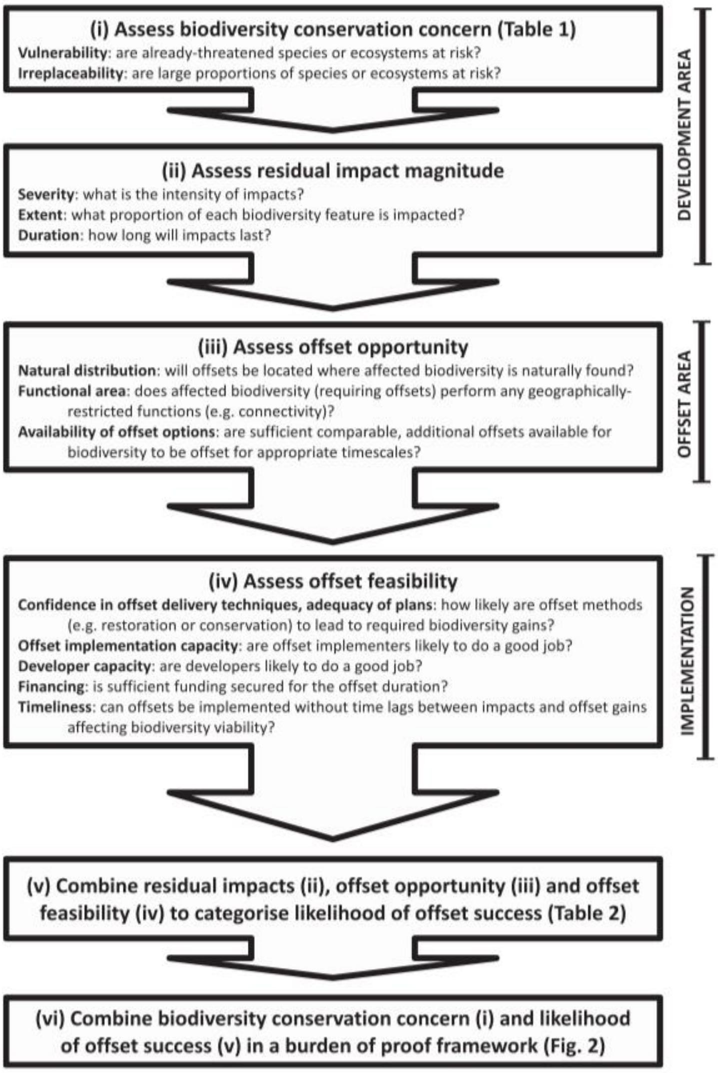

Figure 1 Simplified summary of the proposed process to assess relative offsetability. This process should be iteratively applied during project design and implementation as information on impacts and offsets improves.

Figure 6.A.5. Process of assessing offsetability (Figure 1 from Pilgrim et al. (2013), reproduced).

Within the framework, conservation concern of a biodiversity feature is defined as the combined level of vulnerability and irreplaceability.

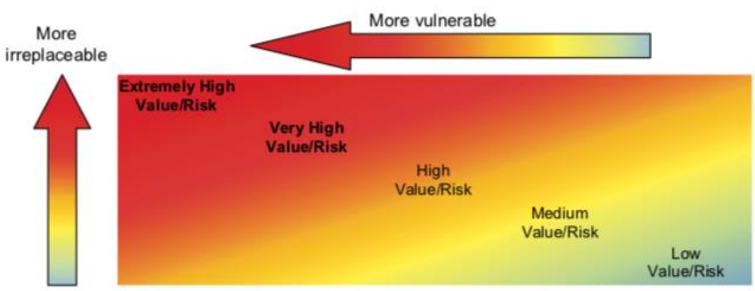

Figure 6.A.6. Reproduction of Figure 2 of DOC (2014), illustrating the format of ranking biodiversity conservation concern in terms of irreplaceability and vulnerability.

Vulnerability is measured in terms of existing formally recognised threat status. For the designation area, available data sources are One Plan ecosystem threat status listings (e.g., Schedule F) and for species national threat classification system lists (e.g., for flora, de Lange *et al*. 2018). In simple terms, the assessment of vulnerability asks the question – are already threatened species or ecosystems at risk? (Pilgrim et al., 2013).

An assessment of irreplaceability asks the question – within a region, what are the options for replacing the threatened species and habitats? Some biodiversity types have many options, other biodiversity types have no options.

The value of biodiversity increases as vulnerability and irreplaceability increase, and this also increases the risk that a biodiversity offset cannot be achieved (DOC, 2014).

An appraisal of residual impact magnitude, offset opportunities, and feasibility provides information to categorise likelihood of offset success. Offsetability can then be assessed as the combination of likelihood of success and conservation concern.

6.3 Limits to Offsetting for Ecosystems Within the Designation Area

The ecosystems within the designation area have a range of vulnerability and irreplaceability and this translates to a gradation in levels of conservation concern from low (native shrublands and seral broadleaved forests and scrublands) to high/extremely high (old-growth alluvial swamp forests and swamp maire). The various levels of conservation concern are presented in Figure 6.A.7 and broken down in Table 6.A.17. These data show that the old-growth alluvial forest ecosystem type and swamp maire stand are of greatest conservation concern. Therefore, these ecosystems are most at risk of falling beyond the limits of offsetability.

The kahikatea-pukatea-tawa and podocarp/tawa-mahoe forest compositions on alluvial surfaces, which are collectively referred to here as alluvial forest ecosystems, have 2.45% and 2.48% (respectively) of their former extent remaining regionally. Clearance of alluvial sites for land use conversions to agriculture (and other commercially productive land uses) has been widespread across New Zealand and the Horizons region provides a classic example of clearance of alluvial forests. In contemporary landscapes nationally, the alluvial forests are amongst the rarest forest compositions remaining, and regionally the alluvial forests are the most threatened forest types in the region (refer One Plan Schedule F). For this reason, the alluvial forests are of extremely high vulnerability. Old-growth forests are of the greatest value within the already rare alluvial subset. These old-growth stands hold attributes that cannot be replaced with restorative replacement planting treatments (e.g., high levels of structural diversity, an emergent forest tier). Thus, not only are most candidate sites for the restoration of alluvial forests occupied by commercially productive land uses, the old-growth attributes at risk are fundamentally irreplaceable. In the Horizons region, alluvial forests are restricted to few sites, are of limited extent, and there are few offset locations available for alluvial forest restoration[27], particularly within close proximity of the potential impact location (refer Policy 13–4 (d) (iii) above).

The severe national decline of swamp maire (Threatened–Nationally Critical) is such that the species is on a trajectory towards extinction. This attribute makes the species of extremely high vulnerability. Swamp maire is mostly found in riparian forest, in waterlogged ground, or on the margins of swamps and stream sides (or on hill slopes with impeded drainage; New Zealand Plant Conservation Network [NZPCN], 2018). These specific microhabitats are alluvial in nature and have been subjected to the same land use pressure and pattern of land conversion as described above for alluvial forest generally. These circumstances mean there are few sites suitable for restoration and conservation of the species elsewhere, thus the species is of very high irreplaceability.

The high value seepage wetland has a very high level of vulnerability in that <3% of wetlands remain in the Horizons region. The seepage has a very high level of irreplaceability as few other sites exist for conservation of the ecosystem and species supported.

[27] One local option for restoration of alluvial forest is Ashhurst Domain.

Table 6.A.17. Relative levels of conservation concern (as defined by the combined rating of irreplaceability and vulnerability) of ecosystems within the proposed designation.

	Criteria	Swamp maire	Old-growth forest (alluvial)	Old-growth forest (hill country)	Secondary broadleaved forest with old-growth signatures	Old-growth treeland	Kānuka /Kunzea forest	Advanced secondary broadleaved forest	Indigenous dominated seepage wetland (high value)	Indigenous dominated seepage wetland (moderate value)	Secondary broadleaved forest and scrubland	Mānuka, kānuka, and divaricating shrubland
Conservation concern	Irreplaceability of affected biodiversity components (at the development site and beyond)	(VH) Restricted to few sites/limited extent, few offset locations	(VH) Restricted to few sites/limited extent, few offset locations	(H) Not commonplace but still several viable options for conserving elsewhere	(H) Not commonplace but still several viable options for conserving elsewhere	(H) Not commonplace but still several viable options for conserving elsewhere	(H) Not commonplace but still several viable options for conserving elsewhere	(M) Not commonplace but still several viable options for conserving elsewhere	(VH) Restricted to few sites/limited extent, few offset locations	(H) Not commonplace but still several viable options for conserving elsewhere	(L) Well-represented on many sites. Plenty of viable options for conserving this biodiversity elsewhere. Effective restoration techniques available	(L) Well-represented on many sites. Plenty of viable options for conserving this biodiversity elsewhere. Effective restoration techniques available
	Vulnerability of affected biodiversity components (at the development site and beyond)	(EH) Population has a very high ongoing or predicted decline of >70%	(EH) < 2.5% remains regionally. Nationally scarce	(VH) <19.5% remains regionally	(VH) <19.5% remains regionally	(VH) <19.5% remains regionally	(H) Threatened ecosystem, Threatened Nationally Vulnerable	(H) Negative trends are affecting biodiversity – significant proportion of sites under threat of degradation	(VH) <3% of wetland ecosystems remain regionally	(VH) <3% of wetland ecosystems remain nationally	(L) Species are widespread, not known to be threatened or declining, options to add conservation value through offsetting	(L) Species are widespread, not known to be threatened or declining, options to add conservation value through offsetting

Notes. L = Low, M = Moderate, H = High, VH = Very High, EH = Extremely High.

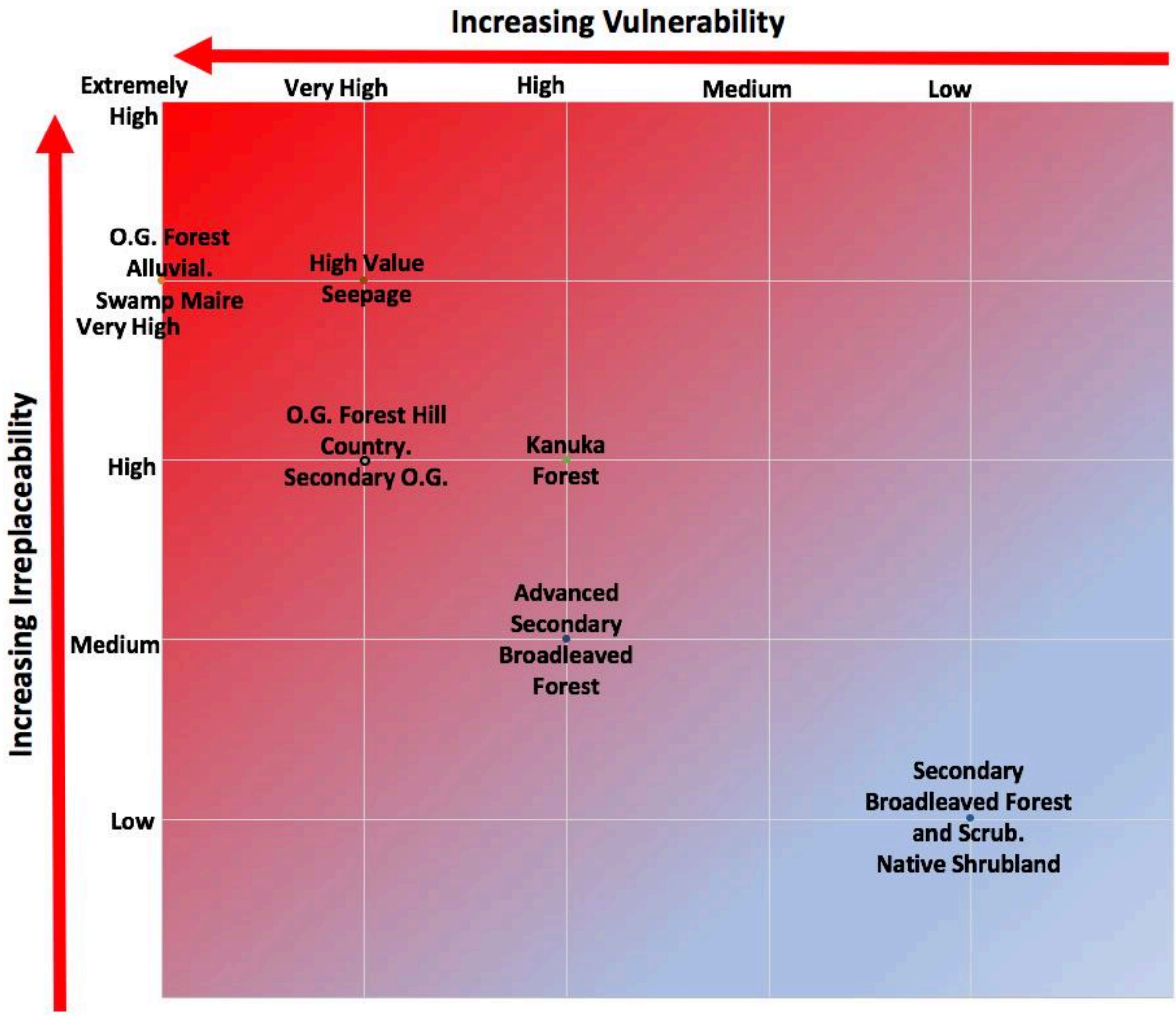

Figure 6.A.7. Levels of conservation concern for ecosystems within the proposed designation area as defined by the combination of vulnerability and irreplaceability (format follows Figure 6.A.6).

With an embankment option, impacts to the old-growth alluvial forest would likely be unavoidable. Impacts would be direct and would result in forest clearance. Given the scarcity of old-growth alluvial forests in proximity to the Project, clearance would result in a severe decline in old-growth alluvial forest biodiversity (Class 1, see Appendix F). As the land would be required for embankment placement, the duration of impact would be permanent. Both the severity and duration of alluvial old-growth forest loss rank as Class 1 and indicate the lowest likelihood of offset success.

The combination of Class 1 likelihood of success with an ecosystem of Very High/Extremely High conservation concern indicates that the biodiversity loss associated with severe and permanent loss of old-growth alluvial forest is beyond the limits of offsetting (Figure 6.A.7 & Figure 6.A.8).

In contrast, with a viaduct option, direct impacts to the old-growth alluvial forest could be avoided/minimised, in which case, effects management would be addressed early in the mitigation hierarchy and offsetting would not be necessary.

Assessment of likelihood of success for swamp maire and seepage wetland impacts are summarised in Table 6.A.18 below. For both swamp maire and seepage wetlands, the embankment would result in severe and permanent loss and this reduces the likelihood of successfully offsetting impacts to biodiversity. The reduced severity and duration of impacts associated with a viaduct arrangement mean that biodiversity impacts to the seepage wetland and swamp maire would be within the limits of offsetting.

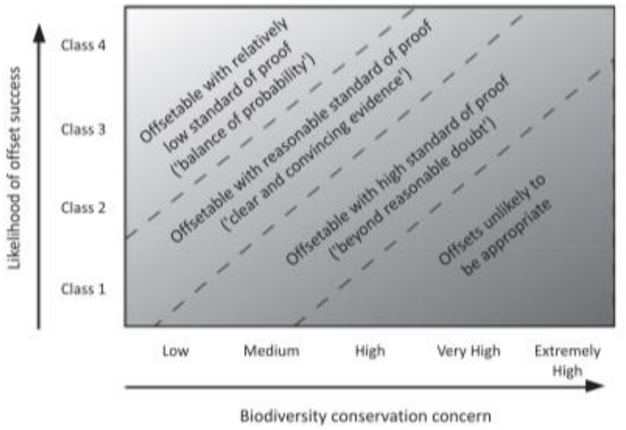

Figure 2 Burden of proof conceptualization of offsetability, combining biodiversity conservation concern and likelihood of offset success. A practical framework may thus, e.g. view offsets as unlikely to be appropriate for: Class 1 likelihood of offset success for areas of High, Very High, and Extremely High conservation concern; Class 2 for Very High and Extremely High concern; and Class 3 for Extremely High concern.

Figure 6.A.8. Offsetability as indicated by the relationship between conservation concern and likelihood of offset success. Taken from Figure 2 of Pilgrim *et al.* (2013).

Table 6.A.18. Summary comparison of likelihood of offsetting biodiversity loss from embankment versus viaduct options on the threatened-nationally critical swamp maire stand and the rare seepage ecosystem.

	Embankment (i.e., assuming complete and permanent loss)	**Viaduct (i.e., assuming localised disturbance with little or no permanent loss)**
	Likelihood of success (criteria defining class)	
Threatened swamp maire	Class 1 (Severity, Duration)	Severity and duration reduced to Class 4 (low magnitude[28] of effect)

[28] Effect magnitude terminology in this table follows Pilgrim *et al*. (2013).

Rare seepage wetland	Class 1 (Severity, Duration)	Severity and duration reduced to Class 4 (low magnitude of effect)

6.4 Avoidance, Minimisation, Rehabilitation/Restoration, Offsetting Proposed

Specific effects envelopes have been defined for CH4000–4400, and two QEII protected areas to ensure that the levels of effect fall within the bounds of offsetting. Effects have been minimised in these locations and direct adverse effects beyond these envelopes are avoided. These avoidance and minimisation and remediation measures will be prescribed in conditions and in the Ecological Management Plan to be developed at the detailed planning stages of the project.

Rehabilitation and restoration will be required following works within seepage wetlands, to reinstate both wetland function and indigenous cover within disturbed areas. The effects on forest habitats from edge effects will be addressed through restorative edge buffer planting, to effectively seal the newly created forest edge. Effects from fragmentation and isolation would be addressed through the configuration of restorative replacement planting (creating linkages and corridors between existing habitats) and through the use of bridge structures that maintain a level of ecological connectivity beneath/past the road. The Western QEII site is particularly vulnerable to edge effects and treatments around that crossing point would be essential in order to reduce adverse effects on the forest.

Mitigation and offset activities will be additional to conservation actions that would have occurred without the Project. The replacement planting and offset package components would serve important extensions to existing habitat areas and would increase habitat availability and landscape scale connectivity between the Manawatū Gorge Scenic Reserve (Department of Conservation) and the surrounding existing QEII forested sites (private ownership), existing indigenous vegetation areas currently amongst farmland (private ownership), and the Ashhurst Domain (Palmerston North City Council).

Replacement planting mitigation treatments would be like-for-like in terms of the sites selected and the compositions chosen for planting. An important component of the offset replacement planting is the restoration of the low terrace alluvial site at Ashhurst Domain. This site provides a rare opportunity to restore alluvial forest within close proximity of the designation area. Given the highly reduced and threatened status of alluvial forests, it would be desirable for forest restoration at the Ashhurst Domain to be pursued even if alluvial forest effects are avoided through the project design. This could be considered a trading up, where less threatened vegetation assemblages are mitigated for with restoration of alluvial swamp forest of greater rarity. The Ashhurst Domain also presents opportunities for long-term community engagement. The QEII National Trust, the Department of Conservation, Iwi and relevant Councils (including Palmerston North City and Manawatū District Council regarding Ashhurst Domain) should be given opportunities to guide the detailed design of the ecological replacement plantings.

Restoration/replacement plantings relate to effects on the following ecosystem types contained in the first six rows of Table 6.A.19. The restoration treatments constitute replacement planting with recommended multipliers (Environmental Compensation Ratios; ECRs) applied to address the differing degrees of induced scarcity of existing ecosystem types and also the time lag required to replace the pre-existing qualities of affected ecosystems.

The resulting restoration/replacement planting area is 90.15 ha; and this quantity of mitigation replacement planting assumes clearance and mitigation of all the six mapped ecosystem type extents. The resource consent and management plan parameters will promote the minimisation of effects to these ecosystem types during construction. In addition, the offset package currently requires 13.44 ha of like-for-like replacement planting and *c*. 32 ha of retirement, protection and canopy gap planting of mature forest surrounding the CH4000–4400 area. Retirement and protection of these forests would secure the ecosystems for the long term and strengthen the ecological connectivity between existing vegetation/replacement plantings on the hill country with the Ashhurst area. Within the retire/protect areas, restorative planting to fill canopy gaps and clearings would be important to accelerate the restoration of forest structure and interior microclimate. All areas of restoration planting would be legally protected in perpetuity and receive integrated pest control in perpetuity, or a similar suitable alternative pest control biodiversity enhancement project, potentially a collaboration with Iwi, DOC and Horizons. The permanent duration of these positive effects is important, in that these offset components are recommended to address permanent loss of biodiversity, thus offset measures must also be enduring so that the net-gain biodiversity outcome is secure.

For the purposes of the NoR, the six mitigation and four offset replacement planting items/quantities are offered (see Section 5.1 of the Terrestrial Vegetation and Habitats Assessment report). Once the detailed design is available, any further avoidance of specific vegetation areas achieved can be confirmed, thus potentially reducing the required replacement planting quantity as calculated through application of the respective ECRs to slope-corrected measures of affected vegetation. Any such changes would need to respond to and be up to/within the level of effects specified in Table 6.A.19 below.

Direct impacts to swamp maire would be addressed through replacement planting. For any pruning or canopy damage, replacement planting with ecosourced seedlings (including from the affected stand) should be carried out in suitable locations at a rate of 100 replacement trees per tree that is modified. Should unforeseen complete loss occur, the replacement ratio is 200 trees per tree that is lost.

Table 6.A.19. Mitigation and offset quantities.

Mitigation quantities			
Ecosystem type	**Area actually/ potentially affected (ha)**	**ECR**	**Replacement planting requirement (ha)[29]**
Secondary Broadleaved Forests with Old-Growth Signatures	3.07	5	15.35
Old-Growth Treelands	0.41	5	2.05
Kānuka Forests	1.59	5	7.95
Advanced Secondary Broadleaved Forests	2.93	4	11.72
Secondary Broadleaved Forests and Scrublands	16.32	3	48.96
Manuka, Kānuka and Divaricating Shrublands	4.12	1	4.12
Mitigation replacement planting total area			90.15
Swamp maire mitigation planting are to be at the rates of 1:100 for damage (but retention); and 1:200 for unforeseen permanent loss			
Offset quantities			
Old-Growth Forests (Alluvial)^	0.15	12	1.8
Old-Growth Forests (Hill Country)^	1	10	10
Raupō Dominated Seepage Wetlands (High Value)	0.13	4	0.52
Indigenous-Dominated Seepage Wetlands (Moderate Value)	0.56	2	1.12
Offset replacement planting total area			13.44

Other treatments in the offset package	**Area required (ha)**
Retirement, protection and canopy gap planting	c. 32[30]
Integrated pest control[31] in perpetuity over the entire replacement planting and retirement, protection and gap planting treatment areas, or a similar suitable alternative pest control project	135.59

[29] As above, these areas assume no further avoidance is achieved at detailed design.

[30] This quantity should include all indigenous forest that is unaffected by the project works in the wider vicinity of CH4000–4400. See Figure 6.A.9 for the extent of the retirement, protection and canopy gap treatment area. All of this area that remains post-detailed design should be retired, protected, and gap planted.

[31] It is my professional opinion that net gain would be achieved through animal pest control over the mitigation areas addressing brushtail possums and rats and maintaining the density of those species below a 5% residual trap catch/tracking index. If this monitoring method or target proves inappropriate for the configuration of control areas, an alternative outcome-related target (e.g., foliar browse) will be specified in the Ecological Management Plan. Plant pest control will target pest species that threaten the regeneration and/or long-term maintenance of forest plants (e.g., shade tolerant species (e.g., barberry) or light demanding vines (e.g., old man's beard); not gorse or broom).

6.5 Proposed Mitigation and Offset Areas

The land areas shown in Figure 6.A.9 have been identified as providing adequate area of ecologically suitable sites for the replacement planting treatments and the retirement, protection and gap planting treatment. Further work would be required to clarify the nature of existing constraints (e.g., wind turbines, land ownership) and to confirm the final configuration of mitigation/offset replacement planting areas.

The highest priority site for terrestrial restoration treatments would be Areas 1 and 2, the alluvial forest replacement planting area located both within Ashhurst Domain (green in Figure 6.A.9) and south of the point of Manawatū–Pohangina river convergence. These sites are representative of alluvial landforms and presents a rare opportunity to restore alluvial forest compositions. Site 1 also presents an opportunity to connect and enlarge with the existing alluvial remnant forest patch located within Ashhurst Reserve. Given these sites' ease of access, there are clear opportunities for community involvement in these restoration areas.

The third highest priority for terrestrial replacement planting would be Area 3, the area located between the Manawatū Gorge Scenic Reserve (MGSR) and the proposed road corridor (Figure 6.A.9). This area presents a significant opportunity to extend the regionally significant MGSR to the north, at the same time connecting with remnants of the affected QEII forest sites. The area would strengthen landscape connectivity and form part of a potential ecological corridor along the alignment.

Area 4 would serve similar roles and functions as Area 3.

Areas 5 and 6 would provide a major contribution to enhancing landscape connectivity and would act as a physical extension to the MGSR, this time to the west, and towards the existing grazed forests shown in green (Area 10). Area 7 would be valuable as a large revegetation area or as opportunities for riparian restoration.

The retirement, protection and gap planting of Area 10 would form a valuable part of the offset package, I recommend this be agreed with the relevant landowners. Restoration of these existing forests builds on the positive biodiversity effects provided by the replacement planting. The proximity of this treatment is also important in that existing forests immediately adjoining the impacted area of CH4000–4400 would be restored – the positive effects would be as close as practically possible to the adverse effects in this location. Sites 11 and 12 are further options for retirement, protection, and gap planting.

The existing seepage at CH4200 presents an opportunity to restore a rare wetland ecosystem type and this could include protecting, buffering and enlarging the swamp maire stand at CH4130.

Additional wetland mitigation opportunities exist within the existing wetland area of the Ashhurst Domain (orange polygon in Figure 6.A.9).

The above sites present an opportunity to fulfil the required mitigation and offset treatments and to achieve a net-gain biodiversity outcome.

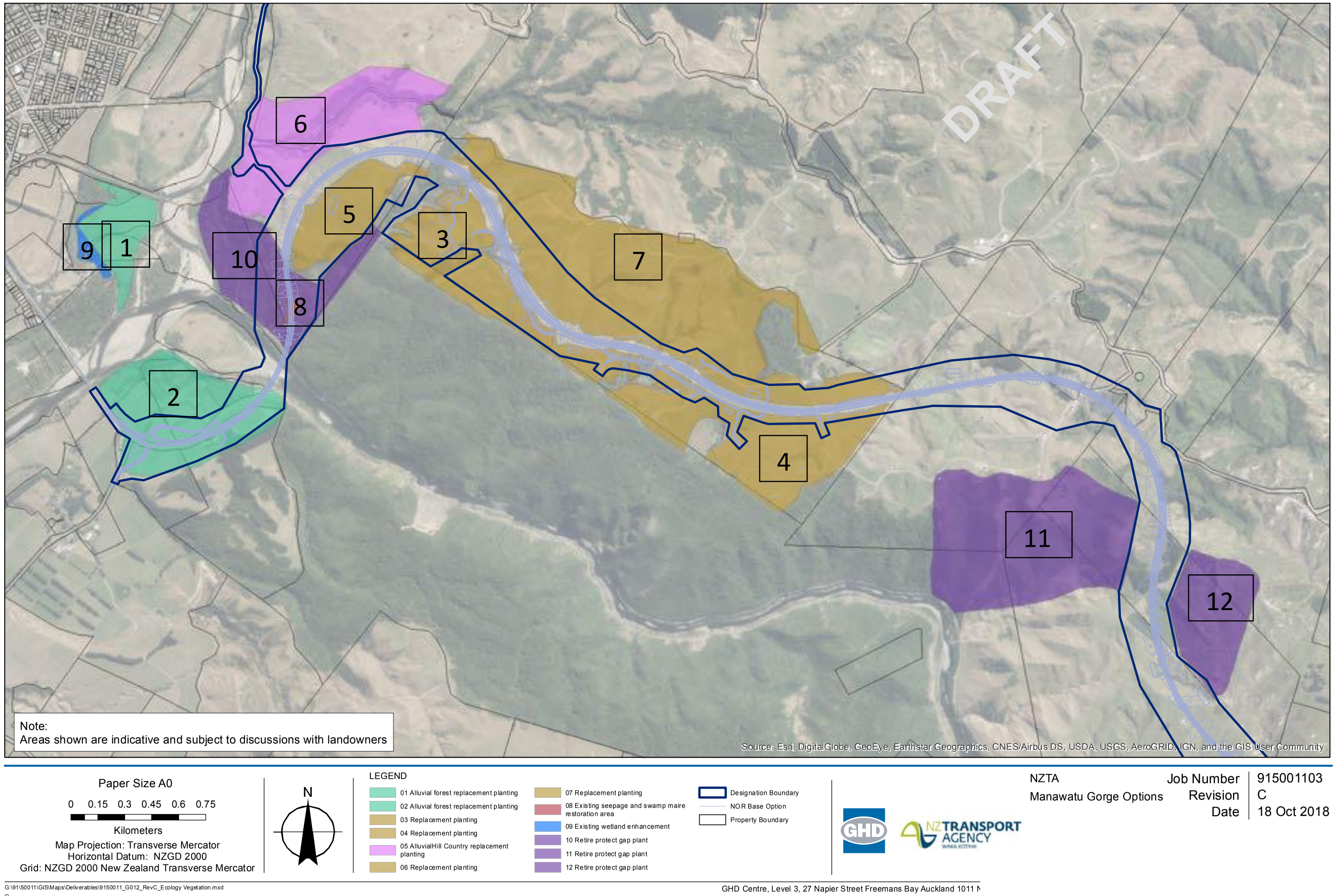

Figure 6.A.9. Potential mitigation/offset replacement planting and retirement areas. Treatments are numbered in order of preference applying ecological principles. More area is identified than would be needed.

6.0 RECOMMENDATIONS

An Ecological Management Plan should be prepared to encompass the ecological values and effects management measures described in this report.

Further work should be undertaken to confirm the mitigation and offset site locations and to confirm the associated restorative and protection treatments/mechanisms.

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Appendices

Appendix A: Photographs of Examples of Ecosystem Types within the Proposed Designation Area
Appendix B: Forest Dominance (Point-Centred Quarter) Survey Data
Appendix C: Recce Survey Data
Appendix D: Forest Condition (FORMAK) Assessment Data
Appendix E: Assumptions Regarding Construction Access Requirements
Appendix F: Assessment of Offsetability (following Pilgrim et al., (2013) Table 2)
Appendix G: Assessment of Threatened Flora (Singers & Bayler, 2018)

Appendix A: Photographic Examples of Ecosystem Types within the Proposed Designation Area

1: Old-Growth Forest (Alluvial)
2: Old-Growth Forest (Hill Country)
3: Secondary Broadleaved Forests with Old-Growth Signatures
4: Kānuka forest
5: Advanced Secondary Broadleaved Forests
6: Secondary Broadleaved Forests and Scrublands
7: Manuka, Kānuka and Divaricating Shrublands
8: Indigenous-Dominated Seepage Wetland (High Value)
9: Indigenous-Dominated Seepage Wetland (Moderate Value)

1: Old-Growth Forest (Alluvial) CH4000–4400. July 2018.

2: Old-Growth Forest (Hill Country) CH5650. July 2018.

3: Secondary Broadleaved Forests with Old-Growth Signatures. (Left) Secondary forest containing mature tawa, hinau, and totara (CH7350). (Right) Secondary broadleaved forest containing mature tawa and pukatea (CH10500–10600). July 2018.

4: Kānuka forest (CH4000–4300). July 2018.

5: Advanced Secondary Broadleaved forest (CH5700–5800). July 2018.

6: Secondary Broadleaved Forests and Scrublands (CH10100). July 2018.

7: Manuka, Kānuka and Divaricating Shrublands (CH10200). July 2018.

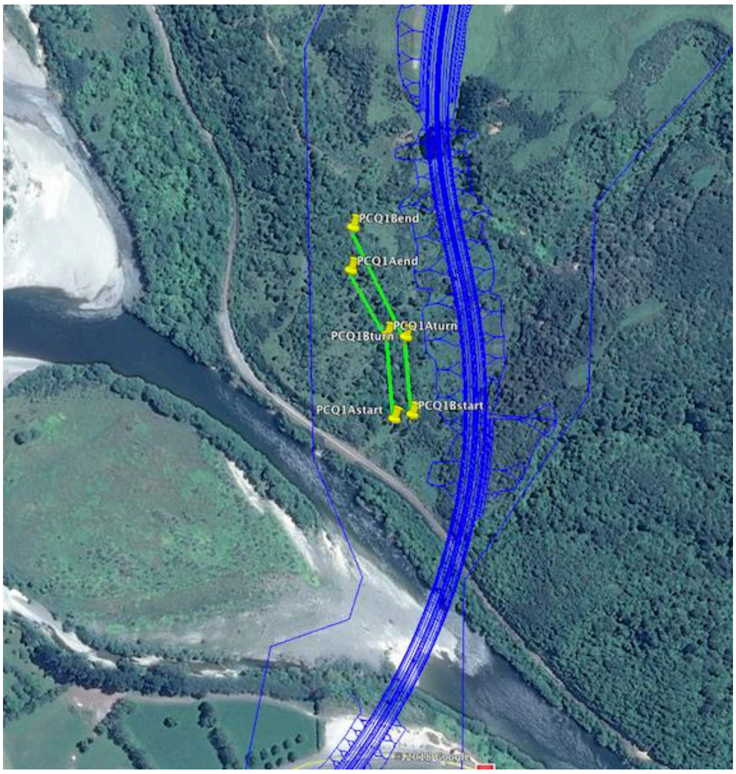
8: Indigenous-Dominated Seepage Wetland (High Value; CH4200). July 2018.

9: Indigenous-Dominated Seepage Wetland (Moderate Value; CH10100). July 2018.

Appendix B: Forest Dominance (Point-Centred Quarter) Survey Data

P-C Q 1 A and B at c. CH4000–4400:

Transect locations:



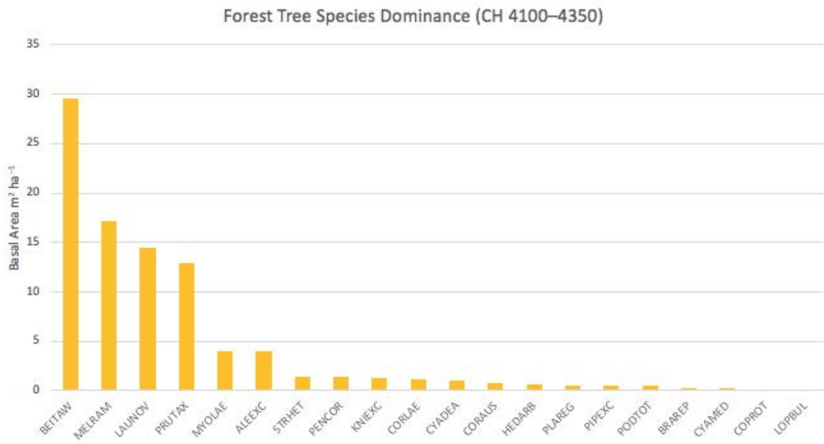
Tree stem density:

Number of trees				# in Quarters	# of trees per ha
	ALEEXC	4	88	0.05	33.74
	BEITAW	20	88	0.23	168.70
	BRAREP	1	88	0.01	8.43
	COPROT	2	88	0.02	16.87
	CORAUS	1	88	0.01	8.43
	CORLAE	1	88	0.01	8.43
	CYADEA	2	88	0.02	16.87
	CYAMED	1	88	0.01	8.43
	HEDARB	2	88	0.02	16.87
	KNIEXC	1	88	0.01	8.43
	LAUNOV	4	88	0.05	33.74
	LOPBUL	1	88	0.01	8.43
	MELRAM	19	88	0.22	160.26
	MYOLAE	2	88	0.02	16.87
	PENCOR	8	88	0.09	67.48
	PIPEXC	1	88	0.01	8.43
	PLAREG	2	88	0.02	16.87
	PODTOT	1	88	0.01	8.43
	PRUTAX	11	88	0.13	92.78
	STRHET	4	88	0.05	33.74

Basal area:

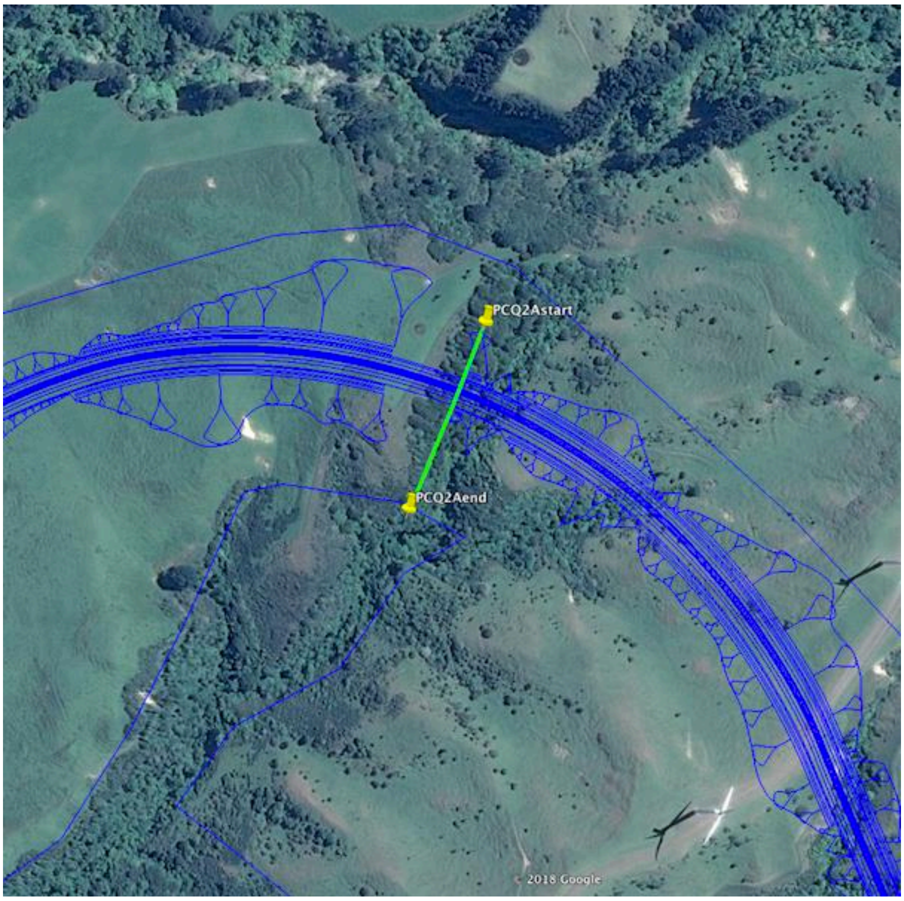
Basal area (m	ALEEXC	BEITAW	BRAREP	COPROT	CORAUS	CORLAE	CYADEA	CYAMED	HEDARB	KNIEXC	LAUNOV	LOPBUL	MELRAM	MYOLAE	PENCOR	PIPEXC	PLAREG	PODTOT	PRUTAX	STRHET
	0.3167332	0.0892084	0.03142	0.0056752	0.0908038	0.1326874	0.0363097	0.0268837	0.0594034	0.1590638	0.3217408	0.0046572	0.2123992	0.196375	0.0172056	0.057263	0.0433792	0.057263	0.0336579	0.0292591
	0.0213852	0.1046482		0.007855			0.0804352		0.0176738		0.0510771		0.1493204	0.28278	0.0181482		0.0201088		0.0897387	0.0089932
	0.0711671	0.1555486									0.0188716		0.3019462		0.022701				0.4072032	0.041553
	0.0683581	0.3421638									1.327495		0.1307575		0.0188716				0.0829684	0.085541
		0.1313992											0.0208699		0.0298686				0.108117	
		0.2922846											0.0669749		0.0283566				0.0779412	
		0.0962238											0.0103882		0.013275				0.085541	
		0.1662118											0.1213197		0.013275				0.0594034	
		0.145239											0.0804352						0.3739766	
		0.108117											0.0254502						0.173517	
		0.2043086											0.0615832						0.0452448	
		0.1590638											0.0363097							
		0.0978804											0.0176738							
		0.4266592											0.0113112							
		0.0543322											0.0380182							
		0.5675238											0.03142							
		0.1194746											0.0206147							
		0.1288416											0.50272							
		0.1018008											0.196375							
		0.0169739																		

Forest tree dominance (stem density & basal area):



P-C Q 2 A at c. CH5600:

Transect location:



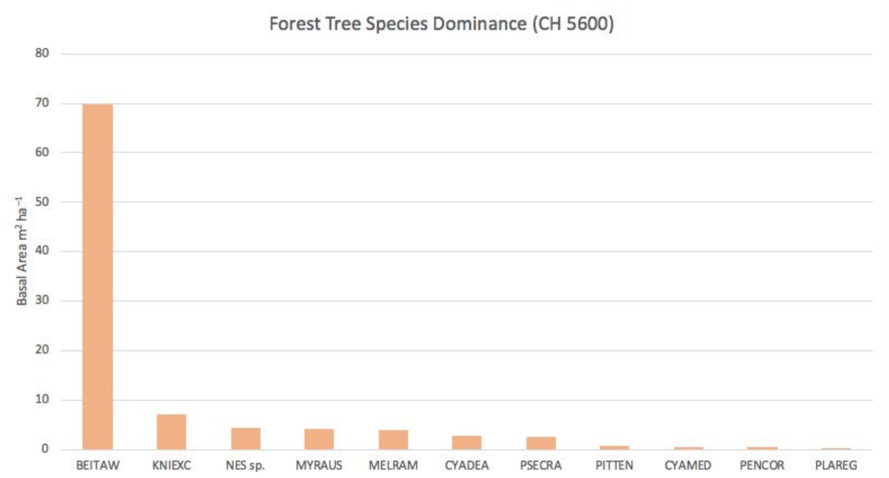
Tree stem density:

Number of trees				# in Quarters	# of trees per ha
	BEITAW	22	44	0.50	669.99
	CYADEA	2	44	0.05	60.91
	CYAMED	1	44	0.02	30.45
	KNIEXC	2	44	0.05	60.91
	MELRAM	3	44	0.07	91.36
	MYRAUS	3	44	0.07	91.36
	NES sp.	2	44	0.05	60.91
	PENCOR	1	44	0.02	30.45
	PITTEN	1	44	0.02	30.45
	PLAREG	1	44	0.02	30.45
	PSECRA	6	44	0.14	182.72

Basal area:

Basal area (m2)											
	BEITAW	CYADEA	CYAMED	KNIEXC	MELRAM	MYRAUS	NES sp.	PENCOR	PITTEN	PLAREG	PSECRA
	0.07646371	0.00950455	0.01767375	0.02405594	0.10579821	0.00554249	0.06202387	0.01389471	0.0237818	0.00950455	0.02630561
	0.10753495	0.0804352		0.2123992	0.0113112	0.01767375	0.0804352				0.00817234
	0.06027063				0.00950455	0.1134262					0.01207785
	0.007855										0.01188383
	0.04155295										0.00950455
	0.24370059										0.01431574
	0.07211597										
	0.05107714										
	0.02270095										
	0.01720559										
	0.20833424										
	0.03464055										
	0.05811443										
	0.24195364										
	0.10293506										
	0.13204255										
	0.1146233										
	0.196375										
	0.14863624										
	0.0201088										
	0.31176495										
	0.02243467										

Forest tree dominance (stem density & basal area):



Appendix C: Recce Survey Data
Location: P-C Q 1 A&B at c. CH4000–4400

Plot photo:

Plot data:

Plot ref.		Measured by	Recorded by	Date	GPS ref. S	GPS ref. E	Prec. ± m	Plot dia. (m)	Elevation (m, Garmin)	Elevation (m, Diff. GPS)	Physiography	Aspect (Deg.)	Slope (Deg.)	Shape	Drainage	Meso (%)							
																45	90	135	180	225	270	315	360
2	66	AF	AF	10/07/18			8	10 × 10			face	90	30	convex	good	27	30	18	21	70	85	47	15

%bedrock & %broken rock	Broken rock < or > 30 cm	Broken rock trans.	Vege parameters of plot; % plot @ < 1.35 m covered by:						Average top height (m)	Total canopy cover (%) >1.35 m.a.g.l	Basal area (m²/ha)	Additional cultural info:				
			liage, trunks	Non-vascular	Litter	Bare ground	Exposed rock	Sum >100?				Cultural	Fauna	Browse	Browse spp.	
0			10	0	80	5	5	100	35	95			Wood pigeo	heavy		Cattle access. Heavy browse

Seedlings:

Plot ref.		Species Code	SEEDLINGS HEIGHTS <15 (cm)	16–45 (cm)	46–75 (cm)	76–105 (cm)	106–135 (cm)	SUM#seedlings
2		GRILIT	1					0
		PIPEXC	1					0
		ALEEXC		1				1
		COPARE		5	1			6
		HEDARB	1					0
		MELRAM	1					0
		STRHET			1			1
		GENLIG	1					0
		PENCOR		1				1
		RHOSAP	1					0
		BEITAW	1					0

Saplings and Trees:

Plot ref.	Date	Time	Species Code	SAPLINGS NWQ #saplings	NEQ #saplings	SWQ #saplings	SEQ #saplings	SUM#saplings	TREES DBH dbh (cm)
2	10/07/18	03:45:00	BEITAW						7.3, 76, 20.5, 42, 7.2, 32.2,14,21
			MELRAM						(23.6, 19.5)
			CYAMED						16

Composition:

Plot ref.				Cover classes: 1 = <1%, 2 = 1–5%, 3 = 6–25%, 4 = 26–50%, 5 = 51–75%, 6 = 76–100%													
				Tier 1 >25 m		Tier 2 12–25 m		Tier 3 5–12 m		Tier 4 2–5 m		Tier 5 0.3–2 m		Tier 6 <0.3 m		Tier 7 Epiphytes/vines	
			Overall cover														
2																Metrosideros	1
																Astelia sp.	1
				BEITAW	6		5		3		3						
																RIPSCA	1
														GRILIT	2		
														PIPEXC	2		
														ALEEXC	1		
												COPARE	2				
														HEDARB	1		
														MELRAM	1		
														GENLIG	1		
														PENCOR	1		
														RHOSAP	1		
														STRHET	1		

Appendix D: Forest Condition (FORMAK) Assessment Data

Location: P-C Q 1 A&B at c. CH4000–4400

FORMAK Site Assessment Form Issue date: 4-6-04

Site Location

Names	Map Grid Reference or..	GPS Coordinates	Offset (if any)
Site Name: PCQ1 A&B	NZMS 260 Map No:	East: 175 46 15.32 E	Offset bearing:
Catchment: Unnamed. Bolton	East:	North: 40 18 08.68 S	Offset (m):
Region: Manawatu	North:	~~Accuracy(m)~~: WGS84	

Assessment radius (m)	T PCQ Area

Ownership (tick the box)		Legal Protection (tick the box)	
☑ Private	☐ Local Authority	☑ Informal (no legal protection)	☐ Reserve
☐ Department of Conservation	☐ Other	☐ Legal Covenant	☐ Conservation estate

Site Assessment

Assessed by: Adam Forbes	Recorded by: Adam Forbes.	Assessment Date: 10/7/18

1) Management

Management

History - Is the forest (tick the box)
- ☐ 1) Primary (original, mature native forest).
- ☑ 2) Modified Primary (forest that has major changes from e.g. past logging)
- ☐ 3) Secondary (forest that has regenerated following land clearance)
- ☐ 4) Revegetated (forest actively re-established on bare land)

Note on history: Signs of fire in forest. Charcoal/Charred Logs.

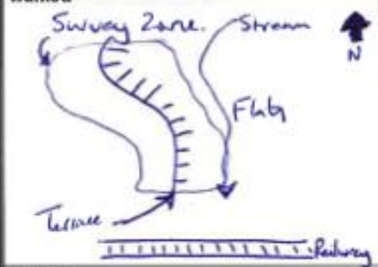
Current animal pest control – Yes / No / Don't know
Notes on control: Possum Bait Station present.

Current weed control – Yes / No / Don't know
Notes on control:

Past animal control (last 5 yrs)-Yes / No / Don't know.
Notes on control:

Past weed control (last 5 yrs) - Yes / No / Don't know.
Notes on control:

Sketch of area assessed, and route walked



Notes: Survey zone covered the area surveyed by PCQ1 A+B.

2) From Overview Site See FORMAK Visual Guide

	Estimate (Circle appropriate level)	Notes Species etc
Size	1) 0-5ha 2) 5-25ha. 3) 25-100ha 4) Over 100ha.	
Shape	1) Narrow long strip, sometimes can look through from one side to other – may be 20m or less in width. 2) Some wider areas where cannot see through forest. 3) Most of forest area in compact shape without extensive exposed strips, but occasional small fingers do occur. 4) Extensive approximately round or square area.	Sometimes forest on top terrace adds considerable width.
Nearby native forest	1) No forest areas over 10ha in size within 5km. 2) Closest areas of forest over 10ha in size are 1 - 5 km away. 3) Areas of forest of at least 10 ha present within 50m – 1000m (1km). 4) Large continuous area of forest present within 50m of area assessed.	Manawatu Gorge Scenic Reserve.
Corridors	1) Patch is completely isolated from other tall stature vegetation for over 1km. 2) Vegetation corridors are present within 500m – 1km of the patch. 3) Vegetation corridors are present within 500m of the patch. 4) Extensive vegetation corridors including exotic forest, vegetated waterways are present up to boundary of the forest and extend to other areas of native forest over 10ha in size.	

3) *On the Forest Edge* See FORMAK Visual Guide

	Estimate (Circle appropriate level)	Notes Species etc
Forest edge canopy	1) Major dieback in canopy, dead standing trees. 2) Areas of significant dieback, but all trees live. 3) Small areas of localised dieback. 4) Canopy without dieback.	Extensive dieback on terrace above PCQ transect(s).
Forest edge understorey	1) Understorey completely absent. 2) Some understorey present and occasional seedlings / saplings present close to the edge of the canopy. 3) Considerable understorey and many seedlings / saplings around the edge of the canopy. 4) Vigorous, abundant understorey with a range of seedlings / saplings spreading well beyond the current extent of the canopy.	
Forest edge - weeds	1) Many weeds present along edge – weeds dominate understorey. 2) Weeds common as scattered patches and individuals along the boundary. 3) Few weeds forming isolated patches or individuals on edge. Local native vegetation dominates understorey. 4) No weeds present.	Wild broom, blackberry, woolly nightshade.
Fencing	1) No fencing 2) Some fencing, e.g. one side, or fence poorly maintained with large breaks 3) Most of boundary fenced, includes all areas where stock access likely. Some small recent breaks. 4) Secure, intact fencing around whole area, or area where no possibility of stock entry (e.g. urban).	Stock access throughout.
Adjacent land use	1) Livestock farming (note type) Cattle. 2) Exotic Forest 3) Residential / urban 4) Reserve (public or private reserve land)	Cattle.

4) *Moving Through the Forest* See FORMAK Visual Guide
Doing Simple Counts (see end of this form)

State	Estimate (Circle appropriate level)	Notes Species etc
Canopy Condition	1) Very sparse foliage, many large holes, dieback covers more than 25% of tree crowns. 2) Foliage sparse in some areas, canopy holes common. Some dieback. 3) Foliage mostly dense, only occasional sparse areas, Canopy holes rare, very occasional dieback. 4) Abundant dense foliage over whole canopy, no canopy holes or dieback.	
Canopy Browsing	1) Severe canopy browse: 75-100% of leaves browsed on possum preferred species. 2) Moderate: heavy canopy browse - 25-75% of leaves browsed on possum preferred species 3) Light canopy browse: 1-25% of leaves browsed on possum preferred species. 4) No canopy browse.	No sign of canopy browse.
Understorey / Regeneration	1) Understorey completely bare of all species. 2) Very few plants preferred by deer / goats / stock are present in the knee to shoulder height range. Scattered seedlings of other species. 3) Moderate numbers of plants preferred by deer / goats / stock are present in the knee to shoulder height range. Other species relatively abundant. 4) Abundant plants preferred by deer / goats / stock and other species may also occur.	Mainly COPARE, PIPEXC, URTFER
Understorey Browsing	1) Severe understorey browse. 75-100% of stems of deer/goat/stock preferred species are browsed. Understorey may be completely bare. 2) Moderate – heavy understorey browse. 25-75% of stems of deer/goat/stock preferred species are browsed. 3) Light understorey browse. 1-25% of stems of deer/goat/stock preferred species are browsed. 4) No understorey browse.	
Ground Cover	1) Bare soil, rock / gravel covers more than 20% of ground. Eroding soil common. Ground vegetation (ferns, moss, seedlings etc less than	

State	Estimate (Circle appropriate level)	Notes Species etc
	50cm tall) absent or very uncommon. 2) Scattered bare soil and rock. Eroding soil uncommon. Ground veg (see definition in (1)) covers less than 20% 3) Bare soil, rock absent or very uncommon. No eroding soil. Ground veg (see definition in (1)) covers 20 – 50% of ground. 4) No bare soil, rock, or eroding soil. Ground veg (see definition in (1)), abundant, covering 50-100% of the ground.	
Bird Song	1) Bird song almost entirely absent. Only occasional calls heard. 2) Bird song present some of the time, but with extended breaks. 3) Ongoing bird song but with occasional breaks. 4) Continuous bird song with no breaks.	

5) *Canopy Gaps*

See FORMAK Visual Guide

(Find gaps in the canopy, over 3m in diameter, and examine the understorey vegetation)

Canopy Gap	Estimate (Circle appropriate level)	Notes Species etc
Regeneration	1) No seedlings – area completely open. 2) Occasional seedlings – scattered individuals 3) Seedlings common – brush against you as you walk across area.. 4) Abundant, dense cover of seedlings and undergrowth – you have to continually push your way through.	
Species	1) No plants preferred by deer / goats / stock – dominated by tree ferns, pepperwood or other unpalatable species. 2) Occasional plants preferred by deer / goats / stock amongst dominant tree ferns, pepperwood or other unpalatable species. 3) Common plants preferred by deer / goats / stock. Unpalatable species such as tree ferns, pepperwood etc also common. 4) Abundant plants preferred by deer / goats / stock dominate.	Very few palatable species present in understorey. PURFUL, KNIEXC, CAMNOV present.

6) *Threats ?*

See FORMAK Visual Guide

Threat	Estimate (Circle appropriate level)	Notes Species etc
Vine Weeds	1) Very common, cover more than 50% canopy. 2) Common, 10 – 50% canopy. 3) Occasional, up to 10% canopy. 4) None present.	
Shrub Weeds	1) Very common, more than 50% understorey or canopy. 2) Common, 10 – 50% understorey or canopy. 3) Occasional, up to 10% understorey or canopy. 4) None present.	
Ground cover weeds	1) Very common, cover > 50% ground area. 2) Common, 10 – 50% ground area. 3) Occasional, up to 10% ground area. 4) None present.	
Possums	1) Abundant fresh sign (droppings, pad runs, bark scratching / biting). 2) Common fresh sign but sometimes scattered. 3) Sign uncommon, often quite old. 4) Sign very rare or non existent.	
Deer	1) Abundant fresh sign (droppings, major tracks & hoof prints). Occasional deer may be disturbed 2) Common fresh sign but sometimes scattered. Sightings of deer uncommon. 3) Sign uncommon. Sign is often old 4) No sign	
Goats	1) Abundant fresh sign (droppings, major tracks & hoof prints). Goats commonly heard or seen. 2) Common fresh sign but sometimes scattered. Occasional goats heard or seen. 3) Sign uncommon. Sign is often old 4) No sign	
Stock	1) Abundant fresh sign (droppings, major tracks & hoof prints). Stock heard or seen throughout area. 2) Common fresh sign but sometimes scattered. Occasional stock heard or seen, generally confined to scattered areas on edge.	Lots of faeces, pugging + seen stock.

Threat	Estimate (Circle appropriate level)	Notes Species etc
	3) Sign uncommon. Sign is often old. Only near edges. 4) No sign	
Human Impacts	1) Widespread trampling, and other damage throughout area. 2) Common trampling and damage but limited to certain areas 3) Occasional localised minor damage 4) No damage	

Location: P-C Q 2 at c. CH5600 (Western QEII)

FORMAK Site Assessment Form Issue date: 4-6-04

Site Location

Names	Map Grid Reference or..	GPS Coordinates	Offset (if any)
Site Name: Alistair Bolton QEII	NZMS 260 Map No:	East: 175°46 50.0	Offset bearing:
Catchment: (Western)	East:	~~North:~~ S 40°17 45.0	Offset (m):
Region: Manawatu.	North:	Accuracy(m):	

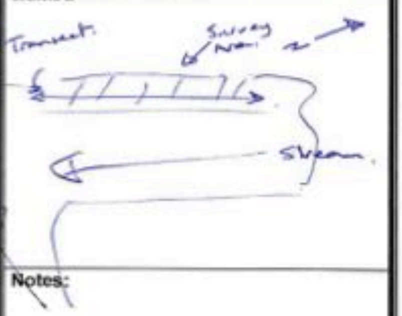
Assessment radius (m)	PCQ2A area.

Ownership (tick the box)		Legal Protection (tick the box)	
☑ Private	☐ Local Authority	☐ Informal (no legal protection)	☐ Reserve
☐ Department of Conservation	☐ Other	☑ Legal Covenant	☐ Conservation estate

Site Assessment

Assessed by: A Forbes	Recorded by: A. Forbes	Assessment Date: 11/7/18

1) Management

Management	Sketch of area assessed, and route walked
History - Is the forest (tick the box) ☑1) Primary (original, mature native forest). ☐2) Modified Primary (forest that has major changes from e.g. past logging) ☐3) Secondary (forest that has regenerated following land clearance) ☐4) Revegetated (forest actively re-established on bare land) Note on history:..	
Current animal pest control – Yes / No / Don't know Notes on control: Deer culling noted by landowner.	
Current weed control – Yes / No / Don't know Notes on control:	
Past animal control(last 5 yrs)-Yes / No / Don't know. Notes on control:	**Notes:**
Past weed control(last 5 yrs) - Yes / No / Don't know. Notes on control:	

2) From Overview Site See FORMAK Visual Guide

	Estimate (Circle appropriate level)	Notes Species etc
Size	1) 0-5ha. 2) 5-25ha. 3) 25-100ha 4) Over 100ha.	
Shape	1) Narrow long strip, sometimes can look through from one side to other – may be 20m or less in width. 2) Some wider areas where cannot see through forest. 3) Most of forest area in compact shape without extensive exposed strips, but occasional small fingers do occur. 4) Extensive approximately round or square area.	
Nearby native forest	1) No forest areas over 10ha in size within 5km. 2) Closest areas of forest over 10ha in size are 1 - 5 km away. 3) Areas of forest of at least 10 ha present within 50m – 1000m (1km). 4) Large continuous area of forest present within 50m of area assessed.	
Corridors	1) Patch is completely isolated from other tall stature vegetation for over 1km. 2) Vegetation corridors are present within 500m – 1km of the patch. 3) Vegetation corridors are present within 500m of the patch. 4) Extensive vegetation corridors including exotic forest, vegetated waterways are present up to boundary of the forest and extend to other areas of native forest over 10ha in size.	Manawatu SR.

3) On the Forest Edge See FORMAK Visual Guide

	Estimate (Circle appropriate level)	Notes Species etc
Forest edge canopy	1) Major dieback in canopy, dead standing trees. 2) Areas of significant dieback, but all trees live. 3) Small areas of localised dieback. 4) Canopy without dieback.	
Forest edge understorey	1) Understorey completely absent. 2) Some understorey present and occasional seedlings / saplings present close to the edge of the canopy. 3) Considerable understorey and many seedlings / saplings around the edge of the canopy. 4) Vigorous, abundant understorey with a range of seedlings / saplings spreading well beyond the current extent of the canopy.	
Forest edge - weeds	1) Many weeds present along edge – weeds dominate understorey. 2) Weeds common as scattered patches and individuals along the boundary. 3) Few weeds forming isolated patches or individuals on edge. Local native vegetation dominates understorey. 4) No weeds present.	
Fencing	1) No fencing 2) Some fencing, e.g. one side, or fence poorly maintained with large breaks 3) Most of boundary fenced, includes all areas where stock access likely. Some small recent breaks. 4) Secure, intact fencing around whole area, or area where no possibility of stock entry (e.g. urban).	
Adjacent land use	1) Livestock farming (note type) Sheep / Beef. 2) Exotic Forest 3) Residential / urban 4) Reserve (public or private reserve land)	Sheep & Beef.

4) Moving Through the Forest See FORMAK Visual Guide
Doing Simple Counts (see end of this form)

State	Estimate (Circle appropriate level)	Notes Species etc
Canopy Condition	1) Very sparse foliage, many large holes, dieback covers more than 25% of tree crowns. 2) Foliage sparse in some areas, canopy holes common. Some dieback. 3) Foliage mostly dense, only occasional sparse areas, Canopy holes rare, very occasional dieback. 4) Abundant dense foliage over whole canopy, no canopy holes or dieback.	
Canopy Browsing	1) Severe canopy browse: 75-100% of leaves browsed on possum preferred species. 2) Moderate: heavy canopy browse - 25-75% of leaves browsed on possum preferred species 3) Light canopy browse: 1-25% of leaves browsed on possum preferred species. 4) No canopy browse.	
Understorey / Regeneration	1) Understorey completely bare of all species. 2) Very few plants preferred by deer / goats / stock are present in the knee to shoulder height range. Scattered seedlings of other species. 3) Moderate numbers of plants preferred by deer / goats / stock are present in the knee to shoulder height range. Other species relatively abundant. 4) Abundant plants preferred by deer / goats / stock and other species may also occur.	
Understorey Browsing	1) Severe understorey browse. 75-100% of stems of deer/goat/stock preferred species are browsed. Understorey may be completely bare. 2) Moderate – heavy understorey browse. 25-75% of stems of deer/goat/stock preferred species are browsed. 3) Light understorey browse. 1-25% of stems of deer/goat/stock preferred species are browsed. 4) No understorey browse.	
Ground Cover	1) Bare soil, rock / gravel covers more than 20% of ground. Eroding soil common. Ground vegetation (ferns, moss, seedlings etc less than	

State	Estimate (Circle appropriate level)	Notes Species etc
	50cm tall) absent or very uncommon. 2) Scattered bare soil and rock. Eroding soil uncommon. Ground veg (see definition in (1)) covers less than 20% 3) Bare soil, rock absent or very uncommon. No eroding soil. Ground veg (see definition in (1)) covers 20 – 50% of ground. 4) No bare soil, rock, or eroding soil. Ground veg (see definition in (1)), abundant, covering 50-100% of the ground.	
Bird Song	1) Bird song almost entirely absent. Only occasional calls heard. 2) Bird song present some of the time, but with extended breaks. 3) Ongoing bird song but with occasional breaks. 4) Continuous bird song with no breaks.	

5) Canopy Gaps

See FORMAK Visual Guide

(Find gaps in the canopy, over 3m in diameter, and examine the understorey vegetation)

Canopy Gap	Estimate (Circle appropriate level)	Notes Species etc
Regeneration	1) No seedlings – area completely open. 2) Occasional seedlings – scattered individuals 3) Seedlings common – brush against you as you walk across area.. 4) Abundant, dense cover of seedlings and undergrowth – you have to continually push your way through.	PRUTAX & PRUFER regen.
Species	1) No plants preferred by deer / goats / stock – dominated by tree ferns, pepperwood or other unpalatable species. 2) Occasional plants preferred by deer / goats / stock amongst dominant tree ferns, pepperwood or other unpalatable species. 3) Common plants preferred by deer / goats / stock. Unpalatable species such as tree ferns, pepperwood etc also common. 4) Abundant plants preferred by deer / goats / stock dominate.	

6) Threats ?

See FORMAK Visual Guide

Threat	Estimate (Circle appropriate level)	Notes Species etc
Vine Weeds	1) Very common, cover more than 50% canopy. 2) Common, 10 – 50% canopy. 3) Occasional, up to 10% canopy. 4) None present.	
Shrub Weeds	1) Very common, more than 50% understorey or canopy. 2) Common, 10 – 50% understorey or canopy. 3) Occasional, up to 10% understorey or canopy. 4) None present.	
Ground cover weeds	1) Very common, cover > 50% ground area. 2) Common, 10 – 50% ground area. 3) Occasional, up to 10% ground area. 4) None present.	
Possums	1) Abundant fresh sign (droppings, pad runs, bark scratching / biting). 2) Common fresh sign but sometimes scattered. 3) Sign uncommon, often quite old. 4) Sign very rare or non existent.	
Deer	1) Abundant fresh sign (droppings, major tracks & hoof prints). Occasional deer may be disturbed 2) Common fresh sign but sometimes scattered. Sightings of deer uncommon. 3) Sign uncommon. Sign is often old 4) No sign	
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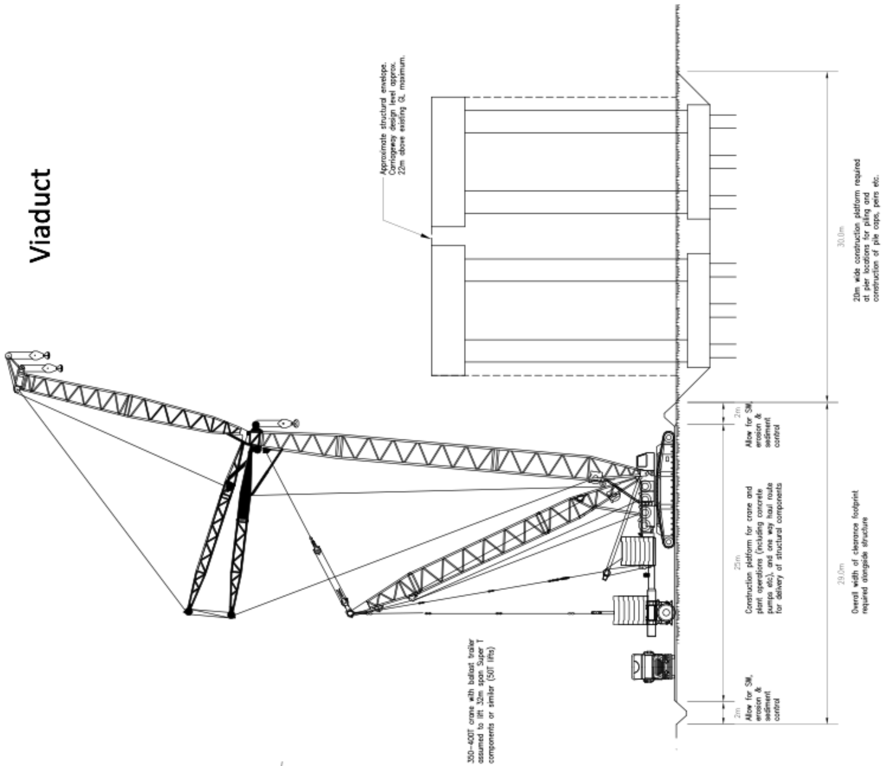
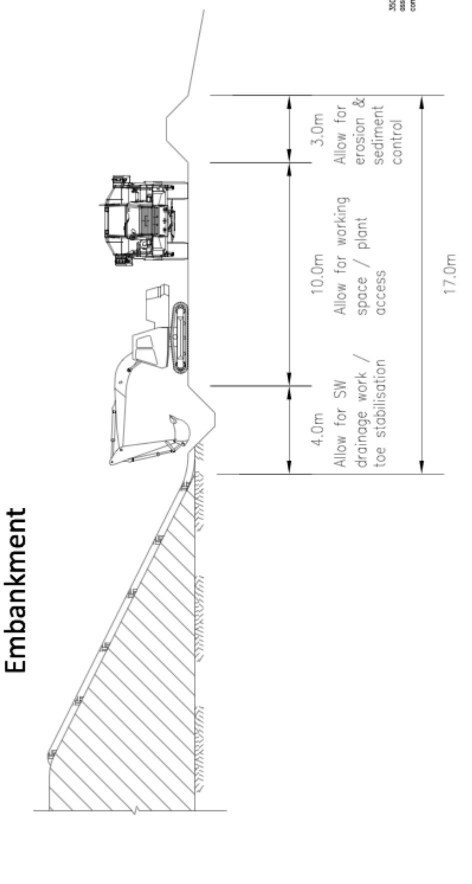
Stock	1) Abundant fresh sign (droppings, major tracks & hoof prints). Stock heard or seen throughout area. 2) Common fresh sign but sometimes scattered. Occasional stock heard or seen, generally confined to scattered areas on edge.	

Threat	Estimate (Circle appropriate level)	Notes Species etc
	3) Sign uncommon. Sign is often old. Only near edges. 4) No sign	
Human Impacts	1) Widespread trampling, and other damage throughout area. 2) Common trampling and damage but limited to certain areas 3) Occasional localised minor damage 4) No damage	

Appendix E: Diagrams Demonstrating Assumptions Regarding Construction Access Requirements





Appendix F: Assessment of Offsetability (following Pilgrim et al., (2013) Table 2)

Example assessment of residual impact magnitude, offset opportunity, and offset feasibility for the alluvial old-growth forest located at CH4000–4400 when compared between generic embankment and viaduct options.

Issue	Sub-issue	Criterion	Embankment				Viaduct			
			Lowest likelihood		Highest likelihood		Lowest likelihood		Highest likelihood	
			Class 1	Class 2	Class 3	Class 4	Class 1	Class 2	Class 3	Class 4
Residual impact magnitude	Severity	Declines of each biodiversity feature at a set scale (per km)	Severe						Moderate	
	Extent	Proportion of range/population of each biodiversity feature impacted			Small					V. small
	Duration	Length of impacts, relative to viability of affected biodiversity	Permanent						Medium	
Offset opportunity	Options	Potential for restoring affected biodiversity functions elsewhere		Possible				Possible		
		Offset options within natural range		Limited				Limited		

		For restoration offsets, condition to which offset can be restored compared to impacted feature			Equal or better				Equal or better	
		For averted loss offsets, landscape-level condition of affected biodiversity	-	-	-	-				
Offset feasibility	Technical	Availability of proven relevant methods for restoration, protection, etc			Some proven methods				Some proven methods	
		Adequacy of long-term offset implementation plans	[TBD]	[TBD]	[TBD]	[TBD]				
		Adequacy of long-term offset monitoring plans	[TBD]	[TBD]	[TBD]	[TBD]				
	Financial	Funding for long-term offset implementation		Post impacts				Post impacts		

		Funding for long-term offset monitoring				Includes funding for independent input				Includes funding for independent input
	Temporal	Time after impacts until offset gains replace affected biodiversity, relative to viability		Medium-term				Medium term		
	Capacity	Capacity of offset implementer for relevant methods at necessary scale			Some				Some	
		Capacity of developer to keep residual impacts within predicted magnitudes			Some				Some	
Overall likelihood of offset success			Class 1					Class 2		

Notes. Following Pilgrim *et al.* (2013), the overall likelihood of offset success is indicated by the lowest class for which a project is ranked on any table row, from Class 1 (lowest likelihood of success) to Class 4 (highest likelihood of success).

Appendix G: Assessment of Threatened Flora (Singers & Bayler, 2018)

6.B
TERRESTRIAL FAUNA ECOLOGICAL EFFECTS ASSESSMENT

Te Ahu a Turanga; Manawatū Tararua Highway project

Report 6B: Terrestrial fauna ecological effects assessment technical report

Prepared for NZ Transport Agency

26 October 2018

Document Quality Assurance

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Prepared by:	Andrew Blayney Senior Ecologist Boffa Miskell Limited Karin Sievwright Ecologist Boffa Miskell Limited	
Reviewed by:	Vaughan Keesing Senior Ecologist – Associate Partner Boffa Miskell Limited	
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Cover photograph: Looking East along designation, © Boffa Miskell Limited, 2018]

CONTENTS

Figures

6.B.1. Introduction

6.B.1.1 Scope of this Report

The scope of this technical report is to provide a description of the existing ecological values for terrestrial fauna (herpetofauna, terrestrial invertebrates, bats and avifauna) along the proposed designation corridor of the Te Ahu a Turanga; Manawatū Tararua Highway Project (the "Project"). Following this is an assessment of the likely and potential effects of the Project on these ecological values, and recommendations to avoid, remedy and/or mitigate/offset adverse effects. Where ecological values, magnitude of effect, and overall level of ecological effects are stated within this report they relate only to terrestrial fauna. As such, they should not be interpreted in isolation of the overall ecology assessment prepared by Dr Adam Forbes of which this terrestrial fauna assessment contributes to.

6.B.1.2 Project Description

A comprehensive Project description is provided in Volume 2 of the AEE, Part C Description of the Project.

6.B.1.3 Study Area

The detailed area of the Project is shown in Volume 4 of the AEE, Drawings and Plans (all chainage references within this report refers to the maps in this appendix). The Project is located to the south of Saddle Road and the north of the Manawatū Gorge, on the southern foot hills of the Ruahine range.

6.B.2. Methodology

6.B.2.1 Faunal Information & determining their value

6.B.2.1.1 Herpetofauna

A desktop review largely informed by the Manawatū Gorge SH3 Summer Ecology Survey - Herpetofauna (Boffa Miskell Ltd, 2018) (referred to as "the previous herpetofauna survey" and provided in Appendix 6.B.1) was undertaken to determine likely herpetofauna species present and the potential habitat onsite. The previous report accessed the DOC Bioweb herpetofauna database for records within 40km of the Manawatū Gorge (accessed 23 February 2018).

A site walk over was then carried out on 17 and 18 July 2018. That allowed the habitat characterisation from the previous surveys to be confirmed within the updated Project corridor, and for qualitative assessments of habitat quality and likely ecological value for herpetofauna to be made. These qualitative assessments were based on habitat preferences of the potentially present herpetofauna as described by the previous herpetofauna survey (Boffa Miskell Ltd, 2018), as well as ecological context factors such as connectivity to other forest patches (especially the large contiguous Manawatū Gorge Scenic Reserve ("MGSR") south of much of the designation).

Native lizards often occupy habitats of otherwise low ecological value (i.e. weedy vegetation, vegetation margins) (Anderson, Bell, Chapman, & Corbett, 2012). Therefore to attribute ecological value to habitat for this assessment, the threat status (following Hitchmough et al. (2016)) of the potentially present herpetofauna species in each area based on habitat preference was used to assess ecological value for herpetofauna of habitats across the designation.

6.B.2.1.2 Terrestrial Invertebrates

A desktop investigation was carried out to search for any relevant survey data, inventories, or scientific literature available (published or unpublished) regarding the terrestrial invertebrate communities and/or at risk or threatened invertebrates that may be located within or near to the designation.

The assessment of ecological value for terrestrial invertebrates was based on a qualitative assessment of habitats. Habitats were given values based on ecosystem factors known to affect terrestrial invertebrate community assemblages. The factors considered within this assessment are:

- Browsing and grazing mammals (Bromham, Cardillo, Bennett, & Elgar, 1999; Lövei & Cartellieri, 2000; Wardle, Barker, Yeates, Bonner, & Ghani, 2001);
- Forest patch size, shape, and associated edge effects (Ewers & Didham, 2008);
- Vascular plant diversity (Crisp, Dickinson, & Gibbs, 1998; Toft, Harris, & Williams, 2001);
- Isolation of forest fragments (Lövei & Cartellieri, 2000);
- Invasion by non-native plants (Toft et al., 2001);
- Presence of mammalian predators (Lövei & Cartellieri, 2000); and
- “Spill over effects” from forest patches into adjacent exotic pasture (Derraik, Rufaut, Closs, & Dickinson, 2005).

Based on the above factors an ecological value scoring process was devised for terrestrial invertebrate communities for the Project corridor (Table 6.B.1). The scoring guide prioritises potentially intact forest invertebrate communities, as those communities that:

- are most likely to have conservation important taxa;
- will be the hardest to replace/restore; and
- are rarest within the wider area.

While exotic pasture and sparse scrub/pasture habitats can contain diverse invertebrate communities, these habitats are relatively common in the landscape and relatively easily replaced/replicated.

This scoring guide is conservative as there is a lack of knowledge in New Zealand on forest invertebrate communities and their make-up, and methods to provide for their restoration.

The replacement of sufficient vegetative diversity is not standard in mitigation practices, and standard revegetation approaches are unlikely to achieve the restoration of the invertebrate communities lost (Lövei & Cartellieri, 2000) in a timely fashion. As such, sufficient knowledge is not available to effectively ensure the restoration of those invertebrate communities lost or impacted by human activities. Additionally, for most of the terrestrial invertebrates in New Zealand there has not been enough taxonomic or population study to provide an assessment on a threat status of individual species. For this reason, at-risk and threatened species have been suggested within the scoring guide to contribute to a very-high ecological value.

Assessment of the referenced concepts of "naturalness", "diversity and pattern", and "ecological context" follows guidance provided by Davis, Head, Myers, & Moore (2015). Terrestrial invertebrate ecological values are assessed for habitats based on a best fit approach to the habitat attributes stated in Table 6.B.1. I.e. to score "High" a habitat does not have to meet all the criteria stated but must fit best within the descriptors for that category of effect, compared to those provided for other scores.

Table 6.B.1: Project corridor qualitative ecological value scoring guidance for terrestrial invertebrates.

Terrestrial invertebrate ecological value attributed to habitat	**Habitat attributes:**
Very High	− Habitat as described below for high ecological value but contains confirmed at-risk or threatened species.
High	− Mature forest ecosystem with high naturalness, diversity and pattern. − Established and protected remnant natural wetland. − Little to no grazing pressure (effectively fenced from stock). − Intact sub-canopy, epiphyte, and ground cover flora composition. − Intact and undisturbed forest floor with leaf litter, woody debris, and high habitat complexity. − Ecological context: Large patch size of compact shape connected to, or linked by corridors, to established intact forest ecosystem (such as the MGSR).
Moderate	− Secondary forest ecosystems with moderate-low naturalness, diversity and pattern. − Grazing pressure low or large discrete areas protected from grazing by topology/stock access. − Developing sub-canopy and ground cover flora composition with large areas of full canopy closure and absence of pasture grasses. − Forest floor with small amounts of leaf litter, woody debris. − Ecological context: Small-medium patch size or complex of patches. Poor linkage to established intact forest ecosystem (such as the MGSR).
Low	− Regenerating scrub or broadleaved ecosystems with low naturalness, diversity and pattern. − Regenerating or remnant wetland in poor condition. − Grazing pressure moderate to high with possible small discrete areas protected from grazing by topology. − Little to no sub-canopy and ground cover other than pasture grasses or bare open ground. − Disturbed forest floor with negligible amounts of leaf litter, woody debris.

Terrestrial invertebrate ecological value attributed to habitat	Habitat attributes:
	− Ecological context: Small-medium patch size or complex of patches. Poor linkage to established intact forest ecosystem (such as the MGSR).
Negligible	− Short grazed pasture or widely spaced grazing tolerant shrubs with low-negligible naturalness, diversity and pattern. − Pine plantations. − High grazing pressure. − No sub canopy or ground cover. − Ground cover dominated by pasture grasses and occasional graze tolerant shrub or bare due to grazing pressure. − Ecological context: Predominately grazed pasture matrix between forest patches.

6.B.2.1.3 Bats

A desktop review informed by the previous automatic bat monitor survey report (Kessels & Associates Ltd, 2018) (provided in Appendix 6.B.2) was undertaken to assess the likelihood of bats to be present within the Project corridor. A site walk over was then carried out on 17 and 18 July 2018 where a qualitative assessment of the habitat suitability onsite was carried out. The assessment of habitat suitability was based on long-tailed bat habitat preferences such as forest edge habitats, open spaces between forest patches, and riparian habitats (C. F. O'Donnell, 2000; C. F. O'Donnell, Christie, & Simpson, 2006; Rockell, Littlemore, & Scrimgeour, 2017). Long-tailed bats which roost within the forest also immediately leave the forest after emerging at dusk to feed on open forest edges (C. F. O'Donnell et al., 2006).

Long-tailed bats' home range is potentially very large (657-1589 ha in other populations) and the bats frequently change roosts utilising a wide network of roosts across their home range (Rockell et al., 2017). The habitat suitability assessment was carried out on a landscape scale basis rather than the corridor section scale utilised for other terrestrial fauna.

During the site walk over potential roost trees were visually inspected from the ground for suitable roost features such as cavities, hollow limbs, loose bark and epiphytes. There is no formal guidance for categorising the roost potential of trees for New Zealand bats therefore the above categories are based on the experience of bat specialists and studies that have been undertaken on roosting behaviour and roost selection by long-tailed bats (Colin F. J. O'Donnell & Sedgeley, 1999; Sedgeley, 2001; Sedgeley & O'Donnell, 1999, 2004). Features of potential roost trees that were considered during the categorisation of bat roost potential include:

- Type of roost features available – Studies undertaken in unmodified native forest have shown that long-tailed bats preferentially roost in knot-hole cavities with small entrance holes compared to cavities available throughout the forest. This has been linked to the more stable thermal characteristics within knot-hole cavities. Epiphytes, loose bark, and broken limbs can also provide roost features.

- The size (diameter at breast height) of the tree – New Zealand bats preferentially roost in the largest trees available as such trees generally have preferred thermal characteristics;

- Height of roost feature(s) – long-tailed bats generally roost high in trees, >15 m above the ground (Colin F. J. O'Donnell & Sedgeley, 1999), potentially an adaptation to avoid predators;
- Canopy closure – Long-tailed bats are edge-specialists and are not adapted to flying in cluttered spaces. It has been demonstrated that they preferentially roost in trees with more open canopies.

It should be noted that the majority of long-tailed bat roost-selection studies are undertaken in pristine forest where roost trees are not a limiting resource compared to the modified landscape of the Project corridor.

Evidence of use by bats such as staining, scratches and guano around cavities and at the base of the tree were to be noted if they were present. Some potential roost trees found were inaccessible (either by topography and vegetation or time constraint) and in this circumstance their position was noted, or a forest patch was assessed as having potential roost value based on several trees bearing roost features in the patch.

Due to time constraints the roost assessment focused on assessing the presence of potential roost features across the site rather than a comprehensive tree-by-tree identification of potential roosts. This approach is appropriate for the purposes of assessing the available habitat for this assessment. However, in later stages of the Project, if bats are confirmed to be present a tree-by-tree survey will be required prior to felling (this is addressed by the recommendation provided within section 6.B.7.4)

6.B.2.1.4 Avifauna

A desktop review was carried out, largely based on:

- the previous ecological survey report (GHD & NZTA Manawatū Gorge Realignment – Option 3: South of Saddle Road Bats and Bird Habitat and Species Surveys) (Kessels & Associates Ltd, 2018) (Appendix 6.B.2);
- data from the Ornithological Society of New Zealand's atlas that were collated from the two 10x10 km grid squares (274, 609 and 275, 609) (Robertson, Hyvonen, Fraser, & Pickard, 2007) which encompass the Project corridor (Appendix 6.B.3); and
- data from the Te Āpiti wind farm ecological assessment (Project Te Āpiti Saddle Road, Manawatū: Ecological assessment) (Boffa Miskell Ltd, 2003) (Appendix 6.B.4) and post-construction avifauna mortality report (Report on avian mortality at Te Āpiti wind farm) (Boffa Miskell Ltd & Golder Associates, 2009) (Appendix 6.B.5).

Scientific literature (published and unpublished) and websites were also reviewed. The data collated served as a base list of avifauna species that have been observed in the Project corridor or that may potentially use habitats present at or in the vicinity of the Project corridor.

A site walkover and avifauna surveys were conducted within the Project corridor on 17 and 18 July 2018 by ecologists from Boffa Miskell. The site walkover involved traversing the designation, observing the different habitats available for avifauna species and determining what species the different areas potentially provide habitat for (i.e. a determination of likely ecological values for birds). Factors considered included:

- the species present/potentially present;
- size, shape and condition of the habitats;

- connectivity to other habitats (particularly proximity or degree of connectedness to the MGSR for native bush habitats);
- stock access; and
- vegetation composition, complexity and approximate age.

Playback surveys for spotless crake and marsh crake were also opportunistically conducted at two wetland areas within the Project corridor. One wetland was adjacent to Saddle Road at approximately Ch 10200 to Ch 10280 and the other was a raupō wetland north of the proposed Manawatū River bridge site at approximately Ch 4130 and Ch 4230. At the raupō wetland, a playback for Australasian bittern was also conducted. These surveys involved playing recorded calls of these species through an iPod and speakers, listening for a response, then repeating the playback.

Three observational surveys (at different times of the day) were also conducted for species using gravel/shingle riverbed habitat within the Project corridor where the Manawatū River is proposed to be bridged. Observations were also made at two downstream areas of the Manawatū River that contained similar gravel/shingle riverbed habitat as well as at similar habitat by the Saddle Road bridge that crosses the Pohangina River.

A roaming inventory was compiled of all bird species seen on site.

For avifauna, species and habitat value scores have been combined to give one overall value score for each section of the Project corridor. This overall score takes into consideration factors such as:

- the likelihood of At Risk and Threatened species being present, and if so, the quality of this habitat;
- the importance of this habitat for avifauna (i.e. its rarity); and
- what activities species undertake in this habitat (e.g. breeding, foraging and/or roosting).

An example of this scoring application, is that a corridor section that contains a moderate value habitat that is used, or may be used, by a very high value species occasionally or in small numbers may be moderated to have an overall value score of high.

In general, higher combined value scores have been assigned to sections that provide suitable nesting habitat for At Risk and/or Threatened species. This is because disturbance/mortality risks are higher during nesting, particularly if eggs/chicks are present. Conversely, in general, lower combined values have been assigned to areas that do not provide suitable nesting habitat for At Risk and/or Threatened species. This is because disturbance/mortality risks are lower in such areas, as the species considered in this assessment are mobile and can fly away if disturbed.

6.B.2.2 Data Limitations and Assumptions

- This is an initial assessment based on consideration of the proposed Project corridor and noting the final road design within that corridor is not yet confirmed. The type and magnitude of effects (and level of ecological effects) are subject to change depending on the final design of the designation and proposed construction methods. Therefore, this effect assessment should be considered a worst case scenario, based on the envelope of effects on habitats defined by Forbes (2018) and outlined in section 6.B.6.

It should also be appreciated that the level of effect is to fauna or to a specific taxon of fauna; and in considering the overall effect of the Project, this report only reflects a subset of the many aspects to be considered. The EIANZ (2018) indication as to avoiding very high adverse effects is tempered by the taxa thusly affected where that is the case, as well as the wider set of levels of effects. A "very high" level effect on a very small area of high value habitat may not require avoidance and it is up to the ecological team to justify where and what adverse effects are not sustainable.

- Time limitations of this assessment mean that it is likely that there exists information not reviewed within this assessment that would further contribute to the assessment. To account for this possibility a precautionary approach to the presence of fauna and potential effects has been taken as detailed in the following points.
- Terrestrial fauna: This ecological assessment is based on existing literature, of which there is little, on previous ecological field surveys and qualitative assessment of habitats. Detailed field surveys in all identified areas of vegetation loss have not been carried out (and should not be in winter). As such there is a possibility that species are present that have not been considered within this report. For those reasons, this report has not considered the possibility of individual at risk or threatened invertebrate species that may be present along the designation.
- Herpetofauna: The previous surveys for herpetofauna were conducted at a small number of representative sites only, and did not detect any lizards. This approach was appropriate to identify high density, and therefore easily detectable, populations that would be most appropriately avoided. However, herpetofauna survey methods currently available have poor detection rates at low population densities, as herpetofauna species have cryptic colouration and behaviour/activity patterns (Anderson et al., 2012). The presence of low-density populations of herpetofauna in appropriate habitats within the corridor therefore cannot be ruled out. Therefore, the assessment of ecological value for herpetofauna takes a precautionary approach and assumes where suitable habitat occurs the potential herpetofauna species are present.
- Avifauna: Australasian bittern, spotless crake and marsh crake are cryptic species that are generally only responsive to playback calls during the breeding season. Given the difficulty of detecting these species and that playback surveys were conducted outside of the breeding season, the presence or absence of these species within the designation corridor cannot be conclusively determined. As such, a precautionary approach has been taken in that we have assumed their potential presence within the raupō wetland habitats that provide marginal habitat for these species.
- Avifauna: The observational surveys for avifauna, using the gravel/shingle riverbed habitat along the Manawatū River within the area proposed to be bridged, were conducted very early in the breeding season for braided river bird species such as dotterels. Likewise, the acoustic recorder in this area was also set up outside of the main breeding period for these species. Consequently, the presence or absence of such species within this habitat cannot be conclusively determined. As such, a precautionary approach has been taken in that we have assumed their potential presence within the habitat.
- Avifauna: The best seasons to survey for avifauna are spring and summer. A summer survey was conducted (2017-2018 summer) however, given the time constraints of the project, a spring survey has not been conducted. As such, some avifauna species that potentially use habitats within the designation may not have been detected. To address this possibility, a conservative approach has been used in this assessment in that we

have assumed the presence of some species not detected in summer but that may use the habitats present in the Project corridor at other times of the year.

6.B.2.3 Evaluation of the level of ecological effects

The methodology for assessing the significance of the ecological effects associated with the proposal was based on the Environment Institute of Australia and New Zealand's (EIANZ) Ecological Impact Assessment Guidelines (EIANZ, 2018).

In summary, this method required an assessment of:

- Ecosystem/habitat and species values as described in Table 6.B.2 and Table 6.B.3, Section 6.B.2.3.1;
- The magnitude of effect using the criteria listed in Table 6.B.4, Section 6.B.2.3.2; and
- The level of ecological effect using the decision matrix presented in Table 6.B.5, Section 6.B.2.3.3, which determines the level of effect based on the ecological value of the ecosystems or species assessed and the magnitude of effect.

The assessment of magnitude of effects for terrestrial fauna in this report are at a designation corridor scale. This scale was chosen to remain consistent with the approach taken within the vegetation and habitat report by Forbes (2018).

6.B.2.3.1 Assigning ecological value to habitats for fauna species

Each of the fauna groups considered within this report have been assigned an ecological value based on the methodology described within the above sections (6.B.2.1.1, 6.B.2.1.2, 6.B.2.1.3, and 6.B.2.1.4). These scores and methodology have been informed by the EIANZ (2018) guidelines for assigning ecological value which are described below.

For fauna habitats, EIANZ (2018) provides guidance on matters to be considered when assigning ecological value outlined in Table 6.B.2 (summarised from (EIANZ, 2018)). For individual animal species EIANZ (2018). For individual animal species EIANZ (2018) also provides guidance on scoring of ecological value based on the national threat status (Table 6.B.3).

For this report the focus is on fauna only. Therefore, scoring primarily relates to rarity/distinctiveness and the ecological values provided should be considered a component of a site's/habitat's overall ecological value. This assessment is then used to inform the overall ecological assessment (Terrestrial Ecology Assessment # 6 (Forbes, 2018)).

Table 6.B.2: Matters to be considered when assigning ecological value to vegetation and habitats (adapted from EIANZ (2018)).

Matter	Assessment considerations
Representativeness	Extent to which area is typical or characteristic Size
Rarity/distinctiveness	Amount of habitat or vegetation remaining Supporting nationally or locally threatened, at risk or uncommon species

Matter	Assessment considerations
	Regional or national distribution limits Endemism Distinctive ecological features Natural rarity
Diversity and pattern	Level of natural diversity Biodiversity reflecting underlying diversity
Ecological context	Contribution to network, buffer, linkage, pathways Role in ecosystem functioning Important fauna habitat Contribution to ecosystem services

Table 6.B.3: Assigning value to species for assessment purposes (adapted from EIANZ (2018)).

Threat category	Assigned Value
Threatened – Nationally Critical, Endangered or Vulnerable	Very High
Nationally At Risk – Declining	High
Nationally At Risk – Recovering, Relict or Naturally Uncommon	Moderate
Locally (ED) uncommon or distinctive species	Moderate
Nationally and locally common indigenous species	Low
Exotic species, including pests, species having recreational value	Negligible

6.B.2.3.2 Assessing magnitude of effect

Once ecological value had been determined, the magnitude of the effect on ecological values was assessed. The magnitude of the effect was a measure of the extent, or scale, of the effect, its duration, and the degree of change that it will cause. A typical scale of magnitude ranged from very high to negligible, as shown in Table 6.B.4.

Table 6.B.4: Criteria for describing magnitude of effect (from EIANZ (2018)).

Magnitude	Description
Very High	Total loss of, or very major alteration to, key elements/features/ of the existing baseline conditions, such that the post-development character, composition and/or attributes will be fundamentally changed and may be lost from the site altogether; AND/OR Loss of a very high proportion of the known population or range of the element/feature
High	Major loss or major alteration to key elements/features of the existing baseline conditions such that the post-development character, composition and/or attributes will be fundamentally changed; AND/OR Loss of a high proportion of the known population or range of the element/feature
Moderate	Loss or alteration to one or more key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be partially changed; AND/OR

Magnitude	Description
	Loss of a moderate proportion of the known population or range of the element/feature
Low	Minor shift away from existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances or patterns; AND/OR Having a minor effect on the known population or range of the element/feature
Negligible	Very slight change from the existing baseline condition. Change barely distinguishable, approximating to the 'no change' situation; AND/OR Having negligible effect on the known population or range of the element/feature

6.B.2.3.3 Assessing level of ecological effect

The overall level of the effect was determined by applying the following matrix (Table 6.B.5), which combined the ecological value of the site or species (Table 6.B.2 and Table 6.B.3) and the magnitude of effect (Table 6.B.4).

Table 6.B.5: Criteria for describing overall level of effect (From EIANZ (2018)).

		ECOLOGICAL VALUE				
		Very High	**High**	**Moderate**	**Low**	**Negligible**
MAGNITUDE	**Very High**	Very High	Very High	High	Moderate	Low
	High	Very High	Very High	Moderate	Low	Very Low
	Moderate	High	High	Moderate	Low	Very Low
	Low	Moderate	Low	Low	Very Low	Very Low
	Negligible	Low	Very Low	Very Low	Very Low	Very Low
	Positive	Net gain	Net gain	Net gain	Net gain	Net gain

The EIANZ (2018) guidelines note that the level of effect can be used as a guide to the extent and nature of ecological response (e.g., mitigation) required.

For example from EIANZ (2018):

- "Project effects in the 'Very High adverse' category are unlikely to be acceptable on ecological grounds alone (even with compensation proposals). Activities having very high adverse effects should be avoided. It is not the ecologist's role to make determinations with regard to project viability. The ecologist should present an objective and scientifically robust assessment of the effects of the project to assist the applicant in coming to an informed decision about project viability. Where very high adverse effects cannot be avoided, a net biodiversity gain would be appropriate.
- Options in the 'High and Moderate adverse' category represent a level of effect that requires careful assessment and analysis of the individual case. Such an effect could be managed through avoidance, design, or extensive offset or compensation actions.

Wherever adverse effects cannot be avoided, no net loss of biodiversity values would be appropriate

- Low and Very Low categories should not normally be of concern, although normal design, construction and operational care should be exercised to minimise adverse effects. If effects are assessed taking impact management developed during project shaping into consideration, then it is essential that prescribed impact management is carried out to ensure Low or Very Low level effects".

It is important to recognise that the above descriptors and responses to level of effects detailed within the EIANZ (2018) guidelines refer to an overall ecological level of effect. This report deals solely with terrestrial fauna and, like ecological values above, the level of effects need to be considered as a component of a wider assessment of the level of ecological effect. It would therefore be inappropriate to consider, in isolation, the effect levels stated within this report against the above descriptors. The EIANZ (2018) guidelines do not provide interpretative guidance for assessing the level of effect for only a subset of a site's ecological value.

6.B.3. Terrestrial fauna ecological values – Desktop Review

6.B.3.1 Herpetofauna

6.B.3.1.1 Habitat

During previous survey high value habitats for native herpetofauna were identified along the Project corridor, including (Boffa Miskell Ltd, 2018):

- native and non-native scrub;
- regenerating forest in gullies;
- areas of complex ground cover such as woody debris and leaf litter; and
- mature broadleaved forest.

The MGSR was identified as a particularly high-quality habitat and potential source for lizards to colonise regenerating and scrub habitats.

6.B.3.1.2 Species

The summary of potential species present and their general habitat preference is provided by the previous herpetofauna survey (Boffa Miskell Ltd, 2018) and is provided below:

> "Threat classifications and common names follow Hitchmough et al. (2016) for lizard species and Newman et al. (2013) for frog species. Habitat descriptions are summarised to describe likely habitats within the survey area – many species have wider habitat preferences, such as coastal areas, which do not occur within the survey area.

Three native lizard species have been detected within the MGSR[1] (which occurs both sides of the Manawatū River through the Manawatū Gorge). They are:

Barking gecko (*Naultinus punctatus*) – At risk – declining.

> A diurnal arboreal species which lives in forest and scrub. Generally, found amongst foliage in the canopy.

Ngahere gecko (*Mokopirirakau* "southern North Island") – At risk – declining.

> A nocturnal (although often discovered basking during the day) arboreal species which lives in forest and scrubland. Generally, found on trunks and branches of trees and can be found nearer the ground in shrubs, ferns, and crevices.

Raukawa gecko (*Woodworthia maculatus*) – Not threatened

> A nocturnal arboreal and terrestrial species that can occur in forest, creviced rock outcrops, scree slopes, scrubby areas, and in any dense vegetation.

Additional to the above species, within 15km of the proposed designation footprint there are records of:

Pacific gecko (*Dactylocnemis pacificus*) – At risk – relict.

> A nocturnal arboreal and terrestrial species with similar habitat requirements to above common gecko. In southern North Island most often found in hill country forest.

Glossy brown skink (*Oligosoma zelandicum*) – At risk – declining.

> A secretive diurnal terrestrial species found in damp lowland areas such as forest, scrub, and farmland.

Ornate skink (*Oligosoma ornatum*) – At risk – declining.

> A very secretive crepuscular species which lives in forest or open areas that provide stable cover such as deep leaf litter or rock piles. This species seldom emerges from cover.

Northern grass skink (*Oligosoma polychroma*) – Not threatened.

> A diurnal species which inhabits grasslands, rock piles, scree, wetlands and scrub. Often seen basking.

No further species of extant[2] native species had been previously detected within 40km of the designations footprint.

Also recorded within the wider area are:

- Several records of unidentified gecko species (some attribute genus only to records).
- One record of unidentified frog species in the northern end of the Tararua range.

[1] The quoted text here refers to previous surveys undertaken in the area, which were not associated with the Project.

[2] There are bone records of the extinct Markham's frog (*Leiopelma markhami*) located in this wider area.

- Records of three non-native frog species; brown tree frog (*Litoria ewingii*), growling grass frog (*Ranoidea raniformis*), and green and golden bell frog (*R. aurea*)."

The nocturnal visual encounter survey carried out a total of 9.16 person hours of survey effort across 6 different representative areas across the designation and nearby (descriptions and maps of areas surveyed are provided by Boffa Miskell Ltd (2018) in Section 3.3.2 and Appendix 6.B.1 of the report). No lizards were found but weather was an issue in two out of three nights surveying. The survey concluded that "*The habitats along the corridor had high value for native lizards and generally have good connectivity to the MGSR which has previous confirmed detections of several native lizard species and could act as a source of lizards into regenerating scrubland*."

The report also acknowledged New Zealand lizards are difficult to detect, and that despite the non-detection within the nocturnal surveys it is very likely At-risk lizard species occur within the Project corridor. We agree with this assessment and consider it very likely the species previously detected within the MGSR (barking gecko and ngahere gecko) would be present within the Project corridor.

6.B.3.2 Terrestrial Invertebrates

6.B.3.2.1 Habitat

Desktop review of aerial photography, previous site photos and descriptions in surveys for herpetofauna, bats, and birds showed the presence of several potentially high-quality habitats for terrestrial invertebrates near the Project corridor. These include:

- older regenerating secondary forest which has achieved canopy closure in the eastern rise section (Ch 9900-12800) of the Project corridor;
- mature forest in the western rise section (Ch 4100 – 5900) of the corridor; and
- the MGSR.

6.B.3.2.2 Species

The desktop review of available information regarding terrestrial invertebrates within or near to the Project corridor found little to no information regarding the presence of at-risk or threatened invertebrates. The only reference to rare or threatened species potentially present was a rare large Carabid beetle (*Megadromus turgidiceps*) - not classified (Leschen et al., 2012) found in the MGSR ("Into the Gorge," 2008).

During the nocturnal herpetofauna surveys, two phasmid species were noted:

- common stick insect (*Clitarchus hookeri*) which was common amongst kānuka scrub across the corridor; and
- occasionally, an *Acanthoxyla* sp. was observed (Figure 6.B.2).

Both the common stick insect and all of the described *Acanthoxyla* sp. are not threatened (Buckley, Hitchmough, Rolfe, & Stringer, 2016).

Wellington tree weta (*Hemideina crassidens*) were also found to be common in more intact and established forest patches along the corridor (per. obs.). It is possible that Auckland tree weta (*Hemideina thoracica*) are also present as the corridor is within an area of potential overlap of both species (Trewick & Morgan-Richards, 1995) . However, none were noted during the survey[3]. Both tree weta species are not threatened (Trewick, Johns, Hitchmough, Rolfe, & Stringer, 2016).

The MGSR also contains Onchyphora (peripatus) within the species complex of *Peripatoides novaezealandiae* (identified by lack of ovipositor, 15 pairs of legs, and colour – Not threatened (Trewick, Hitchmough, Rolfe, & Stringer, 2018)) (pers. Obs. found in 29-8-2010) (Figure 6.B.1).

Figure 6.B.1: Peripatoides novaezealandiae found previously in the Manawatū Gorge. Photo taken 29-08-2010.

[3] The nocturnal herpetofauna survey did not focus on invertebrates and these observations are incidental only.

Figure 6.B.2: An Acanthoxyla sp. observed along the proposed designation near the Manawatū Gorge during nocturnal herpetological surveys - March 2018.

6.B.3.3 Bats

6.B.3.3.1 Bat Habitat

The previous bat survey report identifies that there are trees present within the Project corridor that have potential roost cavities (large tawa forest specifically identified within the report) (Kessels & Associates Ltd, 2018). The Kessels report also suggests that the high wind levels in the Manawatū Gorge could be a barrier to long-tailed bat use of the site.

Desktop review of aerial photography, previous site photos and descriptions in surveys for herpetofauna and birds showed the presence of several potentially high-quality habitats for bats within the corridor and across the wider landscape. These include riparian and forest edge habitats in gullies, with nearby mature forest feature providing potential roosting sites. There is also a significant mature broadleaved forest and pasture edge along the MGSR boundary on the southern side of the corridor.

6.B.3.3.2 Species

The bioacoustics survey carried out by Kessels & Associates Ltd (2018) did not detect long-tailed bats over 1431 effective survey hours from 27 February to 13 March 2018. The survey report concluded:

- there was no suitable habitat for the central lesser short-tailed bat (*Mystacina tuberculata rhyacobi*) along the Project corridor; and
- while the presence of the threatened – nationally critical (C. F. J. O'Donnell et al., 2018) long-tailed bat (*Chalinolobus tuberculatus*) could not be ruled out, there is low possibility of their presence within the Project corridor.

The closest known populations of long-tailed bat are listed within the Kessels report as Tararua Forest Park to the south (the northern extent of forest contiguous with the Tararua Forest park is within 13km of the southernmost point of the Project corridor), the Ruahine Forest Park to the north (the southern extent of the Ruahine Forest park is within 5km of the northern most point of the Project corridor) and in forested areas approximately 40 km to the south-east.

6.B.3.4 Avifauna

6.B.3.4.1 Avifauna Habitat

During the previous survey, the highest value habitats identified for indigenous and notable bird species included wetlands, indigenous vegetation, including tawa forest and forested gullies and riparian margins of the Manawatū River (Kessels & Associates Ltd, 2018). The Manawatū River is considered a riparian site of significance for banded dotterel and black-fronted dotterel (Horizons Regional Council, 2007).

The designation corridor is very close to the MGSR, which is a large, contiguous, area of remnant and regenerating podocarp-broadleaved (Boffa Miskell Ltd, n.d.). Most of this reserve lies on the south side of the Manawatū River (the Project corridor is to the north of the Manawatū River). This area provides habitat for a diversity of bird species; two At Risk species, North Island rifleman and North Island kākā have occasionally been recorded in the reserve (Boffa Miskell Ltd, 2003).

Bolton Bush is a QEII covenanted area of indigenous vegetation that is within the western rise section of the Project corridor, between approximately Ch 5500 to Ch 5900. The covenanted area is 7.3 ha in size and has regionally representative forest that is in good condition. The covenanted land contains vegetation similar to that of MGSR (Boffa Miskell Ltd, 2003) and is contiguous with the Reserve.

6.B.3.4.2 Species

6.B.3.4.2.1 Kessels & Associates Ltd Survey

An avifauna survey was conducted by ecologists from Kessels & Associates Ltd between 26 February and 13 March 2018 as part of the previous ecological work conducted within and near the Project corridor.[4]

Thirteen 5-minute bird counts were conducted within different habitat types at ten locations across the corridor. Five automatic recording devices (ARDs) were also set up in different habitats and were set to record all sounds from before sunset until after sunrise (5 pm and 9 am) for 14to 15 consecutive nights (800 hours were recorded and analysed using Raven Pro 1.5.0 software developed by Cornell Lab of Ornithology Bioacoustics Research Programme) (Figure 6.B.3). A roaming inventory was also compiled of all bird species seen and heard

[4] At that time the corridor was in the same location as the current Project corridor but was wider.

outside of the formal 5-minute count periods. During these surveys, 32 species were recorded, including 17 indigenous species and 15 introduced species.

The most commonly recorded species were magpie, fantail, blackbird, goldfinch, house sparrow, grey warbler, silvereye, harrier hawk and tūī.

The highest species diversity was recorded at:

- the raupō wetland site (KB21/KA6 site in Figure 6.B.3; 22 species were recorded);
- the pond site that was surrounded by pasture, pine forest and indigenous vegetation (KB10/KS19 site in Figure 6.B.3; 22 species were recorded); and
- the Manawatū River site (KB33/KA14 site in Figure 6.B.3; 21 species were recorded).

The highest numbers of native species were recorded at the Manawatū River site and the pond site.

No Threatened species were detected. One At Risk species, the New Zealand falcon, was detected. Four other At Risk or Threatened species not detected but that could occasionally be present within the Project corridor were noted: North Island kākā, spotless crake, banded dotterel and black-fronted dotterel.

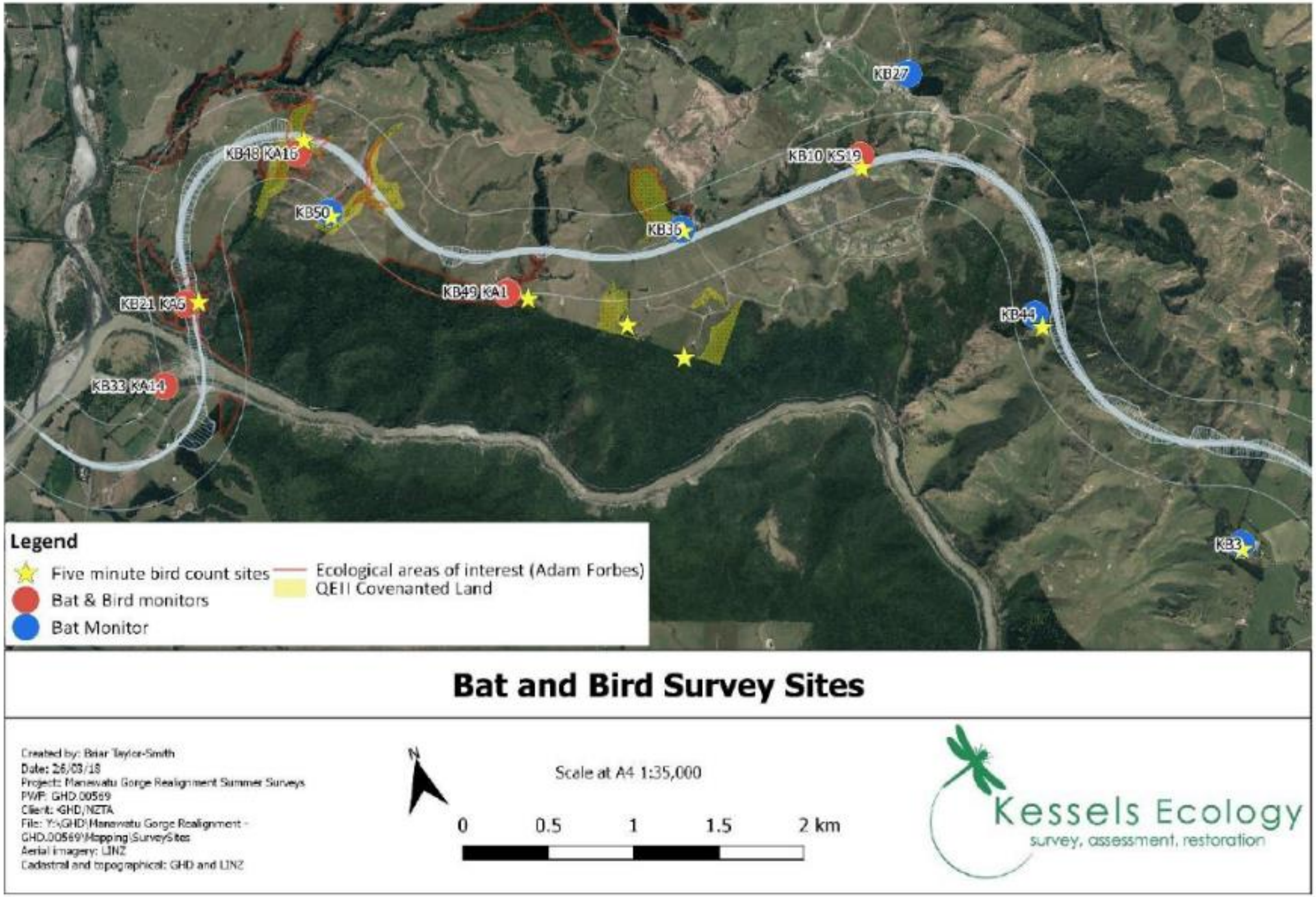

Figure 6.B.3. Five minute bird count and acoustic recording device deployment sites throughout the original designation corridor (Kessels & Associates Ltd, 2018)

6.B.3.4.2.2 Te Apiti Wind Farm Surveys

Comprehensive avifauna surveys have also been conducted within the Te Āpiti wind farm site (which encompasses approximately 4.4 km of the Project corridor between approximately Ch 5550 and 9900). These surveys were conducted for the baseline ecological assessment for wind farm consenting purposes (Boffa Miskell Ltd, 2003), and for post-construction monitoring of avifauna mortality (Boffa Miskell Ltd & Golder Associates, 2009).

During the 2003 baseline ecological survey 25 bird species were recorded within the wind farm footprint. No At Risk or Threatened bird species were observed. Although not recorded at the site, a number of vagrant species are reported that may use habitats on site from time to time such as North Island kākā, bush falcon, North Island rifleman, grey teal and Australasian shoveler. It was also speculated that some wetland bird species such as marsh crake, Australasian bittern and New Zealand dabchick, which are known to occur in the Manawatū area, may pass through the Saddle Road site as they move seasonally between wetlands on either side of the ranges. It is noted though, that perhaps these migratory bird species would be more likely to use the Manawatū Gorge and river terraces as their migratory route (Boffa Miskell Ltd, 2003).

During the mortality survey 31 bird species were recorded within the wind farm footprint, including three At Risk species (New Zealand pipit (30 observations), black shag (two observations of birds flying overhead) and New Zealand falcon (2 observations of birds flying overhead). The most commonly observed birds were Australian magpie, paradise shelduck, spur-winged plover and Australasian harrier hawk (Boffa Miskell Ltd & Golder Associates, 2009).

6.B.3.4.2.3 Other Literature

In addition to the 40 species recorded during other survey work within the area (the aforementioned Kessels Ecology survey and surveys associated with the Te Āpiti wind farm), 29 other species were also identified in the review of other relevant literature (e.g. NatureWatch, eBird, published and unpublished reports, the OSNZ atlas data (refer to Appendix 6.B.3 for the OSNZ atlas grid square locations)) that may potentially use habitats within the Project corridor and/or the wider surrounding area.

These 69 species, of which 45 are native and 24 are introduced (Table 6.B.6 in Section 4.4.1), provide an indication of species that have been recorded using habitat within the Project corridor, or which may potentially do so (e.g. some species have been observed in the MGSR and, given that this area is contiguous with areas of the Project corridor, may use this connection to move between sites).

With regards to the OSNZ atlas data, it must be noted that the data were collected by multiple observers over a five year period (1999-2004), from an area of 200 km^2, with no standardisation regarding effort and timing. Therefore, this data provides only a broad indication of species presence or absence.

In Section 4.4.1 below, this base list of 69 species is reviewed and species of interest/key native species that have been observed within the Project corridor, or that may use habitats within the Project corridor, are identified.

6.B.4. Terrestrial fauna habitats – Site Investigations

Chainage (Ch) references relate to those depicted in the maps in Volume 4 of the AEE, Drawings and Plans.

6.B.4.1 Habitat of Herpetofauna

The habitat along the entire designation can be broadly characterised by a pasture dominated matrix with deeply incised gullies containing varying ages of regenerating areas of native broadleaved, fern, and scrub species with commonly present scrubby pest plants such as broom and gorse. Within this matrix there are discrete areas of established tawa forest and areas of remnant canopy trees such as rimu, kahikatea, tītoki, and mataī. Additionally, there are discrete areas of non-native plantation forests and small farm ponds with surrounding native and non-native vegetation.

Habitat characterisation, based on previous field surveys (Boffa Miskell Ltd, 2018) with further updates and refinement from site walkover for this report, is detailed below.

6.B.4.1.1 Bridge to bridge area. Ch 2500 – 3800.

Within the area of Ch 3400-3800 a large area of felled pine trees exists leaving a large amount of wood debris (aerial images show these pines still standing). There are also young native plantings and older dense roadside vegetation in this area. The area is connected to the MGSR and provides habitat that would allow terrestrial skinks or geckos on the edge of the reserve, which could spill over into these areas (Figure 6.B.4).

Figure 6.B.4: MGSR walk carpark showing felled pine forest in background and native plantings and scrubby vegetation in the foreground.

6.B.4.1.2 New Manawatū River Crossing. Ch 3800 – 4100.

Riverbank vegetation on the true left side of the Manawatū River has similar indigenous habitat condition and values to those described in the above section 6.B.4.1.1. The true right side of the river is densely vegetated with native trees and shrubs and connected to the MGSR and secondary and old growth forests further up the gully. It contains a diverse and high-quality range of habitats suitable for native lizards.

6.B.4.1.3 Western Rise. Ch 4100 – 5900.

Habitat within the area of Ch 4100-4500 consists of predominately grazed mature forest dominated by tawa, māhoe, pukatea, and mataī with little understory, interspersed with areas of kānuka and low stature divaricate *Coprosma* shrubs which is highly impacted by grazing stock on the western side of the Project corridor (Figure 6.B.5 & Figure 6.B.6). The eastern side of the Project corridor in this area consists of a large area of large kānuka, with occasional large canopy trees (of tawa, māhoe, pukatea, and mataī) and a large area of raupō on a terrace above the stream (Figure 6.B.7 & Figure 6.B.8).

Both the west and east side of the Project corridor contain relatively diverse habitats suitable for native lizards, and are relatively contiguous with the MGSR (a source of lizards).

At Ch 5500 to 5900 the corridor crosses an incised gully with established tawa forest on the western side of the gully and secondary broadleaved and kānuka forest on the eastern side of the gully (Figure 6.B.9). The established tawa forest contains large emergent canopy trees with complex epiphyte habitats (Figure 6.B.10). This area is continuous with the MGSR and contains a diverse and high-quality range of habitats suitable for native lizards.

Figure 6.B.5: Area of established canopy trees with interspersed kānuka and divaricate shrubs in western rise area (west side) of Project corridor.

Figure 6.B.6: Area of established canopy trees with limited understory of divaricate Coprosma shrubs in western rise area (west side) of Project corridor.

Figure 6.B.7: Large kānuka with patches of raupō in western rise area (east side).

Figure 6.B.8: Large area of Raupō surrounded by large kānuka in western rise area (east side) of Project corridor. Located South of area depicted in Figure 6.B.7.

Figure 6.B.9: Established tawa forest (background) and secondary broadleaved forest (foreground) at point of corridor crossing gully in western rise area.

Figure 6.B.10: Emergent rewarewa in established tawa forest with complex epiphyte habitat in western rise area.

6.B.4.1.4 Western access designation - ~Ch4700 – North

Extending north from approximately CH4700 a proposed access road follows the designation of an existing farm track towards Saddle Road. Habitats available in this area are restricted primarily to grazed pasture with a small amount of kānuka near the stream crossing; beyond this there is non-native vegetation along the flat and kānuka occurring again as the track nears Saddle Road.

This area contains relatively small amount of habitats suitable for native lizards.

6.B.4.1.5 Te Āpiti Wind Farm and ridge. Ch 5900 - 9900.

A large gully dominated by kānuka scrub with scattered broadleaved and emergent larger rewarewa is crossed at Ch 6000-6400. Mature kānuka occurs mostly at the gully bottom with younger kānuka occurring up the gully sides (Figure 6.B.11). Habitat is diverse and connected to the MGSR and would provide high value habitat to native lizards potentially present at site.

The corridor crosses another gully at Ch 6700-7000. This area has limited kānuka scrub in the gully bottom with scattered larger trees (Figure 6.B.12). Connectivity to MGSR is patchy with short grazed pasture predominant ground cover. There is limited habitat diversity and high disturbance from grazing in this area. However, barking gecko may be present in scrub as a small remnant population or individuals.

A further gully crossing occurs at Ch 7200-7400. Within the gully at this point is kānuka broadleaved regenerating forest. Stock grazing impacts are high, and the understory is dominated by grazed pasture grasses (Figure 6.B.13). Habitat is connected and, in the area the corridor crosses the gully, is relatively close to the MGSR. Incidental individual lizards may be present, but this area is unlikely to support large populations.

Figure 6.B.11: Gully of kānuka and broadleaved regenerating forest. Approximately Ch 6000 to 6400.

Figure 6.B.12: Limited kānuka scrub and canopy trees in cross over point of corridor. Looking from approximately Ch 6700 to 7100.

Figure 6.B.13: Gully area at Ch 7200-7400 with kānuka- broadleaved regenerating forest.

Along the top of the corridor within a gully running east-west from Ch 8800 to 9900 is an area of predominately pasture with highly disturbed and grazing impacted short statured divaricate *Coprosma* on the southern side of the corridor (Figure 6.B.14 & Figure 6.B.15), and a farm pond with kānuka scrub and scattered broad leaf species on the pond margins. Additionally, along this section there are discrete patches of exotic pine trees. This area is relatively disconnected from the MGSR and has high grazing impacts, low habitat diversity, high habitat complexity, and predominately low stature. However, the lizards potentially present such as northern grass skink and barking gecko can be found within these types of disturbed habitats, and exotic frog species could potentially be found in the pond.

Figure 6.B.14: Highly disturbed and grazing impacted stream side vegetation at approximately Ch 9100.

Figure 6.B.15: Low stature divaricate Coprosma vegetation amongst grazed pasture.

6.B.4.1.6 Eastern Rise. Ch 9900-12800

As the corridor starts to drop into the eastern rise section, it traverses a patch of kānuka scrub and fern dominated secondary vegetation at Ch 9900-10000 (Figure 6.B.16). There is some habitat potential for arboreal species, but little refugia for others. Northern grass skink and glossy brown skink may be able to utilise small patches of denser vegetation on the edge or areas where stock cannot access.

In the area of Ch 10100 to 10300 the Project passes through a small area of wet pasture with patchy sedges and rushes in a seep with kānuka scrub surrounding the seep (Figure 6.B.17). This area contains potential habitat for barking gecko and the northern grass skink. There is sparse connectivity to the MGSR along fragmented scrub and secondary forest. The presence of these two species beyond potentially isolated individuals at this location is unlikely due to the young age and lack of connectivity of the vegetation.

At Ch 10500 to 10700 the Project corridor crosses the head of a secondary broadleaved dominated gully (Figure 6.B.18). The vegetation within this gully has little grazing impacts and has a relatively diverse ground cover flora. Habitats range from divaricate *Coprosma* and broom on the edge, and kiekie and fern understory, providing high value habitat for all the potentially present lizards species at this location.

Figure 6.B.16: Kānuka and fern dominated secondary vegetation at Ch 9900-10000.

Figure 6.B.17: Rush and sedges in seep with Kānuka scrub surrounding at approximately Ch 10200.

Figure 6.B.18: Looking down potentially impacted gully of secondary broadleaved forest. Ch 10500-10700.

A pine forest stand is located from Ch 10900 to 11000 (Figure 6.B.19). The plantation is relatively young and contains little habitat value to lizards.

Figure 6.B.19: Immature pine plantation at Ch 10900 to 11000

Adjacent to these pines on the eastern side of the Project corridor there is an area of kānuka/divaricate Coprosma scrub and regenerating broadleaved/fern forest. This area is contiguous with a large regenerating secondary broadleaved and fern forest (Figure 6.B.20) that connects to the Manawatū Scenic Reserve. This fragment provides habitat complexity and habitat diversity suitable for all the lizard species potentially present in the Project corridor.

Figure 6.B.20: Large area of regenerating secondary broadleaved and fern forest with kānuka and divaricate Coprosma scrub. Photo taken of contiguous area to the north of the affected area at Ch 11000.

From Ch 11000 to 11900 the corridor descends the western side of the range through a large area of secondary broadleaved forest (Figure 6.B.21). This regenerating forest gives way to gorse/broom scrub from Ch 11900 to 12300. The corridor between Ch 11900 and 12200 progresses to the southwest of the forested/scrub gully, continuing through the forested and scrubby area. All of these areas, other than short grazed pasture, may contain all of the potentially present lizard species.

Figure 6.B.21: Regenerating broadleaved forest on eastern rise. Photo looking towards face directly impacted by designation.

As the corridor reaches the bottom of the eastern slope it passes over a small immature pine forest plantation (Ch 12500- 12700) with blackberry as the primary ground cover (Figure 6.B.22). This area provides limited value to lizards that prefer arboreal and forest habitats, but the highly complex blackberry ground cover could be utilised by glossy brown skink and northern grass skink.

Figure 6.B.22: Immature pine plantation with blackberry understory (between 12500-12700).

6.B.4.1.7 Woodville gateway. Ch 12800 - 14000

The eastern end of the corridor passes over predominately cropped and grazed pasture with little habitat complexity. Potential habitat is limited to a small area of pine trees at Ch 12900, which has a grazed and relatively bare understory. This entire section has little to no habitat value and is unsuitable for the lizard species.

6.B.4.2 Terrestrial Invertebrates

Habitat descriptions provided within this section are for the most part brief summaries of the habitat descriptions provided within Section 6.B.4.1 for Herpetofauna. That section should be referred to for more general detail. Information is only detailed within this section when specifically required to provide context for attributed ecological value with regards to terrestrial invertebrates.

6.B.4.2.1 Bridge to bridge area. Ch 2500 – 3800.

Habitats within this area are characterised by small areas of planted (young) native vegetation near the Manawatū River, a small area of cutover pine forest, and large areas of grazed pasture.

6.B.4.2.2 New Manawatū River Crossing. Ch 3800 – 4100.

Riverbank vegetation on either side of the Manawatū River with similar habitat attributes for terrestrial invertebrates to those described for the previous and later sections to this crossing. Flooding and disturbance may be a limitation on this area for terrestrial invertebrates.

6.B.4.2.3 Western Rise. Ch 4100 – 5900.

The area of grazed mature forest, scrub, and raupō wetland on the east and west side of the corridor at Ch 4100-4500 contains limited ground cover beyond grazing tolerant *Coprosma* shrubs and small areas of ferns where stock cannot access (ref; Figure 6.B.5, Figure 6.B.6 and Figure 6.B.7).

The established tawa forest at Ch 5500 to 5900 contains a diversity of ground cover habitats as well as epiphytes (Figure 6.B.10). Like the area described above it is also well connected to the MGSR.

6.B.4.2.1 Western access designation - ~Ch4700 – North

Area predominately grazed pasture with small amounts of kānuka present. Little to no habitat attributes of value for terrestrial invertebrates.

6.B.4.2.2 Te Apiti Wind Farm and ridge. Ch 5900 - 9900.

The two regenerating forest areas of kānuka and broadleaved at Ch 6000-6400 and 7200-7400 (Figure 6.B.11 & Figure 6.B.13) contain very little habitat complexity and underdeveloped sub-canopy or groundcover.

The rest of the features described within this section are habitats that have little habitat attributes for terrestrial invertebrates.

6.B.4.2.3 Eastern Rise. Ch 9900-12800

The more mature and intact secondary forest patches in the areas of Ch 10500-10700 and 11000 to 11900 have little grazing pressure beyond the edges, good canopy closure, and a developing ground cover flora with small amounts of leaf litter and woody debris (Figure 6.B.23). They do not have direct connection to a large established forest, however they lie within a landscape of multiple areas of regenerating forest.

The rest of the habitats described in this section of the corridor are all either highly disturbed and dominated by pest plants, or lack understory habitats.

Figure 6.B.23: Understory showing canopy closure and developing ground cover flora and habitat in forest patch located at Ch 11000 to 11900.

6.B.4.2.4 Woodville gateway. Ch 12800 - 14000

Limited to no, habitat for indigenous terrestrial invertebrates beyond grazed pasture.

6.B.4.3 Bats

6.B.4.3.1 Habitat suitability

The landscape the Project corridor falls within contains many habitat features that are suitable and preferred by long-tailed bats such as forest edges, riparian gullies, and open space habitats between forest patches.

Particularly high quality potential habitat was found in the western rise section within the gully system that contains established tawa forest at its northern end and a matrix of open, wetland, scrub, riparian, and large tree habitats at the Manawatū River end of the gully. This gully also terminates in Manawatū Gorge, which would allow foraging and commuting through to the MGSR forest habitats. This area is also largely protected from the strong prevailing westerly wind in the area, if this is a limiting factor for bat presence as noted by the Kessels report (Kessels & Associates Ltd, 2018).

The rest of the corridor may be utilised by long-tailed bats flying through gullies or forested edges for foraging or commuting, such as the northern edge of the MGSR in the Te Āpiti Wind Farm and ridge section and edges of pine forest in the eastern rise section.

Overall, the habitat quality within the Project corridor is highest at the western end with a full suite of preferred habitat features and potential roost sites. The rest of the corridor has potential habitat predominately consisting of edge habitats suitable for foraging and commuting.

6.B.4.3.2 Potential roost sites

The designation contains three potential roost types/localities:

- Large native canopy trees and established tawa forest which contain a mixture of loose bark (large kānuka in area), epiphytes, and cavities in the western rise section (example shown in Figure 6.B.10). Most large trees observed are likely to be suitable for solitary roosts. However, the potential for maternity roosts could not be ruled out without a comprehensive survey and monitoring.
- Large pine trees located at Ch 10500-10600 and 9600-9900, and a deciduous exotic tree at 12000, which contained limited roost features such as broken branches and some cavities (Figure 6.B.24). However, these trees are on ridgelines exposed to the prevailing strong westerly wind and may have unsuitable thermal characteristics for roosting.
- Large secondary broadleaved forest patches which, while lacking large trees, do have large numbers of tree ferns, and in the western area nīkau palms, which long-tailed bats could utilise as solitary roosts by roosting amongst the crowns of the ferns/palms.

Other potential roosts surveyed such as the pine forest plantations along the corridor and isolated native tree species were generally too young to have potential roost features and none were visible at the time of the survey (ref Figure 6.B.19 & Figure 6.B.22 for pine plantations).

No signs of bat presence were observed such as staining or scratch marks around cavities. However, this is not usual even in areas of frequent bat roosting and should not be considered an indication of the absence of long-tailed bats.

Figure 6.B.24: Old pine trees with broken branches and small cavities. Photo taken approximately Ch 9700.

6.B.4.4 Avifauna

During the current avifauna survey 32 avifauna species, comprising 17 indigenous species, 14 introduced species and one hybrid species were recorded within the Project corridor (Table 6.B.6). Two species are classified as At Risk (bush falcon and New Zealand pipit).

One Threatened species (Caspian tern) and two At Risk species (banded dotterel and black shag) were also observed using shingle/gravel bed habitat on the Manawatū River approximately 600m downstream of similar habitat (~Ch 3900) where the Manawatū River is proposed to be crossed within the Project corridor.

Our field survey did not identify any new species in the corridor that had not been recorded in the literature or previous surveys. We therefore consider the 45 native species and 24 introduced bird species listed in the OSNZ atlas and in other sources (predominantly the previous field work conducted on site) to represent the full suite of birds potentially present within the Project corridor (Table 6.B.6).

Table 6.B.6. Bird species recorded within the Project corridor or within 200 sq km of the corridor based on the literature review and surveys conducted at the site (including the current survey, the Te Āpiti wind farm AEE and mortality survey and the Kessels & Associates Ltd survey). Conservation status and habitat preferences are included for each species. Primary habitat/s is indicated by dark green shading and secondary habitat/s is indicated by light green shading.

SPECIES – Robertson et al. 2012	SCIENTIFIC NAME	CONSERVATION STATUS Robertson et al 2017	HABITAT TYPE								SURVEY OBS.	
			Native forest	Exotic Forest	Scrub / shrubland	Farmland / open country	Freshwater / wetlands	Coastal / Estuary	Oceanic	Urban/Residential	Current Survey	Other Surveys on Site
Australasian bittern	*Botaurus poiciloptilus*	Threatened – Nat. Crit.										
White heron	*Ardea modesta*	Threatened – Nat. Crit.										
Grey duck	*Anas s. superciliosa*	Threatened – Nat. Crit.										
Black-billed gull	*Larus bulleri*	Threatened – Nat. Crit.										
Banded dotterel	*Charadrius bicinctus bicinctus*	Threatened – Nat. Vul.										
Caspian tern	*Hydroprogne caspia*	Threatened – Nat. Vul.									✓	
Red-billed gull	*Larus novaehollandiae scopulinus*	At Risk – Dec.										
Whitehead	*Mohoua albicilla*	At Risk – Dec.										
Spotless crake	*Porzana t. tabuensis*	At Risk – Dec.										
New Zealand pipit	*Anthus n. novaeseelandiae*	At Risk – Dec.									✓	✓
North Island rifleman	*Acanthisitta chloris*	At Risk – Dec.										
South Island pied oystercatcher	*Haematopus finschi*	At Risk – Dec.										
Marsh crake	*Porzana pusilla affinis*	At Risk – Dec.										
New Zealand dabchick	*Poliocephalus rufopectus*	At Risk – Rec.										
North Island kaka	*Nestor meridionalis septentrionalis*	At Risk – Rec.										
Bush falcon	*Falco novaeseelandiae*	At Risk – Rec.									✓	✓
Pied shag	*Phalacrocorax varius varius*	At Risk – Rec.										
Black shag	*Phalacrocorax carbo novaehollandiae*	At Risk – Nat. Unc.										✓
Little black shag	*Phalacrocorax sulcirostris*	At Risk – Nat. Unc.										
Black-fronted dotterel	*Charadrius melanops*	At Risk – Nat. Unc.										
Royal spoonbill	*Platalea regia*	At Risk – Nat. Unc.										
Australian coot	*Fulica atra australis*	At Risk – Nat. Unc.										
Australasian pied stilt	*Himantopus h. leucocephalus*	Not Threatened										
Little shag	*Phalacrocorax melanoleucos brevirostris*	Not Threatened										
White-faced heron	*Egretta novaehollandiae*	Not Threatened									✓	✓

Black swan	*Cygnus atratus*	Not Threatened										
Paradise shelduck	*Tadorna variegata*	Not Threatened									✓	✓
Grey teal	*Anas gracilis*	Not Threatened										✓
Australasian harrier	*Circus approximans*	Not Threatened									✓	✓
Pukeko	*Porphyrio m. melanotus*	Not Threatened									✓	✓
Spur-winged plover	*Vanellus miles novaehollandiae*	Not Threatened									✓	✓
Southern black-backed gull	*Larus d. dominicanus*	Not Threatened									✓	✓
Morepork	*Ninox n. novaeseelandiae*	Not Threatened										✓
New Zealand scaup	*Aythya novaeseelandiae*	Not Threatened										
Kereru	*Hemiphaga novaeseelandiae*	Not Threatened									✓	✓
Shining cuckoo	*Chrysococcyx l. lucidus*	Not Threatened										✓
New Zealand kingfisher	*Todiramphus sanctus vagans*	Not Threatened									✓	✓
Welcome swallow	*Hirundo n. neoxena*	Not Threatened									✓	✓
Grey warbler	*Gerygone igata*	Not Threatened									✓	✓
North Island fantail	*Rhipidura fuliginosa placabilis*	Not Threatened									✓	✓
North Island tomtit	*Petroica macrocephala toitoi*	Not Threatened										
Silvereye	*Zosterops lateralis lateralis*	Not Threatened									✓	✓
Bellbird	*Anthornis m. melanura*	Not Threatened									✓	✓
Tui	*Prosthemadera n. novaeseelandiae*	Not Threatened									✓	✓
New Zealand shoveler	*Anas rhynchotis variegata*	Not Threatened									✓	✓
Yellowhammer	*Emberiza citrinella*	Introduced									✓	✓
Chaffinch	*Fringilla coelebs*	Introduced									✓	✓
Greenfinch	*Carduelis chloris*	Introduced									✓	✓
Goldfinch	*Carduelis carduelis*	Introduced									✓	✓
Redpoll	*Carduelis flammea*	Introduced										✓
House sparrow	*Passer domesticus*	Introduced									✓	✓
Starling	*Sturnus vulgaris*	Introduced									✓	✓
Myna	*Acridotheres tristis*	Introduced										✓
Australian magpie	*Gymnorhina tibicen*	Introduced									✓	✓
Rook	*Corvus frugilegus*	Introduced										✓
Feral goose	*Anser anser*	Introduced										
Mallard duck	*Anas platyrhynchos*	Introduced									✓	✓
Feral turkey	*Meleagris gallopavo*	Introduced									✓	✓
Rock pigeon	*Columba livia*	Introduced										
Eastern rosella	*Platycercus eximius*	Introduced									✓	✓
Skylark	*Alauda arvensis*	Introduced									✓	✓
Hedge sparrow	*Prunella modularis*	Introduced										✓
Blackbird	*Turdus merula*	Introduced									✓	✓
Song thrush	*Turdus philomelos*	Introduced									✓	✓
Canada goose	*Branta canadensis*	Introduced										✓

Ring-necked pheasant	*Phasianus colchicus*	Introduced										✓
Mute swan	*Cygnus atratus*	Introduced										
California quail	*Callipepla californica*	Introduced										
Cattle egret	*Ardea ibis coromanda*	Migrant										

6.B.4.4.1 Identification of Key Native Species

We have considered the 24 introduced species recorded locally (Table 6.B.6), and none are believed to make an important contribution to the local ecology or local biodiversity. They are therefore not considered further.

Of the 45 native species observed or potentially present at the site or wider area (based on the literature review), 23 are Not Threatened. With respect to an effects assessment these species are considered to have Low Ecological Value as they are common and widespread species. Given that the Project corridor does not provide crucial habitat for any of these species and there is ample suitable habitat available in the wider area that these mobile species can use if displaced (i.e. surrounding farmland, scrub/shrub habitats, ponds and forest and gully habitats (including the MGSR)). Furthermore, any potential effects on these species will not occur at a population level (i.e. individuals may be affected but this will not have a negative impact on the population). Consequently, these species are not considered further in this assessment.

Of the remaining 22 native species, 6 are Threatened (Australasian bittern, Caspian tern, white heron, grey duck, banded dotterel and black-billed gull) and 16 have a threat status of At Risk.

Of those 22 species, it is highly unlikely that white heron and royal spoonbill use habitat within the Project corridor (as habitat in the wider 200 km^2 in which they have been detected, is more suitable for these species than that available within the Project corridor). Consequently, these species are not considered further in this assessment. Grey duck is also not considered further, given that the biggest threat to grey duck is hybridisation with mallard ducks rather than human activities, and it is near impossible to identify pure grey ducks without DNA analysis. The Project corridor also does not provide core habitat for this species.

Consequently, it has been determined that the Project corridor is potentially utilised by 19 notable indigenous species for various activities (such as nesting, foraging and/or roosting), including 4 Threatened species and 15 At Risk species (Table 6.B.7). These species are considered to have Very High (Threatened species) or High Ecological Value (At Risk species) and are considered further in this report.

Table 6.B.7.Indigenous bird species with recognised ecological value requiring assessment. With respect to habitat use, F=Foraging, R=Roosting/Resting and N=Nesting.

SPECIES - Robertson et al. 2012	SCIENTIFIC NAME	CONSERVATION STATUS Robertson et al 2017	OBSERVED OR POTENTIAL HABITAT USE	Native forest	Exotic Forest	Scrub / shrubland	Farmland / open country	Freshwater / wetlands	Coastal / Estuary	Oceanic	Urban/Residential
Black-billed gull	*Larus bulleri*	Threatened – Nat. Crit.	R								
Australasian bittern	*Botaurus poiciloptilus*	Threatened – Nat. Crit.	F, R								
Caspian tern	*Hydroprogne caspia*	Threatened – Nat. Vul.	R								
Banded dotterel	*Charadrius bicinctus bicinctus*	Threatened – Nat. Vul.	N, F, R								
Red-billed gull	*Larus novaehollandiae scopulinus*	At Risk – Dec.	R								
Whitehead	*Mohoua albicilla*	At Risk – Dec.	N, F, R								
Spotless crake	*Porzana t. tabuensis*	At Risk – Dec.	F, R								
New Zealand pipit	*Anthus n. novaeseelandiae*	At Risk – Dec.	N[5], F, R								
North Island rifleman	*Acanthisitta chloris*	At Risk – Dec.	F, R								
South Island pied oystercatcher	*Haematopus finschi*	At Risk – Dec.	F, R								
Marsh crake	*Porzana pusilla affinis*	At Risk – Dec.	F, R								
New Zealand dabchick	*Poliocephalus rufopectus*	At Risk – Rec.	F, R								
North Island kākā	*Nestor meridionalis septentrionalis*	At Risk – Rec.	F, R								
New Zealand falcon	*Falco novaeseelandiae*	At Risk – Rec.	F, R								
Pied shag	*Phalacrocorax varius varius*	At Risk – Rec.	F, R								
Australian coot	*Fulica atra australis*	At Risk – Nat. Unc.	F, R								
Black shag	*Phalacrocorax carbo novaehollandiae*	At Risk – Nat. Unc.	F, R								
Little black shag	*Phalacrocorax sulcirostris*	At Risk – Nat. Unc.	F, R								
Black-fronted dotterel	*Charadrius melanops*	At Risk – Nat. Unc.	N, F, R								

6.B.4.4.2 Habitat Descriptions

Habitat descriptions provided within this section are for the most part brief summaries of the habitat descriptions provided within Section 6.B.4.1 for Herpetofauna. That section should be referred to for more general detail. Information is only detailed within this section when specifically required to provide context for attributed ecological value with regards to avifauna.

6.B.4.4.2.1 Bridge to bridge area. Ch 2500 – 3800.

The habitats within this area include grazed pasture (dominant), immature, planted native vegetation and an area of cutover pine that is now dominated by weeds. Of the 19 notable species identified above, the habitats within this area might potentially be used by New Zealand

[5] The pasture habitats within the Project corridor are currently grazed and as such do not provide suitable nesting habitat for pipit. However, if stock are removed and the grass becomes rank (i.e. is not mowed/maintained) this may provide suitable nesting habitat for pipit. As such, potential nesting is noted for this species.

falcon (one was observed in a pine tree within this section during the current field survey) and New Zealand pipit. Both species are likely to forage and roost in the area.

6.B.4.4.2.2 New Manawatū River Crossing. Ch 3800 – 4100.

The habitats within this area include gravel/shingle riverbed habitat, planted, immature native vegetation, regenerating native vegetation and a few exotic trees on the river edge (willows) (Figure 6.B.25 and Figure 6.B.26). No At Risk or Threatened species were observed using the gravel/shingle riverbed habitat within the corridor at the bridge location.

However, of the 19 identified notable species, two Threatened species (banded dotterel and Caspian tern) and one At Risk species (black shag) were observed in very similar gravel/shingle habitat on the Manawatū River downstream of the proposed bridge location. Consequently, it has been assumed that these highly mobile species may also use the habitat within the corridor for foraging, roosting and in the case of banded dotterel, nesting.

Black-fronted dotterel, red-billed gull, black-billed gull, little black shag, pied shag and South Island pied oystercatcher may occasionally also use this habitat for foraging and/or roosting, and in the case of black-fronted dotterel, possibly nesting.

Figure 6.B.25. Manawatū River gravel/shingle riverbed habitat, willows on the northern bank of the river and indigenous vegetation.

Figure 6.B.26. Gravel/shingle riverbed habitat within the designation corridor where the bridge across the Manawatū River is proposed to go.

6.B.4.4.2.3 Western Rise. Ch 4100 – 5900.

The habitats between approximately Ch 4100 to Ch 4500 include mature native forest (with little understory due to stock grazing), regenerating indigenous vegetation (kānuka and low stature divaricate *Coprosma* shrubs) and a raupō-dominated wetland.

The habitat between approximately Ch 5500 to Ch 5900 is indigenous vegetation, including mature forest and secondary forest. This vegetation, known as Bolton Bush, has a QEII covenant.

Within this section there are also areas of grazed pasture.

Of the 19 identified notable species, Australasian bittern, marsh crake and spotless crake may use the raupō wetland habitat between approximately Ch 4130 and Ch 4230 for foraging and roosting (Figure 6.B.27, Figure 6.B.28 and Figure 6.B.29). This habitat is highly grazed, pugged by stock and has very little surface water (the latter factor is required for foraging), however a few more dense areas of raupō are present with occasional large *Carex* species interspersed. Based on these characteristics, the potential of this habitat is considered marginal for these species. It is unlikely to provide suitable nesting habitat.

Figure 6.B.27. The raupō wetland is within the orange polygon.

Figure 6.B.28. A pugged area of the raupō wetland where the raupō is less dense and interspersed with grass.

Figure 6.B.29. A more dense area of the raupō wetland with large Carex species.

North Island kaka, North Island rifleman and whitehead may use the native forest habitats within this section. This section and the Western access designation (discussed below) are the only areas along the Project corridor that has been identified as potentially providing suitable habitat for these species. Bolton Bush is likely to provide better potential habitat than the grazed forest between approximately Ch 4100 and Ch 4500 as it is fenced, contains areas of mature tawa and rewarewa (with a dense and diverse understory) as well as secondary broadleaved and kānuka forest, and is connected to the MGSR so provides a corridor for these species to a very large forest remnant (600 ha).

These species may forage and roost in this habitat. Whitehead may also nest in this area. It is unlikely North Island kākā and rifleman nest in this area; they are more likely to nest in mature trees in the MGSR.

New Zealand falcon may potentially forage within this section. New Zealand pipit may also use the pasture habitat for foraging and roosting.

6.B.4.4.2.4 Western access designation - ~Ch4000 – North

The main habitat in this section is grazed pasture with small amounts of kānuka present. New Zealand falcon may forage within this section. New Zealand pipit may also use the grazed pasture habitat for foraging and roosting.

6.B.4.4.2.5 Te Āpiti Wind Farm and ridge. Ch 5900 - 9900.

The main habitat in this section is grazed pasture. There are a few gullies in this section that are dominated by indigenous scrub (mainly kānuka) with occasional scattered broadleaved and larger emergent rewarewa trees. There are a few small, discrete patches of pine forest in this section as well as two farm ponds between approximately Ch 9200 and Ch 9600. The farm ponds are bordered by pasture, kānuka scrub, scattered, immature broadleaved species and occasional rushes.

New Zealand pipit were observed using the grazed pasture habitat within this section. This section also provides foraging and potentially roosting habitat for New Zealand falcon.

Given the general immaturity of the indigenous vegetation within this section (predominantly scrub), the small size of these areas and the tenuous connectivity to the MGSR forest, we consider that this habitat does not provide suitable habitat for North Island kākā, North Island rifleman or whitehead.

The farm ponds, if used by Australian coot and New Zealand dabchick, are likely to provide only marginal habitat for these species given the lack of grassy islands or edges (the edges were grazed) and the sparsity of emergent aquatic vegetation and rushes (cover/shelter) around the pond in which to nest or anchor nests to (there were two small areas of raupō) (Figure 6.B.30, Figure 6.B.31 and Figure 6.B.32). These species were not observed on the ponds and were not recorded by the acoustic recorder deployed in the area.

The recorder was set for two weeks during the breeding season of both of these species (the time at which they are most vocal). However, both species have long breeding seasons (between September and March for Australian coot and year round for New Zealand dabchick with territorial displays during June and July and egg laying mainly during August-February (Heather & Robertson, 2005)) and potential pairs at the site may not have commenced nesting during this two week window, or the site may be visited by non-breeding or vagrant birds. The latter is speculated for New Zealand dabchick in the Te Āpiti wind farm assessment; it is noted that migrating birds may use wetland habitats along Saddle Road (Boffa Miskell Ltd, 2003). As such, to be conservative, we assume the potential use of this habitat by these species for foraging, but it is unlikely they use this habitat for breeding.

Figure 6.B.30. One of the two farms ponds (the eastern one) between approximately Ch 9200 and Ch 9600.

Figure 6.B.31. One of the two farm ponds (the western one) between approximately Ch 9200 and Ch 9600.

Figure 6.B.32. One of the two farm ponds (the western one) between approximately Ch 9200 and Ch 9600. The orange polygon indicates a small area of raupō on the pond margin.

6.B.4.4.2.6 Eastern Rise. Ch 9900-12800

The habitats within this section include scrub (indigenous and exotic), immature pine forest, grazed pasture, a wetland, and regenerating and secondary broadleaved forest.

This section provides foraging habitat for New Zealand falcon (this is the section in which a New Zealand falcon was observed during the Kessels & Associates Ltd (Kessels & Associates Ltd, 2018) survey). Grassland areas within this section provide foraging and roosting habitat for New Zealand pipit.

It is highly unlikely that marsh crake and/or spotless crake use the wetland habitat at approximately Ch 10200 to Ch 10280. This is because the area is small, grazed and pugged and the wetland vegetation is reasonably sparse (i.e. not dense for cryptic species to hide in) and interspersed by pasture grass. There is also no standing water within the area (Figure 6.B.33 and Figure 6.B.34).

Figure 6.B.33. The wetland area between approximately Ch 10200 and Ch 10280 by Saddle Road.

Figure 6.B.34. The wetland area between approximately Ch 10200 and Ch 10280 by Saddle Road.

6.B.4.4.2.7 Woodville gateway. Ch 12800 – 14000

The habitats within this section are predominantly cropped and grazed pasture. This section potentially provides foraging habitat for New Zealand falcon. Grassland areas within this section provide foraging and roosting habitat for New Zealand pipit.

6.B.5. Ecological Values

6.B.5.1 Herpetofauna

Across the Project corridor there are discrete patches of native and non-native scrub, secondary regenerating forest, and established mature tawa forest within a grazed pasture matrix. Many of these discrete habitats are attached to or very close to the MGSR. All of these identified habitats are suitable for one or more at risk species of native lizard. Given the confirmed presence of several at risk species within the MGSR and lack of intensive lizard surveys it is appropriate to use habitat as proxy for species presence in this area.

Therefore, (as potential habitat for at risk species) the designation (other than the Woodville gateway section) has **High** ecological value for native herpetofauna except for-raupō dominated wetlands and grazed pasture habitats. This ecological value is consistent with the assumptions and methodology provided in section 6.B.2.1.1 by considering the threat status of the herpetofauna potentially present in the area and the presence of suitable habitat.

6.B.5.2 Terrestrial Invertebrates

There are several patches of mature and regenerating secondary forest within the Project corridor that contain habitat attributes that would contribute to healthy, relatively intact terrestrial invertebrate assemblages described within Table 6.B.1. The areas of ecological value with regard to terrestrial invertebrates are:

- The grazed mature native forest, scrub and wetland which have **Moderate-Low** ecological values in the western rise area (or western access track) due to having a mixture of habitat attributes outlined in Table 6.B.1 including:
    - Grazing pressure moderate to high with possible small discrete areas protected from grazing by topology.
    - Disturbed forest floor with negligible amounts of leaf litter, woody debris.
    - Small-medium patch size or complex of patches. Poor linkage to established intact forest ecosystem (such as the MGSR).
    - Developing sub-canopy and ground cover flora composition with large areas of full canopy closure and absence of pasture grasses.
- The intact tawa forest stand has **High** ecological values, having habitat attributes outlined in Table 6.B.1 including:
    - Mature forest ecosystem with high naturalness, diversity and pattern.
    - Little to no grazing pressure (effectively fenced from stock).
    - Intact sub-canopy, epiphyte, and ground cover flora composition.
    - Intact and undisturbed forest floor with leaf litter, woody debris, and high habitat complexity.
    - Ecological context: Large patch size of compact shape connected to, or linked by corridors, to established intact forest ecosystem (such as the MGSR).
- The relatively mature regenerating secondary forest in the eastern rise area has **Moderate** ecological value due to having habitat attributes outlined in Table 6.B.1 including:

- Secondary forest ecosystems with moderate-low naturalness, diversity and pattern.
- Grazing pressure low or large discrete areas protected from grazing by topology/stock access.
- Developing sub-canopy and ground cover flora composition with large areas of full canopy closure and absence of pasture grasses.
- Forest floor with small amounts of leaf litter, woody debris.

- The rest of the designation area is of **Low-Negligible** value for terrestrial invertebrates due to having a mixture of habitat attributes outlined in Table 6.B.1 including:
  - Short grazed pasture or widely spaced grazing tolerant shrubs with low-negligible naturalness, diversity and pattern.
  - Grazing pressure moderate to high with possible small discrete areas protected from grazing by topology.
  - Little to no sub-canopy and ground cover other than pasture grasses or bare open ground.
  - Predominately grazed pasture matrix between forest patches.

6.B.5.3 Bats

The Project corridor is located within potential foraging and commuting habitat for long-tailed bats with potential roosting habitat in a few locations. There exists particularly good habitat potential in the gully associated with the western rise area which contains established tawa forest at its northern end and a matrix of open, wetland, scrub, riparian, and large tree habitats at the Manawatū River end of the gully. This would contribute to an ecological value with regard to bats of **Very High** if they are present.

However, initial bioacoustics surveys did not detect long-tailed bat presence and concluded a low-possibility of long-tailed bat presence along the corridor. The Kessels report also identified environmental constraints such as the high wind levels as a potential restriction to long-tailed bat utilisation of the habitats present (Kessels & Associates Ltd, 2018). We agree with this assessment of low-possibility of long-tailed bat presence and do not consider that habitat should be used as a proxy for long-tailed bat presence in this area.

An approach recommended to address this uncertainty and ensure any potential/actual effects on long-tailed bats are avoided, remedied, or mitigated is discussed in the below section 6.B.7.4.

6.B.5.4 Avifauna

The Project corridor provides several different habitats of varying quality for At Risk and Threatened avifauna as described below. These descriptions are based on the attributes to be considered when assigning ecological value or importance to a site or area of vegetation/habitat/community as described in Table 4 of the EIANZ (2018) guidelines (summarized in Table 6.B.2 above). The attributes considered and overall conclusions of the ecological value of these habitats are:

Gravel/boulder riverbed habitat within the proposed bridge corridor:

- representative of natural habitat of riverine avifauna;

- provides habitat for native avifauna (potentially including nesting habitat for At Risk and Threatened species);
- distinct habitat with linkage for avifauna to other such nearby habitat;
- small size relative to amount of similar habitat available nearby; and
- sensitive to flooding and exposed to wind which may impact avifauna nesting success.

Overall, we conclude this habitat has **moderate ecological value** for avifauna.

Grazed under native forest (Ch 4100-4500)

- diversity of mature native canopy trees, a rare habitat type in the area for native avifauna;
- provides older growth habitat for native avifauna (including At Risk and Threatened species) but nesting opportunities are reduced because some expected canopy trees are missing and because of the lack of understory/density due to grazing; and
- linkage for native avifauna to habitat in the MGSR and Bolton Bush QEII covenant.

Overall, we conclude this habitat has **moderate ecological value** for avifauna.

Raupō wetland (Ch 4130-4230):

- rare habitat type in the area for native avifauna but in poor condition due to stock access;
- plant diversity not representative of pre-human state so limited habitat diversity for avifauna;
- potential stepping stone/stopover habitat for migrating native wetland avifauna;
- provides habitat for native avifauna but only marginal habitat for At Risk and Threatened native wetland avifauna species due to poor condition (unsuitable nesting habitat for wetland avifauna); and
- survey to date has not confirmed the absence of At Risk and Threatened species in this area, but if present, then the habitat value would be elevated to moderate or high depending on the species present.

Overall, we conclude this habitat has **low ecological value** for avifauna.

Bolton bush in western rise:

- reasonably representative of pre-human state (but mature canopy species missing);
- good diversity of vegetation and habitats for native avifauna (including intact understory);
- good linkage for native avifauna to habitat in the MGSR;
- provides habitat for native avifauna (potentially including At Risk and Threatened species); and
- provides specific life stage resources, especially for breeding.

Overall, we conclude this habitat has **high ecological value** for avifauna.

Native scrub with scattered broadleaf and larger emergent rewarewa trees (Te Āpiti wind farm and eastern rise):

- provides some habitat diversity for native avifauna;
- small patches, some isolated and exposed to edge effects;
- limited habitat connectivity between areas for avifauna;
- vegetation not representative of pre-human state; and
- good insect resource for insectivores but limited for other guilds.

Overall, we conclude this habitat has **low-moderate ecological value** for avifauna.

Grazed pasture:

- exotic habitat;
- not representative of pre-human state;
- not a diverse or rare habitat for avifauna (common in wider agricultural landscape); and
- does provide habitat for some native avifauna (including foraging and roosting habitat for two At Risk species).

Overall, we conclude this habitat has **low ecological value** for avifauna.

Farm ponds:

- not a rare habitat for avifauna (common in wider agricultural landscape);
- condition of pond margins degraded from stock access;
- some areas of native vegetation around margins, but exotic vegetation also common;
- no submerged or emergent aquatic vegetation for avifauna to nest in or upon (limited diversity); and
- does provide habitat for some native avifauna (potentially including foraging and roosting habitat for two At Risk species).

Overall, we conclude this habitat has **low ecological value** for avifauna.

Immature planted native vegetation, pine and scrub:

- provides habitat for some native avifauna with limited resource;
- common habitats types for native avifauna in the landscape;
- lack of structure or habitat diversity for avifauna; and
- pine habitats are exotic and not representative of pre-human state.

Overall, we conclude this habitat has **low ecological value** for avifauna.

6.B.5.5 Summary

A broad summary of ecological values for fauna broken down to designation section is provided below in Table 6.B.8.

Table 6.B.8: Summary of fauna ecological value by designation section.

Designation section	Herpetofauna	Terrestrial invertebrates	Bats[6]	Avifauna
Bridge to bridge (Ch 2500 - 3800)	High	Low-Negligible	Potentially Very High - foraging and commuting habitat	Low
New Manawatū River Crossing (Ch 3800 - 4100)	High	Low-Negligible	Potentially Very High - foraging and commuting habitat	High[7]
Western Rise (Ch 4100 - 5900)	High	High	Potentially Very High - foraging, roosting and commuting habitat	High
Western access designation (~Ch4700 - North)	High[8]	Low-Negligible	Potentially Very High - foraging, roosting and commuting habitat	Low
Te Āpiti Wind Farm and Ridge (5900 - 9900)	High	Low-Negligible	Potentially Very High - foraging, roosting and commuting habitat	Low-Moderate
Eastern Rise (Ch 9900 - 12800)	High	Moderate	Potentially Very High - foraging, roosting and commuting habitat	Low-Moderate
Woodville gateway (Ch 12800 - 14000)	Negligible	Negligible	Potentially Very High - foraging and commuting habitat	Low

[6] Bats are considered unlikely to be found to be present, but habitat values are presented here in any case.

[7] The habitat is considered Moderate value but the highest value species that may use the habitat (banded dotterel) is scored Very High, giving an averaged potential value of High.

[8] While there are small amounts of high value herpetofauna habitat peripheral to this access designation the vast majority of the area is grazed pasture.

6.B.6. Assessment of Effects

The assessment of effects below is based on the assumed total loss of all indigenous shrublands, secondary broadleaved forests and scrublands within the Project corridor detailed within Volume 4 of the AEE, Drawings and Plans, except for the areas that are described below.

Within the areas of moderate or greater value vegetation types, avoidance and minimisation are proposed through specific effects envelopes and minimal-disturbance management protocols:

- old-growth forests and treelands;
- secondary forests containing old-growth signatures;
- advanced broadleaved forests;
- kānuka forests;
- raupō seepage wetland at Ch4200; and
- moderate value seepage wetlands.

The effects envelopes are detailed in section 5.3 of Forbes (2018).

The summary of types of vegetation classes across the entire designation and the quantity of each that could potentially be directly affected is listed in Table 6.B.9.[9] This table is based on Forbes (2018) quantification of vegetation and habitats.

Table 6.B.9: Summarised potential vegetation/habitat loss for entire Project summarised from Forbes (2018).

Ecosystem classification	Area (ha) within proposed designation boundaries	Area (ha) potentially impacted
Old-Growth Forests (Alluvial)	4.23	0.15
Old-Growth Forests (Hill Country)	1.78	1.00
Secondary Broadleaved Forests with Old-Growth Signatures	3.07	2.2
Old-Growth Treelands	0.41	0.41
Kānuka Forests	4.52	1.39
Advanced Secondary Broadleaved Forests	2.93	0.5
Secondary Broadleaved Forests and Scrublands	16.32	16.32
Mānuka, Kānuka and Divaricating Shrublands	4.12	4.12
Raupō Dominated Seepage Wetlands	0.55	0.13
Indigenous-Dominated Seepage Wetlands	0.56	0.39
Total	38.49	26.61

[9] This table only accounts for vegetative habitat. In circumstances such as where woody debris is identified as potential habitat, this is identified and accounted for within the comments and descriptions below.

6.B.6.1 Herpetofauna

The potential effects on herpetofauna from the construction and operation of the road within the proposed designation are:

- Mortality of lizards during vegetation clearance and earthworks;
- Permanent loss of lizard habitat; and
- Modification of remaining lizard habitat, such as:
    - Habitat fragmentation and isolation (including, potentially, crossing deaths).
    - Increased levels of noise and disturbance during both construction and operation.
    - Introduction of forest/scrub - road edges introducing edge effects such as altering the composition and habitat value of adjacent vegetation.

These potential effects are assessed below in Table 6.B.10.

Table 6.B.10: Potential effects on Herpetofauna described based on designation section.

Designation section	**Habitat types**	**Ecological value**	**Potential magnitude of effect (ref Table 6.B.4)**	**Level of ecological effect (ref Table 6.B.5) prior to mitigation**	**Comments**
Bridge to bridge (Ch 2500 - 3800)	Pine forest slash and roadside vegetation.	High	Low	Low	Removal of an assumed small amount of roadside vegetation and wood debris. Lizards present likely very low density.
New Manawatū River Crossing (Ch 3800 - 4100)	River bank vegetation and native scrub.	High	Low	Low	Small amount of riparian vegetation lost. Flooding likely a major constraint for lizard presence for most of this area.
Western Rise (Ch 4100 - 5900)	Grazed	High (excluding raupō wetland)	High	Very High	Loss of a large amount of high quality habitat (habitat loss somewhat constrained by effects envelope) that has high connectivity to large intact forest remnants to both the east and west including the MGSR. Permanent reduction of remaining habitat value due to fragmentation, disturbance, and edge effects.

Designation section	Habitat types	Ecological value	Potential magnitude of effect (ref Table 6.B.4)	Level of ecological effect (ref Table 6.B.5) prior to mitigation	Comments
Western access designation – (~Ch4700 – North)	Small areas of kānuka forest.	High	Low	Low	Habitats of high value peripheral to designation and a majority of habitats avoided.
Te Āpiti Wind Farm and Ridge (5900 - 9900)	Kānuka scrub and secondary broadleaved forest in gullies, pondside vegetation and divaricate Coprosma vegetation.	High	High	Very High	Loss of a strip of 200-300m of gully vegetation across all vegetated gullies along designation. Habitat includes kānuka and divaricate scrub, which is most areas connected to Manawatū scenic reserve. Habitat loss and road permanently fragments habitats; isolating vegetation to the north of the designation from MGSR and reducing the value of remaining habitats.
Eastern Rise (Ch 9900 - 12800)	Kānuka and fern vegetation, kānuka and rush seep, secondary broadleaved forest, and pine forest.	High	High	Very High	Loss of large area of regenerating broadleaved forest and native and non-native scrub. Habitat loss and road permanently fragments habitats reducing the value of remaining habitats.
Woodville gateway (Ch 12800 - 14000)	Small area of pine trees and grazed pasture.	Negligible	Negligible	Very low	Little to no habitat present or impacted. Loss of grazed pasture and a small amount of pine trees with little to no woody debris. Unlikely to impact native lizard species potentially present.

6.B.6.2 Terrestrial Invertebrates

The potential effects on terrestrial invertebrates from the construction and operation of the road within the proposed designation are:

- Direct mortality;

- Permanent loss of habitat; and
- Modification of remaining habitat such as:
    - Reduction of habitat connectivity through fragmentation and isolation.
    - Creation of edge effects such as altering the composition and habitat value of adjacent vegetation, modifying the microclimates within created edge habitats, and changing terrestrial invertebrate community composition.
    - Increased presence and likelihood of invasion by non-native plant and invertebrate species due to increased human activity and access.

These potential effects are assessed below in Table 6.B.11.

Table 6.B.11: Potential effects on terrestrial invertebrates described based on designation section.

Designation section	Habitat types	Ecological value	Potential magnitude of effect (ref Table 6.B.4)	Level of ecological effect (ref Table 6.B.5) prior to mitigation	Comments
Bridge to bridge (Ch 2500 - 3800)	Pine forest slash and roadside vegetation.	Low-Negligible	Low	Very Low	Small amount of marginal and disturbed habitat lost. Existing invertebrate community likely to be tolerant of disturbance and able to colonise new habitats.
New Manawatū River Crossing (Ch 3800 - 4100)	River bank vegetation and native scrub.	Low-Negligible	Low	Very Low	Small amount of marginal and disturbed habitat lost. Existing invertebrate community likely to be tolerant of disturbance and able to colonise new habitats.
Western Rise (Ch 4100 - 5900)	Grazed mature native forest, kānuka forest, raupō wetland, secondary broadleaved forest, and mature tawa forest.	High	High	Very High	Native canopy trees, kānuka forest, and raupō wetland lost (habitat loss somewhat constrained by effects envelope). However, greatest effect is the loss of up to 1ha established mature tawa forest. Significant fragmentation, creation of a new barrier between habitats, and creation of edge effects to remaining habitat. Invertebrate communities currently present in grazed mature native forest, scrub and raupō likely tolerant of disturbance due to stock access and relative lack of understory habitat. However, invertebrate communities in established tawa forest potentially remnant and sensitive to disturbance, additional edge effects and may have

Designation section	Habitat types	Ecological value	Potential magnitude of effect (ref Table 6.B.4)	Level of ecological effect (ref Table 6.B.5) prior to mitigation	Comments
					limited dispersal and colonisation abilities.
Western access designation – (~Ch4700 – North)	Small areas of kānuka forest.	Low-Negligible	Negligible	Very Low	Minimal impact beyond grazed pasture and small areas of kānuka and therefore little to no impact on terrestrial invertebrates of ecological value.
Te Āpiti Wind Farm and Ridge (5900 - 9900)	Kānuka scrub and secondary broadleaved forest in gullies, pondside vegetation and divaricate *Coprosma* vegetation.	Low-Negligible	Moderate	Low	Habitat lost either recently protected or subject to significant pressure from stock grazing and trampling. Little habitat of value impacted. However, the new road will introduce a new barrier between large amounts of native vegetation to the north and the MGSR.
Eastern Rise (Ch 9900 - 12800)	Kānuka and fern vegetation, kānuka and rush seep, secondary broadleaved forest, and pine forest.	Moderate	Moderate	Moderate	Area of secondary broadleaved forest with relatively stable and diverse understory habitats lost. Reduces the size of the remaining forest patch increasing edge effects and introduces a new barrier between existing habitats and vegetation to the east, noting that there are significant habitats located also to the north and north east. Existing invertebrate community likely to be moderately tolerant of disturbance and able to colonise new habitats. However, community may include species that colonise in later stage succession.
Woodville gateway (Ch 12800 - 14000)	Small area of pine trees and grazed pasture.	Negligible	Low	Very Low	Small amount of marginal and disturbed habitat lost. Existing invertebrate community likely to be tolerant of disturbance and able to colonise new habitats.

6.B.6.3 Bats

It is inappropriate, in this instance, to use habitat presence as a proxy for bat presence. At this stage, the presence of bats is not confirmed and the probability of finding them is low. To assess impacts on long-tailed bats, further work to determine their presence will need to be undertaken. If bats are confirmed to be present, how they are using the habitat and what specific habitat features are being used would need to be identified and impacts on these assessed. An effective assessment of effects cannot be conducted without this information. An approach to address this uncertainty and ensure any potential/actual effects on long-tailed bats are avoided, remedied, or mitigated is discussed in the below section 6.B.7.4.

6.B.6.4 Avifauna

Potential adverse ecological effects on avifauna associated with construction of the Project include:

- Mortalities of nesting birds (including eggs and chicks);
- Disturbance;
- Permanent habitat loss;
- Modification of remaining habitat such as:
    - Reduction of habitat connectivity through fragmentation and introduction of new barriers that may cause habitat isolation for species with limited mobility.
    - Creation of edge effects such as altering the composition and habitat value of adjacent vegetation, modifying the microclimates within created edge habitats and thus altering food supply.
    - During construction potential sedimentation effects on foraging areas along the Manawatū River could reduce prey abundance and/or foraging efficiency of dotterels. While this is a potential effect associated with the resource consent application process (to be lodged later), it is nevertheless a potential ecological effect on an identified value that is related to the designation's spatial location (i.e. where future works are being planned). Mitigation for this impact should be considered at the time those applications are developed.

Potential adverse ecological effects on avifauna associated with operation of the Project include:

- Traffic-related mortalities during road operation.
- Disturbance, including effective habitat loss.

These potential effects are assessed below in Table 6.B.12.

Table 6.B.12: Potential effects on avifauna described based on designation section.

Designation section	Habitat types	Ecological value	Magnitude of effect (ref Table 6.B.4)	Potential level of ecological effect (ref Table 6.B.5) prior to mitigation	Comments
Bridge to bridge (Ch 2500 - 3800)	Grazed pasture, planted native vegetation, weed-dominated cutover pine.	Low	Negligible	Very low	No nesting or core habitats for at-risk or threatened birds in section and large amounts of suitable habitats nearby. Small amount of marginal and disturbed habitat lost.
New Manawatū River Crossing (Ch 3800 - 4100)	Manawatū River and gravel/boulder riverbed habitat.	High	Moderate	High	Potential disturbance, temporary reduction in food quality, and mortality of breeding banded and/or black- fronted dotterels on gravel/shingle habitats. Potential loss of small amounts of gravel habitat depending on bridge design and pier location. No nesting or core habitats for other At Risk or Threatened species; if displaced by construction works, plentiful, suitable habitat is available nearby. Level of ecological effect will be reduced to Low if suggested mitigation is implemented (especially nesting deterrence mechanisms).
Western Rise (Ch 4100 - 5900)	Kānuka forest, raupō wetland, secondary broadleaved forest, and mature tawa forest.	High	Moderate	High	Potential disturbance and mortality of low numbers of breeding whitehead in established forest areas. Extensive, alternative nesting habitat available in contiguous MGSR. Potential disturbance of foraging/roosting cryptic marsh birds in raupō wetland. Loss of relatively small amount of wetland and forest habitats which may be used only occasionally by at risk or threatened birds. Level of ecological effect will be reduced to Low if suggested mitigation is implemented.
Western access designation – (~Ch4700 – North)	Grazed pasture and small amounts of kānuka	Low	Negligible	Very Low	No nesting or core habitats for at-risk or threatened birds in section. Loss of a relatively small amount of agricultural habitat and kānuka which are common and dominant in the landscape.

Designation section	Habitat types	Ecological value	Magnitude of effect (ref Table 6.B.4)	Potential level of ecological effect (ref Table 6.B.5) prior to mitigation	Comments
Te Āpiti Wind Farm and Ridge (5900 - 9900)	Native scrub with scattered broadleaf and larger emergent rewarewa trees.	Low-Moderate	Low	Very Low-Low	No nesting or core habitats for at-risk or threatened birds in section and large amounts of suitable habitats nearby. Loss of relatively small amount of scrub and secondary forest habitats which are used occasionally by at risk or threatened birds.
Eastern Rise (Ch 9900 - 12800)	Regenerating, secondary broadleaf forest.	Low-Moderate	Low	Very Low-Low	No nesting or core habitats for at-risk or threatened birds in section and large amounts of suitable habitats nearby. Loss of relatively small amount of secondary forest habitats, which are used occasionally by at risk or threatened birds.
Woodville gateway (Ch 12800 - 14000)	Cropped and grazed pasture.	Low	Negligible	Very Low	No nesting or core habitats for at-risk or threatened birds in section. Loss of a relatively small amount of agricultural habitats, which are common and dominant in the landscape.

6.B.7. Recommendations to avoid, remedy or mitigate

6.B.7.1 General recommendations

To reduce the level of potential effects on the fauna present along the corridor there should be an emphasis during later design stages to avoid or minimise impacts to native habitats (those assessed as having greater than low level for habitat value). This applies in particular to the mature tawa forest in the western rise area, older regenerating kānuka scrub patches in the Te Āpiti wind farm and ridge area and regenerating broadleaved forest in the eastern rise area. Avoidance mechanisms for these areas could include (but are not limited to):

- Realignment of indicative designation within the proposed designation;
- Bridging;
- Minimisation of cut and fill extents; and
- Rationalisation of access routes and points, spoil dump areas, and compound areas.

To address habitat lost for all fauna, the mitigation using the environmental compensation ratios recommended by the terrestrial vegetation and habitats assessment (Forbes, 2018) will provide habitat value and adequately replace the fauna habitat lost. Criteria for habitat to be created within these mitigation planting areas should be stipulated within an ecological management plan for this Project.

Where the Project does not impact on existing native vegetation and habitats that are not already protected from stock access, fencing and permanently excluding grazing stock to allow natural regeneration could be considered (as part of any mitigation package). This protection would improve the ecological value of the remaining habitats.

Any area that may be subject to predator control, as part of a package designed to achieve net biodiversity gain in terms of One Plan policy 13-4, may suffer from significant re-invasion pressure from pest species and may struggle to achieve and maintain pests at low densities. Therefore, the value of this pest control for fauna mitigation comes from the flora values (which provide habitat) created, protected, and maintained and it is the increase in-habitat area (through the operation of ecological compensation ratios) that is primarily considered to provide mitigation for the impacts on fauna that will eventually return an ecological gain.

6.B.7.2 Herpetofauna

Beyond the replacement/improvement of habitat and pest control described above, the salvage of individual lizards within the impacted areas should also be implemented to reduce the potential for injury or mortality of native lizards due to construction of the road.

All native lizard species are 'absolutely protected' under the Wildlife Act (1953, s63 (1) (c)) Department of Conservation (DOC). A Wildlife Act Authority to capture, handle, transfer lizards, and incidentally kill protected wildlife (even non-threatened species) as part of construction works is required for this project due to the presence of lizard habitats and the potential for absolutely protected wildlife to be present and management that will require handling and relocation of lizards.

With regard to lizard management, it should be noted that lizard survey methods currently available have poor detection rates as a consequence of typically low population densities, species cryptic colouration, difficulty in surveying preferred habitats and behaviour/activity patterns (Anderson et al., 2012). These limitations are particularly evident when attempting to locate cryptic, arboreal, species in tall growth trees. As such we recommend the following approach when habitat is confirmed as being impacted:

- Areas of low growth scrub should be surveyed[10] prior to vegetation clearance to determine the presence of native lizards. If native lizards are confirmed to be present salvage should be carried out.
- Areas of tall stature canopy trees, regenerating broadleaved forest, and mature tawa forest should be salvaged in all cases including destructive searches of the canopies of trees and epiphytes once felled.

A lizard management plan should be drafted for the site detailing the survey and salvage methodology, establishment times of survey equipment, timing for surveys and salvage, a release site for salvaged lizards, and requirements to enhance or protect the release site from predation and disturbance. A lizard management plan will be required to support a Wildlife Act Authority application. Wildlife Act authority permits can take a significant amount of time to process and should be applied for at the earliest opportunity to prevent delays.

With the proposed mitigation planting to replace habitat and pest control that will reduce the predation rates on the remaining populations of native lizards, the effects of the designation will have a **Low** magnitude of effect for all sections of the designation for herpetofauna within the site. This coupled with the **High** to **Negligible** ecological values across the designation would result in a **Low** or **Very Low** level of ecological effect. In the long term, as a result of increased habitat availability, there is likely to be a net gain in the populations of native lizards within the wider area.

6.B.7.3 Terrestrial Invertebrates

The primary response for mitigation for terrestrial invertebrates is to create new habitats, and enhance remaining habitats, such as the MGSR. The enhancement should focus on increasing ecosystem health factors such as reducing edge effects, mammalian predation, and grazing disturbance. This can be achieved through fencing off vegetation, conducting predator control, and ensuring mitigation plantings are contiguous with large, established, high value habitats.

Salvage and transportation of woody debris or other complex habitats is not recommended as not enough is known about the terrestrial invertebrate communities present to ensure there are no negative flow on effects on resident communities or the inadvertent spread of non-native species.

With the proposed planting to replace and protect habitats and to protect and improve the value of existing habit, the designation will have a **Low** magnitude of effect for all sections for terrestrial invertebrates within the site. This coupled with the **High** to **Negligible** ecological values across the designation would result in a **Low** or **Very Low** level of ecological effect. In the long term, as a result of increased habitat availability and potential predator control

[10] Survey effort should be on a case by case basis and determined by an appropriately qualified and experienced herpetologist as sufficient to have a realistic chance of detecting lizards if present (within the limitations of the survey tools and techniques available).

improving habitat value and ecological health, there is likely to be a net gain in terms of the ecological value of terrestrial invertebrates within the wider area.

6.B.7.4 Bats

The previous bat surveys undertaken[11] did not detect any bats, but were only conducted to a level to allow detection of high density populations of long-tail bats and/or core habitats such as maternal and communal roosts. Such values, if present, would be significant. However, the surveys do not give enough information to determine the presence of long tailed bats if at low-density, and so an effects assessment cannot be completed. Given the threatened – nationally critical- status of long-tailed bats it is important that even impacts on low density populations or habitats used infrequently are addressed.

Understanding the effects of construction and operation of roads on long-tailed bats is reliant on understanding the patterns of bat activity across the landscape and what habitat features are important to the population. Further work (the detection surveys explained below) is required to provide an understanding of:

- Whether bats at low density are present in the area; and
- If they are present in the area how they are using the habitat, what features are being used and whether it is a resident population.

We consider the likelihood of long-tailed bats being present at low densities within the Project area to be low. However, to gain further understanding and inform the required mitigation for long-tailed bats we recommend further intensive bioacoustics surveys are carried out under a bat survey plan developed by an appropriately qualified and experienced ecologist. These surveys should include two survey periods during:

- **November-December** - this monitoring period is during the breeding season. Breeding female bats and their dependant young occupy maternity roosts that generally occur in the most productive habitat within their colony's range (Pryde, O'Donnell, & Barker, 2005). Consequently, if high levels of bat activity are recorded in the project area during this period it is likely the project area is near core habitat for a bat colony; and
- **March** - this is generally considered a time when the home range of young bats is at its largest and therefore surveying during this period will maximise the likelihood of detecting bats.

These surveys should target identified potential high value long-tailed bat habitats described within this report with a high density of bioacoustic recorders to increase the probability of detecting bats if present. If the recommended surveys detect long-tailed bats a long-tailed bat management plan should be drafted. This plan should include (but not be limited to):

- Understood bat use patterns of the impacted habitats such as areas of potential roosting, foraging or commuting corridors;
- Further survey work needed if any to confirm bat use of the habitats;
- Activity levels detected in each potential habitat area;
- Analysis of effect on bats as a result of the proposed designation;

[11] This previous survey by Kessels & Associates Ltd (2018) was carried out 27 February to 13 March 2018 included 10 survey locations within or close to the current designation.

- A detailed approach to avoid, remedy, or mitigate the assessed effect of the road designation on bats; and
- A post mitigation level of effect on long-tailed bats and how any residual effects will be managed.

If no bats are detected within the identified habitats during the intensive bioacoustic surveys an incidental detection protocol should be developed (or integrated into an environmental management plan for the site) to outline the process that is followed if a bat is incidentally encountered during vegetation removal. It is acknowledged that a lack of detection does not indicate a lack of presence. However, if intensive surveys fail to detect long-tailed bats it would indicate that long-tailed bats are below detection density. As such monitoring potential roost trees prior to felling with automatic detection equipment or dusk surveys would be very unlikely to avoid disturbance on potentially present individual long-tailed bats and an accidental discovery protocol would be the most appropriate mechanism to manage effects.

This approach should ensure that long-tailed bats are appropriately managed in this area if present and their habitat use patterns are understood before a level of effect and required mitigation is assessed.

This uncertainty does not allow recommendations for the avoidance of long-tailed bat habitat specifically. The avoidance of native vegetation, lizard habitat, and high value terrestrial invertebrate habitats where practicable will translate to the avoidance of potential long-tailed bat habitats. This will provide interim guidance for avoidance of potential long-tailed bat habitat during the period of uncertainty between the publication of this report and the development of a long-tailed bat management plan, if bats are found to be present onsite.

6.B.7.5 Avifauna

Beyond the replacement of habitat described above, the following actions or periods of action are recommended to be avoided where practicable. None of the following are required (because of the assessed values) avoidance, but are methods to reduce effects and present opportunities to avoid effects:

6.B.7.5.1 Habitat avoidance consideration

- Minimise clearance of the raupō wetland within the western rise section. The habitat is degraded, but wetlands are rare and potential habitat to specialist species, so avoidance is recommended and where necessary clearance minimised. This area could serve as an important mitigation/offset opportunity and be greatly enhanced through stock exclusion/fencing.
- Minimise effects/avoid the gravel/shingle riverbed habitat within the designation corridor where the Manawatū River is proposed to be bridged in the breeding season to avoid potential mortality of river birds that may nest in this habitat.
- Minimise effects/avoid the farm ponds between approximately CH9200 and CH9600 to reduce potential impacts on avifauna species using this habitat. This area also has restoration/enhancement and mitigation/offset potential through stock exclusion and planting of indigenous plant species, although because the land farmland and will remain part of the farm in the long term, this benefit is unlikely to be able to be realised.

- If works are to be conducted in grassland habitat during the breeding season for New Zealand pipit (August to March), efforts should be made to avoid letting grass become rank (as this may provide suitable nesting habitat for pipit). Currently the grass is grazed, but if stock are removed, it may become rank. Regular mowing is a suitable alternative maintenance method if stock are removed (very regular mowing to prevent birds nesting should be done prior to and during pipit breeding season).
- Minimise effects/clearance of the Bolton Bush QEII area (CH5600-5800). Bridging this vegetation would be a preferred option.
- If clearance of the raupō wetland does occur then pre-clearance surveys (by a suitably qualified ecologist) for cryptic bird species potentially using the raupō wetland habitat should be undertaken to avoid potential bird death.
- If works are to be conducted during the breeding season for black-fronted and banded dotterels (broadly between July and March), measures should be implemented in the non-breeding season before works to deter these species from nesting in the works area. A successful method that is recommended to deter New Zealand dotterels from nesting in a works area is the erection of silt fences. By erecting these at knee height in rows spaced 5-10 m apart, the birds' views are blocked; this makes the area unattractive for nesting. Deterrence methods are likely to be suitable for banded dotterel and black-fronted dotterel. Potentially displaced birds would be able to use the abundant, nearby shingle/gravel bed habitat. After implementing these measures, a pre-construction survey (by a suitably qualified ecologist) for nesting dotterels would still need to be conducted to check the success of these deterrence mechanisms. If nesting birds are detected within the area, an exclusion zone would need to be erected around the nest, and works should not be conducted in this area until nesting activities are completed, or chicks have been safely herded away (by a suitably qualified ecologist) if this mechanism is approved via an authority under the Wildlife Act 1953.
- Pre-clearance surveys (by a suitably qualified ecologist) for whitehead if vegetation clearance in the western rise and western access designation is to occur during the breeding season for this species (September to January). If nesting birds are detected, an exclusion zone should be erected around the tree the nest is in, as well as a buffer of nearby trees, and works should not be conducted in the area until nesting activities are completed. An authority under the Wildlife Act 1953 could also be sought to move nests to a safe location outside of the works area.
- If grassland habitat is not maintained and becomes rank, this may provide potential nesting habitat for New Zealand pipit. If there are areas of rank grass that need to be cleared during the pipit breeding season (August to March), a pre-clearance check (by a suitably qualified ecologist) for nesting pipit should be conducted. If nesting pipit are identified, an exclusion zone should be erected around the nest until nesting activities are completed. An authority under the Wildlife Act 1953 could also be sought to move nests to a safe location outside of the works area.
- An avifauna management plan should be drafted for the site detailing pre-clearance survey methods (including the timing of such surveys), implementation of deterrence measures and the construction of exclusion zones if required.

The implementation of these avoidance and mitigation actions (as well as the general recommendations for all fauna) will result in the proposed designation corridor having a **Negligible** to **Low** magnitude of effect on avifauna present (or potentially present) across the site. This, coupled with the **High** to **Low** ecological values, results in **Low** to **Very Low** overall levels of ecological effect on avifauna. In the long term, as a result of increased habitat availability and potential predator control improving habitat value and ecological health, there is likely to be a net gain in terms of the ecological value of avifauna within the wider area.

6.B.8. Conclusions and recommendations

The proposed designation corridor includes a number of habitats for terrestrial fauna (herpetofauna, invertebrates, bats, avifauna), including actual and potential habitat for a variety of At Risk and Threatened species. The highest value habitats for terrestrial fauna in the designation are the intact tawa forest in the western rise area (Bolton Bush QEII site (CH5600-5800)), the mature, regenerating secondary forest in the eastern rise area, and the matrix of open, wetland, riparian and large tree habitats at the Manawatū River end of the western rise gully. This ecological assessment is based on existing literature, of which there is little, on previous ecological field surveys and qualitative assessment of habitats, which was limited. As such, a conservative approach has been taken in assigning ecological values.

A number of actual and potential adverse effects on terrestrial fauna values are associated with the proposed designation corridor. These include:

- construction and operational-induced mortality of terrestrial fauna;
- permanent loss of fauna habitat;
- modification of fauna habitat (e.g. fragmentation, isolation, noise, construction, introducing edge effects and operational disturbance); and
- increased presence and likelihood of invasion by non-native plant and invertebrate species due to increased human activity and access.

Without avoidance and mitigation, the magnitude of these effects varies between **Negligible** and **High** on terrestrial fauna, resulting (once the value of effects is considered) in the overall level of effects ranging between **Very Low** and **Very High**. This effects assessment is based on a corridor and not a design of the actual road to be built. As such, there is significant uncertainty on effects and we have therefore taken a conservative approach to the effects assessment.

These effects (or the level of them) can generally be avoided or mitigated by:

- avoiding impacting native habitats;
- producing fauna management plans that detail methodologies for pre-clearance fauna surveys, deterrence measures for seasonally present species, and relocation where required;
- undertaking vegetation clearance outside of the breeding season for selected avifauna species;
- undertaking further intensive bioacoustic surveys for bats under a bat survey plan; and
- implementing the habitat and revegetation mitigation recommended by Forbes' (2018) ecological impact assessment where identified valued habitat is lost.

The implementation of these avoidance, mitigation, and offsetting actions will reduce the magnitude of potential effects on terrestrial fauna, resulting in **Very Low-Low** overall levels of ecological effect. In the long term because of increased habitat (based on the ECR's advanced), reduced predation of native fauna, and increased ecosystem health there is likely to be a net gain in terms of the ecological value of terrestrial fauna within the wider area.

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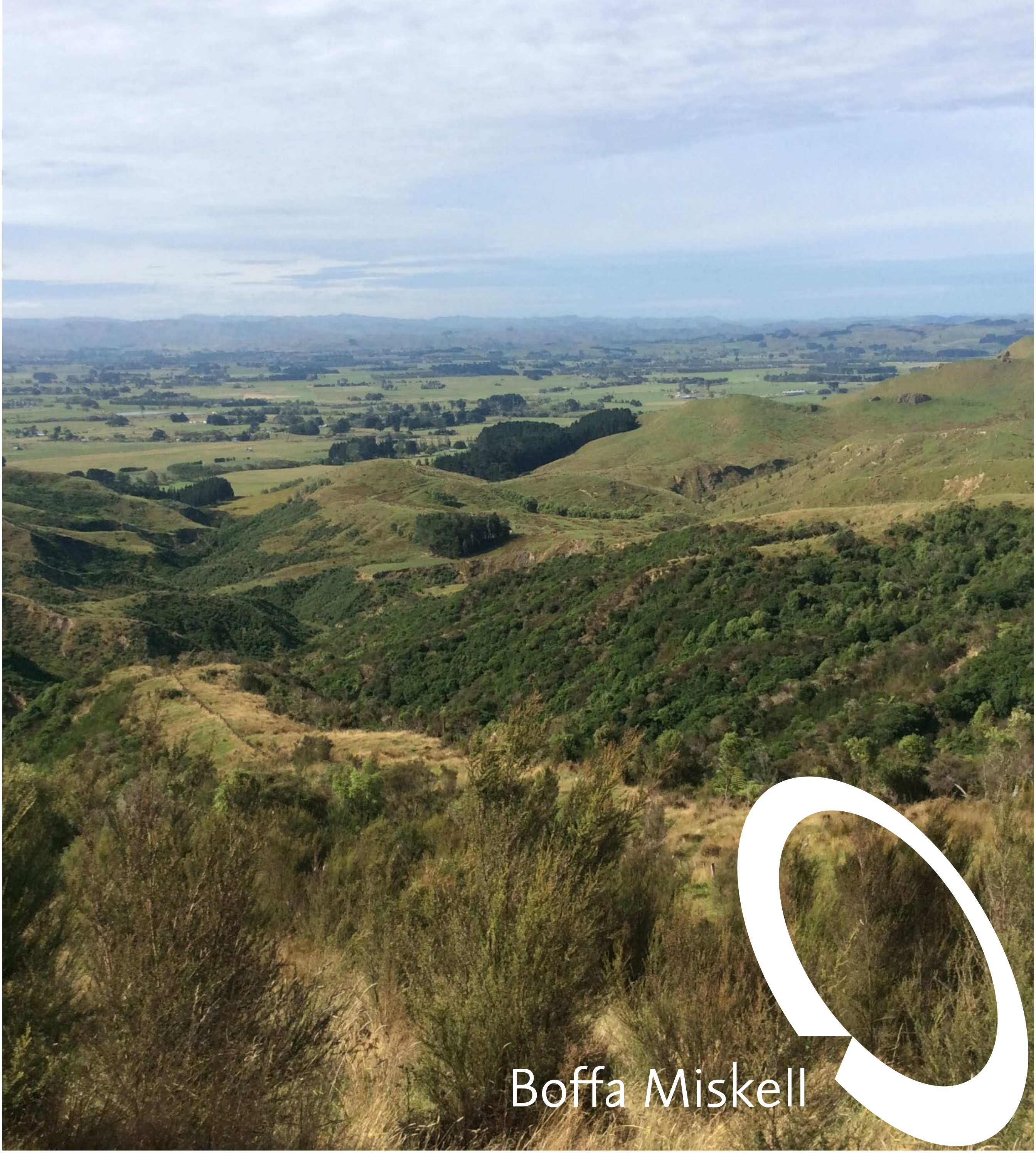
6.B.1
SUMMER ECOLOGY SURVEY - HERPTOFAUNA - BOFFA MISKELL LTD 21 MARCH 2018

Appendix 6.B.1: Manawatū Gorge SH3 - Summer Ecology Survey – Herpetofauna – Boffa Miskell Limited 2018

Manawatu Gorge SH3

Summer Ecology Survey - Herpetofauna
Prepared for GHD and the New Zealand Transport Authority

21 March 2018



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Cover photograph: [Manawatu Gorge foot hills looking east, Boffa Miskell, 2018]

Contents

1.0 Introduction

New Zealand Transport Agency (NZTA) with GHD Ltd commissioned Boffa Miskell Ltd (BML) to undertake summer ecology surveys for herpetofauna for the preferred proposed new alignment of SH3. The purpose of the surveys is to characterise the habitat available for herpetofauna and conduct a rapid visual and spotlighting survey across representative areas to attempt to confirm the presence of native herpetofauna within the preferred corridor and proposed associated infrastructure to inform future ecological assessments.

2.0 Methodology

A desktop assessment and review of previous herpetofauna records in the Manawatu gorge area was carried out by accessing the Department of Conservation's (DOC) BioWeb herpetofauna database. Records were gathered from within 40km of the Manawatu gorge to capture all species potentially present in the area. Additional to these records landowners and staff encountered during field visits were questioned on any lizard sightings in the area.

Field surveys were carried out with day time surveys across the entire alignment to characterise the habitat available for the lizard species found to be potentially present in the area. Habitat characterisations focused on factors which would influence the likelihood of native herpetofauna occurring such as; approximate vegetation age, composition, complexity, connectivity, amount of natural and/or artificial debris, evidence of pests, land use, stock access, and the presence of microhabitats important to native lizards (rocky outcrops, boulder banks, scree, woodpiles, rotten logs, dense under growth, etc.). Visual encounter surveys (VES) were also carried out during the habitat characterisation surveys. This survey was non-randomised and biased towards areas which potentially contain the target species identified in the desktop assessment.

Representative habitats which were accessible and identified during habitat characterisation survey to have potential habitat value for nocturnal lizards were returned to at night to carry out nocturnal VES. These searches used LED spotlights periodically assisted by binoculars to expand survey area beyond the vegetation edge. The nocturnal VES primarily focused on the edge of vegetation features where the canopy was visible and binoculars could be used to survey further in from the edge of the features across the canopy. However, where able to, searches extended under the canopy and surveyed the sub-canopy, forest floor, and epiphytes. As with the daytime VES this survey was non-randomised and biased towards areas which potentially contain the target species identified in the desktop assessment.

3.0 Results

3.1 Desktop assessment

The DOC herpetofauna database was accessed on 23 February 2018. Listed below are the species previously recorded in the area. Threat classifications and common names follow Hitchmough et al. (2016) for lizard species and Newman et al. (2013) for frog species. Habitat descriptions are summarised to describe likely habitats within the survey area – many species have wider habitat preferences such as coastal areas which do not occur within the survey area.

Three native lizard species have been detected within the Manawatu scenic reserve which occurs both sides of the Manawatu river through the Manawatu gorge. They are:

Barking gecko (*Naultinus punctatus*) – At risk – declining.

> A diurnal arboreal species which lives in forest and scrub. Generally found amongst foliage in the canopy.

Ngahere gecko (*Mokopirirakau* "southern North Island") – At risk – declining.

> A nocturnal (although often discovered basking during the day) arboreal species which lives in forest and scrubland. Generally found on trunks and branches of trees and can be found nearer the ground in shrubs, ferns, and crevices.

Raukawa gecko (*Woodworthia maculatus*) – Not threatened

> A nocturnal arboreal and terrestrial species that can occur in forest, creviced rock outcrops, scree slopes, scrubby areas, and in any dense vegetation.

Additional to the above species within 15km of the proposed alignment footprint there are records of:

Pacific gecko (*Dactylocnemis pacificus*) – At risk – relict.

> A nocturnal arboreal and terrestrial species with similar habitat requirements to above common gecko. In southern North Island most often found in hill country forest.

Glossy brown skink (*Oligosoma zelandicum*) – At risk – declining.

> A secretive diurnal terrestrial species found in damp lowland areas such as forest, scrub, and farmland.

Ornate skink (*Oligosoma ornatum*) – At risk – declining.

> A very secretive crepuscular species which lives in forest or open areas that provide stable cover such as deep leaf litter or rock piles. This species seldom emerges form cover.

Northern grass skink (*Oligosoma polychroma*) – Not threatened.

> A diurnal species which inhabits grasslands, rock piles, scree, wetlands and scrub. Often seen basking.

No further species of extant[1] native species had been previously detected within 40km of the alignments footprint.

Also recorded within the wider area are:

- Several records of unidentified gecko species (some attribute genus only to records).
- One record of unidentified frog species in the northern end of the Tararua range.
- Records of three non-native frog species; brown tree frog (*Litoria ewingii*), growling grass frog (*Ranoidea raniformis*), and green and golden bell frog (*R. aurea*).

While not recorded within the DOC Bioweb herpetofauna database; personal experience indicates that the invasive plague skink (*Lampropholis delicata*) is present in abundance in Palmerston North close to the railway corridor and it is likely they extend beyond the city limit along this corridor.

While onsite several landowners confirmed encountering lizard species either in vegetation in the surrounding area or periodically in their homes. The descriptions given for these species match those species previously recorded in the area such as the barking gecko (described as a green gecko), and either the ngahere gecko or raukawa gecko (described as a grey/brown gecko).

3.2 Habitat characterisation

The habitat along the entire alignment can be broadly characterised by a pasture dominated matrix with deeply incised gullies containing varying ages of regenerating areas of native broad-leaf, fern, and scrub species with scrubby pest plants such as broom and gorse common. Additional to this there are discrete areas of non-native plantation forests and small farm ponds with surrounding native and non-native vegetation.

In general, much of the vegetation present has good habitat values for most of the potential species present in the area. With large amounts of available habitat available for arboreal geckos such as the barking gecko and the more grassland dwelling species such as the northern grass skink. Also, within several secondary forest/scrub patches there are areas of habitat that would be suitable for other species that rely on more complex refugia. A lot of the vegetation is also well connected to the Manawatu scenic reserve which has several lizard species confirmed to be present and would provide a source of lizards into the regenerating vegetation.

Assessments of habitat suitability are based on accepted and understood habitat preferences for relevant species, however, species are regularly detected in areas outside of these understood habitat preferences and therefore the below stated habitat suitability should be a guide only.

During the habitat characterisation fieldwork two stoats and one feral cat were observed in the alignment area, both are potential predators of native lizards.

Below areas have been broadly grouped to distinct areas or gullies and their habitat value briefly described. Area numbers and descriptions refer to habitat maps in Appendix 1:

[1] There are bone records of the extinct Markham's frog (*Leiopelma markhami*) located in this wider area.

3.2.1 Manawatu Gorge scenic reserve and contiguous areas contained within rail and road corridors.

These areas consist of a large contiguous mature broad-leaf dominated forest with kanuka, broom, and divaricate *Coprosma* species common along the pasture edge (Figure 1) and in some larger areas at the western end of the gorge (Figure 2). The undergrowth and epiphytes provide complex microhabitats. There is evidence of stock intrusion into the area with grazing and trampling on the forest edge. Habitat suitable for all species potentially present in the area with habitat suitable for arboreal, sub-canopy and terrestrial species. One of the few areas where the leaf litter and cover is stable and deep enough to be considered suitable for ornate skinks.

Figure 1: Broad-leaf dominated forest on pasture edge. Manawatu Scenic Reserve and surrounds.

Figure 2: Scrub dominated vegetation associated with Manawatu Reserve and surrounds on western end of Manawatu gorge.

3.2.2 Area 01

Area which was previously pines but has now been harvested leaving considerable woody debris behind with regenerating scrub species now covering the area. Well connected to the Manawatu gorge scenic reserve and could provide habitat for terrestrial skinks or geckos on the edge of the reserve (see area indicated in red in Figure 3).

Figure 3: Area of woody debris and scrub after felling pine trees. Manawatu Gorge.

3.2.3 Areas 02, 03, and 04

Steeply incised gullies with a relatively mature secondary vegetation with tall kanuka, broad-leaf species, fern species, nikau, cabbage tree, and broom and gorse on the edges. Area 3 appears to be the oldest of the areas with higher kanuka and greater amounts of broad-leaf species present. All areas well connected to the Manawatu Scenic reserve but contain predominately pasture undergrowth but in areas of canopy closure does have some diversity of refugia and undergrowth. Epiphyte cover and complexity is high in some areas. Areas are not fenced from stock. Potentially suitable microhabitats for all potential species in these areas with large amounts of suitable habitat for barking gecko in the scrub and broad leaf canopy. Example photos provided in Figure 4-6.

Figure 4: Looking up the gulley within Area 02 showing relatively mature kanuka/ broadleaf secondary vegetation.

Figure 5: Area 03 relatively mature kanuka/ broadleaf secondary vegetation with extensive tall kanuka scrub.

Figure 6: Area 04 with kanuka scrub vegetation of a younger age than areas 02 and 03.

3.2.4 Areas 05

Steeply incised gully of relatively young, short statured native (kanuka) and non-native scrub species in the northern end of the gully which then progresses into areas of taller scrub and broad-leaf native species towards the southern end. Divaricate *Coprosma* species on the edges common. Wild pines scattered throughout area particularly in the northern end. Ground cover is predominately pasture grasses. Has connectivity to the Manawatu scenic reserve that could act as a source for native lizards. Habitat suitable for barking gecko and northern grass skink with potential for refugia and cover complexity that would be suitable for other species in the southern end of the gully amongst older vegetation.

Figure 7: Area 05 showing low stature native scrub in the northern section of the gully with taller kanuka and broadleaf species in the southern end.

3.2.5 Area 06

Forest patch consisting of older broadleaf-dominated canopy (Figure 8). Has good diversity of refugia in the undergrowth with dense vegetation and leaf litter present including some areas of non-native species such as bamboo which provide a thick dense leaf litter (Figure 9). Suitable microhabitats for all potential species in the area.

Figure 8: Area 06 forest patch with dense broad-leaf canopy.

Figure 9: Area 06 dense leaf litter under non-native bamboo that would provide suitable refugia for native lizards.

3.2.6 Area 07

Small area of planted natives adjacent to a farm pond that is surrounded in non-native vegetation including pines. Small area of planted native is effectively fenced from stock and the undergrowth is dense fern and scrub (Figure 11). Potential for habitat for gecko species in planted native patch but this is disconnected from other vegetation. Limited habitat values around farm pond but still potential for lizard utilising rank grass and non-native scrub vegetation.

Figure 10: Area 07 farm pond and surrounds showing rank pasture and planted non-native species.

Figure 11: Area 07 planted native patch showing dense undergrowth.

3.2.7 Areas 08 and 09

Areas of patchy regenerating kanuka scrub, tree fern, and broad-leaf native species. Broom, and gorse common on edges with patches of pine trees and scattered induvial pines present. Grazing extensive under canopy with little refugia or habitat complexity other than small amounts of woody debris present. Habitat potential for arboreal species but little refugia for others. Northern grass skink may be able to utilise small patches of denser vegetation on edge or areas where stock cannot access.

Figure 12: Area 09 showing area of scrub and fern dominated secondary vegetation.

3.2.8 Areas 10 and 11

Areas of relatively mature secondary vegetation with tall kanuka, broad-leaf species, fern species, nikau, cabbage tree, and divaricate *Coprosma* species on the edges. Broom and gorse also common on pasture edge. Area 10's canopy has a greater proportion of native broad-leaf species than Area 11 (Figure 13 and Figure 14). Both areas have grazing access but this appears to be limited as there is still good cover of undergrowth which likely provide diverse refugia for lizards. Within the core of Area 10 there was also kiekie and other complex sub-canopy species. Potentially suitable microhabitats for all potential species in these areas with large amounts of suitable habitat for barking gecko in the scrub and broad leaf canopy.

Figure 13: Area 10 looking from top of gully to the bottom showing intact broad-leaf dominated canopy.

Figure 14: Area 11 showing kanuka dominated scrub canopy.

3.2.9 Area 12

Steeply incised gully with relatively young, short stature, kanuka scrub, scattered native broad-leaf species, and few non-native scrub species in the northern end of the gully (Figure 15).

Vegetation then progressively turns to non-native dominated scrub vegetation (broom and gorse) (Figure 16). Divaricate *Coprosma* species on the edges common. Ground cover is predominately pasture grasses. Habitat suitable for barking gecko and northern grass skink with potential for refugia and cover complexity that could be suitable for other species in the northern end of the gully amongst older native dominated vegetation.

Figure 15: Northern end of Area 12 showing low stature kanuka scrub with scatter broad-leaf vegetation.

Figure 16: Photo showing Area 12 progressing from native scrub in the north to non-native scrub to the south. Approximate area where gorse and broom dominate is indicated in red.

3.3 Visual encounter surveys

3.3.1 Daytime VES

Due to the large area in which surveys were to cover daytime VES were opportunistic and carried out during habitat characterisation surveys which occurred on 26, 27, and 28 February 2018. Scrub vegetation was visually searched and the limited amount of woody debris found was lifted to look for lizards. No lizards were found during these surveys. While no detections during daytime VES is not uncommon when searching for the highly cryptic and secretive species potentially present in this area, contributing to this was sub-optimal weather conditions during most of the survey period. Weather conditions varied across the survey period; 26 February consisted of rain with occasional heavy periods, 27 February consisted of strong winds across the survey area, and 28 February weather was fine and warm. Survey hours or effort was not captured for the daytime VES as the searches were sporadic and opportunistic and it is considered inappropriate to attribute a defined time or person hour of effort to the searches.

3.3.2 Night-time VES

Night-time VES was hampered by the previous day's rain during the night of 26 February as the wet foliage reflects light making spotlighting lizards difficult. Twenty minutes of spotlighting by two people occurred in the vicinity of Area 02 before it was decided to abandon the night's survey. Despite the wet vegetation the night-time weather conditions were suitable for spotlighting with light wind and a temperature of ~15°C. Survey effort: 0.66 person hours. No lizards found.

On the night of 27 February Areas 10 and 11 were surveyed. Conditions were initially suitable for spotlighting with light winds, temperature of ~15°C, and prey species such as moths were abundant. Complex scrub habitat on the pasture edge was searched in both areas as well as the sub-canopy, epiphytes, and forest floor in areas of Area 10 by two people. 1.5 hours into the survey light rain began to fall turning to steady rain by 1.75 hours when the survey was stopped. Survey effort: 3.5 person hours. No lizards found.

On the night of 28 February sections of the Manawatu gorge scenic reserve and Areas 04,05 and 06 were surveyed. Conditions were suitable through the survey period with little wind, temperature of ~16°C, with prey species such as moths common throughout the survey period. During this night's survey an additional person from Meridian Energy accompanied the survey team and assisted with the spotlighting – this person has not been included in the calculation of survey effort. Survey summary:

- Area 04: broad-leaf southern section of area surveyed. Large amount of epiphytes visually searched.1.7 person hours. No lizards found.
- Area 05 and Manawatu Scenic Reserve edge: southern end of area 05 and pasture edge of Manawatu Scenic Reserve heading towards area 04 surveyed. Large amounts of divaricate and scrub species. Area almost entirely sheltered from wind. 2.3 person hours. No lizards found.
- Area 06: southern pasture edge surveyed. Large amounts of broad-leaf canopy and trunks and branches of edge vegetation. Area sheltered from wind. 1 Person hour. No lizards found.

4.0 Summary

There are several native lizard species known to be present within the wider area that could potentially be present within the preferred alignment corridor. These species include several arboreal and terrestrial geckos and skinks which have a threat classification of At risk.

The habitats within the corridor have high value for native lizards and generally have good connectivity to the Manawatu Scenic reserve which has previous confirmed detections of several native lizard species and could act as a source of lizards into regenerating scrubland.

Due to the large area to be covered surveys targeted key area that were representative and were considered to have the highest likelihood of encountering native lizards. Lizard survey methods currently available have poor detection rates as a consequence of typically low population densities, species' cryptic colouration and behaviours, and behaviour/activity patterns (Anderson, Bell, Chapman, & Corbett, 2012).

Although survey of the area failed to detect native lizards we consider it very likely that At risk native geckos and skinks occur at low densities within the alignment area, given the confirmed presence of native species in the nearby Manawatu gorge scenic reserve and large areas of potential habitat available within the corridor. It is not uncommon to not detect native lizard species even where they are present. We would propose avoidance and mitigation measures for construction phase including:

- Minimise loss of shrub and forest patches where practicable through design.
- Early development of a lizard management plan for all preliminary and construction works detailing the required processes to follow when carrying out works. This management plan should also identify a suitable release site for each potential species – the Manawatu scenic reserve is likely the best candidate for this and there should be areas suitable for all species present.
- The lizard management plan should be used to support a Wildlife Act Authority application to the Department of Conservation. This authority will allow the survey, handling, and potentially translocation of affected herpetofauna. There should be a priority put on applying for this authority early as processing times can be significant (six months plus).
- Intensive surveys for native lizards in confirmed areas of vegetation loss to establish appropriate mitigation measures.
- Salvage and/or habitat enhancement where native lizards are affected by construction.

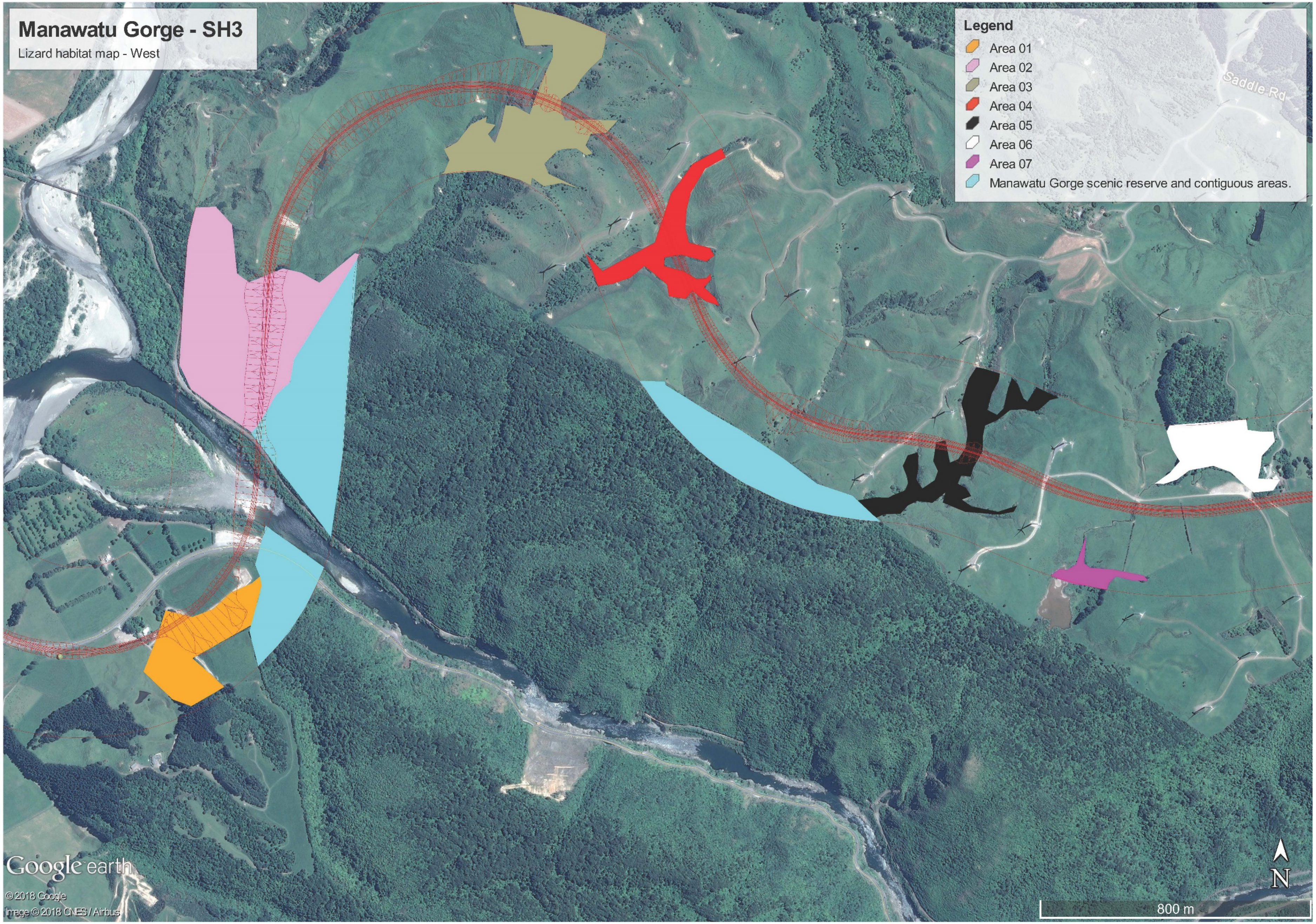
5.0 References

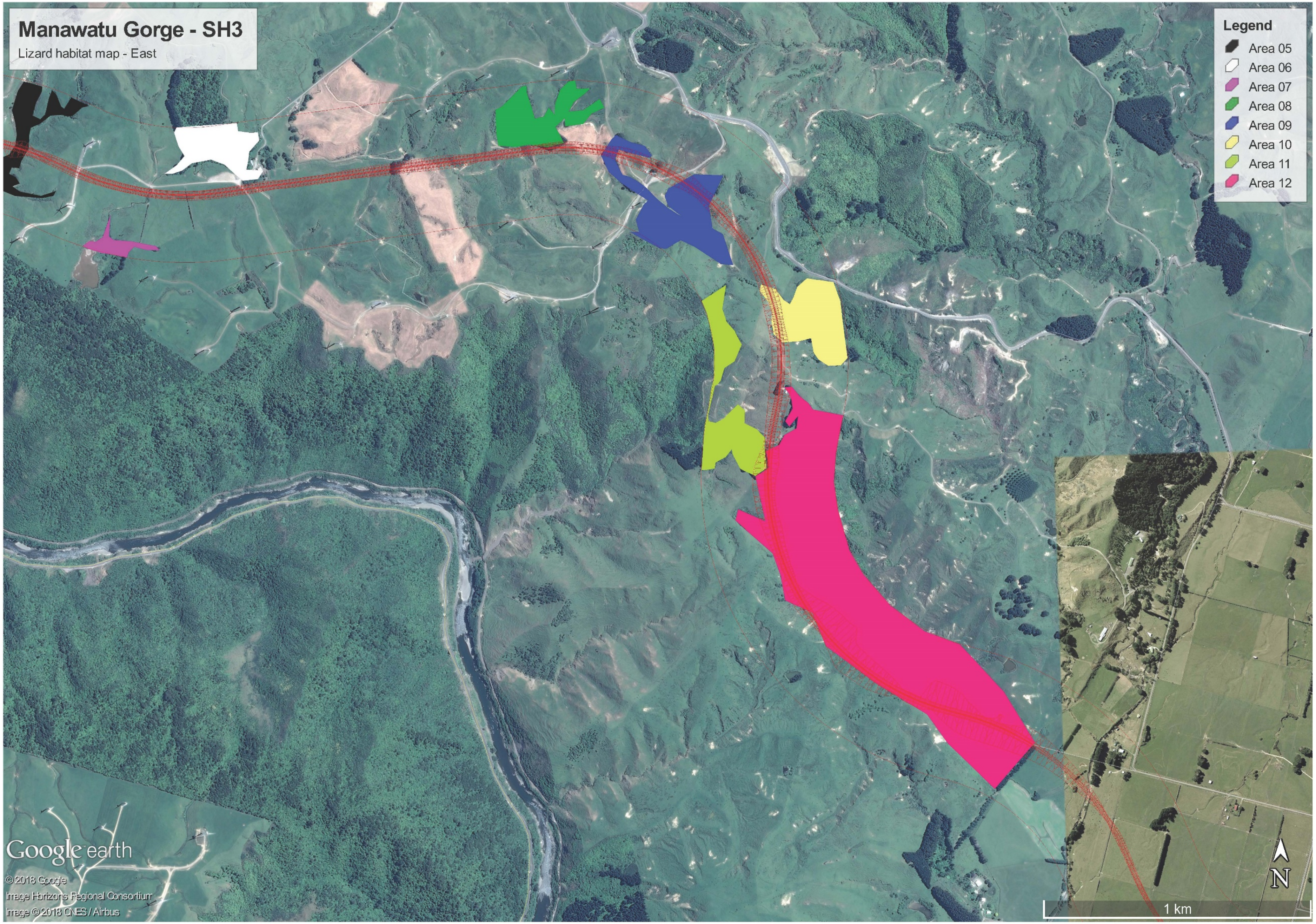
Anderson, P., Bell, T., Chapman, S., & Corbett, K. (2012). *SRARNZ New Zealand lizards conservation toolkit: A resource of conservation management of the lizards of New Zealand*. Society for Research on Amphibians and Reptiles of New Zealand.

Hitchmough, R., Barr, B., Lettink, M., Monks, J., Reardon, J., Tocher, M., … Rolfe, J. (2016). *Conservation status of New Zealand reptiles, 2015* (New Zealand Threat Classification Series No. 17). Wellington: Department of Conservation.

Newman, D. G., Bell, B. D., Bishop, P. J., Burns, R. J., Haigh, A., & Hitchmough, R. A. (2013). *Conservation status of New Zealand frogs, 2013* (New Zealand Threat Classification Series No. 5). Wellington: Department of Conservation.

6.0 Appendix 1 – Lizard habitat maps.




Manawatu Gorge - SH3
Lizard habitat map - East
Legend
Area 05
Area 06
Area 07
Area 08
Area 09
Area 10
Area 11
Area 12
N
1 km
Google earth
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6.B.2

GHD & NZTA MANAWATŪ GORGE REALIGNMENT OPTION 3: SOUTH OF SADDLE ROAD BATS & BIRD HABITAT & SPECIES SURVEYS

Appendix 6.B.2: GHD & NZTA Manawatū Gorge Realignment. Option 3: South of Saddle Road Bats & Bird Habitat and Species Surveys.

GHD & NZTA
Manawatu Gorge Realignment

Option 3: South of Saddle Road
Bats & Bird Habitat and Species Surveys

Kessels Ecology
survey, assessment, restoration

Table of Contents

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Reviewed by: Gerry Kessels

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Executive Summary

Kessels Ecology has been engaged by GHD, on behalf of the New Zealand Transport Agency, to carry out initial species and habitat surveys for bats and birds within and in the vicinity of the proposed Manawatu Gorge Realignment preferred option (Option 3: South of Saddle Road). The proposed realignment would cross through pasture-dominated farmland and part of Te Apiti Wind Farm. Within this landscape there are a number of indigenous forest and scrubland fragments, streams and wetlands which may provide habitat for a range of indigenous birds and possibly long-tailed bats. The purpose of the surveys is to establish potential presence, absence and distribution of these targeted indigenous birds and long-tailed bats within the corridor and areas affected by this. These surveys will inform future ecologists commissioned to prepare the Assessment of Ecological Effects in understanding the existing ecological value of the project area.

Bat and bird surveys were conducted from 26th February to 13th March 2018. For bats, static digital recorders (Automatic Bat Monitors; ABMs) were deployed in areas assessed to be potential bat habitat to detect bat activity in the form of echolocation calls during the night. For birds, five-minute bird counts (5MBCs) were used in conjunction with Automatic Recording Devices (ARDs) that recorded all sounds from before sunset until after sunrise for the duration of the period. Detectors were left on site for fourteen consecutive nights to establish presence or absence of bats and birds.

Acoustic surveys and 5MBCs revealed the presence of 32 bird species within the proposed Manawatu Gorge realignment corridor, comprising seven endemic species, ten native species, and 15 introduced species. A densely vegetated wetland surrounded by indigenous vegetation and two wetlands with open water recorded the highest levels of endemism with five endemic species recorded at each. High numbers of native species were recorded adjacent to the Manawatu River.

The field survey identified the presence of only one notable bird species in the project area - the At risk-recovering New Zealand falcon, New Zealand's only extant endemic raptor. Other bird species detected include five endemic but not-threatened species. Four notable bird species not detected during the surveys, but which could be present on occasion due to the available habitat are: North Island kaka; spotless crake; and two dotterel species.

Overall, the results indicate that the alignment traverses a largely an agricultural land space, with habitats of greatest value to indigenous (and notable) birds within the survey corridor are the wetlands, riparian margins of the Manawatu River, and indigenous vegetation including tawa forest and forested gullies. Additional surveys are recommended within these habitats, in particular to detect wetland birds and dotterel species.

No long-tailed bats were detected within the corridor; however non-detection does not equate absence and additional surveys are recommended in areas requiring pre-construction vegetation removal.

1 Introduction

Kessels Ecology has been engaged by GHD on behalf of the New Zealand Transport Agency to carry out initial species and habitat surveys for bats and birds within and in the vicinity of the proposed Manawatu Gorge Realignment preferred option. The purpose of the surveys is to establish potential presence, absence and distribution of indigenous birds and long-tailed bats within the preferred corridor and areas affected by this to inform future ecologist(s) commissioned to prepare the Assessment of Ecological Effects in understanding the existing ecological value of the project area.

The Manawatu Gorge is located to the east of Palmerston North and forms a passage running between the Tararua Range in the north and the Ruahine Range in the south. The Gorge is unique in that it is a water gap with the Manawatu River flowing directly from the east to the west. At the western end of the gorge, the Manawatu River is joined by the Pohangina River, a wandering river (i.e. a transitional pattern between a braided river and a single-thread meandering channel). The northern and southern slopes of the gorge are covered in indigenous vegetation ranging from regenerating scrub to tawa forest. The surrounding countryside is predominantly farmland, with multiple windfarms situated along the ridges.

The Manawatu Gorge Road (State Highway 3) links the eastern and western regions of the southern North Island; however, it has been closed for much of the past ten years due to recurring rockfall. The Saddle Road to the north and the Paihiatua Track to the south have been used as alternative routes but in their current state are inadequate as permanent alternatives to the Manawatu Gorge.

Four possible options have been proposed to replace the gorge:

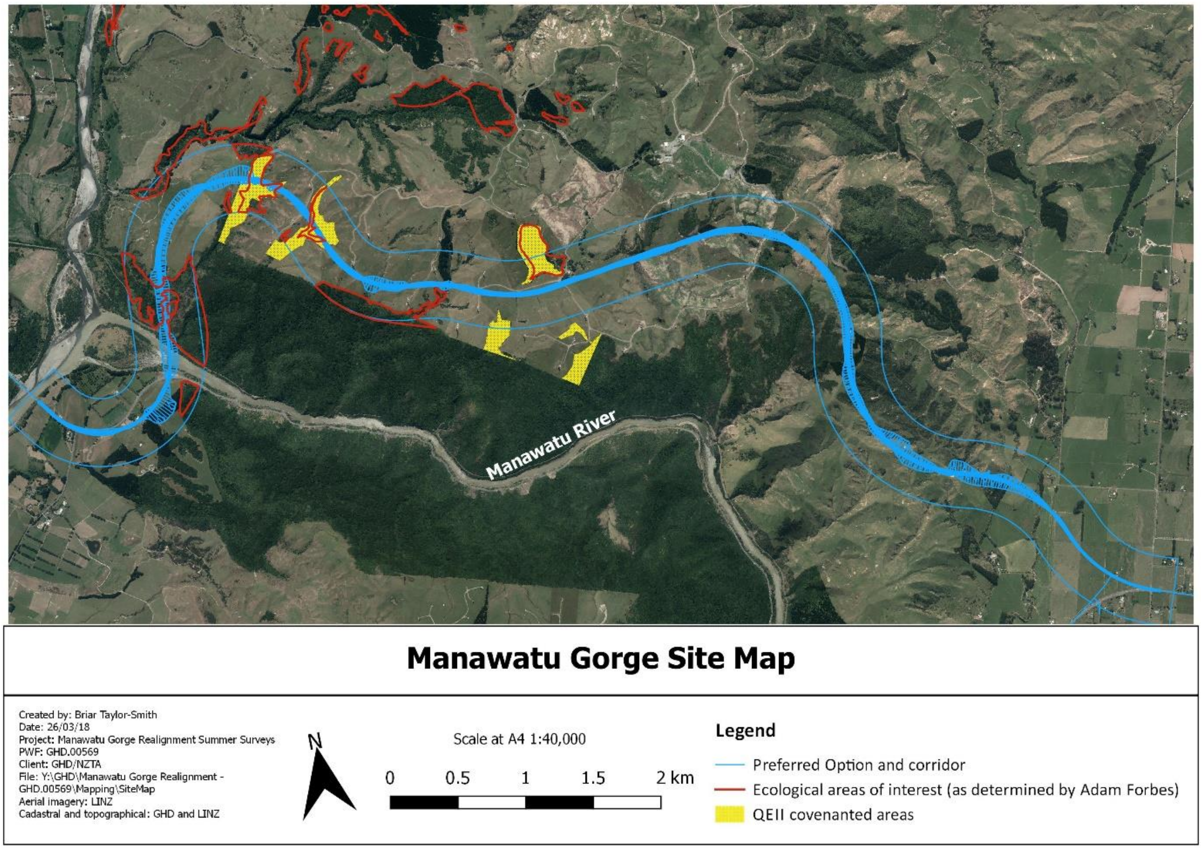
- Option 1: North of Saddle Road;
- Option 2: Saddle Road Upgrade;
- Option 3: South of Saddle Road; and
- Option 4: South of Gorge.

Currently Option 3: South of Saddle Road is the preferred option (Figure 1). The building of the new road will take 5 – 6 years to complete the 12.4 km length that will run through Te Apiti Wind Farm, farmland, and several "ecologically significant" areas. The sites of "ecological significance" include forest, treeland and wetland and were determined during an initial assessment by the ecologist, Adam Forbes, and polygons were provided to us by the client.

Bat and bird surveys were conducted from 26th February to 13th March 2018 to determine the extent and use of these habitats by birds and bats. For bats, static digital recorders were employed to detect bat activity in the form of echolocation calls during the night. For birds, 5MBCs were used in conjunctions with Automatic Recording Devices (ARDs) that recorded all sounds from before sunset until after sunrise for the duration of the period. Detectors were left on site for fourteen consecutive nights to establish presence or absence of bats and birds.

This report provides the results of bat and bird surveys undertaken within and around the proposed corridor of Option 3. The report presents methodology and results of the surveys, and recommendations for additional work to support an Assessment of Ecological Effects for the proposed road.

Figure 1. Manawatu Gorge realignment preferred option and corridor. Ecological areas of interest (as previously determined) are also highlighted.



2 Methodology

2.1 Background Literature Review

Existing information on bats and avifauna in the vicinity of the Manawatu Gorge were reviewed to inform on the potential presence, absence and distribution within the preferred corridor and potentially affected areas.

The following documents and databases were reviewed for the survey planning:

- The Ornithological Society of New Zealand (OSNZ) Atlas of Bird Distribution in New Zealand 1999–2004;
- Naturewatch;
- BioWeb; and
- Various consulting reports.

Any nationally threatened or at risk threatened species found were recorded and their threat status checked against the relevant national threatened species classification lists (O’Donnell et al., 2018; Robertson et al., 2017).

2.2 GIS Mapping

The extent of Short list Option 3 – South of Saddle Road and its 300 m corridor (provided by the client) was projected using QGIS 2.18.7. Sites of “ecological significance”, as determined during an initial assessment by ecologist Adam Forbes, were provided as a layer by the client.

2.3 Bird surveys

2.3.1 Point surveys and incidental observations

Five-minute bird counts were undertaken in accordance with the methodology described by Dawson & Bull (1975). No bird was knowingly recorded twice within the five-minute time period and no bird was assumed to be present (e.g. only the accurate number of birds heard calling or seen were recorded, not the size of the flock estimated to be present by the amount of calling heard). All incidental bird observations while on-site were recorded.

Five-minute bird count sites are shown in Figure 2. Specific locations are shown in Appendix I.

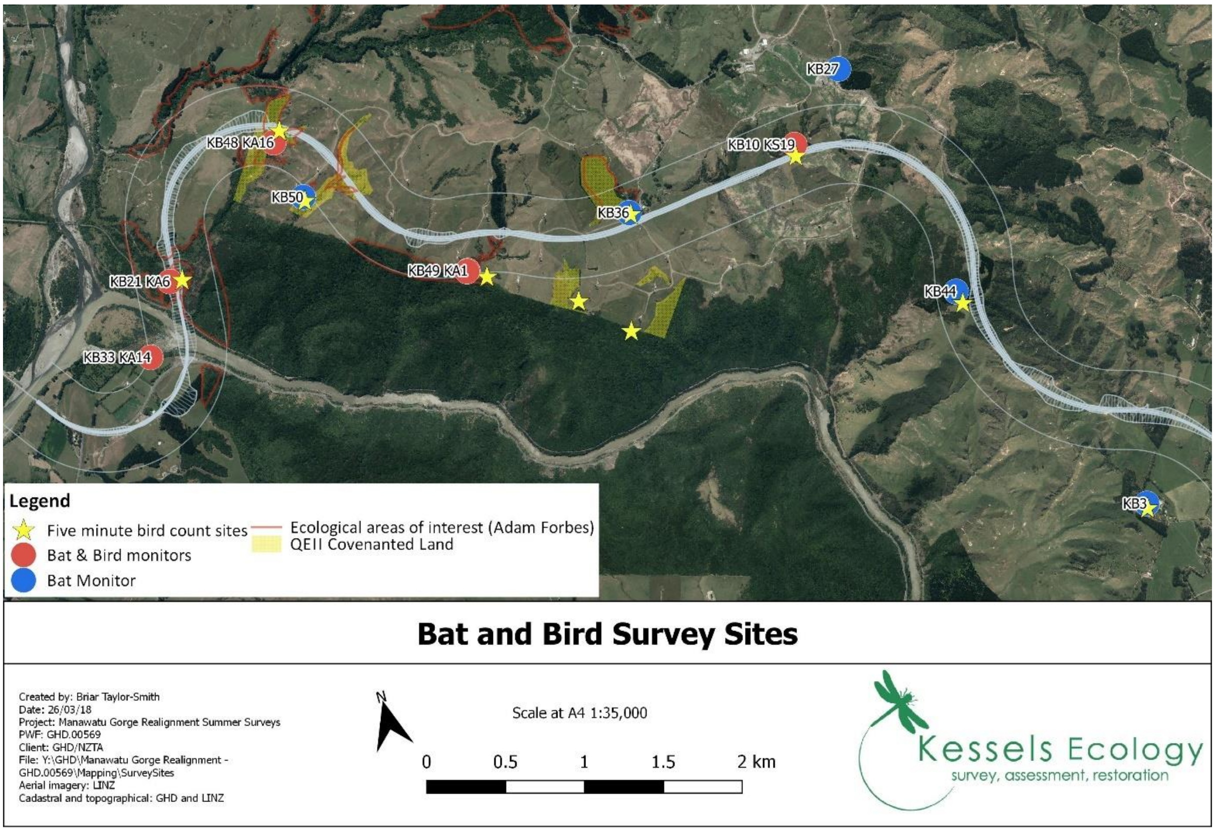


Figure 2. Five-minute bird count and acoustic recording device deployment sites throughout the Manawatu Gorge realignment Option 3 corridor.

2.3.2 Bioacoustic surveys

Bird surveys were conducted using ARDs at selected locations along the corridor. Bioacoustics are a useful method to identify vocal migratory, nocturnal or cryptic species, which require long monitoring periods to ensure detection and often migrate or move between feeding and roosting locations at night. For example, cryptic wetland species, such as spotless crake and bitterns, call very early in the morning, often well before dawn.

An array of four Department of Conservation (DOC) automated digital sound recorders (Version D.2) were deployed across the site (Figure 2, specific locations shown in Appendix I). The recorders were deployed over the length of the corridor at selected locations offering a range of bird habitats. They were pre-set on "low" (0 - 4 kHz) and set to record between the hours of 5:00 pm and 9:00 am to monitor crepuscular and nocturnal birds that could not be detected during our daytime bird surveys. One ARD was deployed on 26th February 2018. Four ARDs were deployed on 27th February. ARDs recorded from their deployment date until 9:00am on March 13th 2018 (14 – 15 nights).

The sound files were analysed using Raven Pro 1.5.0 software, developed by Cornell Lab of Ornithology Bioacoustics Research Programme. Calls were manually classified on the basis of their audible characteristics and by comparison of spectrograms.

2.4 Bat surveys

A survey to detect the presence of bats in the vicinity of the project site was conducted over 14 nights from 27th of February 2018 until 13th March 2018.

An array of ten DOC designed and built ABMs were deployed across the site from 27 February to 13 March 2017 (Figure 2, Appendix I). ABMs record anything that may be an 'echo-location call' generated by either of the two extant New Zealand bat species. ABMs were deployed in locations near water or on the edge of natural corridors where bats are likely to feed and travel (Borkin & Parsons, 2009; O'Donnell, 2000; Dekrout, 2009). The ABMs were used in accordance with protocols prescribed by Lloyd (2009) and each was set to record bat echolocation calls between the hours of 6:45 pm and 8:00 am to monitor for bats one hour either side of sunset and sunrise for the entire survey period.

The data was analysed visually using BatSearch 3.11, software that was developed to help quickly view the files and create data from them. The frequency spectrum covered ranges from 0 Hz to 88 kHz and images represent 1-6 seconds of recording. Long-tailed bat passes show up as clicks centred at about 40 KHz extending upwards, but may show spikes extending downwards when the clicks are so loud that they overwhelm the sensor and cause an artificial frequency image.

3 Results

3.1 Bird Surveys

The Atlas of bird distribution in New Zealand (1999-2004) forms a relevant set of data on the birds of the locality (Robertson et al., 2007). These records, along with additional reports and databases, provide an indication of the bird species present in a region. The literature review indicated the presence of 68 bird species within the vicinity of the Manawatu Gorge. Table 1 provides a complete list of all bird species recorded within the vicinity of the Manawatu Gorge and their conservation status (Robertson et al., 2017).

Table 1. Bird species recorded within the vicinity of the Manawatu Gorge and their conservation status (Robertson et al., 2017).

Common name	Scientific name	Threat status
New Zealand pipit	*Anthus novaeseelandiae*	Declining
Red-billed gull	*Larus novaehollandiae*	Declining
South Island pied oystercatcher	*Haematopus finschi*	Declining
Spotless crake	*Porzana tabuensis*	Declining
Whitehead	*Mohoua albicilla*	Declining
Blackbird	*Turdus merula*	Introduced
California quail	*Callipepla californica*	Introduced
Canada goose	*Branta canadensis*	Introduced
Chaffinch	*Fringilla coelebs*	Introduced
Common redpoll	*Carduelis flammea*	Introduced
Eastern rosella	*Platycercus eximius*	Introduced
Goldfinch	*Carduelis carduelis*	Introduced
Greenfinch	*Carduelis chloris*	Introduced
Greylag goose	*Anser anser*	Introduced

Hedge sparrow	*Prunella modularis*	Introduced
House sparrow	*Passer domesticus*	Introduced
Magpie	*Gymnorhina tibicen*	Introduced
Mallard	*Anas platyrhynchos*	Introduced
Mute swan	*Cygnus olor*	Introduced
Myna	*Acridotheres tristis*	Introduced
Ring-necked pheasant	*Phasianus colchicus*	Introduced
Rock pigeon	*Columba livia*	Introduced
Rook	*Corvus frugilegus*	Introduced
Skylark	*Alauda arvenis*	Introduced
Song thrush	*Turdus philomelos*	Introduced
Starling	*Sturnus vulgaris*	Introduced
Wild turkey	*Meleagris gallopavo*	Introduced
Yellow hammer	*Emberiza citrinella*	Introduced
Cattle egret	*Ardea ibis*	Migrant
Australasian bittern	*Botaurus poiciloptilus*	Nationally critical
Black-billed gull	*Larus bulleri*	Nationally critical
Grey duck	*Anas superciliosa*	Nationally critical
White heron	*Ardea modesta*	Nationally critical
Banded dotterel	*Charadrius bicinctus*	Nationally vulnerable
Caspian tern	*Hydroprogne caspia*	Nationally vulnerable
Australian coot	*Fulica atra*	Naturally uncommon
Black shag	*Phalacrocorax carbo*	Naturally uncommon
Black-fronted dotterel	*Elseyornis melanops*	Naturally uncommon
Little black shag	*Phalacrocorax sulcirostris*	Naturally uncommon
Royal spoonbill	*Platalea regia*	Naturally uncommon
Australasian shoveler	*Anas rhynchotis*	Not threatened
Bellbird	*Anthornis melanura*	Not threatened
Black swan	*Cygnus atratus*	Not threatened
Grey teal	*Anas gracilis*	Not threatened
Grey warbler	*Gerygone igata*	Not threatened
Little shag	*Phalacrocorax melanoleucos*	Not threatened
Morepork	*Ninox novaeseelandiae*	Not threatened
New Zealand fantail	*Rhipidura fuliginosa*	Not threatened
New Zealand pigeon	*Hemiphaga novaeseelandiae*	Not threatened
New Zealand scaup	*Aythya novaeseelandiae*	Not threatened
NZ Kingfisher	*Todiramphus sanctus*	Not threatened
Paradise shelduck	*Tadorna variegata*	Not threatened
Pied stilt	*Himantopus novaezelandiae*	Not threatened
Pukeko	*Porphyrio melanotus*	Not threatened
Shining cuckoo	*Chrysococcyx lucidus*	Not threatened
Silvereye	*Zosterops lateralis*	Not threatened
Southern black-backed gull	*Larus dominicanus*	Not threatened
Spur-winged plover	*Vanellus miles*	Not threatened
Swamp harrier	*Circus approximans*	Not threatened

Tomtit	*Petroica macrocephala*	Not threatened
Tui	*Prosthemadera novaeseelandiae*	Not threatened
Welcome swallow	*Hirundo neoxena*	Not threatened
White-faced heron	*Egretta novaehollandiae*	Not threatened
New Zealand dabchick	*Poliocephalus rufopectus*	Recovering
New Zealand falcon	*Falco novaeseelandiae*	Recovering
North Island kaka	*Nestor meridionalis*	Recovering
Pied shag	*Phalacrocorax varius*	Recovering
Black stilt x Pied stilt hybrid	*Himantopus himantopus x novaezelandiae*	NA (Hybrid)

3.1.1 Summary results

Thirteen five-minute bird counts were carried out at ten locations throughout the alignment (Figure 2; Appendices II, III) on February 27th and March 13th between the hours of 9:30 am and 3:20 pm. Acoustic monitoring took place in five different locations over the length of the corridor (Figure 2) and recorded for a total of 800 hours. A total of 32 species were recorded within the realignment corridor comprising seven endemic species, ten native species, and 15 introduced species (Table 2). Between sites the proportion of total indigenous species ranged from 40% (Site 4) to 83% (Site 11; Figure 3). Sixty-two percent of 5MBCs showed a greater abundance of indigenous birds than introduced birds (Figure 4).

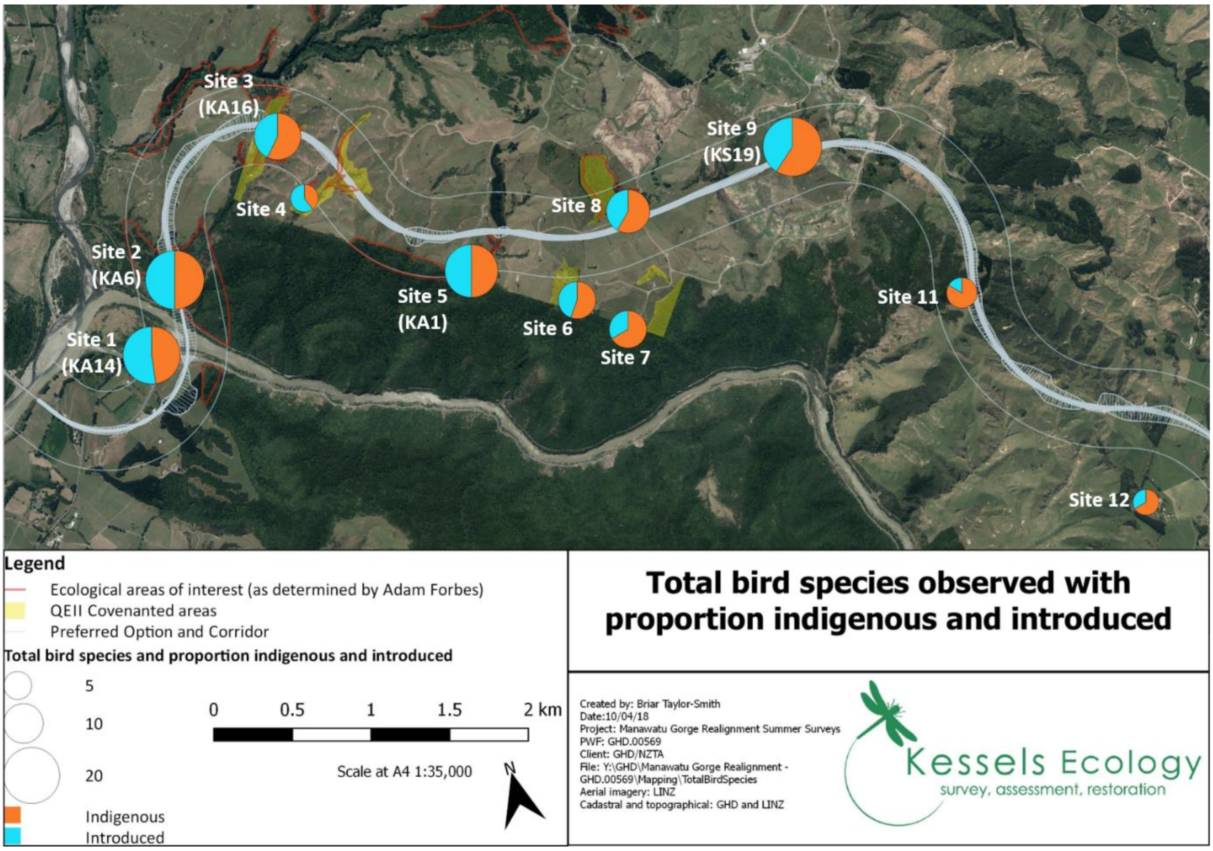


Figure 3. Bird surveys sites (numbered) showing total bird species observed and proportion indigenous and introduced. Included in these counts are birds observed during 5MBCs and acoustic recordings and incidental. Site 10 is not shown as it was a bat survey site only.

Table 2. List of bird species observed within the vicinity of the realignment, with threat status as defined by Robertson et al. (2017). Method of detection is shown in the final two columns.

Common name	Scientific name	Threat status	Acoustic Recording Device	Five-minute bird count site (Sites listed in Appendix I)
Blackbird	*Turdus merula*	Introduced	KA1, KA6, KA14, KS19	S4, S5, S7, S8, S9
Chaffinch	*Fringilla coelebs*	Introduced	KA1, KA6, KA14, KA16, KS19	S3, S5, S9
Eastern rosella	*Platycercus eximius*	Introduced	KA6, KA14, KS19	S8
Goldfinch	*Carduelis carduelis*	Introduced	KA1, KA6, KA14, KS19	S3, S4, S9, S12
Greenfinch	*Carduelis chloris*	Introduced	KA1, KA6, KA14, KS19	S5, S6, S9
Hedge sparrow	*Prunella modularis*	Introduced	KA6	No
House sparrow	*Passer domesticus*	Introduced	KA1, KA6, KA14, KA16, KS19	S2, S5, S7, S8, S9
Magpie	*Gymnorhina tibicen*	Introduced	KA1, KA6, KA14, KA16, KS19	S2, S3, S4, S6, S7, S8, S9, S11
Mallard	*Anas platyrhynchos*	Introduced	KA1, KA6, KA14, KS19	S6, S9
Myna	*Acridotheres tristis*	Introduced	KA1	No
Ring-necked pheasant	*Phasianus colchicus*	Introduced	KA6, KA14	No
Song thrush	*Turdus philomelos*	Introduced	KA6, KA14	No
Starling	*Sturnus vulgaris*	Introduced	KA1, KA6, KA14, KA16, KS19	S3
Wild turkey	*Meleagris gallopavo*	Introduced	No	Incidental - Near S3
Yellow hammer	*Emberiza citrinella*	Introduced	No	S8
Australasian shoveler	*Anas rhynchotis*	Not threatened	No	S9
Bellbird	*Anthornis melanura*	Not threatened	KA1, KA6, KA14, KA16	S2, S7
Grey teal	*Anas gracilis*	Not threatened	KA14	NA
Grey warbler	*Gerygone igata*	Not threatened	KA1, KA6, KA14, KA16, KS19	S2, S3, S5, S7, S8, S9, S11
Morepork	*Ninox novaeseelandiae*	Not threatened	KA1, KA6, KA14, KA16, KS19	No
New Zealand fantail	*Rhipidura fuliginosa*	Not threatened	KA6, KA14, KA16	S2, S3, S4, S5, S7, S8, S9, S11, S12
New Zealand pigeon	*Hemiphaga novaeseelandiae*	Not threatened	KA6	S7, S8
NZ Kingfisher	*Todiramphus sanctus*	Not threatened	KA1, KA6, KA14, KS19	No
Paradise shelduck	*Tadorna variegata*	Not threatened	No	S6, S9
Pukeko	*Porphyrio melanotus*	Not threatened	KA1, KA6, KA14	S2, S6
Silvereye	*Zosterops lateralis*	Not threatened	KA1, KA6, KA14, KA16, KS19	S3, S5, S8, S9, S11
Spur-winged plover	*Vanellus miles*	Not threatened	KA1, KA6, KA14, KA16, KS19	No
Swamp harrier	*Circus approximans*	Not threatened	KA6, KA14, KS19	S3, S6, S7, S8, S9, S11
Tui	*Prosthemadera novaeseelandiae*	Not threatened	KA1, KA6, KA14, KA16, KS19	S2, S3, S4, S5, S6, S7, S8, S12
Welcome swallow	*Hirundo neoxena*	Not threatened	No	S6, S8, S9
Southern black-backed gull	*Larus dominicanus*	Not threatened	KS19	No
New Zealand falcon	*Falco novaeseelandiae*	Recovering	No	S11

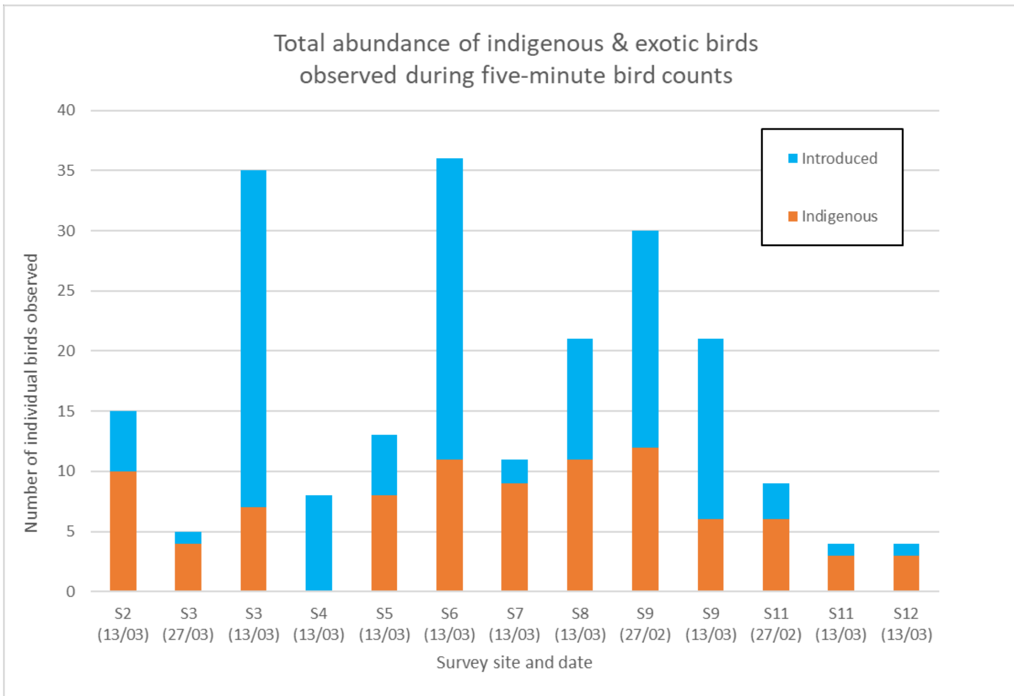


Figure 4. Total abundance of indigenous and exotic birds observed during five-minute bird counts.

The most commonly recorded species were fantails (endemic) and magpies (introduced), recorded at 10 of the 11 bird surveys sites within the alignment (Figure 5; Figure 6) . Other commonly recorded species included blackbird, goldfinch, house sparrow, grey warbler, silver eye, swamp harrier and tui. The site 2 wetland (amongst indigenous vegetation), site 6 (open pasture near forest and wetland) and site 9 (open wetland surrounded by pasture, pine forest and indigenous vegetation) recorded the highest levels of endemism with five endemic species recorded at each. The greatest numbers of native species were recorded at sites 1 (adjacent to the Manawatu River) and site 9 (wetland). The wetlands at sites 2 and 9 also had the highest species diversity with 22 species recorded. Site 1 by the Manawatu River also had high species diversity with 21 species recorded.

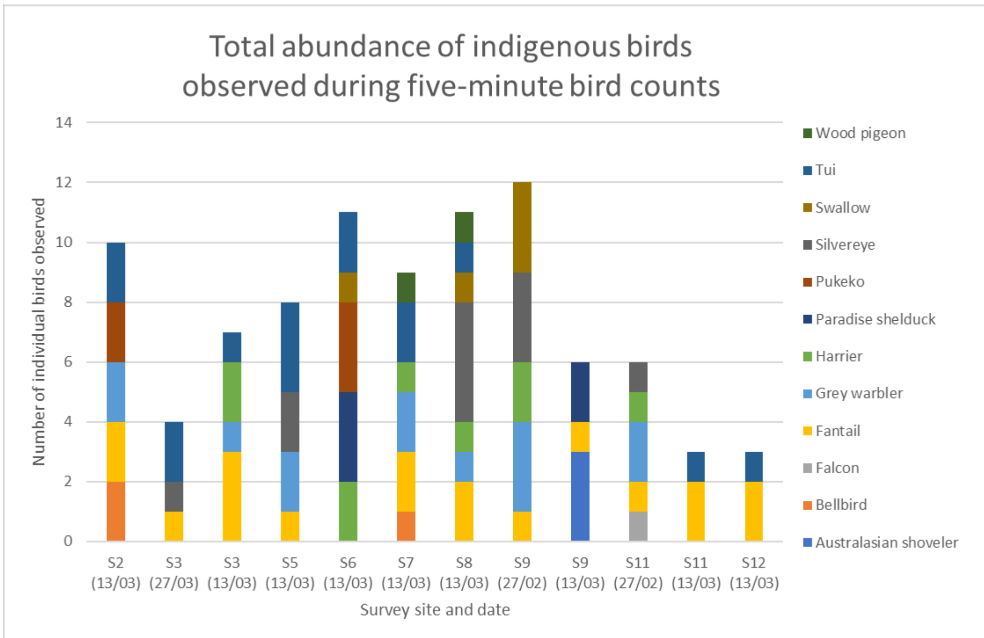


Figure 5. Total abundance of indigenous birds observed during five-minute bird counts. Note that Site 4 had no indigenous birds and is not shown.

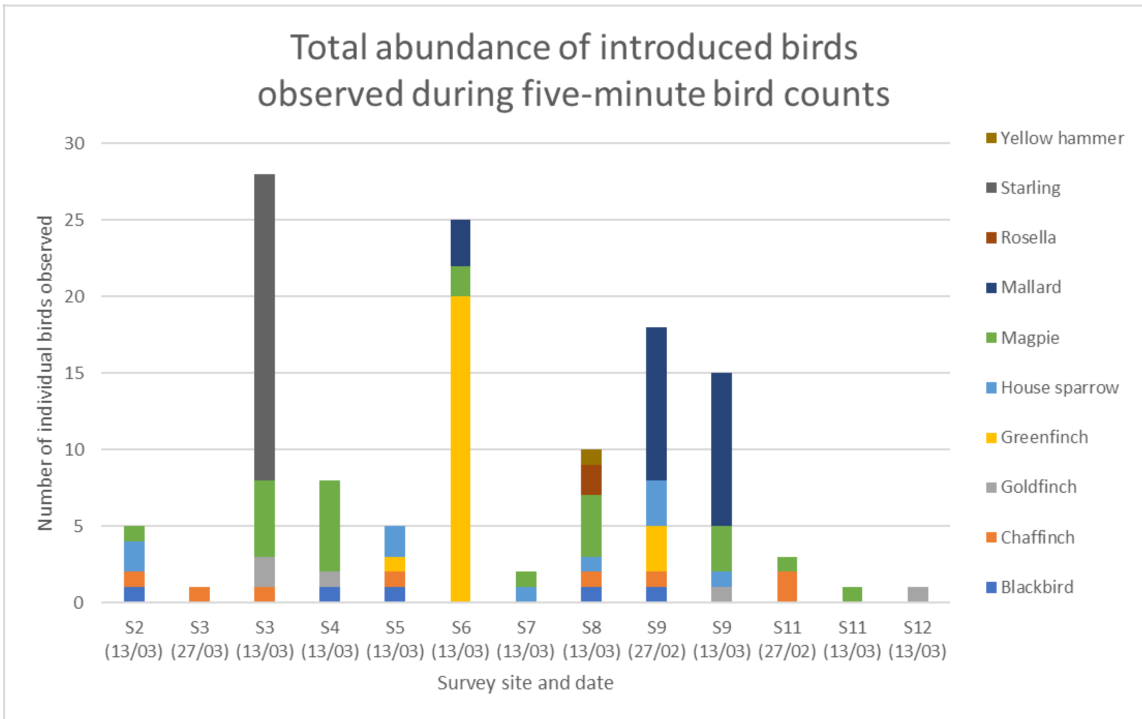


Figure 6. Total abundance of introduced birds observed during five-minute bird counts.

The greatest number of birds was recorded at site 6 (pasture overlooking wetland at the edge of indigenous vegetation), with 36 birds. The high numbers were due to the presence of a flock of greenfinches. Site 12 (indigenous and exotic vegetation near house) had the lowest abundance of birds, with four individuals recorded. The highest abundance of endemic birds was recorded at site 2 (wetland) and site 7 (tawa forest) with eight endemic birds each.

One 'At risk – recovering' species, the New Zealand falcon, was recorded flying over pasture at site 11 and has been recorded in the Ashhurst area directly to the west of the alignment (Robertson et al., 2007).

Overall, these results indicate that the habitats of greatest value to indigenous birds within the survey corridor are the wetlands, river margin, and indigenous vegetation including tawa forest and forested gullies.

3.1.2 Notable bird species

The field survey identified the presence of notable bird species in the project area (Table 3), including New Zealand falcon, New Zealand's only extant endemic raptor. NZ falcons are adapted to hunting within forests but are also found in open areas such as farmland where they hunt small birds on the wing and occasionally small mammals and insects. NZ falcons are susceptible to habitat modification and degradation, predation by introduced pests, and electrocution. Other notable species detected include five endemic but not-threatened bird species (tui, bellbird, grey warbler, NZ pigeon and fantail). Details on the distribution, behaviour, breeding and ecological significance of these species can be found in Table 3. Paradise shelduck is also a not-threatened endemic species recorded on open water at two wetland sites within the corridor. It is not considered notable as in recent decades it has undergone a dramatic increase in abundance and is now widely distributed on farmland, parks and lake shorelines throughout New Zealand (Williams 2013).

Four species were not detected during the surveys but may utilise this locality due to the available habitat. These species are North Island kaka (Recovering, endemic), which have been seen utilising the lowland forest habitats on a seasonal basis in the bush areas immediately south in the Tararua ranges (Robertson et al., 2007). Found throughout native forest, including within the Ruahine Ranges to the north, they can be regarded as vagrant visitors to this locality. Kaka travel long distances to forage and can be cryptic when alone. Spotless Crake (declining, native) are widely distributed, but patchy, throughout the North Island where they live amongst dense wetland vegetation as found at Site 2. These birds are secret and crepuscular.

The riparian margin of the Manawatu Gorge has been identified as a riparian site of significance for banded dotterel and black-fronted dotterel (Lambie 2007). Banded dotterel, an endemic and nationally vulnerable species, nest on gravel and sand on seashores, estuaries, and riverbeds, travelling to estuaries and coastal wetlands once the July to January breeding season is over. Black-fronted dotterel, a native and naturally uncommon species, is found in small numbers in the Manawatu region beside waterways and ponds; however, they are cryptic birds.

The habitats of greatest value to notable birds within the survey corridor include forested areas, wetland and riparian margins of the Manawatu River.

Table 3. Notable bird species present or with suitable habitat within the alignment corridor.

Notable species	Field survey findings	Habitat, behaviour, breeding and ecological significance
New Zealand falcon, Threatened – recovering, endemic	A single New Zealand falcon, was recorded flying over pasture at Site 11.	Is adapted to hunting within forests but also found in open areas such as farmland. Hunt small birds on the wing, but occasionally hunt small mammals and insects. Breed in spring and summer nesting in trees, rocky outcrops and on the ground. New Zealand's only extant endemic raptor.
Bellbird, not threatened, endemic	Bellbirds were recorded at six locations throughout the corridor including on farmland, in native and exotic vegetation surrounding wetlands, in gullies and within tawa forest.	Inhabits native and exotic forest, scrub, farm shelterbelts, parks and gardens. Territorial during the breeding season, but nomadic and solitary after. Mainland bellbirds lay in September-January. Important pollinator and seed disperser.
Grey warbler, not threatened, endemic	Grey warblers were recorded at eight locations within the corridor throughout all habitat types surveyed.	Prefers dense vegetation in both rural and urban areas through New Zealand. Pairs remain within their territories year-round. Breed in spring and summer.
New Zealand fantail, not threatened, endemic	Fantails were recorded at all but one bird survey site within the corridor.	Has a wide distribution and habitat preferences, including both native and exotic forest and shrubland habitats. Fantails are locally common. Breeding season is variable but tends to be long. Important seed-disperser.
New Zealand pigeon, not threatened, endemic	New Zealand pigeons were recorded at three sites within and adjacent to native vegetation within the corridor.	Widespread and locally common. Will defend food trees and can travel long distances to feed. Have been recorded breading year-round.
Tui, not threatened, endemic	Detected at nine sites within the corridor throughout all habitat types surveyed.	Widespread passerine found in forest and urban areas. Aggressive, territorial birds that often commute to good nectar sources. Tui lay in September-January. Important pollinators and seed disperser.
Banded dotterel, nationally vulnerable, endemic	Not detected during the surveys likely due to the season, but the riparian margin of the Manawatu Gorge has been identified as a riparian site of significance based on the habitat requirements of banded dotterel (Lambie 2007)	Widespread on mainland New Zealand during breeding season (July – January), where they nest gravel and sand on seashores, estuaries, and riverbeds. Inland-breeding birds travel to estuaries and coastal wetlands post-breeding.
Black fronted dotterel, naturally uncommon, native	Not detected during the surveys, but the riparian margin of the Manawatu Gorge has been identified as a riparian site of significance based on the habitat requirements of black-fronted dotterel (Lambie 2007)	Found in small numbers in the Manawatu region beside waterways and ponds. Cryptic birds seen in pairs of small flocks. Breeding season is August to March.
Spotless Crake, declining, native	Although not detected by ARDs, 'At Risk-Declining' spotless crake may be present amongst the dense wetland vegetation at Site 2.	Widely distributed, but patchy, throughout the North Island where it lives amongst dense wetland vegetation. Secret, crepuscular and territorial birds. Breeding season from August to January.
North Island kaka, recovering, endemic	Not detected during surveys but have been seen utilising the lowland forest habitats on a seasonal basis in the bush areas immediately south in the Tararua ranges (Robertson et al., 2007).	Found throughout native forest and are present in both the Tararua Ranges and Ruahine Ranges. Can be regarded as vagrant visitors to this locality from their strongholds further south. Travel long distances to forage and can be cryptic when alone. Breed in spring and summer.

3.2 Bat Surveys

Critically threatened (O'Donnell et al., 2018) long-tailed bats (*Chalinolobus tuberculatus*) have been recorded in both the Tararua Forest Park to the south (Arkins, 1999), the Ruahine Forest Park to the north (Kessels et al., 2013) and in forested areas approximately 40 km to the south-east (Shaw and van Meeuwen-Dijkgraaf, 2011). Unidentified bat species were recorded within the vicinity of the gorge prior to 1960 (Daniel and Williams, 1984). The south-eastern Tararua Ranges now contain the only known short-tailed bat population in the southern North Island (Arkins, 1999), but it is considered highly unlikely that short-tailed bats will be found in the vicinity of the proposed alignment, as the habitat is unsuitable (G Kessels, pers com).

Monitoring took place in ten different locations over the length of the corridor (Figure 2). These sites were deemed to contain suitable bat foraging, roosting or commuting habitat based on the presence of roosting trees, the degree of habitat connectivity and vicinity to water (See table in Appendix I; photos in Appendix II). Seven of the ten ABMs recorded successfully for the full fourteen nights of monitoring while three ABMs only recorded data for 8 - 12 nights, giving a total recording period of 1815 hours.

Bats are more active during calm, warm weather with low rainfall. Weather data (Table 4) was sourced from the closest weather station to the gorge which was a NIWA/AgResearch weather station in Palmerston North (-40.38195, 175.6092). Based on these conditions 11 of the 14 survey nights were optimal for bat emergence (O'Donnell, 2000): daily rainfall exceeded 2 mm in the two hours immediately after sunset on one occasion (6 March); the minimum temperature during the four hours after sunset was never below 10°C; maximum wind speed exceeded 60 km/h on two nights (8 – 9 March); and the average nightly wind speed exceeded 20 km/h on one occasion (March 8). Based on this Palmerston North derived weather data,1431 hours of recording can be deemed effective. Note however that weather within the realignment corridor is likely more extreme than weather in Palmerston North (pers obs, Appendix IV).

No bats were detected any of the locations.

Table 4. Weather data from Palmerston North. Data obtained from NIWA/AgResearch CliFlo database, station number 21963.

Date	Minimum temperature to 4 hrs after sunset (°C)	Maximum overnight wind gust (Km/hr)	Mean overnight wind speed (Km/hr)	Rainfall 2 hours after sunset (mm)
Feb-27	11.9	41.4	12.4	0.5
Feb-28	14.1	33.8	14.0	0
Mar-01	18.3	24.5	8.3	0
Mar-02	18.6	14.8	6.11	0
Mar-03	18.2	22.7	7.1	0
Mar-04	15.8	20.9	5.8	0
Mar-05	16.8	10.8	4.0	0
Mar-06	17.0	13.3	3.2	10.8
Mar-07	15.3	43.2	10.4	0.2
Mar-08	14.7	77	32.3	0.3
Mar-09	12.0	65.5	16.7	0
Mar-10	10.4	35.3	11.8	0
Mar-11	11.3	23.8	8.9	0
Mar-12	14.8	16.6	5.4	0

4 Conclusions and recommendations

Acoustic surveys and 5MBCs revealed the presence of 32 bird species within the proposed Manawatu Gorge realignment corridor, comprising seven endemic species, ten native species, and 15 introduced species. A densely vegetated wetland surrounded by indigenous vegetation and two wetlands with open water recorded the highest levels of endemism with five endemic species recorded at each. High species diversity of indigenous birds was also recorded adjacent to the Manawatu River.

The field survey identified the presence of notable bird species in the project area and included the At Risk-recovering New Zealand falcon, New Zealand's only extant endemic raptor. Other notable bird species detected include five endemic but not-threatened forest residents. Four species not detected during the surveys are considered notable due to the available habitat and/or threat status of the birds: North Island kaka; spotless crake; and two dotterel species. Kaka can be considered a vagrant species that may feed within the gorge while migrating between the ranges to the north and south. Spotless crake may be utilising the densely vegetated wetland north of the Manawatu River at the eastern end of the alignment (Site 2). Banded and black-fronted dotterel may be nesting within the riparian margin of the Manawatu River at the site where the preferred corridor crosses the river.

Overall, the results indicate that the habitats of greatest value to indigenous (and notable) birds within the survey corridor are the wetlands, riparian margins of the Manawatu River, and indigenous vegetation including tawa forest and forested gullies. Additional surveys are recommended within these habitats, in particular to detect cryptic wetland birds and dotterel species and other species that may be present (Table 2).

An array of ten ABMs were deployed across the site in areas deemed to be suitable bat roosting, feeding and/or commuting habitat. Weather data from Palmerston North, indicated that 11 of 14 nights were suitable for bat emergence; however no bats were detected. The non-detection does not necessarily equate absence and there are multiple reasons why bats may not have been detected. A likely confounding factor is that weather conditions within the gorge are likely worse than conditions in Palmerston North, and this may reduce bat emergence or deter bats from using the site. In fact no bats have been detected within the vicinity of the gorge in recent times. In the Netherlands, the number and distribution of feeding sites that provide shelter from wind are a major constraint on the density of common pipistrelles (*Pipistrellus pipistrellus*), especially in very windy locations (Verboom & Huitema 2010). If long-tailed bats are similarly affected by wind, then bat densities in very windy locations, such as the Manawatu Gorge, may be very low, if indeed they are present at all. Given that potential bat roost trees were observed (Appendix II) and that there is still a low possibility that bats may be present given the survey constraints, we recommend that additional surveys are carried out in all areas requiring pre-construction vegetation removal to provide absolute surety that this Critically Endangered species is not present and there is minimal risk of any individuals being harmed during tree felling.

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Appendix I: Survey Sites

ARD Deployment Sites

Site Code	Device	Site name and brief description	Latitude (°)	Longitude (°)
1	KA14	Shannon property. Paddock edge above river. Pasture and exotic vegetation	-40.306115	175.768159
2	KA6	Wetland amongst indigenous vegetation on Stuart Bolton's property	-40.302346	175.771628
3	KA16	Steep gully at western end of Graeme Bolton's property. Indigenous vegetation – predominantly kanuka	-40.296124	175.781181
5	KA1	Gully on Graeme Bolton's property. Indigenous veg on edge of pasture	-40.306095	175.792586
9	KS19	Pond surrounded by pasture, pine forest and indigenous vegetation on Meridian property	-40.304089	175.818191

ABM Deployment Sites

Site code	Device	Site name and brief description	Latitude (°)	Longitude (°)	Bat habitat type
1	KB33	Shannon property. Paddock edge above river. Pasture and exotic vegetation	-40.306115	175.768159	Commuting; feeding. Large trees present – potential cavities
2	KB21	Wetland amongst indigenous vegetation on Stuart Bolton's property	-40.302346	175.771628	Commuting; feeding. Large trees present – potential cavities
3	KB48	Steep gully at western end of Graeme Bolton's property. Indigenous vegetation – predominantly kanuka	-40.296124	175.781181	Commuting; feeding.
4	KB50	Gully on Graeme Bolton's property. Indigenous veg on edge of pasture	-40.299555	175.782252	Commuting; feeding.
5	KB49	Gully on Graeme Bolton's property. Indigenous veg on edge of pasture	-40.306095	175.792586	Commuting; feeding.
8	KA36	Indigenous vegetation, large pines and other exotics near old house site on Graeme Bolton's property	-40.305217	175.805450	Commuting; feeding. Large trees present – potential cavities
9	KB10	Pond surrounded by pasture, pine forest and indigenous vegetation on Meridian property	-40.304089	175.818191	Commuting; feeding. Large trees present – potential cavities
10	KB27	Pine forest east of Saddle Road with indigenous scrub understory on edge of pasture	-40.300399	175.823318	Commuting; feeding. Large trees present – potential cavities

11	KB44	Pine forest and scrub at top of Andrew Bolton's Property	-40.314359	175.827496	Commuting; feeding.
12	KB3	Indigenous and exotic vegetation with some large trees near house on Andrew Bolton's Property	-40.314359	175.827496	Commuting; feeding. Large trees present – potential cavities

Five-Minute Bird Count Sites

Site Code	Site name and brief description	Latitude (°)	Longitude (°)
2	Wetland amongst indigenous vegetation on Stuart Bolton's property	-40.302346	175.771628
3	Steep gully at western end of Graeme Bolton's property. Indigenous vegetation – predominantly manuka/kanuka	-40.296124	175.781181
4	Gully on Graeme Bolton's property. Indigenous veg on edge of pasture	-40.299555	175.782252
5	Gully on Graeme Bolton's property. Indigenous veg on edge of pasture	-40.306095	175.792586
6	Pasture overlooking wetland on Graeme Bolton's property at the edge of indigenous vegetation	-40.309206	175.800160
7	Old tawa forest below Graeme Bolton's property	-40.311866	175.803808
8	Indigenous vegetation, large pines and other exotics near old house site on Graeme Bolton's property	-40.305217	175.805450
9	Pond surrounded by pasture, pine forest and indigenous vegetation on Meridian property	-40.304089	175.818191
11	Pine forest and scrub at top of Andrew Bolton's Property	-40.314359	175.827496
12	Indigenous and exotic vegetation with some large trees near house on Andrew Bolton's Property	-40.314359	175.827496

Appendix II: Site Photos

See Appendix I for location coordinates and property owners.

Site 1: Looking north from paddock edge above river. Pasture and exotic vegetation

Site 2: Wetland north of river

Facing west

Facing east

Facing south.

Farmland east of wetland

Site 3: On cliff edge in steep gully.

Looking south from above site 3 towards sites 1 and 2.

ARD deployed in steep gully.

Site 4: Indigenous vegetation on pasture edge

Site 5: Gully with indigenous vegetation on edge of pasture

Site 6: Pasture overlooking wetland at the edge of indigenous vegetation

Site 7: Old tawa forest

Facing south

Trees with potential bat roost cavities within the tawa forest

Site 8: Indigenous vegetation, large pines and other exotics

Site 9: Water body surrounded by indigenous vegetation, pine forest and pasture.

Site 10: Pine forest on edge of Saddle Road with indigenous scrub understory

Site 11: Pine forest and scrub at the head of a gully leading to the gorge

Site 12: Indigenous and exotic vegetation with some large trees

Appendix III: Five Minute Bird Count Data Sheets

Observer: Andree Hickey-Elliott, Briar Taylor-Smith

General location	Site no.	GPS	GPS	Date	Start time	Species	Seen	Heard	Temperature	Wind	Other noise	Sun (minutes)	Precipation value
Wetland amongst indigenous vegetation on Meridian Property	S9	-40.304089	175.818191	27/02/2018	10:28 AM	Swallow	1	2	mild, 11-15°C	Leaves and branches in constant motion (Beaufort 3+4)	Moderate	0	0
						Sparrow	2	1					
						Greenfinch	1	2					
						Fantail		1					
						Grey warbler		3					
						Mallard	10						
						Harrier	2						
						Blackbird		1					
						Silver eye		3					
						Chaffinch		1					
Steep gully at western end of Graeme Bolton's property. Indigenous vegetation – predominantly kanuka	S3	-40.2961240	175.781181	27/02/2018	12:30 PM	Finch		1	warm, 16-22°C	Leaves and branches in constant motion (Beaufort 3+4)	moderate	5	0
						Silver eye		1					
						Tui	1	1					
						Fantail	1						
Pine forest and scrub at top of Andrew Bolton's Property	S11	-40.3143590	175.827496	27/02/2018	2:45 PM	Fantail	1		warm, 16-22°C	Leaves rustle (Beaufort 2)	Not important	0	0
						Silver eye	1						
						Grey warbler	2						
						Finch		2					
						Magpie		1					
						Harrier	1						
						Falcon	1						
Wetland amongst indigenous vegetation on	S9	-40.304089	175.818191	13/03/2018	9:30 AM	Paradise shelduck	2		mild, 11-15°C	Branches or trees sway (Beaufort 5-7)	Moderate	0	0
						Sparrow	1						
						Magpie		3					

Meridian Property						Fantail		1					
						Australasian shoveler	3						
						Mallard	10						
						Goldfinch	1						
Indigenous vegetation, large pines and other exotics near old house site on Graeme Bolton's property	S8	-40.305217	175.80545	13/03/2018	10:10	Fantail		2	Mild, 11-15°C	Branches or trees sway (Beaufort 5-7)	Loud	0	0
						Silvereye		4					
						Magpie		4					
						Swallow	1						
						Rosella	2						
						Tui	1						
						Finch	1						
						Sparrow		1					
						Grey warbler		1					
						Blackbird		1					
						Harrier	1						
						Wood pigeon	1						
						Yellowhammer	1						
Pasture overlooking wetland on Graeme Bolton's property at the edge of indigenous vegetation	S6	-40.309206	175.80016	13/03/2018	10:30	Magpie	2		Cool, 6-10°C	Branches or trees sway (Beaufort 5-7)	Moderate	0	0
						Swallow	1						
						tui		2					
						harrier	2						
						Greenfinch	20* estimate						
						Pukeko	3						
						Mallard	2	1					
						Paradise shelduck	3						
Old tawa forest below Graeme Bolton's property	S7	-40.311866	175.803808	13/03/2018	10:50	Fantail		2	Cool, 6-10°C	Branches or trees sway	Loud	0	0
						Magpie	1						
						tui		2					

						Sparrow	1			(Beaufort 5-7)			
						Grey warbler		2					
						Harrier	1						
						Wood pigeon	1						
						Bellbird		1					
Gully on Graeme Bolton's property. Indigenous veg on edge of pasture	S5	-40.306095	175.792586	13/03/2018	11:20	Fantail		1	Mild, 11-15°C	Branches or trees sway (Beaufort 5-7)	Loud	0	0
						Silvereye		2					
						Tui		3					
						Chaffinch		1					
						Sparrow		2					
						Grey warbler		2					
						Blackbird		1					
						Greenfinch		1					
Steep gully at western end of Graeme Bolton's property. Indigenous vegetation – predominantly kanuka	S3	- 40.2961240	175.781181	13/03/2018	12:30	Fantail	1	2	Mild, 11-15°C	Branches or trees sway (Beaufort 5-7)	Loud	0	0
						Magpie		5					
						Tui		1					
						Goldfinch		2					
						Chaffinch		1					
						Greywarbler		1					
						Harrier		2					
						Starling	20* estimat e						
Gully on Graeme Bolton's property. Indigenous veg on edge of pasture	S4	-40.299555	175.782252	13/03/2018	13:10	Goldfinch	1		Mild, 11-15°C	Branches or trees sway (Beaufort 5-7)	Loud	0	0
						Magpie	5	1					
						Blackbird	1						
Wetland amongst indigenous vegetation on	S2	-40.304572	175.818547	13/03/2018	14:40	Magpie		1	Mild, 11-15°C	Leaves and branches in	Moderate	0	0
						Tui		2					
						Pukeko		2					

Stuart Bolton's property						Fantail	1	1		constant motion (Beaufort 3+4)			
						Grey warbler		2					
						Blackbird		1					
						Sparrow		2					
						Chaffinch	1						
						Bellbird	1	1					
Indigenous and exotic vegetation with some large trees near house on Andrew Bolton's Property	S12	-40.314359	175.827496	13/03/2018	15:20	Goldfinch		1	Mild, 11-15°C	Leaves and branches in constant motion (Beaufort 3+4)	Not important	0	0
						Tui		1					
						Fantail	2						
Pine forest and scrub at top of Andrew Bolton's Property	S11	- 40.3143590	175.827496	13/03/2018	15:20	Magpie		1	Mild, 11-15°C	Leaves and branches in constant motion (Beaufort 3+4)	Not important	0	0
						Tui		1					
						Fantail	1	1					

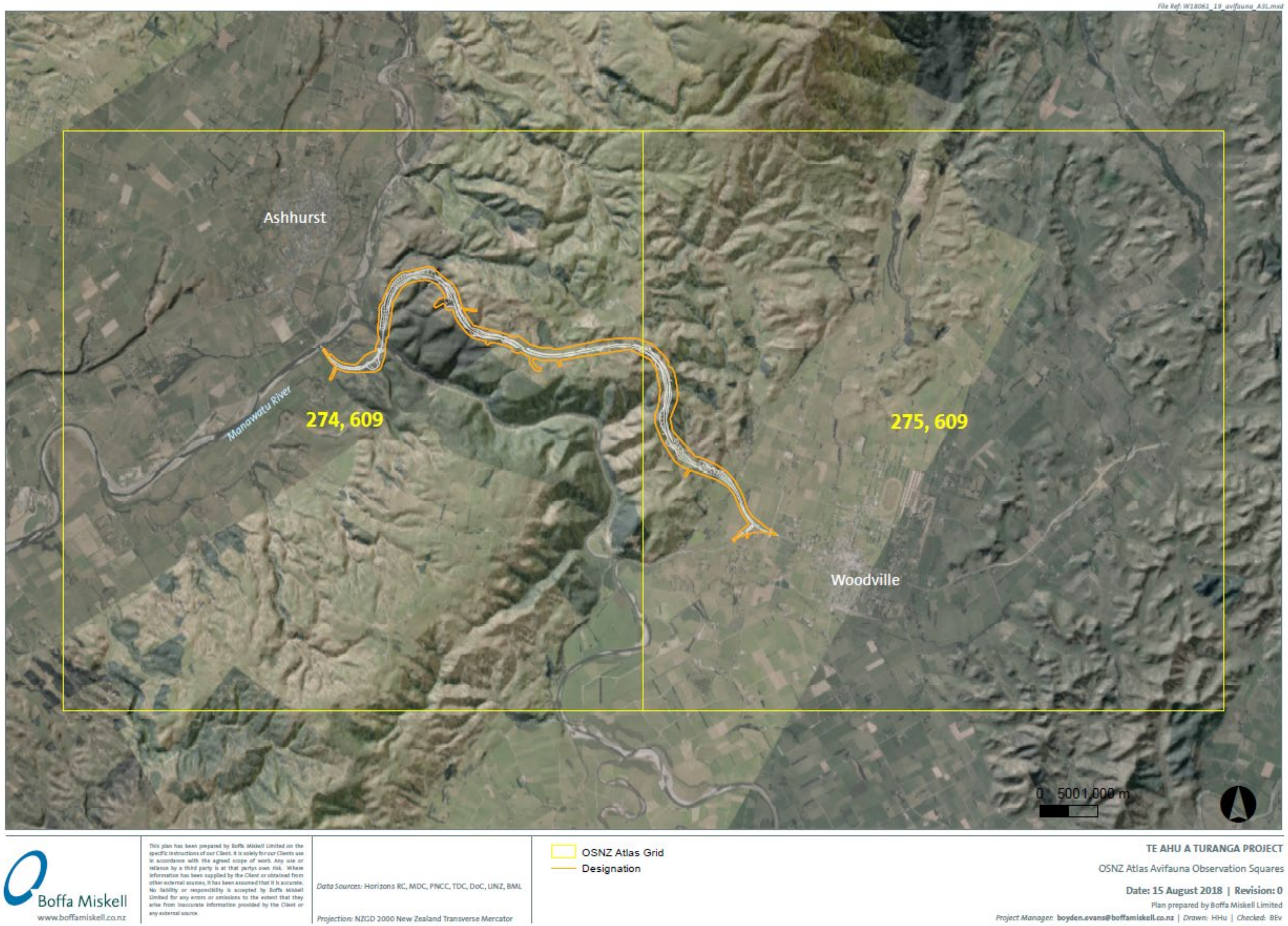
Appendix IV: Rainfall – 24 hrs (mm)

Rainfall in Palmerston North compared to rainfall within the realignment corridor

Date	Total rainfall – 24 hours (mm)	
	NIWA/AgResearch weather station in Palmerston North	Ballantrae Farm within the realignment corridor
Feb-27	12.4	27
Feb-28	1.8	0
Mar-01	0	0
Mar-02	0	0
Mar-03	0	0
Mar-04	0	0
Mar-05	0	0
Mar-06	0.4	1.5
Mar-07	20.4	40
Mar-08	10.2	25
Mar-09	6.4	39
Mar-10	0	0
Mar-11	0	0
Mar-12	0	0

6.B.3
OSNZ BIRD ATLAS SQUARES THAT ENCOMPASS THE DESIGNATION CORRIDOR

Appendix 6.B.3: OSNZ Bird Atlas Squares that Encompass the Designation Corridor (Robertson et al, 2007)



6.B.4
PROJECT TE ĀPITI SADDLE ROAD, MANAWATŪ- ECOLOGICAL ASSESSMENT - BOFFA MISKELL LTD 2003

Appendix 6.B.4: Project Te Apiti Saddle Road, Manawatū – ecological assessment – Boffa Miskell Limited 2003

PROJECT TE ĀPITI SADDLE ROAD, MANAWATU

ECOLOGICAL ASSESSMENT

BOFFA MISKELL LIMITED

Meridian Energy

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planning • design • ecology

Project Te Apiti
Saddle Road, Tararua

Assessment Of Ecological Effects

Prepared for

Meridian Energy

By

Boffa Miskell Limited

June 2003

BOFFA MISKELL
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Meridian Energy

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1 EXECUTIVE SUMMARY

Introduction

Meridian Energy proposes to construct and operate a wind farm on the high terraces to the north of Manawatu gorge. This is an assessment of the potential ecological effects of this proposal. The assessment includes a literature review, interviews with local experts, and site visits by a suitably qualified ecologist.

This report describes significant ecological features in and around the proposed wind farm, assesses the conservation significance of these features, identifies potential environmental effects due to the proposal, and suggests ways in which potential effects can be avoided, remedied and/or mitigated.

The Te Apiti Wind Farm Site

The proposal is on private land that is largely in pasture but also includes small areas of exotic woodlots. It contains one area of significant vegetation a QEII covenant.

The site lies between two significant conservation areas, the Ruahine Forest Park to the north and the Manawatu Gorge Scenic Reserve to the south. These protected natural areas contain species of wildlife that have the potential to interact with the windfarm. The site lies within the Manawatu River watershed, a river with significant ecological values.

Results

No areas of significant vegetation or habitats will be affected by the construction of the windfarm.

The specifics of the site combined with the proposed design and layout of the wind farm give this proposal a range of attributes that make it a low risk for bird strike. In our view, there is a minimal and acceptable risk of interactions between the windfarm and any indigenous wildlife species that are endangered, vulnerable, or in serious decline.

It is unlikely that the wind farm will act as a barrier for movement of birdlife between the Manawatu Gorge Scenic reserve to the south and the Ruahine Forest Park to the north. Within the site, most natural vegetation has been cleared. The best forest corridors in the area are found in deep gullies to the west of the site and these will not be affected by the wind farm proposal.

Sediment movement from areas of excavation has the potential to impact on local streams and rivers. The measures for erosion and sediment control, which are detailed in the Opus Consultants construction report, are appropriate to manage this risk.

Conclusion

The results show that the proposed Te Apiti windfarm is ideally sited to avoid or reduce effects such as vegetation loss and habitat impacts. The specifics of the site ensure that critical wildlife are unlikely to interact with the wind turbines, and the proposed layout and design of the wind farm complies with international guidelines for minimising effects on wildlife generally. The adverse ecological effects of the proposed wind farm on the local ecology will therefore be minor. A number of recommendations are made which will assist in the avoidance, remedy or mitigation of potential effects.

2 INTRODUCTION

2.1 LOCATION AND GENERAL DESCRIPTION

Meridian Energy is seeking to develop a wind farm (55 turbines) on a number of properties in the Tararua District, which is generally known as the Te Apiti wind farm.

The proposal is on private land that is largely in pasture but also includes small areas of forestry. The site lies between three significant conservation areas, the Ruahine Forest Park to the north and the Tararua Forest Park and Manawatu Gorge Scenic Reserve to the south.

2.2 THIS ASSESSMENT

This report comprises an assessment of the ecological effects of this proposal with particular regard to the ecological matters identified in Parts 6 & 7 of the Act:

- Matters of national importance, specifically: - the protection of areas of **significant indigenous vegetation** and **significant habitats of indigenous fauna**;
- Other matters, specifically: - **intrinsic values** of ecosystems, maintenance and enhancement of the **quality of the environment**, any **finite characteristics** of natural and physical resources, the protection of the habitat of **trout and salmon**.

This assessment looks broadly at the range of potential direct and indirect effects, which could occur because of the construction and operation of this wind farm.

Direct effects relate to actual loss of habitat because of construction of the turbines and associated works (roads, cut and fill) and to the possible death of native bird species through collisions with the turbines or their blades. Indirect effects relate to downstream issues such as sediment movement and the potential for displacement of bird species by the windfarm.

2.3 OBJECTIVES

The objectives of this assessment are:

1) Describe the ecological features in and adjacent to the site.
2) Assess the conservation value of these features.
3) Describe the characteristics of the construction and operation of the wind farm including discharges, hazardous substances and installations.
4) Identify actual or potential effects on the ecological environment, plants, animals or habitats.
5) If potential adverse effects are identified, recommend ways such effects can be avoided, remedied or mitigated.
6) Determine whether ongoing monitoring is required.

2.4 METHODOLOGY

The methodology used to achieve these objectives was:

- A review of international and national literature on wind farms and their effects.
- A review of available information on the biology of the site, its flora and fauna, and of the adjacent ecological districts (literature review and consultation – local knowledge).
- Interviews with local specialists.
- A qualitative survey of vegetation, habitats and fauna (vertebrate spp only).
- An assessment of the conservation significance of the study area.
- An assessment of the potential negative and positive effects of the proposal
- An assessment of possible measures to avoid, remedy, or mitigate potential adverse effects of the proposal.

Information on landforms, soils and erosion was derived from the New Zealand Land Use Resource Inventory (NZLRI). Vegetation was mapped based on field observation and the use of stereo-photography (NZ Aerial Mapping Limited Flight Run TL 116 / 062-064). Other information on the site was derived from 1:50,000 scale topographical maps (NZMS T24 and T23).

A species list of birds found in the Manawatu and their national status was derived from the Department of Conservation (DoC) national database (Doc 2001). Their regional status was derived from the Conservation Management Strategy for the Wanganui Conservancy (DoC 1995).

Details on the scale of works, quantities of fill and areas of works were provided by OPUS International Consulting.

The site was visited on 18 March and 29 April. All turbine sites and all proposed deposit sites were visited or viewed during these visits. Habitat, topography, vegetation and birdlife were observed.

The site visits were not intended to be quantitative surveys but were used to verify reference information and personal communications obtained from local specialists, and to gain an understanding of the habitat and topography of the site and of habitats immediately adjacent to it. From this work, all key habitats were identified and a list of bird species known to be present was compiled, together with a list of species likely to occur as vagrants. The use of the site by these species was determined, and the potential risks assessed.

The site visits were also used to understand better the scope of the project, discuss issues between the various disciplines (ecology, landscape, engineering, property), and where possible identify issues early in the design process so that potential effects could be avoided.

0 20 km

Location of Project Te Apiti

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Reference:
W02020-2 Report Figures v1.pmd

PROJECT TE ĀPITI
Location Map and Sub-Regional Context

Meridian Energy

FIGURE 1

3 CONSULTATION

Consultation was conducted with a range of people with specialist knowledge of the area under consideration.

Initially a few key organisations were contacted (Department of Conservation, Horizons, Fish and Game, QEII, Massey University) for information on protected natural areas, wildlife and vegetation in and around the wind farm site.

Once the site had been visited, a draft ecological assessment was produced and its preliminary findings were presented to a wider audience including conservation NGO's, and interested individuals. This was done at a workshop held on 22 May 2003.

Feedback was received from this workshop and the report amended to address issues raised or include new information that had been volunteered.

The following table lists those agencies that assisted with the initial assessment and/or attended the workshop.

Table 3.1. Organisations Involved in Consultation

- Department of Conservation
- Horizons Manawatu
- Palmerston North City Council
- QEII national Trust
- Manawatu & Hawkes Bay Branch of the Ornithological Society of NZ
- Manawatu Branch of the Royal Forest & Bird Protection Society
- New Zealand Fish & Game Council
- Local Landowners
- Environment Network Manawatu
- EarthPlan Consultants
- Rangitaane O Manawatu

4 RELEVANT PLANNING & POLICY

4.1 CONSERVATION MANAGEMENT STRATEGY (CMS)

The wind farm site lies across two Department of Conservation conservancies (Hawkes Bay - *Hill Country/Ruahine Ranges* & Wanganui - *Manawatu Gorge/Pohangina River*). The conservancy boundary closely follows Saddle Road, effectively splitting the wind farm site into two. The Palmerston North Area Manager noted that the Wanganui Office would handle the application for both Conservancies.

Due to this conservancy boundary the windfarm site falls under two separate Conservation Management Strategies, the Wanganui Conservancy CMS 1997-2007, and the Hawke's Bay Conservancy CMS 1994-2004.

The Wanganui CMS contains the following policy (page 324 Power Generation).

24.9.3 Implementation

(i) The Department will advocate through statutory and non-statutory processes, the protection of land and water with high natural, historic or recreation value from power generation developments by ensuring that any adverse effects on those values are avoided, remedied or mitigated.

(ii) The Department will seek conditions on any power generation proposal to protect natural, historic and recreation values or alternatively may consider the potential for achieving conservation benefits through compensation or other means as agreed between the parties.

4.2 PROTECTED NATURAL AREA PROGRAMME (PNAP)

The PNAP aims to establish a network of reserves and other protected natural areas, which are representative of the full range of New Zealand's natural diversity. Ecological districts are surveyed and areas identified which best represent the diversity of their natural features. These are termed Recommended Areas for Protection (RAP's).

A PNAP survey has only been conducted for the Wairarapa Plains Ecological District. The Ruahine Ranges and Manawatu Gorge area have not been surveyed and contain no areas recommended for protection.

4.3 MANAGEMENT PLANS

A draft management plan was prepare for the Manawatu Gorge Scenic Reserve in 1985 but was never formally approved. Its role was largely taken over by the Wanganui Conservancy CMS.

5 PHYSICAL ENVIRONMENT

5.1 GENERAL DESCRIPTION

This proposed wind farm site is on a landform known as the Manawatu Saddle. It is a moderately rolling landform ranging from 250 metres to 400 metres above sea level. The saddle lies between the Ruahine Ranges to the North and Tararua Ranges to the south.

5.2 TOPOGRAPHY

The wind farm site is generally contained in a triangular shaped terrace of rolling to moderately steep land, which is surrounded by steep to very steep slopes descending to the river plains to the west, south and east. To the north, the land rises to Wharite Peak and onward to the Ruahine Ranges.

The site is underlain by sedimentary "soft rock" units (sandstones, siltstones and conglomerates), which are easily eroded forming deeply incised gullies and gorges. They lie over stronger greywacke. The following description of topography and landform is derived from the New Zealand Land Resource Inventory (Fletcher 1987).

To the south, the site drops steeply into the Manawatu gorge (Unit 8e5, 8e4 and 7e10). To the northwest are moderately steep to strongly rolling hills of sandstone and mudstone (units 6e12, 6e3 & 6e2) that are deeply incised to the north by heavily eroded river valleys (7e3). To the east and northeast, the pattern is repeated with rolling hills (6e3 & 6e2) deeply incised by eroded river valleys (7e10 and 7e2).

Table 5.1. Land Form Descriptions

UNIT	Unit Description
8e5	Long, very steep greywacke mountain slopes with a thin mantle of Tephra. Slight to very severe wind and sheet and slight to moderate soil slip, debris avalanche and scree creep erosion (*North slope of Manawatu Gorge with forest cleared).*
8e4	Long very steep forested mountain slopes with slight to moderate debris avalanche, soil slip and scree creep erosion *(North slopes of Manawatu Gorge still in forest)*
7e10	Steep and very steep slopes with shallow, strongly leached soils developed on greywacke in the Ruahine Ranges. There is potential for severe soil slip, debris avalanche, sheet, and scree erosion *(Shoulder slopes immediately above Manawatu Gorge, and valley systems to the northeast).*
7e3	Steep to very steep hills of moderately consolidated sandstone. There is potential for severe soil slip and moderate sheet erosion *(Deeply incised gullies to the northwest)*.
7e1 & 7e2	Steep to very steep hills with fertile soils developed on massive and jointed mudstone. Potential for severe soil slip and moderate earth flow, gully and sheet erosion *(Deeply incised gullies to the east).*
6e12	Moderately steep, to steep hills on unconsolidated and moderately consolidated sandstone mantled with loess in some areas. Potential for moderate soil slip, sheet and tunnel gully erosion *(Hill country to the north and northwest descending toward Ashhurst and the Pohangina River).*
6e3	Strongly rolling to moderately steep hills with soils developed on mudstone or andesitic Tephra on mudstone. There is potential for moderate earthflow and soil slip erosion (Hill country through the centre of the site).

6e2	Strongly rolling to moderately steep short hill slopes and terrace scarps with yellow brown earths developed on loess. Potential for slight sheet and moderate soil slip erosion *(Hill country to the east of the site descending toward Woodville).*
3w2	Flat, narrow, alluvial valley floors subject to runoff from adjacent slopes. Alluvial soils *(A narrow section running through the centre of the site).*

5.3 WATERBODIES

The great majority of the proposed site lies within the Manawatu River catchment, some areas drain directly into the Manawatu Gorge, others drain east into smaller unnamed tributaries.

The Pohangina River drains the western Rauhines, including the western margins of the Saddle Road area, before joining the Manawatu River a short distance from the mouth of the Manawatu Gorge. A small number of turbines lie along the ridgeline separating the Pohangina watershed from the Manawatu.

As the proposed windfarm lies on a high terrace there are no significant waterbodies present. Small farm ponds and dams are present throughout the area. A few gullies with impeded drainage have formed small heavily vegetated wetland areas. The majority of water movement across the site is however in small farm streams which appear to be seasonally dry.

5.4 SUMMARY

- The site is located on young sedimentary rocks. Without appropriate control measures there is potential for erosion and sediment movement from the site.
- There are no large waterbodies, lakes, streams or rivers within the site, although the site drains into two large rivers - the Pohangina to the west, and the Manawatu to the east and south.

6 ECOLOGICAL ENVIRONMENT

6.1 PROTECTED NATURAL AREAS

The proposed windfarm lies between several significant protected natural areas.

Reserves

The only scenic reserve in near proximity to the wind farm site is the Manawatu Gorge Scenic Reserve. Most of this reserve lies on the south side of the Manawatu River. A small triangular portion lies on the northwest side of the gorge. At its closest point, it is some 200 metres from turbine A13.

The Manawatu Gorge Management Plan identifies a few notable species that contribute to the scientific value of the area. They include the rare fern *Adiantum formosum,* large totara, and the unusual combination of lowland forest species and montane forest species, e.g. *Rytidosperma buchananii* combined with ngaio and nikau.

The only notable fauna listed in this plan was a rare species of ground beetle.

Railway Land

The majority of the large forest remnant on the northern slopes of the Manawatu Gorge and immediately to the south of the windfarm is land owned by TranzRail. It is, however, managed by the Department of Conservation for its conservation values.

Forest Parks

The wind farm site lies between two significant forest parks. The Ruahine Forest Park is 1.6 kilometres to the north of the northern most turbines. The Tararua Forest Park lies approximately 13 kilometres to the south of the southern most turbines

Covenants

A single QEII Covenant lies in the southern portion of the wind farm site at grid reference NZMS 260 T24 483-965. The closest turbine to it is A04, which lies on the ridge immediately above it to the North metres to the southeast.

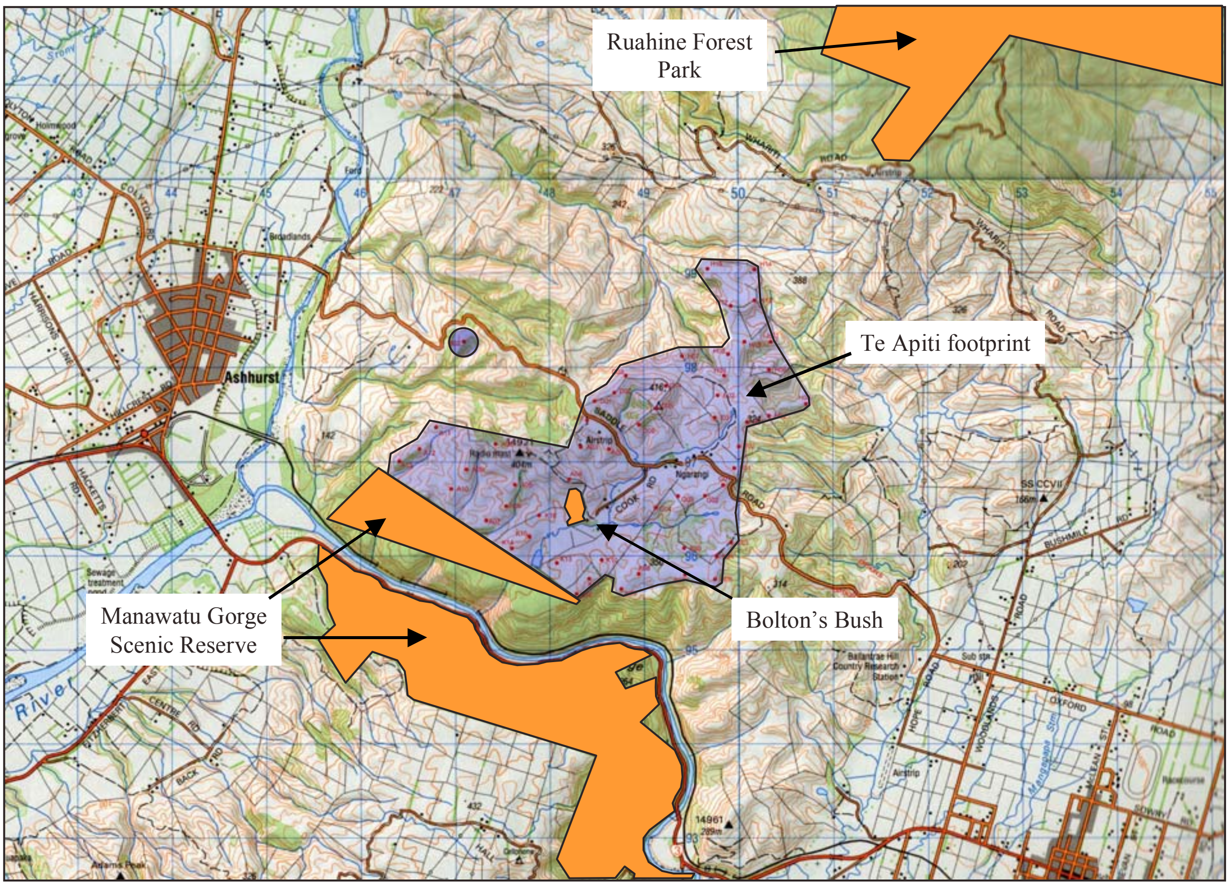
This site is commonly referred to as Bolton Bush. It is 7.3 ha in size and has a rating of 2, which suggests that it has regionally representative forest that is well looked after and in good condition.

The covenanted land contains vegetation similar to that of Manawatu Gorge Scenic reserve.

6.2 VEGETATION

The vegetation of the site is shown in Figure 3 on the following pages. It is dominated by improved pasture with a number of native forest remnants in deep gullies, particularly in moister soils to the west of the site.

These forest remnants have a similar composition to the Manawatu Gorge Scenic reserve, forests dominated by tawa and rewarewa up to 30 metres tall with occasional



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Reference:
W02020-2 A4 Ecology Report Figs 245.pmd

PROJECT TE ĀPITI
Protected Natural Areas

Meridian Energy

FIGURE 2

tall podocarps such as totara and rimu. They have a sub canopy dominated by mahoe, pigeonwood, lacebark, lemonwood, supplejack and hinau.

These forest remnants are typically unfenced and farm stock has free access to their interiors. Despite this, the high diversity of canopy species provides potential for rapid recovery if stock were removed. The forest remnants, particularly on the western side of the site are also likely to provide important seasonal habitat for birds such as tui, bellbird, and kereru.

In addition to these forest remnants, many farm gullies contain small patches of young regenerating native treeland typically dominated by mahoe, kanuka, putaputaweta, and cabbage tree over toetoe, Carex and Juncus species, and rank pasture grasses.

On the drier eastern side of the range, almost no forest remnants occur but there is abundant regeneration of kanuka, gorse and broom on dry slopes, and mahoe and mamaku in gullies. Kanuka is, however, typically viewed as a weed by farmers and is usually controlled to maintain pasture. In the time between site-visits in mid March and late April large areas of this kanuka-dominated scrub had been killed by aerial spraying.

Pine is common on site, both as numerous shelterbelts and as small plantations.

There are a number of small farm ponds and some small wetland areas in the southeast of the site where the rolling topography and loess derived soils lend themselves to impeded drainage and wetland formation. They contain small artificial lakes including areas of rush and reed beds. These will provide important habitat for pukeko and other marsh and wetland species. Maemae's are present at most of these ponds.

6.3 WILDLIFE

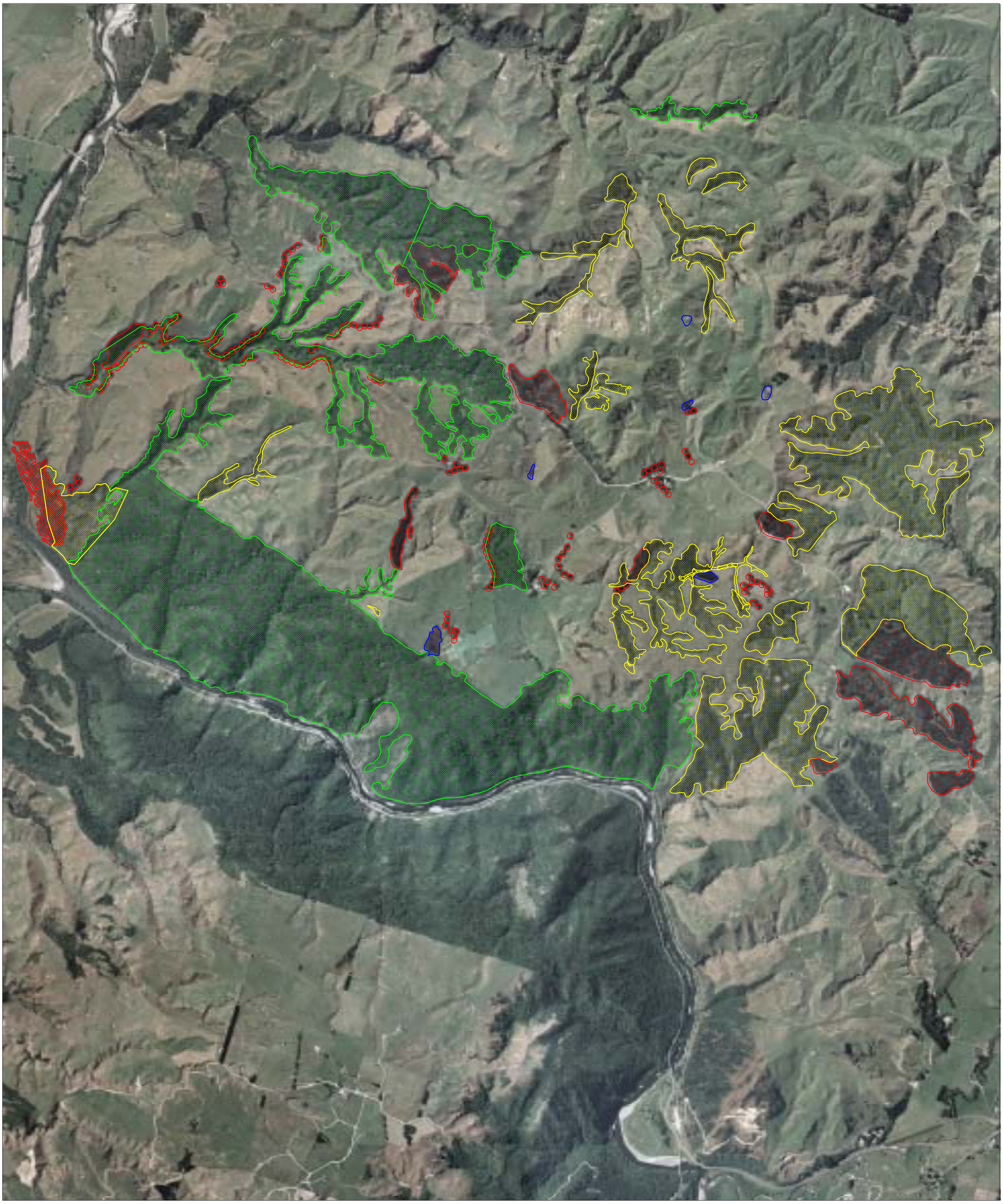
The types of birds found on site are consistent with a largely pastoral environment with bush fragments and pine windbreaks. In line with similar assessments conducted for windfarm development, the birds present or likely to occur at the site can be grouped into three categories – resident, vagrant and migratory.

Resident Birds

Resident birds essentially live in one area throughout the year, although they often move between food sources within the location.

Thirty bird species have been identified as residents of the site or are almost certainly present. Twelve are introduced species and two are recent colonisers (spur winged plover and welcome swallow). The remaining sixteen species of bird are native or indigenous birds. Most are passerines or songbirds such as the tui, bellbird, silvereye and grey warbler.

In terms of abundance, exotic species predominate; especially seed feeding finches, starlings and hedge sparrows. Most native and indigenous species are confined to the bush fragments and pine forests. The exceptions to this are the harrier hawk, New Zealand pipit, pukeko, paradise shelduck, and the recent New Zealand colonisers, spur winged plover and welcome swallow. None of these species are threatened and two, the pukeko and paradise shelduck, are game birds. The paradise shelduck is the single most common waterfowl in the area, expanding its population up to as many as 300 birds each summer before duck hunting season each May culls the population.



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Reference :
W02020-2 sr ecology v1.dwg

PROJECT TE APITI
Ecological Map

FIGURE 3

Table 6.1. Known Resident Bird Species

English Name	Origin	National Threat classification	Regional Threat classification	Source
New Zealand pigeon, kereru	E	5 Gradual decline	Not threatened	SF / DoC
Australasian harrier	N	Not threatened	Not threatened	SF / DoC
Bellbird	E	Not threatened	Not threatened	DoC
Grey warbler	E	Not threatened	Not threatened	SF/ DoC
Morepork	E	Not threatened	Not threatened	Blaschke
New Zealand kingfisher	E	Not threatened	Not threatened	-
New Zealand pipit	E	Not threatened	Not threatened	SF
North Island fantail	E	Not threatened	Not threatened	SF/ DoC
Paradise shelduck	E	Not threatened	Not threatened	SF
Pied tit	E	Not threatened	Not threatened	DoC
Pukeko	N	Not threatened	Not threatened	SF
Shining cuckoo	E	Not threatened	Not threatened	Blaschke
Silvereye	N	Not threatened	Not threatened	SF
Southern black backed gull	N	Not threatened	Not threatened	SF
Tui	E	Not threatened	Not threatened	SF / DoC
White faced heron	N	Not threatened	Not threatened	SF
Spur-winged plover	N	Coloniser	Not threatened	SF
Welcome swallow	N	Coloniser	Not threatened	SF
Black bird	I	Introduced	-	SF
Canada goose	I	Introduced	-	SF
Chaffinch	I	Introduced	-	SF / DoC
Dunnock	I	Introduced	-	SF
Goldfinch	I	Introduced	-	SF
Greenfinch	I	Introduced	-	SF
Magpie	I	Introduced	-	SF / DoC
Mallard	I	Introduced	-	SF
Rook	I	Introduced	-	SF
Skylark	I	Introduced	-	SF
Starling	I	Introduced	-	SF / DoC
Yellow hammer	I	Introduced	-	SF

E = endemic, N = native, I = Introduced

(SF = observed in the course of this field survey, DoC = Manawatu Scenic Reserve Management Plan, Blaschke = Blaschke 2002)

Vagrant Birds

Vagrant birds are species that are uncommonly or rarely found in an area but do occur from time to time.

A few birds have been recorded historically as vagrants at the Manawatu Scenic Reserve, suggesting their movement to the area from either the Tararua Ranges or Ruahine Ranges. They include the New Zealand bush falcon, the North Island kaka and the North Island rifleman. Of these the kaka and falcon are identified as nationally threatened or vulnerable. None of these have been seen in recent years (D. Smith pers.com).

In addition, a number of waterfowl are highly mobile seasonally, are present in the Manawatu Gorge area, and while they have not been recorded on site they are likely to utilise the small farm ponds and wetland areas of the site from time to time. These include shags, grey teal, shoveler, and scaup.

Petrels &/or shearwaters have been heard flying over Palmerston North in the direction of the Ruahines but the species and their destination is not known (D. Smith pers.com). Several species may be involved. The five species listed as present in the Wanganui Conservancy (DoC 2001) are Flesh-footed and sooty shearwaters both listed as ”gradual decline”, and the Grey-faced petrel, Fluttering shearwater, NZ white-faced storm petrel, and Northern diving petrel, all listed as “not threatened”. It is likely they are nesting in scrub and open ground around Wharite Peak.

Table 6.2. Likely Vagrants

English Name	Origin	National Threat classification	Regional Threat classification	Source
North Island kaka	E	2 Nationally endangered	Endangered	DoC/Blaschke
Bush falcon	E	3 Nationally vulnerable	Endangered	DoC
Little black shag	N	6 Sparse	Not threatened	Blaschke
North Island Rifleman	E	Not threatened	Not threatened	DoC
Grey teal	N	Not threatened	Not threatened	Blaschke
Australasian shoveler	E	Not threatened	Not threatened	Blaschke
NZ scaup	E	Not threatened	Not threatened	Blaschke
NZ Pied oystercatcher	E	Not threatened	Not threatened	Blaschke
Little shag	E	Not threatened	Not threatened	Blaschke
Petrels / shearwaters	E / N	Various	Not threatened	DoC

Migratory Birds

Migratory birds are birds that move large distances on a seasonal basis, either between sources of food, or between nesting areas often travelling thousands of kilometres between spring breeding sites and winter-feeding areas.

A large number of migrant birds have been recorded in the Manawatu District many of which breed in the Northern Hemisphere and over winter in New Zealand. Most however are confined to coastlines, estuaries and large river and wetland systems and are unlikely to use the saddle road area as a stop over point.

Similarly, there are some wetland birds such as marsh crake, bittern, and NZ dabchick, which are known to occur in the Manawatu area and which may pass through the saddle road site as they move seasonally between wetlands on either side of the ranges. It is perhaps more likely that migratory birds would use the Manawatu Gorge and river terraces as a route when travelling between the two coastlines.

Native Bats

Bats are New Zealand’s only terrestrial native mammals and are declining nationally. Therefore, these species are a high priority for conservation.

Bats still occur widely, from Northland south to Stewart Island, but their distribution is patchy, and their numbers very low in many areas. Two species of bat are recorded from the district and are probably present in the Ruahines ranges to the north. They are the short tailed bat, which is regionally endangered and has the national status of range restricted, and the long tailed bat, which is considered regionally endangered and nationally vulnerable.

New Zealand bats typically live within areas of mature native forest, selecting the largest and oldest trees for roosting and breeding. The short tailed bat is known for its habit of foraging on a forest floor. The long tailed bat prefers to feed aerially choosing forest margins and native scrub to hunt. Individual bats can range over 50 square kilometres when feeding at night and so may occur as vagrants at the study site travelling south from the Ruahine ranges.

The Department of Conservation is in the process of conducting a bat survey within the Wanganui conservancy and new information may come to hand.

A more detailed list of all native bird species found with in the Manawatu Conservancy, including potential vagrant and migratory species, is been provided in Table 13.1 pg 32. National threat classification is derived from Hitchmough 2001. Regional threat classification is derived from DoC 1995.

6.4 FRESHWATER HABITAT

The site drains to the east and south into the Manawatu River and to the west into the Pohangina River. These rivers are regionally significant wildlife habitats containing a high diversity of indigenous fish species including banded kokapu, short and long finned eel, and four species of bully. There is also an informal record of the brown mudfish being present in the Pohangina River near the Ashhurst Domain.

These rivers also provide habitat for many species of waterfowl and are recognised as significant trout fisheries with high value for recreational fishing. Both have the potential to be affected by this proposal.

Within the windfarm site are a number of small streams, which are heavily modified by stock access. There are no records of native fish in the streams within the windfarm area.

6.5 CORRIDORS

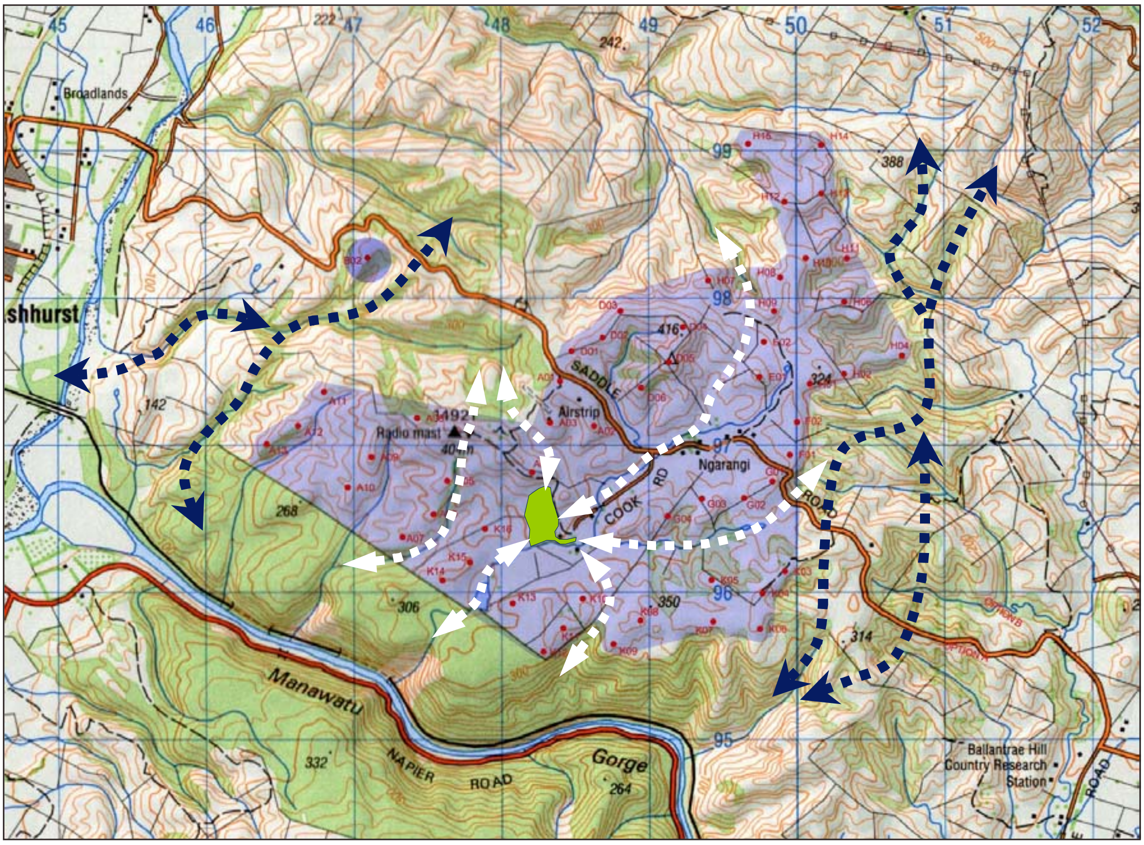
In 2001, Boffa Miskell was commissioned by the Palmerston North City Council to undertake an assessment of ecological processes for the City. This report highlighted the severe loss and fragmentation of forest within the area and the threat this fragmentation posed to the ecological sustainability of many sites. It identified the importance of movement of “keystone” native birds such as bellbird, tui and kereru, which are essential for the distribution of seed and the pollination of key forest tree species, thereby ensuring their long term viability (Blaschke 2002). It also highlighted the importance of access to these fragments to ensure year round access to food species for the birds.

A subsequent issues and options paper prepared by Horizons Manawatu has identified several key wildlife corridors in the area, which are a priority for protection and enhancement. The site of the Te Apiti Wind Farm sits in the middle of the proposed “Ruahine – Gorge” corridor which links the Manawatu Gorge Scenic Reserve and Ruahine forest park with Manawatu floodplain remnants (Janssen 2002). The total width of this corridor zone is approximately 7 kilometres, however, in reality only very narrow passages of vegetation, gullies and saddles, within this largely pastoral zone will provide for effective movement of small forest species.

Assuming that movement of key forest bird species is occurring through this corridor, it is suggested that the most likely routes are within forest remnants in deep gullies to the west of the wind farm site. To the east of the wind farm sites areas of regenerating kanuka may be used but this will be limited by ongoing clearance and farm improvement. Within the site, there is only one small forest remnant, the QEII Covenant which lies near the southern margin. Generally, however, within the windfarm site and wildlife movement will be either over open pasture or via pine shelterbelts.

6.6 SUMMARY

- The site on which the wind farm will be located is predominantly improved farmland with vegetation and wildlife typical of this type of environment. A number of small bush fragments and swampy gullies occur in this area, which are locally important as wildlife habitat.
- Two protected natural areas are located adjacent to the site and one forest remnant (Bolton Bush) lies within the proposed wind farm. These sites are regionally significant wildlife habitats.
- The site supports a moderate diversity of bird species, both native and introduced, that are adapted for open grassland, forest margin, shrubland and scrub, and to a lesser extent freshwater streams and wetlands.
- None of the resident bird life found in the area is nationally or regionally threatened, however, two nationally endangered species have historically been observed in the Manawatu Gorge Scenic Reserve adjacent to the wind farm site.
- The site contains tributaries of two rivers, the Manawatu and Pohangina which are regionally significant freshwater habitats and important for recreational fishing.
- The site lies in the centre of a recognised bird corridor, native forest species utilising the small bush fragments to travel between the Ruahine Ranges, Manawatu Gorge Scenic Reserve, and Tararua Ranges.



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BOFFA
MISKELL
planning design ecology

PROJECT TE ĀPITI
Possible Wildlife Corridors

Meridian Energy

Reference:
W02020-2 A4 Ecology Report Figs 245.pmd

FIGURE 4

7 SCOPE OF WORKS

The nature of the proposal and ancillary works are described in detail in the application for consent and the construction reports prepared by Opus Consulting. In summary the scope of the works, which this assessment has considered, are as follows.

Turbines

The turbines will be placed on 70 metres tall tubular towers with a base width of 4.2 metres. The rotor diameter will be 72 metres and it will travel at between 10 and 25 revolutions per minute depending on the final design chosen and whether it will be variable speed or fixed speed. The full height of each turbine, when the blade is standing vertically, will be 106 metres.

Each turbine will be placed on a foundation up to fifteen metres square.

Layout

The turbines will be located over an area of approximately 1,150 ha. The turbines will not be laid out in a geometric grid but each turbine micro-sited to best utilise the wind capacity within the overall site, often following short parallel spurs. The minimum spacing for turbines in a row will be approximately 210 metres and the minimum spacing between rows will be will be approximately 405 metres apart.

Actual spacings between turbines in some areas are closer to 300 metres and some rows are up to 500 metres apart, depending on terrain.

Earthworks

The turbines will be connected by approximately 21 kilometres of access track will need to be formed or upgraded to an average of 10 metres in width to accommodate the construction and transport vehicles necessary to carry the pre-fabricated turbine components, and surfaced in crushed rock. At the location of each turbine, a flat platform will be formed approximately 50 metres by 20 metres.

The total area of excavated works including the turbine pads and road footprints will be approximately 35 hectares will be exposed and approximately 640,000 – 880,000m^3 of material will be excavated. This fill will need to be deposited in a number of disposal sites around the wind farm.

Ancillary Works

Some other works will be associated with the project. Five wind monitoring towers will be installed ranging from 30 metres to 69 metres in height.

A lay-down and assembly area of approximately 4 ha will need to be prepared and this will involve the levelling of the site and culverting of just over 200 metres of stream.

The turbines will need to be connected to the national grid. It is proposed each turbine will be connected to a new substation located at the summit of Saddle Road by underground cabling. From the sub-station, approximately 4.2 km of aerial cables will descend to the existing Woodville substation. These aerial cables are a permitted activity.

8 POTENTIAL IMPACTS ON WILDLIFE

8.1 INTERNATIONAL EXPERIENCE

Internationally wind farms have been implicated in bird deaths at a number of sites. As a result, a large body of research has been conducted to determine the causes of bird mortality and design wind farms better to avoid these effects. Based on this international research the following general conclusions have been reached.

- Where effects occur they result from either habitat loss, disturbance leading to displacement, or collision mortality.
- Actual collisions are rare. There are only a few windfarms implicated in significant avian mortality due to their poor siting and design. These windfarms have been placed either within dense populations of susceptible species (estuaries, wetlands) or on migratory flight paths where many hundred to several thousand bird-movements can be experienced each hour.
- Displacement from habitat as a result of wind farm operation is also rare, most species adapting to the wind farm presence over time. However, for a few species displacement does occur and can be ecologically significant, particularly if they are displaced from their breeding territory.
- Over time, most avian species resident near a windfarm learn to avoid the turbines or adjust their flight to pass under the rotor sweep or between the turbines. The most at risk species are those that migrate through the area or have behaviour that over-rides the avoidance response (hunting raptors).
- A number of research projects have shown that some migratory birds will alter their routes after one or two years of exposure to windfarms.
- Most migration of both waterfowl and passerines occurs well above the height of turbines. The period of greatest risk is during take off and descent at a stop-over point or destination.

Many different factors combine in different ways to create conditions where windfarms are either safe, or hazardous, to wildlife. These factors operate both temporally and spatially; involve terrain, climate, turbine design, spatial patterns of turbine distribution, the particular species of bird present at the site, and factors that affect their breeding, feeding, roosting behaviour and movement patterns. Each site must be considered in its own right based on the unique set of factors known to occur there. This section considers the Te Apiti site in relation to international experience and looks specifically at:

- The design and layout of the windfarm
- The susceptibility of wildlife known to occur at the site.

The following table identifies specific features of windfarms and wind turbines that are implicated in bird strike and displacement internationally, and compares these features with the proposed Te Apiti Windfarm.

Table 8.1. Risk Factors for Collision & Displacement

Known risk factors	Te Apiti comparison
Large concentrations of turbines (1,000+)	55
Closely spaced turbines (<30 m)	Minimum spacing of 210 m between turbines Up to 500 m between rows
Towers in uniform rows across the landscape (barrier)	Micro-sited – random
Lattice Towers – (encourages perching)	Solid tubes
Fast rotating blades 50-72 RPM	10.5 to 24.4 RPM (depending on machine chosen)
Turbines in steep valleys, across saddles	All located on ridges and hill tops
Transmission Lines perpendicular to prevailing winds and without flagging	Turbines connected by underground cables. Connection to national grid follows existing lines.
Transmission lines crossing water	No
Frequent fog & low cloud common (esp. during migration season)	Fog and mist occur year round but most common autumn and spring.
Turbines lie across migratory route	No known migratory routes (See Part 6).
High use of area by susceptible species	Not significant (See Part 6)
Large Prey Base (attracting raptors)	Not significant (See Part 6)
Other	Bottom of blade at lowest point 35 metres from ground

In summary early windfarms often had very large numbers of small turbines with fast rotors, distributed in long chains, with close spacings. Some were located across major migratory routes. These windfarms posed significant risks to birdlife. By comparison the Te Apiti site has a few, large, widely spaced turbines, with slow blades, which are sited on ridge crests and summits, in an area with little or no use by migratory species.

8.2 NEW ZEALAND SITUATION

There has been no research done in New Zealand on the incidence or cause of bird strike on structures of any kind, be they transmission cables, radio masts, or house windows. In particular, there is no body of information relating to wind turbines and their effects on indigenous wildlife, either mortality due to collision, loss of habitat due to site avoidance, or their possible effect as a barrier to migration.

There have been no reported bird strikes at any of the three existing turbine sites in New Zealand although there is anecdotal evidence of mortality of black-backed gulls at the Tararua wind farm. Gulls are recognised as a high-risk group internationally and so this is not unexpected. There is no information to say whether these bird strikes are rare or common.

At the single Brooklyn wind turbine, which is located immediately adjacent to the Karori Wildlife Sanctuary in Wellington, there have not been any reported bird deaths. The Karori Wildlife Sanctuary contains some significant species including two that may be occasional visitors to the Saddle Road site, the bush falcon, and North Island kaka. This area is monitored regularly by staff of the Sanctuary and is a popular tourist spot.

8.3 TE APITI WIND FARM

In determining the risk profile of a site a range of factors need to be considered such as the presence or absence of sensitive bird species, their feeding, roosting and nesting behaviour; the presence or absence of migratory routes, and the specifics of the turbine layout and construction.

The following table identifies bird groups that feature in bird strike statistics internationally, together with an indication of native species found at the Te Apiti Site, which fit within these groups.

Table 8.2. At Risk Bird Groups

Order or Family recognised internationally as "at risk".	NZ Native Equivalents found at Te Apiti Site		Disturbance displacement	Barrier to movement	Collision	Direct habitat loss damage
	Resident	Vagrant				
Mergini (*seaducks*)	-	-	X	X	X	X
Gaviidae, (*divers, loons*)	-	-	X	X	X	
Alcidae (*alcids, auks, puffins*)	-	-	X		X	X
Otididae (*bustards*)	-	-	X		X	X
Tetraonidae (*black grouse*)	-	-	X		X	X
Sternidae (*terns*)	-	-			X	
Sulidae (*gannets & boobies*)	-	-			X	
Podicipedidae (*grebes, dabchicks*)	-	-	X			
Ciconiiformes (*herons & storks*)	White faced heron	-			X	
Accipitridae (*raptors*) **Strigiformes** (*Owls*)	Harrier hawk Morepork	Falcon	X		X	
Charadriiformes (*waders & gulls*)	Spur wing plover Black backed gull	Oystercatchers	X	X	X	
Anatidae (*swans & geese*)	Paradise shelduck	Black Swan Grey Teal NZ Shoveler	X		X	
Gruiformes, (*cranes*)	Pukeko				X	
Phalacrocoracidae (*shags*)		Little Black Shag Little Shag				X
Bats	-	-			X	
Other indigenous NZ species potentially at risk.	Kereru	Kaka	?		?	

8.3.1 <u>Resident Birds</u>

Table 8.2 shows that seven native species that are resident on site are identified with a high-risk group based on international experience. Of these seven species the hunting birds raptors (morepork and Australasian harrier) are considered most at risk from collision due to their feeding and flight behaviour. Displacement due to wind farm avoidance is also possible depending on the species. The larger waterfowl which are identified here (paradise shelduck, pukeko, heron and gull) utilise farm ponds and open pasture within the wind farm site. They are potentially at risk from both collision, and displacement because of turbine avoidance.

It is not known whether Kereru is at risk but a cautionary approach may suggest that its slow and cumbersome flight as it moves between bush fragments could put it at risk from collision. Alternatively, it may avoid the turbines limiting its movement through the site and reducing its range.

None of the species likely to interact with the wind farm are nationally or regionally significant. Occasional deaths associated with the wind farm would not affect local populations, however, if seed carrying birds such as kereru are displaced from the wider area the farm may affect sustainability of some bush fragments on the site. Avoidance leading to displacement is therefore seen as the most significant potential effect. (See Section 9.6 pg. 22, Corridors).

8.3.2 Vagrant Birds

Of the eight species of vagrants that have been recorded on or around the site, two, the bush falcon and North Island kaka, are considered significant. The nationally vulnerable falcon is identified with raptors as an at risk bird group and could be affected either by collision or displacement. International research suggests, however, that the initial reaction of small raptors such as falcons to the construction of wind farms is avoidance. Over time as they become accustomed to the operation of the turbines, they begin to utilise the habitat again and then are at risk of collision. Given that the falcon are only rare visitors it is assumed their initial reaction will be avoidance and that long term familiarity is unlikely to occur.

There are no records of parrots being affected by wind farms internationally but this may relate more to a lack of wind farms in areas where large parrots are common. There is a possibility that kaka, which is nationally endangered, could interact with the wind farm as they move between forest remnants. Alternatively, kaka may choose to avoid the site utilising forest corridors to the west. Given the intelligence of these birds this may be the more likely scenario.

The other known vagrants are common to the area and are classified as not threatened nationally.

8.3.3 Migratory Birds

There are no known species of migratory birds that utilise the proposed wind farm site.

8.4 SUMMARY

- The wind farm design and turbine type has a range of characteristics that make it a low risk for bird strike and displacement when compared to international indicators.
- International research has shown that resident species of bird adjust their behaviour over time to avoid wind turbines.
- International experiences shows that the groups of birds most at risk are migratory species, particularly during takeoff and landing. No migratory species are known to utilise the site during their travels.
- The range of species present in the Saddle Road area, and which belong to groups recognised as being at-risk, are common to abundant at the site and are not rare or threatened.

9 ASSESSMENT OF ECOLOGICAL EFFECTS

9.1 INTRODUCTION

Potential adverse effects are discussed below. Potential effects considered cover both the construction phase of the wind farm and its ongoing operation. This report considers direct effects such as habitat loss, and indirect effects such as avoidance and displacement of wildlife from the site. Each section concludes with recommendations for mitigation of identified effects.

9.2 PROTECTED NATURAL AREAS

9.2.1 Discussion

All works are on private land. None of the proposed works will affect protected natural areas.

9.2.2 Measures to Avoid, Remedy, Mitigate

Significant sites have been avoided.

9.2.3 Monitoring

No monitoring is required.

9.3 EFFECTS ON INDIGENOUS VEGETATION

9.3.1 Discussion

Bush Remnants

The installation of the turbines, formation of access roads, and the siting of disposal areas will not result in the removal or disturbance of any forest remnants.

Wetland areas

All proposed disposal sites and quarry sites were visited with the project engineer and the natural values of each discussed. A number of potential disposal sites were subsequently removed from the list due to the likely loss of habitat. Several sites were also modified to avoid bush remnants. To compensate for those sites that were removed, several new sites were added. None of the quarry sites were in areas with indigenous vegetation and the installation of turbines, formation of access roads and the siting of disposal areas will not result in the removal or disturbance of any significant wetland areas.

9.3.2 Measures to Avoid, Remedy, Mitigate

Significant sites have been avoided.

9.3.3 Monitoring

No monitoring is required.

9.4 EFFECTS ON AVI-FAUNA

9.4.1 Discussion

Habitat Loss

No wildlife habitat will be lost as a result of this proposal.

Collision

There is a high degree of confidence that the wind farm will not result in mortality of significant species of wildlife. The layout of the windfarm and the design of the turbines are consistent with international recommendations for minimising bird strike.

Birdstrike cannot be ruled out for some species. However, the species most at risk are resident birds of the open country, which are abundant on site and not under threat nationally.

International research would suggest that the two significant vagrant species, the kaka and bush falcon, are most likely to avoid the turbines.

Displacement

The wide spacing of turbines and their micro-sited layout is unlikely to result in displacement of wildlife from feeding or breeding areas. If displacement does occur in some parts of the site, it will only affect species that inhabit the open farmland upon which the windfarm is located. None of these species are threatened nationally or regionally and their displacement would not affect the local ecology.

9.4.2 Measures to Avoid, Remedy, Mitigate

1) The layout of the windfarm, and the design of the turbines, is consistent with international best practice for reduction of the risk of bird strike. No additional mitigation is considered necessary.

9.4.3 Monitoring

1) It is recommended that the applicant record and report all bird strike. If any bird species listed in Appendix 2 pg. 32 as Nationally Critical, Nationally Endangered, Nationally Vulnerable, or in Serious Decline is found injured or killed at the site they will notify the Department of Conservation and provide the bird for autopsy or rehabilitation.
2) If significant bird deaths occur, consideration can be given to establishing a more intensive monitoring programme. At this point additional measures can be investigated for improving tower visibility or enhancement of bird corridors.

9.5 FRESHWATER HABITAT

9.5.1 Discussion

Habitat Loss

It is proposed that a large area near Cook Road be set aside for laydown and storage of materials and for the assembly of various components. This will require levelling of up to 4 ha of the site and the culverting of up to 200 metres of stream. This watercourse is a typical farm stream incised into a basin of grazed pasture. It has low natural value but will provide habitat for some species of birds and invertebrates. The length of culverting is kept to the least extent practicable.

Downstream effects

Given the quantities of material involved with the excavation of the turbine foundations and access roads, and disposal sites, the most significant potential adverse effect of this proposal is movement of sediment into local watercourses and eventually into the Manawatu and Pohangina /Rivers.

Avoidance of this effect is aided by the location of almost all access roads and turbines on ridges or spurs, and the location of deposit sites in upper reaches of gullies. This provides opportunities for capture and management of sediment before it can reach water bodies.

However, close attention will still need to be given to the design, implementation and monitoring of appropriate sediment management techniques. An Erosion and Sedimentation Control Plan will be prepared to address this risk as detailed in the Opus Consultants construction report.

Contaminants

In addition to the movement of sediment, there is the issue of potential discharges of petrochemicals from storage facilities, concrete waste from truck wash down areas, and during construction and maintenance of Turbines. Like the issue of sedimentation, this will require careful site management and is addressed as part of construction planning and monitoring.

9.5.2 Measures to Avoid, Remedy, Mitigate

1) Significant sites have been avoided.
2) The laydown area should be kept as small as practicable to avoid excessive culverting of the farm stream at Cook road.
3) It is recommended that works be conducted outside the winter months, preferably between October and May.
4) A stormwater runoff, erosion and sedimentation control plan will be prepared prior to commencement of construction setting out appropriate measures to ensure the effects of stormwater runoff are minimised. Control to be based firstly on protection of the soil surface, or minimising the extent of disturbance from rain and run off, and secondly on capturing eroded soil particles on site. Measures to include but not limited to:
    - Run off diversion channels
    - Contour drains
    - Earth bunds
    - Sediment retention ponds
    - Silt fences (filter fabric)
    - Check dams
    - Top-soiling and revegetation (including hydro-seeding)
    - Appropriate cut batters where large cuts are required.
5) The plan should include appropriate measures for the use and control of contaminants, and the management of accidental spills. Measures to include but not be limited to:
    - Separate bunded storage area on-site for diesel fuel and lubricants.
    - Minimise the amount of diesel held on site.
    - Separate concrete batching and wash out areas to be bunded.
    - Contingency plan for spillage outside storage and refilling areas.

9.5.3 Monitoring

1) A standard monitoring regime be established to be defined by the sedimentation management plan.

9.6 CORRIDORS

9.6.1 Discussion

International research suggests that the wind farm layout as proposed will not create a significant hazard to wildlife and any bird movement that currently occurs will continue unchanged once the farm is operational.

If however, some species of bird do avoid the wind farm site, passage will still be possible around the site, to the east using a series of small bush remnants, pine forest and regenerating kanuka forest, to the west via a series of vegetated gullies that connect the two largest forest fragments to the Manawatu Gorge Scenic reserve.

9.6.2 Measures to Avoid, Remedy, Mitigate

Adverse effects are considered unlikely. It is not believed that measures to avoid remedy or mitigate effects are required.

9.6.3 Monitoring

See recommendations in section 8.4.

9.7 SUMMARY

Vegetation and habitats

- No protected natural areas or significant habitats will be affected by construction of the proposed wind farm.

Avi-Fauna

- Some bird strike is likely but the species most likely to be involved are not rare and occasional losses will not have a significant adverse effect on the ecology of the area or the populations of these species.

Freshwater Habits

- There is potential for downstream effects, given the large areas of excavation and the nature of the soil and substrate. The planning, implementation and monitoring of sediment control measures as detailed in the Opus Consultants construction report will address this risk.

Corridors

- The design and layout of the windfarm suggest that it will not have a significant affect on bird movement through the site. The best forest corridors connecting the Ruahine Ranges to Manawatu Gorge lie outside the footprint of the windfarm to the west.

10 CONCLUSIONS

In summary:

Physical environment

1) Land ownership on the project site is private. Land use would continue relatively unchanged (pastoral farming) by the construction of wind turbines.

2) Parts of the site are located on young and erodable sedimentary rocks. There is potential for erosion and sediment movement from the site if the soil mantle is disturbed.

3) There are no large waterbodies, lakes, streams or rivers within the site, although the site drains into two large rivers the Pohangina to the west and the Manawatu to the east and south.

Natural Environment

1) The site is predominantly improved farmland with vegetation and wildlife typical of this type of environment. A number of small bush fragments and swampy gullies occur in this area, which are locally important as wildlife habitat.

2) A number of protected natural areas can be found surrounding the site and one covenant site lies within the proposed wind farm. These sites are regionally significant wildlife habitats.

3) The site supports a moderate diversity of bird species, both native and introduced, that are typically birds of open grassland, forest margin, shrubland and scrub, and to a lesser extent freshwater streams and wetlands.

4) None of the resident bird life found in the area are nationally or regionally threatened, however, two nationally endangered species are rare visitors.

5) The site contains tributaries of two rivers, the Manawatu and Pohangina which are regionally significant freshwater habitats and important for recreational fishing.

6) The site lies in the centre of a recognised bird corridor, with forest birds utilising the small bush fragments to travel between the Ruahine Ranges, Manawatu Gorge Scenic Reserve, and Tararua Ranges.

Potential Impacts on Wildlife

1) The wind farm design and turbine type has a range of characteristics that make it a low risk for bird strike and displacement when compared to international indicators.

2) International research has shown that resident species of bird adjust their behaviour over time to avoid wind turbines.

3) International experiences shows that the groups of birds most at risk are migratory species, particularly during takeoff and landing. Current information suggests that migratory birds do not use the site.

4) The range of species present in the Saddle Road area, and which belong to groups recognised as being at-risk, are common at the site, and are not classified as rare or threatened nationally.

Project Description

1) The proposed Te Apiti wind farm, comprising 55 turbines, is small by international standards (often 500 to several thousand turbines).

2) The proposal will involve significant amounts of earthworks including disposal sites for fill and lay down areas during construction. A number of ancillary structures will also be built.

Assessment of Effects

1) No protected natural areas or significant habitats will be affected by construction of the proposed wind farm.

2) Some bird strike is likely but the species most likely to be involved are not rare and occasional losses will not have a significant adverse effect on the ecology of the area or the populations of these species.

3) There is potential for downstream effects, given the large areas of excavation and the nature of the soil and substrate. The design, implementation and monitoring of sediment control measures as outlined in the engineers report, will be appropriate to address this risk.

4) The design and layout of the windfarm suggest that it will not have a significant affect on bird movement through the site. The best forest corridors connecting the Ruahine Ranges to Manawatu Gorge lie outside the footprint of the windfarm to the west.

In conclusion, the results show that the study area is ideally suited to the development of a wind farm and to the avoidance or reduction of potential effects associated with its construction and operation.

Construction will not remove significant indigenous vegetation or habitats of significant indigenous fauna. The specifics of the site ensure that critical wildlife are unlikely to interact with the wind turbines. In addition, the proposed layout and design of the wind farm complies with international guidelines for minimising effects on wildlife generally.

With proper sediment control and management of discharges there should be little or no impact downstream of the works.

The adverse ecological effects of the proposed wind farm on the local ecology are therefore likely to be minor. A number of recommendations are made which will assist to avoid, remedy or mitigate potential effects.

11 RECOMMENDATIONS

Based on what is known about avian risk factors at wind power plants in North America and Europe, the species (type and numbers of individuals) that frequent the project site, and what was learned from the literature search, site visits, and interviews, the following recommendations are made to assist in the avoidance, remedy or mitigation of potential effects.

WILDLIFE MONITORING

It is recommended that the applicant record and report all bird strike. If any bird species listed in Table 13.1 pg. 32 as Nationally Critical, Nationally Endangered, Nationally Vulnerable, or in Serious Decline is found injured or killed at the site they will notify the Department of Conservation and provide the bird for autopsy or rehabilitation.

If bird deaths occur, consideration can be given to establishing a more intensive monitoring programme. At this point additional measures can be investigated for improving tower visibility or further enhancing bird corridors.

TIMING OF WORKS

It is recommended that given the unstable nature of the soil and substrate works be conducted outside the winter months, preferably between October and May.

SEDIMENT MANAGEMENT

A stormwater runoff, erosion, sedimentation control, and monitoring plan be prepared prior to commencement of construction setting out detailed measures to ensure the effects of stormwater runoff are minimised.

CONTAMINANTS

Include in the standard specifications of contract of appropriate measures for the use and control of contaminants, and the management of accidental spills.

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Windfarms and Birds: An Analysis of the effects of windfarms on birds, and guidance on environmental assessment criteria and site selection issues. Report prepared by Birdlife on behalf of the Bern Convention Sept 2002. 37 pp.

12.1 WEB SITES

Watchdogs / Ngo's

Bird Strike

The International Bird Strike Committee - www.int-birdstrike.com/

The Fatal Light Awareness Program (FLAP) - www.flap.org/new/nestegg2.htm

TowerKill.com - www.towerkill.com/

Swedish Ornithological Society - www.sofnet.org/index.asp?DocID=932

U. S. Fish and Wildlife Service - www.fws.gov/

Migratory Birds

The Convention on the Conservation of Migratory Species - www.wcmc.org.uk/cms

The Council of Europe for the Bern Convention - www.coe.int/portalT.asp

Migratory Birds Div U. S. Fish and Wildlife - www.migratorybirds.fws.gov/issues/towers/abcs.html

Sustainable Energy

International Institute for Sustainable Development - www.iisd.org/default.asp/

Green Energy Ohio - www.greenenergyohio.org/

Industry / Government

The World Energy Council - www.worldenergy.org/wec-geis/

The National Wind Coordinating Committee - www.nationalwind.org/

The California Energy Commission - www.energy.ca.gov

The British Wind Energy Association - www.bwea.com/

The Canadian Wind Energy Association - www.canwea.ca/

The European Wind Energy Association - www.ewea.org/index.html

The Danish Wind Industry Association - www.windpower.org/core.htm/

Wind service Holland - home.wxs.nl/~windsh/english.html

NZ Energy Efficiency and Conservation Authority - www.eeca.govt.nz/

NZ Wind Energy Association - www.windenergy.org.nz/

NZ Wind Farm Development - www.windfarmdevelopments.co.nz/

Wind Prospect Australia - www.windprospect.com.au/

The Australian Wind Energy Assn - www.auswea.com.au/

The British Dept of Trade and Industry - www.dti.gov.uk/renewable/pdf.html

Research & Technology

U.S. National Wind Technology Centre - www.nrel.gov/wind/

Includes avian literature database - www.nrel.gov/wind/avian

U.S. Laboratory for renewable energy -- www.nrel.gov/research/wind/wind.html

U.S. Office of Energy Efficiency and Renewable Energy	-	www.eere.energy.gov/
U.S. Office of Scientific and Technical Information	-	www.osti.gov
Energy research Centre of the Netherlands	-	www.ecn.nl/index.html
Danish National Environmental Research Institute	-	www.dmu.dk/forside_en.asp

AEE

AEE Prince Edward Island Dec-01	-	www.bsc-eoc.org
AEE Toronto Feb-2000	-	www.torontohydro.com
Risk Assessment May-2002	-	www.marylandwind.com
Planning Guidelines South Australia	-	www.planning.sa.gov.au/windfarms/index.html
Renewable Energy Systems – Drummuir wind farm	-	www.res-ltd.com/drummuir/landv.htm
Tennessee Valley Authority	-	www.tva.gov/environment/reports/windfarm/
Nai Kun Wind Farm – Uniterre Resources Ltd.	-	www.uniterre.ca/Nai_Kun_Wind_Farm_rep.pdf
Pacific Hydro – Portland wind farm	-	www.pacifichydro.com.au/

Wind Farm Opponents

Country Guardian	-	www.countryguardian.net/
Wind farm forum	-	www.windfarmforum.org/
A.L.A.R.M	-	www.darrylmueller.com/alarm.html
Campaign for the Protection of Rural Wales	-	www.cprw.org.uk/wind/windindc.htm
Makara Guardians	-	makara.freeyellow.com/MGfrontpage.htm
Alliance to protect Nantucket Sound	-	www.saveoursound.org/index.html
Fight To Save Barningham High Moor.	-	www.wind-farm.co.uk/

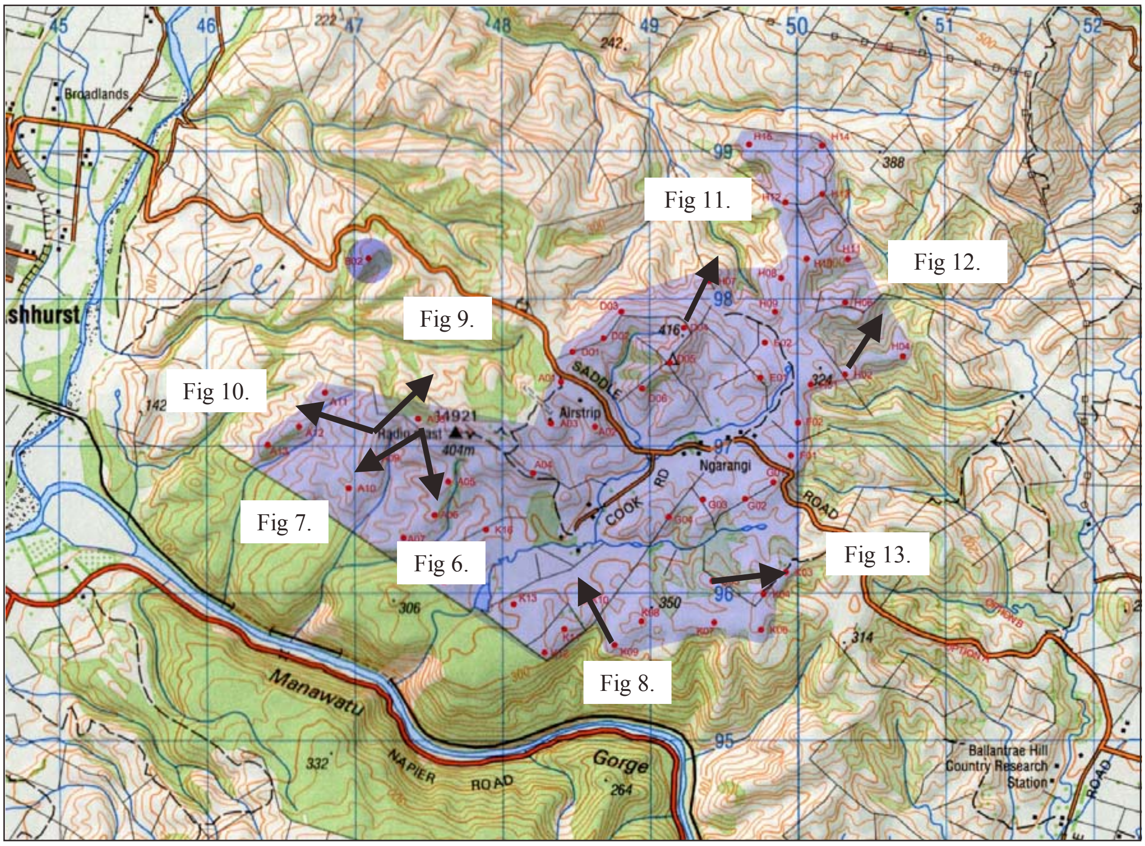
Journals

WIND Directions -official magazine of the EWEA	-	www.ewea.org/src/directions.htm
Wind Power Monthly	-	www.wpm.co.nz/
Wind Energy Monthly – Wiley Science	-	www3.interscience.wiley.com/cgi-bin/jtoc?ID=6276

13 Plants Species Names used in Text and their Latin Equivalents.

Broom *	*Cytisus scoparius*
cabbage tree	*Cordyline australis*
fivefinger	*Pseudopanax arboreus*
gorse *	*Ulex europaeus*
hinau	*Elaeocarpus dentatus*
kanuka	*Kunzea ericoides*
kanuka	*Cunzya ericoides*
kohekohe	*Dysoxylum spectabile*
lacebark	*Hoheria populnea*
lemonwood	*Pittosporum ericoides*
macrocarpa *	*Cupressus macrocarpa*
mahoe	*Melicytus ramiflorus*
manuka	*Leptospermum scoparium*
ngaio	*Myoporum laetum*
nikau	*Rhopalostylis sapida*
pasture grasses*	Typically *Dactylis glomeratus* (Cocksfoot) *Trifolium spp. (Clover)* *Anthoxanthum odoratum (Sweet vernal)* *Lolium perenne (Perrenial ryegrass)*
pigeonwood	*Hedycarya arborea*
pine *	Typically *P. radiata*
putaputaweta	*Carpodetus serratus*
rewarewa	*Knightia excelsa*
rimu	*Dacrydium cupressinum*
supplejack	*Ripogonum scandens*
tawa	*Beilschmiedia tawa*
toetoe	*Cortaderia* spp.
totara	*Podocarpus totara*
treefern	Typically *Cyathea medullaris* (mamaku)

* = introduced species



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planning design ecology

Reference:
W02020-2 A4 Ecology Report Figs 245.pmd

PROJECT TE ĀPITI
Location of Photographs

FIGURE 5

Figure 6 : *Rolling farmland descending to the hard forest edge of the Manawatu Gorge Scenic Reserve*

Figure 7 : *Another view of forest margin, Manawatu Gorge Scenic Reserve*

Figure 8 : *"Bolton Bush" the QEII Covenant, middle right, in relation to the edge of the Manawatu Gorge Scenic Reserve bottom centre.*

Figure 9 : *The largest unprotected forest fragment on the slopes to the west of the windfarm proposal, Saddle Road crosses the hillside middle distance.*

Figure10 : *Forested gully which forms one of the important wildlife corridors to the west of the site.*

Figure 11 : *Another small forest fragment on the western side of the site. Wharite Peak in the distance.*

Figure 12 : Mixed kanuka and gorse typical of gullies to the east of the windfarm site. This area has recently been sprayed.

Figure 13 : A wet gully of Carex and Cyperus. Kanuka shrubland fringing. This gully was one of several ruled out as deposit areas following field survey. Alternative sites without wetland vegetation were found.

Table 13.1. Listing of bird species likely to be present or liable to occur seasonally at the site.
Sorted by national status (threat classification) and by likely occurrence at site.

English Name	Scientific Name	Threat classification	Origin	Resident	Vagrant	Possible migrant	Highly unlikely
New Zealand pigeon, kereru	*Hemiphaga novaeseelandiae*	5 Gradual decline	**E**	✓			
Australasian harrier	*Circus approximans*	Not threatened	**N**	✓			
Bellbird	*Anthornis melanura melanura*	Not threatened	**E**	✓			
Grey warbler	*Gerygone igata*	Not threatened	**E**	✓			
Morepork	*Ninox novaeseelandiae novaeseelandiae*	Not threatened	**E**	?			
New Zealand kingfisher	*Todiramphus sanctus*	Not threatened	**E**	✓			
New Zealand pipit	*Anthus novaeseelandiae novaeseelandiae*	Not threatened	**E**	✓			
North Island fantail	*Rhipidura fuliginosa placabilis*	Not threatened	**E**	✓			
Paradise shelduck	*Tadorna variegata*	Not threatened	**E**	✓			
Pied tit	*Petroica macrocephala toitoi*	Not threatened	**E**	✓			
Pukeko	*Porphyrio melanotus*	Not threatened	**N**	✓			
Shining cuckoo	*Chrysococcyx lucidus lucidus*	Not threatened	**E**	?			
Silvereye	*Zosterops lateralis*	Not threatened	**N**	✓			
Southern black-backed gull	Larus dominicanus dominicanus	Not threatened	**N**	✓			
Tui	*Prosthemadera novaeseelandiae novaeseelandiae*	Not threatened	**E**	✓			
White-faced heron	*Ardea novaehollandiae*	Not threatened	**N**	✓			
Spur-winged plover	*Vanellus miles*	Coloniser	**N**	✓			
Welcome swallow	*Hirundo tahitica neoxena*	Coloniser	**N**	✓			
Black bird	*Turdus merula*	Introduced	**I**	✓			
Canada goose	*Branta canadensis*	Introduced	**I**	✓			
Chaffinch	*Fringilla coelebs gengleri*	Introduced	**I**	✓			
Dunnock	*Prunella modularis occidentalis*	Introduced	**I**	✓			
Goldfinch	*Carduelis carduelis britannica*	Introduced	**I**	✓			
Greenfinch	*Carduelis chloris*	Introduced	**I**	✓			
Magpie	*Gymnorhina tibicen*	Introduced	**I**	✓			
Mallard	*Anas platyrhynchos*	Introduced	**I**	✓			
Rook	*Corvus frugileus*	Introduced	**I**	✓			
Skylark	*Alauda arvensis*	Introduced	**I**	✓			
Starling	*Sturnus vulgaris*	Introduced	**I**	✓			
Yellow hammer	*Emberiza citrinella caliginosa*	Introduced	**I**	✓			

Table cont …Vagrants & Possible Migrants

English Name	Scientific Name	Threat classification	Origin	Resident	Vagrant	Possible migrant	Highly unlikely
North Island kaka	*Nestor meridionalis septentrionalis*	2 Nationally endangered	**E**		✓		
Bush falcon	*Falco novaeseelandiae* "bush"	3 Nationally vulnerable	**E**		✓		
Long-tailed cuckoo	*Eudynamys taitensis*	5 Gradual decline	**E**		?		
Yellow-crowned kakariki	*Cyanorhamphus auriceps*	5 Gradual decline	**E**		?		
Black swan	*Cygnus atratus*	Not threatened	**N**		?		
North Island Rifleman	*Acanthisitta chloris granti*	Not threatened	**E**		✓		
Red-billed gull	*Larus novaehollandiae scopulinus*	Not threatened	**E**		?		
Red-crowned kakariki	*Cyanorhamhus novaezelandiae novaezelandiae*	Not threatened	**E**		?		
Whitehead	*Mohoua albicilla*	Not threatened	**E**		?		
White heron	*Egretta alba modesta*	1 Nationally critical	**N**			?	
Australasian bittern	*Botaurus poiciloptilus*	2 Nationally endangered	**N**			?	
Grey duck	*Anas superciliosa superciliosa*	4 Serious decline	**E**			✓	
Black shag	*Phalacrocorax carbo novaehollandiae*	6 Sparse	**E**			?	
Little black shag	*Phalacrocorax sulcirostris*	6 Sparse	**N**			✓	
Pied shag	*Phalacrocorax varius varius*	6 Sparse	**E**			?	
New Zealand dabchick, weweia	*Poliocephalus rufopectus*	6 Sparse	**E**			?	
Marsh crake	*Porzana pusilla affinis*	6 Sparse	**E**			?	
Spotless crake	*Porzana tabuensis plumbea*	6 Sparse	**N**			?	
Grey teal	*Anas gracilis*	Not threatened	**N**			✓	
Australasian shoveler	*Anas rhynchotis*	Not threatened	**E**			✓	
New Zealand scaup	*Aythya novaeseelandiae*	Not threatened	**E**			✓	
New Zealand Pied oystercatcher	*Haematopus finschi*	Not threatened	**E**			✓	-
Pied stilt	*Himantopus himantopus leucocephalus*	Not threatened	**N**			✓	
Little shag	*Phalacrocorax melanoleucos brevirostris*	Not threatened	**E**			✓	

Table cont, Species listed in Manawatu but unlikely to be found at the Te Apiti Site

English Name	Scientific Name	Threat classification	Origin	Resident	Vagrant	Rare migrant	Highly unlikely
Black stilt	*Himantopus novaezelandiae*	1 Nationally critical	**E**				-
Blue duck, whio	*Hymenolaimus malachorhynchos*	2 Nationally endangered	**E**				-
Wrybill, ngutu-parore	*Anarhynchus frontalis*	3 Nationally vulnerable	**E**				-
North Island brown kiwi	*Apteryx mantelli*	4 Serious decline	**E**				-
Banded dotterel	*Charadrius bicinctus bicinctus*	5 Gradual decline	**E**				-
North Island fernbird, Matata	*Bowdleria punctata vealeae*	6 Sparse	**E**				-
Northern New Zealand dotterel	*Charadrius obscurus aquilonius*	6 Sparse	**E**				-
North Island Robin	*Petroica australis longipes*	Not threatened	**E**				-
Variable oystercatcher	*Haematopus unicolor*	Not threatened	**E**				-
Nankeen night heron	*Nycticorax caledonicus*	Coloniser	**C**				
Bar-tailed godwit	*Limosa lapponica*	Migrant	**M**				-
Cattle egret	*Bubulcus ibis*	Migrant	**M**				-
Curlew sandpiper	*Calidris ferruginea*	Migrant	**M**				-
Grey plover	*Pluvialis squatarola*	Migrant	**M**				-
Large sand dotterel	*Charadrius leschenaultii*	Migrant	**M**				-
Lesser knot	*Calidris canutus*	Migrant	**M**				-
Mongolian dotterel	*Charadrius mongolus*	Migrant	**M**				-
Pacific golden plover	*Pluvialis fulva*	Migrant	**M**				-
Red-necked stint	*Calidris ruficollis*	Migrant	**M**				-
Turnstone	*Arenaria interpres*	Migrant	**M**				-
Central short-tailed bat	*Mystacina tuberculata rhyacobia*	7 Range restricted	**E**				-
Long-tailed bat (North Island)	*Chalinolobus tuberculata* (North Island)	3 Nationally vulnerable	**E**				-

Threat classification derived from DoC 2002.

6.B.5

REPORT ON AVIAN MORTALITY AT TE ĀPITI WIND FARM - BOFFA MISKELL LTD & GOLDER ASSOCIATES 2009

Appendix 6.B.5: Report on Avian Mortality at Te Āpiti Wind Farm – Boffa Miskell Limited & Golder Associates 2009

Report on Avian Mortality at Te Apiti Wind Farm

Te Apiti Windfarm, Palmerston Nth, North Island

Submitted to

Meridian Energy Limited

Report Number W08040-005

October 2009

Golder Associates

Boffa Miskell

CONTENTS

TABLES

FIGURES

1 INTRODUCTION

Since the construction of the first large scale wind turbine in New Zealand in 1993 the number of wind farms being proposed and constructed has increased exponentially. Currently (2009) the combined capacity of wind farms in New Zealand is 404 megawatts which generates about 3% of New Zealand's electricity (1,040 gigawatt hours in the year to March 2008). One projection is that by 2025 New Zealand could have 2,500 to 3,000 megawatts of installed wind energy capacity supplying 15 to 20 percent of our electricity (NZWEA Website).

However, to date, no investigation into the effects of an operational wind farm on New Zealand's birds has been completed (Powlesland 2009). This situation will change with most windfarm consents now requiring post construction monitoring but until these studies are undertaken we remain reliant on overseas studies for the assessment of potential effects. Overseas literature indicates that in some circumstances birds are prone to collision mortality with wind turbines (Birdlife International 2003, NWCC 2001, Erickson 2001) but the conclusions that can be drawn from these overseas studies remain limited due to variation in location and behaviour between species (Powlesland 2009).

Since the completion of Te Apiti wind farm in August 2004 by Meridian Energy Limited (Meridian) a number of collision mortalities have been recorded at this site. These include, one sacred kingfisher (*Halcyon sancta*), 11 Australian magpies (*Gymnorhina tibicen*) and two harrier hawks (*Circus approximans*). However, these observations have relied on passive monitoring by operational staff that record carcasses whenever they are encountered during routine work. Due to the low intensity of this monitoring it is highly likely that this underestimates the frequency of collision mortality and we suggest that this approach is also biased towards larger, more visible species.

As a result, Meridian sought to address the lack of information on collision mortality by undertaking an assessment of bird strike at Te Apiti wind farm using more rigorous survey techniques. This additional study was not required by consent, but was seen as an opportunity to identify the species likely to be affected, reduce uncertainty in the consenting process, and establish survey protocols for windfarms where post construction surveys were now required.

This report details the results of two months of intensive collision mortality monitoring at Te Apiti wind farm in 2008, and outlines recommendations for future collision mortality monitoring at New Zealand's wind farms. The aims of this study were to:

- Determine the limitations of passive monitoring vs. focussed searching,
- Develop a robust methodology to provide guidance for use at other New Zealand wind farms, and
- To more accurately describe the frequency of collision mortality and the species affected at Te Apiti wind farm.

2 STUDY AREA

Te Apiti wind farm is situated to the north of the Manawatu gorge, in the lower Central North Island of New Zealand, approximately 20 km east of Palmerston North City (figure 1). It consists of 55, 1.65 MW turbines, with 35 m blades mounted on 70 m high tubular towers (figure 2). The turbines are typically located in pasture on ridgelines with fingers of native bush extending up gullies between them. The bush varies from kanuka scrub to remnant podocarp broadleaved forests. There are also areas of plantation pine, and abundant farm ponds of varying size within the wind farm footprint. The turbines are located at varying distances from bush margins, with the closest turbines being located 75 m from Manawatu Gorge Scenic Reserve. Farming of sheep and beef continues in the pasture beneath each turbine maintaining a relatively short sward.

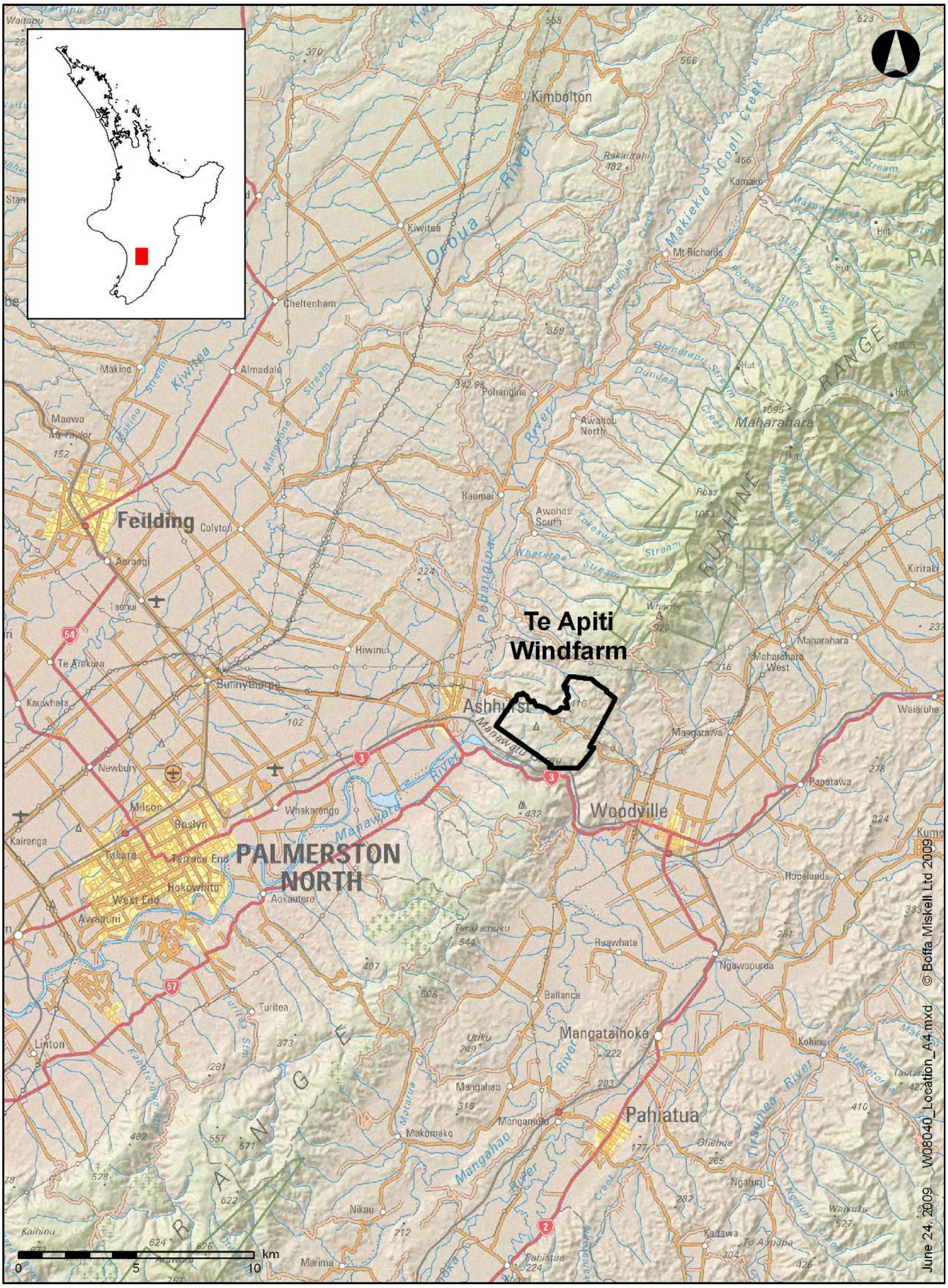

Figure 1: Map illustrating the location of Te Apiti wind farm.

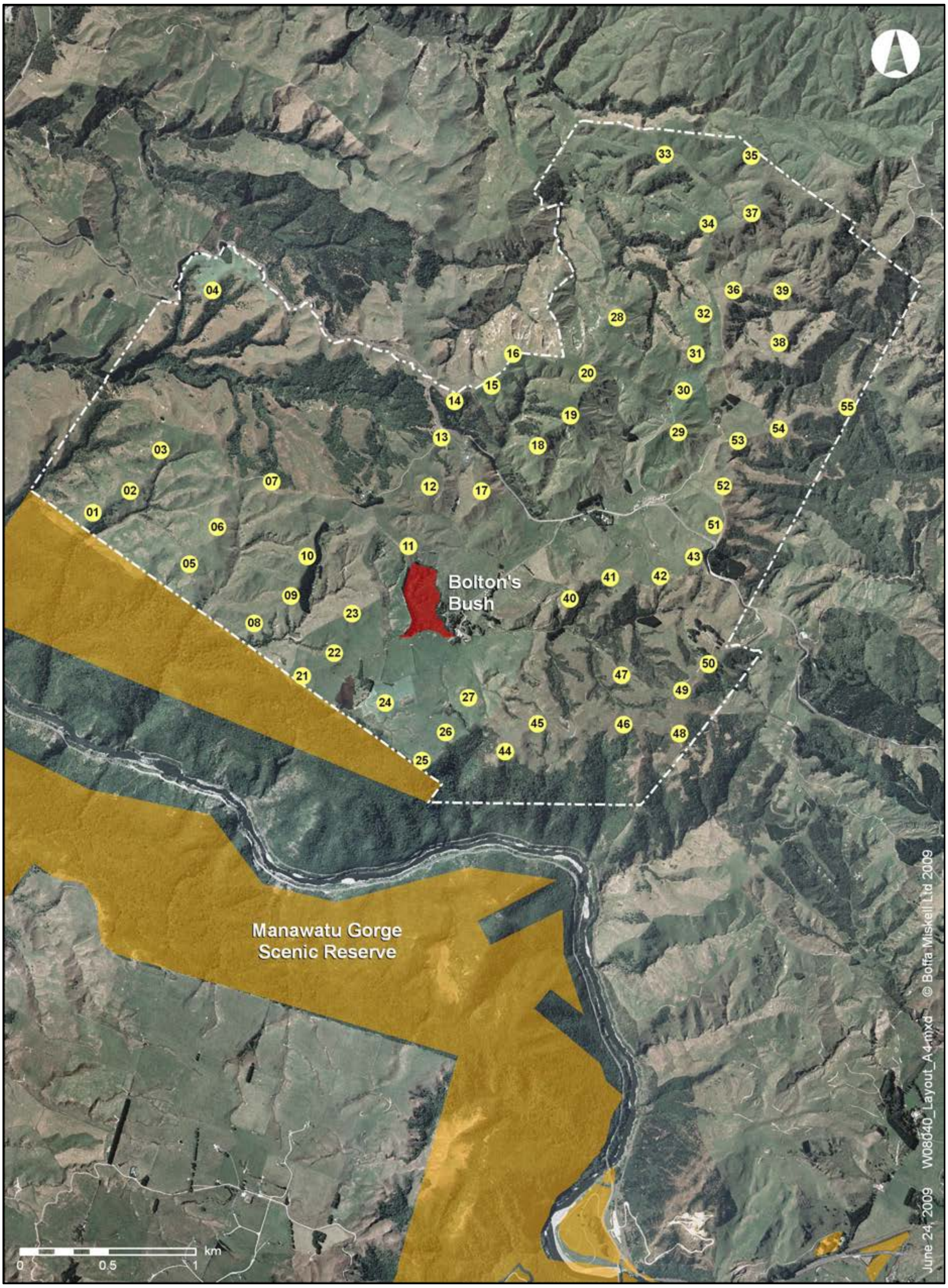

Figure 2: Te Apiti Windfarm layout. Bolton's Bush QEII covenant in red. Manawatu Gorge Scenic Reserve highlighted in Brown.

3 METHODS

At the commencement of this study a range of international methodologies were reviewed and key issues for carcass searches identified, including scavenging\decomposition rates, searcher efficiency, terrain, vegetation, and effort. These methodologies included guidance notes such as Morrison 2002, Anderson 1999, AUSWEA 2005, Canadian Wildlife Service 2006, and NWCC 2005; and a range of mortality studies and papers such as Erickson 2004 and Johnson et al 2002.

There is considerable variation between these methodologies in the areas of search frequency, timing, and extent. There is also considerable variation with regard to the scale of scavenger and searcher efficiency trials. The methodology developed below was set up not only to describe the occurrence of bird collision mortality at Te Apiti but also to assess the suitability of international methodologies to the New Zealand situation.

3.1 Search Effort

The greatest variation in international methodology related to search effort. Recommendations ranged from searches of all turbines every 2 weeks, to searches of a subset of turbines every two to three days. Some methodologies recommended different search efforts depending on season, with greatest effort during spring and autumn, usually with a focus of migration events and breeding.

For this trial our approach was to search a subset of turbines six days a week for one month in April 2008 (autumn), and one month in November 2008 (spring). By combining this intensity of search effort with scavenger trials we sought to determine the most efficient interval of search effort for future projects.

We also sought to limit the effects of day time scavenger losses by searching turbines in the morning. Searches commenced soon after sunrise until around midday. This gave a total of 60 days searching, or 560 hours of search effort (80 minutes per turbine).

3.2 Turbine Selection

Initial field trials indicated that it takes two people approximately 40 minutes to search the base of a turbine (Section 3,3). Due to limited resources it was therefore not possible to monitor all 55 turbines every day. This is a logistical and resourcing problem likely to occur at many wind farms in New Zealand. Daily monitoring of a sample of turbines was therefore employed to assess how frequently it was necessary to search a turbine in order to accurately assess the occurrence of collision mortality.

For the first monitoring period six turbines were selected (Turbine numbers 21, 22, 23, 24, 25, & 44) (Figure 3). Given the high diversity and abundance of native birds in the Manawatu Gorge Scenic Reserve the key ecological concern during consenting was the proximity of the turbines to this reserve (Boffa Miskell 2003). Those turbines selected therefore included several of the turbines closest to the edge of the Manawatu Gorge Scenic Reserve (figure 3 & table 1). Four turbines also lay in relatively close proximity to a large farm pond noted for its sizeable resident population of waterfowl. These turbines were also chosen to sample expected flyways through the site between Manawatu Gorge Scenic Reserve and other bush fragments including the QEII covenant, Bolton's Bush (figure 3).

In the second monitoring period the number of turbines monitored was increased to eight, including the original six turbines and a further two (Turbine numbers 12 & 17) (Figure 3). The additional two turbines were located at a greater distance from forest margins in order to test whether turbines located further from forest margins pose less of a collision risk to birds (Table 1).

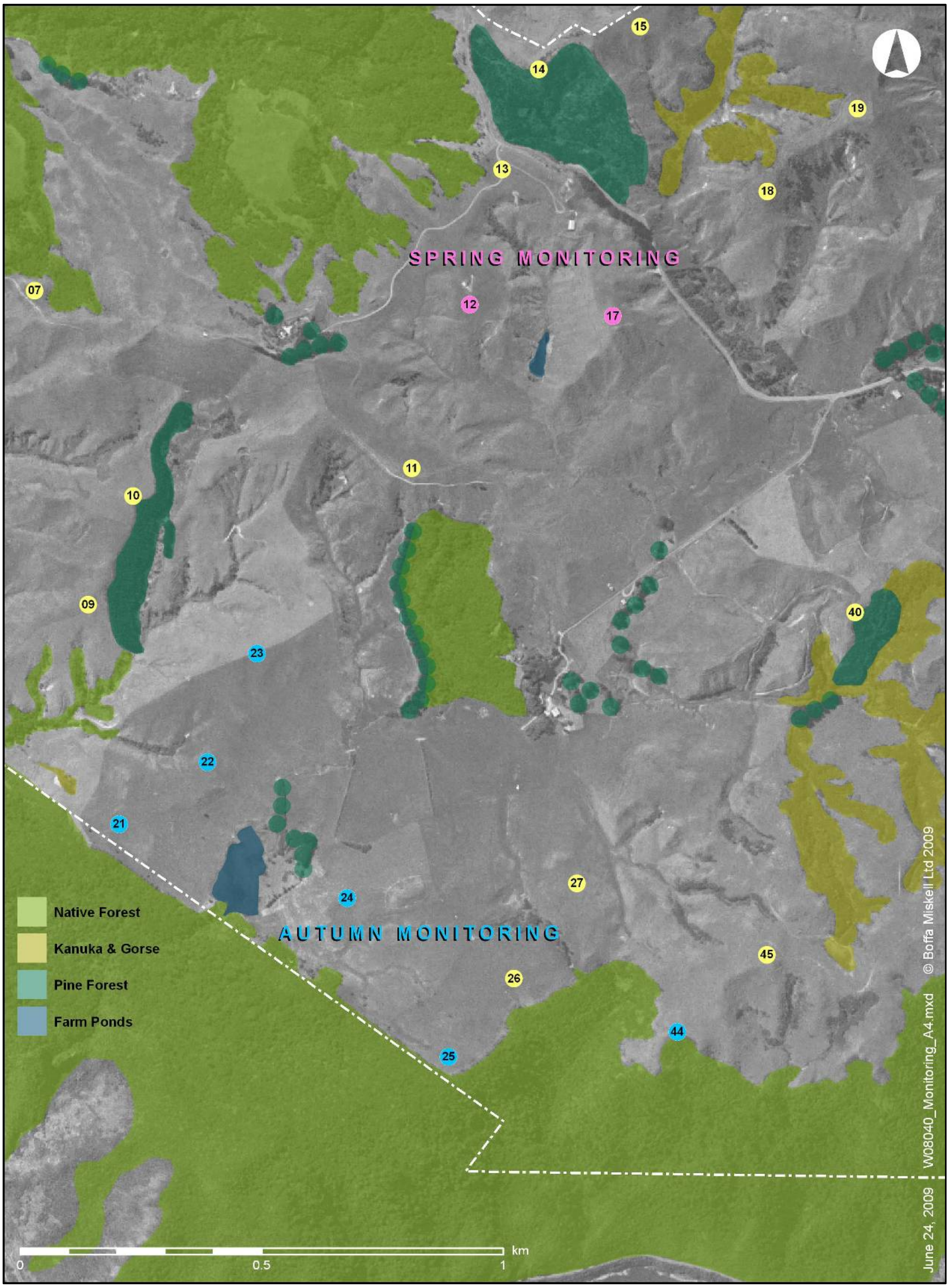

Figure 3: Te Apiti wind farm sample turbines and habitat type. Blue turbines monitored in spring, Pink turbines added to the autumn study. Yellow turbines not included.

The turbines selected also generally had a minimum of 100 m of easily searchable terrain surrounding them with the exception of turbine 44 which was slightly more constrained. In all cases the search area was in pasture and was grazed to a low turf by sheep and cattle. Figure 4 shows part of the study area, the type of terrain and vegetation encountered.

Table 1: Distance of sample turbines to the Manawatu Scenic Reserve, other bush fragments within the wind farm footprint and to the nearest wetland areas.

Turbine Number	Distance to Manawatu Gorge Scenic Reserve (m)	Distance to nearest native bush margin (m)	Distance to nearest Stock Pond (m)
21	65	65	230
22	262	262	140
23	511	325	350
24	158	158	175
25	75	75	455
44	20	20	925
12	1,350	190	150
17	1,520	410	130

Figure 4: Typical 1.65 MW wind turbines at Te Apiti wind farm (70 m high supporting column with 35 m blades). Also note the edge of Manawatu Scenic Reserve behind the turbines.

3.3 Carcass Search Technique

Following a review of a number of overseas studies (e.g. Anderson et al. 1999; Johnson et.al 2002, Erickson 2004) a search radius was settled on that was equivalent to 1.5 to 2 times the length of a turbine blade. 100 x 100 m search grids were set up centred on each turbine providing for a search area which was a minimum of 50m and up to 68m from the turbine base (see Figure 6). As per international guidelines we used square plots rather than circular plots to facilitate marking search boundaries, and conducted the search using parallel transects.

It is acknowledged that some birds may be thrown further than the outskirts of the 100 m grid (e.g. Erickson 2004) but wind farm studies from the USA and Europe indicate that most birds struck by turbines fall within 40m of the tower, and the great majority fall within 65m (Young et al 2003, Orloff & Flannery 1992). Blade length is an important consideration and these studies typically defined a search grid ranging from 1.5 to 3 times the blade length. At Te Apiti, with turbine blade length of 35m, a 100m search grid was seen as a workable compromise between search efficacy and effort.

The grids were searched by two observers walking parallel transects approximately two metres apart until the whole of the 100 x 100 m grid area had been visually scanned. Observers walked slowly to reduce the chances of any carcasses being missed. The time that each search took was recorded to ensure search effort was standardised between turbines and over time (each grid took approximately 40 minutes to search).

Data recorded on bird carcasses included, time and date located, species, sex, age, turbine number, turbine activity at the time, distance from turbine, condition of carcass (intact, scavenged, dismembered, feather spot) weather and comments regarding suspected cause of death. Feather spot was defined as ten or more feathers of the same species in the same location (Erickson 2004). This definition was necessary in order to avoid single random feathers not associated with collision mortality being recorded as potential fatalities. Surveys were carried out regardless of the weather conditions (unless there was risk of lighting strike) in order to test the effect that weather conditions, in particular poor visibility, had on turbine strike. Weather conditions recorded, included wind direction, speed, temperature, precipitation and cloud cover.

Because cause of death is not always able to be determined due to scavenging or decomposition, international studies provide two alternative approaches (AUSWEA 2005). The first is to establish reference plots and determine natural baseline mortality rates for the site. This significantly increases search effort. The second approach is to assume all birds found within the search grid were turbine mortalities even though some may be natural deaths. This approach will therefore over-estimate the number of turbine mortalities but is more cost effective. We have adopted the later method.

In order to assess whether there was any relationship between the relative abundance of bird species in the area and collision risk the species present within the wind farm footprint were noted along with a score of relative abundance.

3.4 Carcass Removal and Decay Trials

We have relied on international studies for developing a methodology for carcass removal and decay, summarised in Morrison (2002). Removal rates will strongly influence the frequency of searching and must be factored into the final analysis of mortalities.

The various studies described by Morrison showed scavenging varied from almost immediate removal of a carcass, to in-situ scavenging over a long period and where the carcass remained identifiable for weeks, or in some cases, months.

These studies suggested a mean length of stay for carcasses ranged from three days to two weeks. Several studies noted that the rates of removal changed seasonally with carcasses remaining longer in autumn and winter. This seasonal variation will relate to changes in the seasonal populations sizes of predator and scavenger species.

Several studies also noted that the scavenger and removal rates differed depending on the size of the bird with smaller birds tending to be removed over a relatively short period and larger birds tending to be scavenged on site over a longer period.

Rates of scavenging, decomposition, and removal of carcasses were measured using both wild carcasses found on site and through the placement of domestic chicken carcasses. Eleven day old chicks and eight half grown pullets were randomly placed under the study turbines the night before searches took place. These were broadly intended to represent small passerines and waterfowl respectively. Searchers were not aware of the location of the carcasses or when this element of the study would take place.

All carcasses were left in situ to allow the assessment of how quickly they degraded and/ or were scavenged. The wild carcasses were mapped in relation to the turbine tower to determine how far from the turbine tower carcasses were likely to be located.

Wild carcasses were monitored for the full duration of observation after they were located. Chicken carcasses were monitored for two weeks.

3.5 Detection Success

The same domestic chicken carcasses were also used to determine the detection success of observers.

Searcher efficiency has been variously reported between 35% and 100% with terrain and vegetation playing a significant role, with efficiency rates varying from 70% to 100% in grassland and reducing in taller vegetation. The size of the bird has also been found to affect searcher efficiency with one study reporting searcher efficiency of 50% for small birds and 87.5% for large birds (Morrison 2002).

Detection success was measured by placing 11 day old and 8 half grown chickens within the turbine search areas the evening before a search. The location maps drawn by the searchers were then compared with the maps of carcass placements.

3.6 Bird Activity

To provide some context to any mortality that was encountered an assessment of bird diversity and activity within the study area was also recorded.

Rather than use the standard 5-minute (10m) bird counts, we undertook a more subjective study that recorded all visible activity over pasture within the windfarm footprint. During each site visit bird activity within the wind farm footprint was recorded onto standardised field sheets. Abundance was broadly measured as; Single, Few (2-5), Many (5-20), Abundant (20+).

3.7 Weather Conditions

On each day of study a range of weather conditions were recorded including visibility, precipitation, temperature, wind strength, and wind direction.

4 RESULTS

4.1 General Bird Activity

Thirty-one species of bird, including three threatened species were recorded within the wind farm footprint during autumn and spring carcass monitoring periods (Table 2). There was some variation in bird assemblage and abundances between seasons, but the species most active within the site were species common to this type of rural environment and included Australian magpie (*Gymnorhina tibicen*), Paradise shelduck (*Tadorna variegata*), Spur-winged plover (*Vanellus miles*), Australasian harrier (*Circus approximans*), starling (*Sturnus vulgaris*), goldfinch (*Carduelis carduelis*), welcome swallow (*Hirundo tahitica*), grey warbler (*Gerygone igata*), and tui (*Prosthemadera novaeseelandiae*), which were seen on 60% of visits or more.

Table 2: The species of bird present within the wind farm footprint during spring and autumn carcass monitoring periods, their threat class, and the proportion of days each species was observed.

			Autumn		Spring		Combined	
Common	**Latin**	**Status**	**Count**	**%**	**Count**	**%**	**Count**	**%**
Australian magpie	*Gymnorhina tibicen*	Introduced	30	100%	30	100%	60	100%
Paradise shelduck	*Tadorna variegata*	Not threatened	28	93%	29	97%	57	95%
Spur-winged plover	*Vanellus miles*	Not threatened (SO)	27	90%	27	90%	54	90%
Australasian harrier	*Circus approximans*	Not threatened (SO)	23	77%	26	87%	49	82%
Starling	*Sturnus vulgaris*	Introduced	13	43%	27	90%	40	67%
Goldfinch	*Carduelis carduelis*	Introduced	30	100%	8	27%	38	63%
Welcome swallow	*Hirundo tahitica*	Not threatened (Inc SO)	18	60%	20	67%	38	63%
Grey warbler	*Gerygone igata*	Not threatened	12	40%	25	83%	37	62%
Tui	*Prosthemadera novaeseelandiae*	Not threatened (OL St)	13	43%	23	77%	36	60%
Yellowhammer	*Emberiza citrinella*	Introduced	3	10%	30	100%	33	55%
New Zealand pigeon	*Hemiphaga novaeseelandiae*	Not threatened (CD Inc)	16	53%	14	47%	30	50%
New Zealand pipit	*Anthus novaeseelandiae*	Declining	23	77%	7	23%	30	50%
Chaffinch	*Fringella coelebs*	Introduced	7	23%	22	73%	29	48%
Mallard	*Anas platyrhynchos*	Introduced	8	27%	19	63%	27	45%
Eastern rosella	*Platycercus eximius*	Introduced	10	33%	16	53%	26	43%
Black-backed gull	*Larus bulleri*	Not threatened (SO)	3	10%	22	73%	25	42%
House sparrow	*Passer domesticus*	Introduced	0	0%	21	70%	21	35%
Shining cuckoo	*Chrysoccyx lucidus*	Not threatened (DP)	0	0%	21	70%	21	35%
Fantail	*Rhipidura fulginosa*	Not threatened	11	37%	7	23%	18	30%
Blackbird	*Terdus merula*	Introduced	2	7%	15	50%	17	28%
Greenfinch	*Carduelis chloris*	Introduced	6	20%	11	37%	17	28%
Sacred kingfisher	*Halycon sancta*	Not threatened	4	13%	13	43%	17	28%
White-faced heron	*Ardea novaeseelandiae*	Not threatened (SO)	5	17%	5	17%	10	17%
Song thrush	*Turdus philomelos*	Introduced	0	0%	9	30%	9	15%
Rook	*Corvus frugilegus*	Introduced	5	17%	0	0%	5	8%
Silvereye	*Zosterops lateralis*	Not threatened (SO)	5	17%	0	0%	5	8%
Redpoll	*Carduelis flammea*	Introduced	1	3%	3	10%	4	7%
Bellbird	*Anthornis melanura*	Not threatened	2	7%	1	3%	3	5%
Black shag	*Phalacrocorax carbo*	Naturally uncommon (SO, sp)	0	0%	2	7%	2	3%
New Zealand falcon	*Falco novaeseelandiae*	Nationally vulnerable	0	0%	1	3%	1	2%
Skylark	*Alauda arvensis*	Introduced	0	0%	1	3%	1	2%

Status: New Zealand threat classification (Miskelly et al 2008)
Qualifiers: **CD**, Conservation Dependent; **DP**, Data Poor; **Inc**, Increasing; **OL**, One Location; **SO**, Secure Overseas; **St**, Stable;

Native species commonly observed flying over within the wind farm envelope included Tui (*Prosthemadera novaeseelandiae*), grey warbler (*Gerygone igata*), New Zealand pigeon (*Hemiphaga novaeseelandiae*), Australasian harrier (*Circus approximans*), New Zealand pipit (*Anthus novaeseelandiae*) and black backed gull (*Larus bulleri*). A pair of New Zealand falcon (*Falco novaeseelandiae*) were observed on one occasion flying through the centre of the site, which is the first time they have been recorded at Te Apiti. A more detailed table providing data on daily abundances can be found in Appendix 8.3 and 8.4.

4.2 Weather Conditions

Turbine searches were carried out in a wide variety of weather conditions summarised in the following table.

Table 3: Summary of weather conditions during autumn and spring monitoring periods combined (see Appendix 8.1 & 8.2 for more detailed daily weather descriptions).

		COUNT	%
Visibility	Fine/ Sunny	15	16%
	Partly cloudy	22	23%
	Overcast	18	19%
	Heavy cloud	10	11%
	Mist/fog	14	15%
	Rain	16	17%
Precipitation	None	42	49%
	Dripping foliage	7	8%
	Drizzle	12	14%
	Light	6	7%
	Moderate	10	12%
	Heavy	9	10%
Temperature	Freezing (<0)	2	3%
	Cold (0-5)	5	7%
	Cool (5-11)	32	42%
	Mild (11-16)	30	39%
	Warm (16-22)	6	8%
	Hot (>22)	1	1%
Wind strength	Calm	10	11%
	Light breeze	15	16%
	Mod. Breeze	23	24%
	Fresh wind	14	15%
	Strong wind	21	22%
	Near gale	12	13%
Wind direction	Northerly	17	24%
	Southerly	3	4%
	Westerly	13	18%
	Easterly	10	14%
	North Easterly	4	6%
	South Easterly	6	8%
	North Westerly	19	26%

Visibility varied from clear skies to heavy cloud and mist or fog was experienced on 15% of visits. There were 13 days of rain, mist, and fog in autumn and 15 days in spring.

Temperatures ranged from 0 to 22 degrees Celsius but were typically cool to mild in both seasons. Winds varied from calm to near gale, and blew predominantly from the north, northwest and west.

4.3 Detection Success

Out of the 11 day-old chicks placed in pasture nine were successfully located the next morning; one was overlooked, but located the next day, the other had been removed and was presumably scavenged. Of the ½ grown chickens all eight individuals were successfully located the next day.

This gives a 100% detection rate for large sized birds and a 90% detection success rate for small birds. However, it needs to be highlighted that the sites were all in closely cropped pasture and that these high detection rates are unlikely to be applicable to other types of vegetation, where it is likely to be considerably more difficult to visually locate carcasses.

Not including birds removed by scavenging, this indicates that the search technique was efficient and is likely to identify a high proportion of collision mortalities occurring at these turbines during the study period.

4.4 Collision Mortality

Four bird carcasses were already present beneath the study turbines before the monitoring commenced, two in autumn and two in spring; a mallard (*Anas platyrhynchos*) and a goldfinch (*Carduelis carduelis*) in autumn, and an Australian magpie and a silvereye (*Zostrops lateralis*) in spring (Table 4 - Figure 5). It was not possible to confirm whether the mortalities of the goldfinch and silvereye were caused by collision with the turbines or how long they had been dead due to the stage of decomposition. However, we have assumed based on their locations that they were turbine strikes. The mallard was also highly decomposed not allowing an assessment of the time of death, but had an obvious fracture at the back of the skull indicating a high likelihood of turbine strike. The magpie was present at the start of the spring monitoring period but based on scavenging rates discussed below, we conclude it had been killed no more than two days previous and possibly the night before the start of the monitoring period.

During the two month monitoring period three further carcasses were located beneath the study turbines, a mallard, a silvereye, and a chaffinch (*Fringella coelebs*) (table 4 - figure 5). Additionally, during the spring study period the carcasses of an Australasian harrier and an Australian magpie were located by operational staff at turbine sites not part of this monitoring programme (Table 4 - Figure 5). Of particular note is the silvereye mortality in spring, where the moment of collision was actually observed by the field team carrying out a search at the base of a turbine (Figure 5.d.).

All carcasses located were assumed to have died as a result of collision with turning turbine blades. In some cases this is indicated by fractured bones (table 4). However, other carcasses were too heavily scavenged or decomposed to confirm cause of death. We have assumed they died as a result of collision due to their location beneath the turbines (table 4). This may therefore represent a bias in the data.

Figure 6 shows the compass bearing of each carcass and their distance from the turbine base. Too few carcasses were found to provide any meaningful analysis of this distribution.

Table 4: Details of carcasses located beneath turbines during autumn and spring monitoring periods.

	Autumn				Spring				
Collision no.	1	2	3	4	5	6	7	8	9
Species	Goldfinch	Mallard	Mallard	Silvereye	Australian magpie	Silvereye	Australian magpie	Chaffinch	Australasian harrier
Figure	5.a.	5.b.	5.c.	5.d.	5.e.	5.f.	5.g.	5.h.	5.i.
Date located	31/03/08	31/03/08	11/04/08	12/04/08	20/10/08	20/10/08	23/10/08	28/10/08	04/11/08
Age	-	Adult	Adult	Adult	Adult	Adult	Adult	-	Adult
Likely time of death	Unknown	Unknown	10/04/08	12/04/08	18-19/10/08	Unknown	Unknown	27/10/08	Unknown
Turbine number	23	24	22	23	22	23	11	22	10
Wind conditions*	-	-	Calm	normal	-	-	-	Near gale	-
Wind direction**	-	-	-	Easterly	-	-	-	North	-
Distance from turbine (m)	11.5	45.7	51.4	27.2	17.5	27.4	-	60	28.7
Direction to turbine (º)	60	134	282	150	270	290	-	256	20
Remains	Wings	Almost whole	Feathers & bones	Two parts	Almost whole	Body	-	Wing	Wing missing
Condition	-	Decomposed	Fresh	Fresh	Fresh	Decomposed	Decomposed	-	Decomposed
Scavenged?	Yes	No	Yes	No	Yes	No	?	Yes	Possibly
Evidence	Location	Fractured skull	Fractured wing	Observed	Fractured wing	Location	Location	Location	Fractured wing
How long detectable for (days)	34 +	34 +	23 +	22 +	34 +	34 +	-	25	-

* Classes: Calm; light breeze; moderate breeze; fresh wind; strong wind; near gale Details given for date when the collision is suspected to have occurred.

** Details given for date when the collision is suspected to have occurred.

5.a. Goldfinch

5.b. Mallard

5.c. Mallard

5.d. Silvereye

5.e. Australian magpie

5.f. Silvereye

5.g. Australian magpie

5.h. Chaffinch

5.i. Australasian harrier

Figure 5: Photos of bird carcasses the day they were discovered.

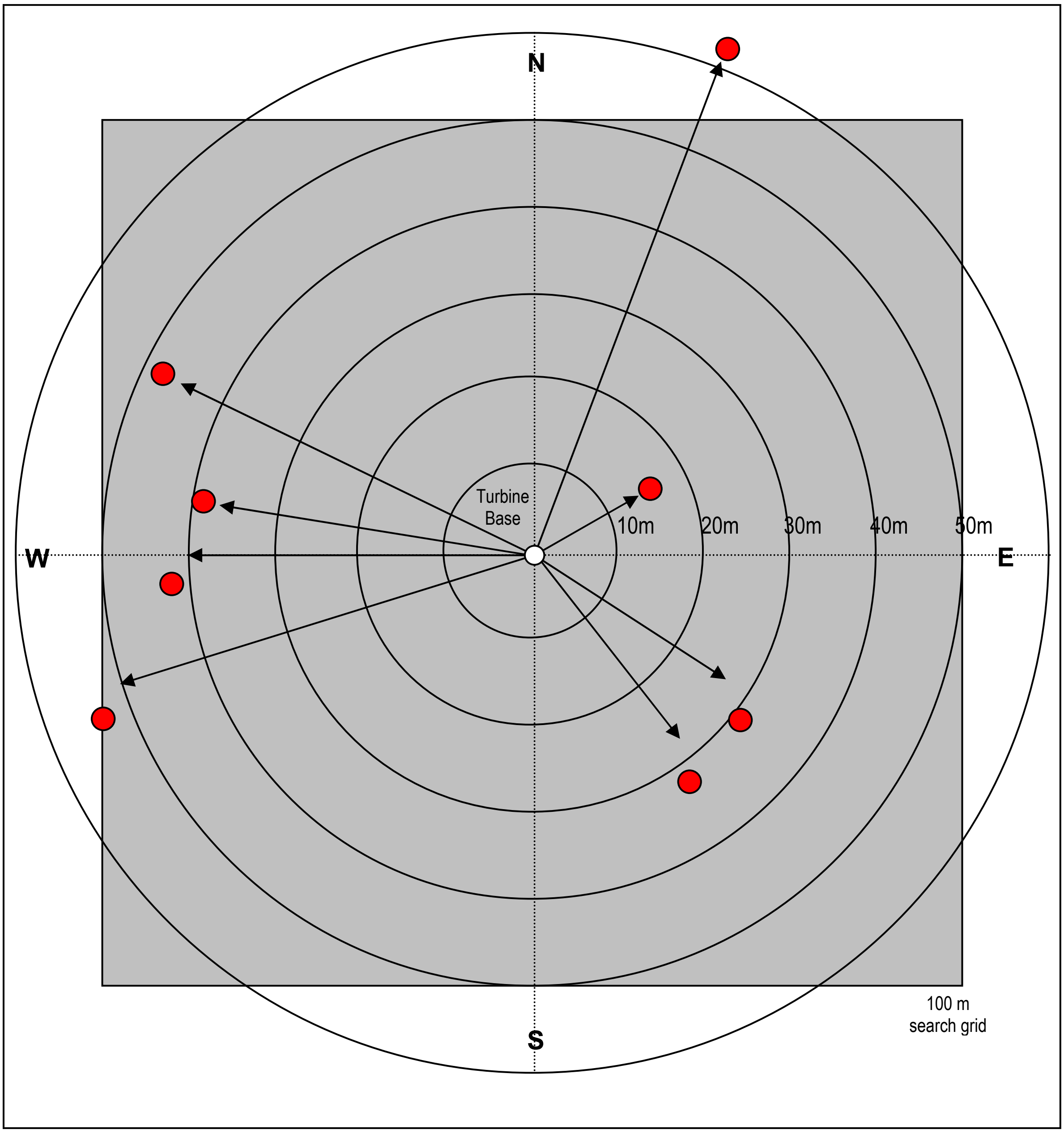

Figure 6: Location and distance of bird carcasses relative to turbines.

5 CARCASS REMOVAL RATES

5.1 Domestic Chicken

One day old chick was removed on the first night; six were removed after seven days (Figure 7). After two weeks nearly all sign of the day old chicks had gone, with the remains of only two chicks remaining as feather spots after 11 days. Day old chicks tended to be removed from the site without any remains being left, indicating they are eaten whole insitu or are removed offsite before feeding.

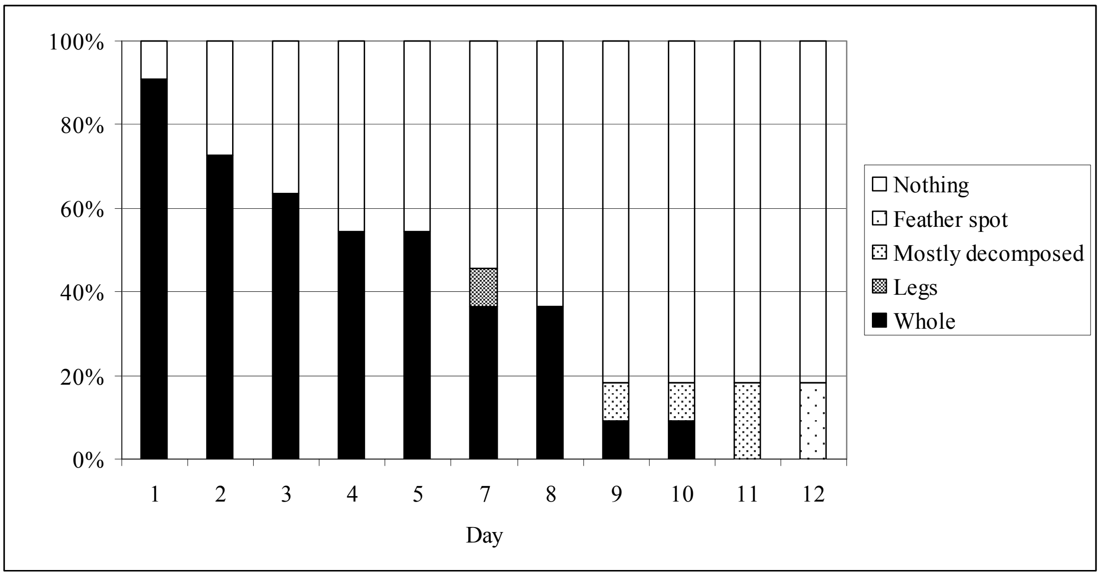

Figure 7: Graph of scavenging/ removal rates of day olds chicks (n=11) in autumn.

Larger carcasses were more obviously scavenged and within a week were largely reduced to feather spots (Figure 8). However, after two weeks all carcasses were still detectable as feather spots. Overall, neither day old chicks or half grown chickens were moved very far from the place they were originally placed, indicating that the place in which wild carcasses are located beneath turbines is close to where they landed after turbine collision.

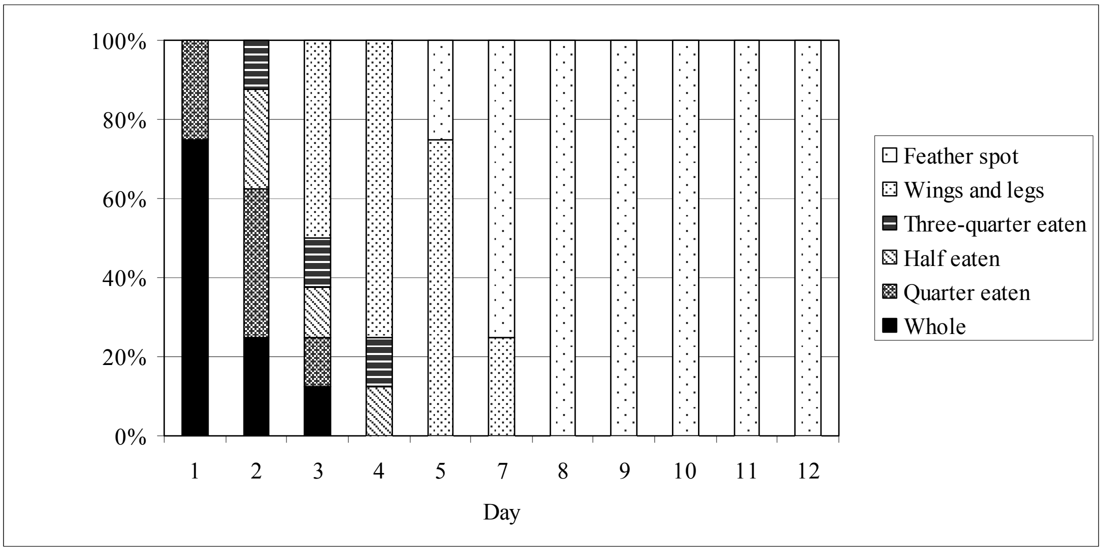

Figure 8: Graph of scavenging/ removal rates of half grown chickens (n=8) in autumn.

5.2 Wild Carcasses

Of the seven wild carcasses located under turbines during the study period, all seven were still detectable and identifiable more than 20 days after discovery (table 4).

During the autumn, the goldfinch remained present as a feather spot for the whole of the monitoring period. The first mallard was mostly decomposed and semi-desiccated when discovered and changed little during the monitoring period. The second mallard however was scavenged the first day but remained as a feather spot. The silvereye was not scavenged, remaining for the whole period as a feather spot after decomposing. During spring the magpie was scavenged but left largely intact during the whole monitoring period. The silvereye also remained largely intact, but the feather spot of the chaffinch disappeared after 25 days, presumably having been blown away.

Overall this indicates that signs of wild carcasses may remain onsite longer than the day old and half grown chickens used to experimentally describe carcass removal rates.

5.3 Annual Collision Mortality Rates

Below we examine the potential total number of birds that may suffer collision mortality per turbine per annum, and for Te Apiti wind farm as a whole, based on the results from the subset of turbines monitored over the two month study and correcting for scavenging and detection rates.

Overall, nine wild carcasses were located within the study period (table 4), however only four are included in this analysis. Three carcasses died at an undefined time prior to the study commencing so in order to avoid bias they are not included in this scaling analysis. One harrier and one magpie were located during the study period but at turbines outside the study area, and at an undefined time, so are also not included. One magpie was present on the first day of the spring monitoring period, but we believe that it had been killed that night or the day before and for this reason we have included it with the other three mortalities that were observed during the two month study.

5.3.1 CORRECTING FOR DETECTION SUCCESS

The detection success was 100% for large bird carcasses and 90% for small bird carcasses, therefore no correction factor was required to account for detection of large birds but a correction factor of 10% was required to account for small birds being overlooked.

5.3.2 CORRECTING FOR REMOVAL OR SCAVENGE

Nine percent of day old chicks were removed the day after they were placed out beneath turbines. However, because they were put out just before dark and the searches began at first light the next day, a correction factor of 27% (see figure 7) was used for small birds (i.e. chaffinch & silvereye) in order to account for the fact that some birds could have collided shortly after a turbine was searched in the morning and then had a daylight scavenging period as well as a night time scavenging period within which to have been scavenged. No correction was required for large birds (i.e. magpie & mallard).

5.3.3 CALCULATION OF ANNUAL COLLISION RATES PER TURBINE AND PER ANNUM

Overall, a mean of four birds are predicted to be killed through collision with turbine blades per year at each turbine, or 224 birds per year over the whole wind farm (Table 5).

Table 5: Annual predicted collision mortalities calculated from the results of intensive searches, per turbine and for Te Apiti wind farm as a whole. Results are shown per season, taking account of different number of turbines monitored between seasons, with an average for the two seasons.

	Autumn	Spring
Large carcasses found	1	1
Small carcasses found	1	1
Correction factor for detection success for large birds	0.00	0.00
Correction factor for detection success for small birds	0.10	0.10
Correction factor for large bird removal	0.00	0.00
Correction factor for small bird removal	0.20	0.20
Total mortalities during study period after correction factor applied	2.30	2.30
Days of study	30	30
Number of sample turbines	6	8
Mortalities per turbine during study period	0.38	0.29
Mortalities per turbine per day	0.01	0.01
Mortalities per turbine annually	4.66	3.50
Total mortalities over wind farm per annum	256.51	192.39
MEAN NUMBER OF COLLISONS PER TURBINE PER YEAR	**4**	
MEAN NUMBER OF COLLISONS AT TE APITI PER YEAR	**224**	

6 DISCUSSION

6.1 Monitoring success

6.1.1 Passive versus Active Searching

As expected, the numbers of birds and the species recorded colliding with turbine blades differs between passive and intensive monitoring techniques. Using passive monitoring techniques not only results in fewer individuals being recorded, but fewer species, and a bias towards relatively large species. In contrast a broad size range of birds, from 13g silvereye's to 1,300g mallards, were recorded by the intensive monitoring employed during this study. This included three species not previously recorded as colliding with turbines at Te Apiti (silvereye, goldfinch, and chaffinch). Overall, intensively monitoring the bases of a sample of turbines daily allowed the number and type of collision mortalities to be determined with a high degree of confidence.

6.1.2 Detection Success

Detection success was relatively high, although this may be largely due to the relative ease in which it was possible to search the area below the turbines and detection rates are likely to be far lower in even slightly longer grass, and especially in different habitat types such as tussock and scrub. Therefore, should collision studies be required at future wind farms, it is important that consideration is given to the surrounding vegetation. For example, if revegetation of the turbine platform is proposed as part of consent, this should possibly be delayed until after any collision studies are completed.

6.1.3 Search Area and Effort

Carcasses were located between 11 and 60 m from turbine bases with an average distance of 33m. The upper 95% confidence interval gives a distance of 45m, and a more conservative two standard deviations gives an upper limit of 67m. Both of these values are very similar to the values obtained from overseas studies as discussed above, however, we have a very small sample size (n = 8) which to some degree limits confidence in this distribution.

This study gives no indication of the likely distance a bird may be thrown on collision with a turbine blade, although it is noted that the silvereye that was observed colliding with the turbine blade fell directly to the ground after collision, rather than being thrown any distance. It is plausible to imagine a bird being thrown a greater distance than the 100 x 100 m area searched in this study but as the search area is expanded effort increases geometrically with distance from the turbine ultimately reaching a point of diminishing returns. A search area needs to be selected which can be covered efficiently and where the highest concentration of carcasses might be expected.

International guidance suggests that in making this decision it is generally preferable to search a larger number of turbines, but with a smaller search area at the base of each turbine, than to search intensively at only a few turbines. This is because it is possible that only a few turbines may cause problems for birds (Canadian Wildlife Service 2006).

6.1.4 Climatic Influence

Weather conditions, in particular poor visibility, may influence collision strike risk although the link has not been confirmed and may be more of an issue for migratory species (NWCC 2005). However, given the high rates of fog and cloud on many potential windfarm sites, it is an issue that needs further consideration. The sample size collected during this study was not sufficient to investigate the effects of weather. However, although the study was carried out over a relatively short period, a wide variety of weather conditions occurred and it can be assumed that any effects due to weather are broadly representative.

6.2 Recommendations for future monitoring

Although monitoring the bases of a sample of turbines daily allowed the number and type of collision mortalities to be determined with a high degree of confidence, in doing so the number of turbines that could be searched was reduced. However, results of removal rates indicate if turbines are not searched daily then much more reliance is placed on the accuracy of correction factors. It is essential therefore that the rate at which bird carcasses are removed and the length of time that evidence of bird strike remains is accurately determined before designing the study and making a decision on the frequency that searches are to take place.

Two different approaches can be taken to this. The first is to search frequently, as was done for this study, to limit the effect of scavenging on the final results. The second approach is to search less frequently, assume that a significant proportion of carcasses will be removed by scavengers without being recorded, and to place much greater reliance on extensive scavenger trials to account for these removal rates. Both approaches are used internationally.

6.2.1 Removal Rates

Observations of wild carcasses indicated that small carcasses were possible to find as feather spots more than 20 days after first being located. However, the day old chicks used in investigations of removal rates were generally removed far earlier. The lack of hard penned feathers and the soft bones of day old chicks may well explain this. It is also conceivable that domestic chickens are more visible to scavengers and so scavenger rates are higher. It is therefore recommended that in future studies carcasses of birds more closely representing the types and sizes of species likely to be encountered should be used. We also recommend that due to the large differences in removal rates between small and large birds, a third medium sized category of bird should be used for future trials.

A number of factors including weather and scavenger density will vary between different areas of New Zealand. It is therefore essential that removal studies are carried out at each site to investigate the situation in each area. Further, the time of year may also influence removal and decomposition rates and the more times investigations of removal can be repeated through the year the more accurate the correction factors will be. Carcasses should be placed beneath turbines early in the day, the day before any searches take place, to ensure one day and one night of scavenging occurs before searches. Consideration must also be given to the fact that a large number of carcasses could encourage increased scavenger numbers, although it is acknowledged that at what point this may occur, and how to account for this, is difficult to determine.

6.2.2 Search Effort

Considering the results above, the optimum search effort for Te Apiti windfarm would be to undertake turbine searches on a weekly rotation. In doing so it would be possible to survey nearly all of the turbines at Te Apiti weekly with the same effort, while still locating a high proportion of collision mortalities. Ideally the study would cover all four seasons and would extend for a minimum of two years to cover annual variation in avian activity.

However, further trials that more accurately establish the removal rates of small birds need to be completed to confirm the appropriateness of this search frequency and the necessary correction factor.

6.2.3 Searcher efficiency

Searcher efficiency in this trial was very high when compared to some international studies. We believe that this is largely due to the generally flat to rolling terrain and closely cropped grass pasture that all turbines were located within.

However, even with the grass beneath the turbines being kept to a short sward by grazing stock it was still very difficult to locate small birds such as finches. It is therefore recommended that the 80 minute searches' using transects spaced approximately 2 m apart employed in this study, is an appropriate search intensity. The use of at least two team members to reduce the levels of monotony in searching is further recommended.

We anticipate that other sites which are steeper or which have a greater proportion of scrub and shrubland will pose greater problems for searchers and the efficiency rates will fall accordingly.

6.2.4 Cause of death

Ideally, carcasses should be checked for signs of collision by a qualified vet. Nevertheless, in this study when signs of the cause of mortality were not obvious (e.g.

large broken bones or missing wings) it is unlikely that a vet would have added any further interpretation. Some international studies have suggested the most efficient approach is to assume that all carcasses located in the search area have died as a result of collision mortality even if this occasionally will result in natural deaths being included in the sample. Nevertheless, due to difficulties in feather identification it is strongly recommended that somebody familiar with bird identification using bird feathers (e.g. a museum curator) confirms the species of all collisions.

6.3 Implications for collision mortality of New Zealand birds

- This study calculates 4 mortalities per turbine per annum for the Te Apiti wind farm. This number is consistent with overseas studies (NWCC 2001, Birdlife International 2003).
- This study recorded considerable activity of a wide range of bird species, raptors, passerines (native and exotic) and waterfowl within the windfarm footprint over two seasons. Of the 31 species observed in the site, mortalities were recorded of 7 species (chaffinch, goldfinch, mallard, magpie, silvereye, harrier, and kingfisher). This number includes the results of this study combined with the previous 4 years of passive observation.
- All affected species are common species of open country and dissected farmland. No mortalities were recorded of species of the surrounding forests and shrublands such as tui, bellbird, kereru, grey warbler, and shinning cuckoo, all of which were recorded passing through the windfarm footprint.
- Three of the species killed, were amongst the most abundant recorded on site (magpie, harrier hawk, goldfinch). However, two species that were recorded colliding twice (mallard and silvereye) were observed in relatively low numbers and a number of other species that were recorded as abundant (e.g. paradise shelduck, spur winged plover, starling, and welcome swallow) were not recorded as collision fatalities. This suggests that the risk of collision mortality varies between species, possibly due to differences in behaviour. For example, mallards will fly at night between roosting and feeding grounds, harriers use the wind to slowly quarter the ground for prey, and chaffinch, goldfinch, and silvereyes exhibit flocking behaviour, all of which could potentially make these species more prone to collision with turbine blades.
- This was a trial study and future wind farm monitoring should be carried out over a greater time period and include more turbines. However, while this study is unlikely to have picked up every species that was killed, especially where mortality rates are very low (1 per annum), it is likely to be representative of the relative level of impact for common and abundant species.
- In conclusion the level of mortality calculated by this study is highly unlikely to affect local populations of the species killed. All affected species are abundant at this site regionally and nationally.

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8 APPENDICES

8.1 Weather conditions - autumn monitoring period (detail)

	Visibility						Precipitation						Temperature						Wind strength						Wind direction						
	Fine/ Sunny	Partly cloudy	Overcast	Heavy cloud	Mist/fog	Rain	None	Dripping foliage	Drizzle	Light	Moderate	Heavy	Freezing (<0)	Cold (0-5)	Cool (5-11)	Mild (11-16)	Warm (16-22)	Hot (>22)	Calm	Light breeze	Mod. Breeze	Fresh wind	Strong wind	Near gale	Northerly	Southerly	Westerly	Easterly	North Easterly	South Easterly	North Westerly
31 Mar 08					X					X						X				X											
1 Apr 08					X			X	X							X							X				X				
2 Apr 08		X					X								X								X					X			
3 Apr 08	X						X								X								X					X			
4 Apr 08			X				X									X					X										X
5 Apr 08			X				X									X					X										
6 Apr 08																															
7 Apr 08						X	X		X							X							X					X			
8 Apr 08		X					X								X								X					X			
9 Apr 08			X				X								X						X										
10 Apr 08	X						X									X			X												
11 Apr 08	X						X														X						X				
12 Apr 08		X					X									X						X						X			
13 Apr 08																															
14 Apr 08		X					X									X					X								X		
15 Apr 08				X				X									X				X				X						
16 Apr 08					X				X							X					X										
17 Apr 08					X	X					X	X				X						X				X					
18 Apr 08				X		X				X						X								X							X
19 Apr 08		X					X								X					X										X	X
20 Apr 08																															
21 Apr 08	X						X								X						X				X						
22 Apr 08				X		X				X		X				X							X				X				
23 Apr 08		X					X		X						X									X	X						
24 Apr 08			X				X									X				X					X			X			
25 Apr 08	X				X		X									X			X												
26 Apr 08					X		X								X						X							X			
27 Apr 08																															
28 Apr 08			X					X			X						X			X					X						
29 Apr 08				X		X				X						X					X								X		
30 Apr 08		X					X									X							X		X						
1 May 08			X			X	X					X		X		X					X			X		X					X
2 May 08		X	X			X	X		X		X	X			X								X	X							X
3 May 08	X						X							X								X									X
COUNT	6	8	7	4	6	7	21	3	5	4	3	4	0	2	9	17	2	0	2	4	11	3	8	4	6	2	3	7	2	1	6
%	16%	21%	18%	11%	16%	18%	53%	8%	13%	10%	8%	10%	0%	7%	30%	57%	7%	0%	6%	13%	34%	9%	25%	13%	22%	7%	11%	26%	7%	4%	22%

8.2 Weather conditions - spring monitoring period (detail)

	Visibility							Precipitation							Temperature							Wind strength							Wind direction						
	Fine/ Sunny	Partly cloudy	Overcast	Heavy cloud	Mist/fog	Rain		None	Dripping foliage	Drizzle	Light	Moderate	Heavy		Freezing (<0)	Cold (0-5)	Cool (5-11)	Mild (11-16)	Warm (16-22)	Hot (>22)		Calm	Light breeze	Mod. Breeze	Fresh wind	Strong wind	Near gale		Northerly	Southerly	Westerly	Easterly	North Easterly	South Easterly	North Westerly
23 Oct 08						X						X					X								X									X	
24 Oct 08						X				X							X						X												X
25 Oct 08					X					X								X				X				X			X		X	X			
26 Oct 08																																			
27 Oct 08		X						X								X											X		X						
28 Oct 08		X	X					X									X								X	X									X
29 Oct 08				X	X			X				X					X									X	X								X
30 Oct 08	X	X						X									X	X					X	X							X			X	
31 Oct 08		X						X									X								X	X	X								X
1 Nov 08			X			X		X		X							X								X	X	X								X
2 Nov 08																																			
3 Nov 08		X						X		X							X							X					X		X				
4 Nov 08			X					X		X							X	X					X	X	X										X
5 Nov 08				X	X	X						X	X			X										X	X				X				
6 Nov 08			X	X		X						X	X				X									X	X								X
7 Nov 08	X			X		X						X	X				X							X	X	X			X		X				
8 Nov 08	X	X						X									X	X	X				X									X			
9 Nov 08																																			
10 Nov 08			X					X										X				X							X		X				
11 Nov 08		X	X					X										X					X	X											X
12 Nov 08		X			X			X									X							X										X	
13 Nov 08	X	X			X			X	X								X						X	X											X
14 Nov 08		X						X									X	X						X	X	X							X		
15 Nov 08			X		X				X								X	X				X	X	X							X				
16 Nov 08																																			
17 Nov 08			X	X	X	X				X		X	X				X	X				X	X			X			X		X				
18 Nov 08		X				X		X			X						X							X	X	X					X				X
19 Nov 08			X					X									X								X	X	X		X						
20 Nov 08	X	X	X					X	X								X	X	X			X	X						X					X	
21 Nov 08	X							X									X	X				X													X
22 Nov 08	X	X						X									X	X	X				X	X	X				X						X
COUNT	9	14	11	6	8	9		21	4	7	2	7	5		2	3	23	13	4	1		8	11	12	11	13	8		11	1	10	3	2	5	13
%	16%	25%	19%	11%	14%	16%		46%	9%	15%	4%	15%	11%		4%	7%	50%	28%	9%	2%		13%	17%	19%	17%	21%	13%		24%	2%	22%	7%	4%	11%	29%

	Visibility							Precipitation							Temperature							Wind strength							Wind direction						
	Fine/ Sunny	Partly cloudy	Overcast	Heavy cloud	Mist/fog	Rain		None	Dripping foliage	Drizzle	Light	Moderate	Heavy		Freezing (<0)	Cold (0-5)	Cool (5-11)	Mild (11-16)	Warm (16-22)	Hot (>22)		Calm	Light breeze	Mod. Breeze	Fresh wind	Strong wind	Near gale		Northerly	Southerly	Westerly	Easterly	North Easterly	South Easterly	North Westerly
BOTH SEASONS	15	22	18	10	14	16		42	7	12	6	10	9		2	5	32	30	6	1		10	15	23	14	21	12		17	3	13	10	4	6	19
%	16%	23%	19%	11%	15%	17%		49%	8%	14%	7%	12%	10%		3%	7%	42%	39%	8%	1%		11%	16%	24%	15%	22%	13%		24%	4%	18%	14%	6%	8%	26%

8.3 Bird Abundance - autumn monitoring period (detail)

Date	Australian magpie	Goldfinch	Paradise shelduck	Spur-winged plover	Australasian harrier	New Zealand pipit	Welcome swallow	New Zealand pigeon	Starling	Tui	Grey warbler	Fantail	Eastern rosella	Mallard	Chaffinch	Greenfinch	Rook	Silvereye	White-faced heron	Sacred kingfisher	Black-backed gull	Yellowhammer	Bellbird	Blackbird	Redpol	Black shag	House sparrow	New Zealand falcon	Shining cuckoo	Skylark	Song thrush
31 Mar 08	A	A	M	F	F	F	F	A			F		F	M	F		S	A	S	S	S			F	M						
1 Apr 08	A	M	M	M	F	F			M	S	S						S														
2 Apr 08	M	A	M	F		S			M	S			S																		
3 Apr 08	M	A	M	F		S			F		F	S					S														
4 Apr 08	A	A	M	F	F		M		F				M						S												
5 Apr 08	A	A	F	F	F	F		F		S	S	S	F		S	F	F	A			S	S									
6 Apr 08																															
7 Apr 08	M	M	F	F	F	S	F																								
8 Apr 08	M	A	M	F		S			F																						
9 Apr 08	M	A	M	M	F			M	F	F		S		F	F																
10 Apr 08	A	A	A	F	F	S	M	M	F	F		F	F		S	M															
11 Apr 08	M	A	M	F			F	F	S	S			F							S											
12 Apr 08	M	A		F	S	S	F	S		F		F				M		S													
13 Apr 08																															
14 Apr 08	M	A	M	F	S		S		M	F				M				F													
15 Apr 08	A	A	M	F	S	S		S	M	F	F			F	S	M					S										
16 Apr 08	M	A		F		S				S																					
17 Apr 08	A	A	F			S				S									S												
18 Apr 08	M	A	M	F			F												S												
19 Apr 08	M	A	M	F	S	S	M	M	M	F	S	F	F		S	F															
20 Apr 08																															
21 Apr 08	A	A	M		S		M	F	F						S	F						S									
22 Apr 08	M	A	M		S	S	S	M				S																			
23 Apr 08	M	A	M	F	S	F		F				S																			
24 Apr 08	M	A	M	M	M	F	M	A	F		F	F	M																		
25 Apr 08	M	A	M	F	S	F	S	S					S																		
26 Apr 08	M	A	M	M	M	F	F	M			F	S						M	S	S		F	F	S							
27 Apr 08																															
28 Apr 08	M	M	M	F	M	F		F				S		M																	
29 Apr 08	A	A	M	F	M	F	F	A						F									S								
30 Apr 08	M	A	M	F	M	S	F				S			F																	
1 May 08	M	A	A	F	F	F					S									S											
2 May 08	M	A	M	F	F	F	F				S		F				F														
3 May 08	M	A	M	F	F		F			S	F			M																	
COUNT	30	30	28	27	23	23	18	16	13	13	12	11	10	8	7	6	5	5	5	4	3	3	2	2	1	0	0	0	0	0	0
%	100%	100%	93%	90%	77%	77%	60%	53%	43%	43%	40%	37%	33%	27%	23%	20%	17%	17%	17%	13%	10%	10%	7%	7%	3%	0%	0%	0%	0%	0%	0%

S - Single | F - Few (2-5) | M - Many (5-20) | A - Abundant (20+)

8.4 Bird Abundance - spring monitoring period (detail)

	Australian magpie	Yellowhammer	Paradise shelduck	Spur-winged plover	Starling	Australasian harrier	Grey warbler	Tui	Black-backed gull	Chaffinch	House sparrow	Shining cuckoo	Welcome swallow	Mallard	Eastern rosella	Blackbird	New Zealand pigeon	Sacred kingfisher	Greenfinch	Song thrush	Goldfinch	Fantail	New Zealand pipit	White-faced heron	Redpol	Black shag	Bellbird	New Zealand falcon	Skylark	Rook	Silvereye
20 Oct 08	M	M	M		F				S				F		F		S														
21 Oct 08	M	M	M	F	M	S	F	F				F				S						F									
22 Oct 08	M	M	M	F	M	F	F	S					S		F			S													
23 Oct 08	M	M	M	F			F	F	M	S				S		S		F						S							
24 Oct 08	M	M	M	M	A	F	F	F	M	F			F	F			S	S			F			S							
25 Oct 08	M	M	M	M	A	F	M	S				M		F	F																
26 Oct 08																															
27 Oct 08	M	M	M	F	A	S			S	S	M			M	F																
28 Oct 08	M	A	M	M	M	F					M									S									S		
29 Oct 08	M	A	M		A		S							M	M		F														
30 Oct 08	M	A	M	M		M	M	F		M	M			M		F	F	S	M	S			F				F				
31 Oct 08	M	M	M	F	M	S	F		S	F	F	S	F	F	F			S			F					S					
1 Nov 08	M	A	M	F	M	S	F		S	S	F	S	F		F	S						S	S								
2 Nov 08																															
3 Nov 08	M	A	M	M	M	F	M	F	S	M	M	F	F							S			S								
4 Nov 08	M	A	M	M	F	F	M	S	F	M	F	F	M	F	S	F	F						S								
5 Nov 08	M	M	M	F	M				S	M	F			M	F			S													
6 Nov 08	M	A	M	F	A	S		S	F	F		S	F		F	S	F			S			S								
7 Nov 08	M	M	M	M	A	F	F	F	S	M	F	F	S	M	S	F				S						S					
8 Nov 08	M	A	M	M	M	S	F	F		F	M	F	F	M		F	F		M	F		F	F								
9 Nov 08																															
10 Nov 08	M	M	M	M	M	F	M	F	F	M	M	F	M		S		F	F		S	S	F		F	F			F			
11 Nov 08	M	M	M	F	M	M	M	F	M	F	M	F	M	F	F	F	F		F	S		F	S		F						
12 Nov 08	M	M	M	F	F	F	M	M	F	M	M	F	F	F		F		F	M		F				F						
13 Nov 08	M	M	M	F	M	F	F	F	F	F	M	F	F		F	F	F	F	M		F			S							
14 Nov 08	M	M	M	F	M	F	F	F	F	F	M	F	F	M		F	S	S			F										
15 Nov 08	M	M	M	F	M	F	F	F	F	F	F	F	F			F		S	F			S									
16 Nov 08																															
17 Nov 08	M	M		F	M	F	F	F	F			F	F	M		S			S					F							
18 Nov 08	M	A	M		F	F	F	F	F	F	M	F	S				S		F												
19 Nov 08	M	M	M	F	F	F	F	F	S	F	M	F		F	S		S														
20 Nov 08	M	A	F	F	M	F	F	M	S	F	F	F	F	F	F			F	F		F	F									
21 Nov 08	M	M	M	F		F	F	M			M	F	F	F			F	F	F	F	F										
22 Nov 08	M	M	M	F	M	F	F	F	F	F	F	F		F		S			F												
COUNT	30	30	29	27	27	26	25	23	22	22	21	21	20	19	16	15	14	13	11	9	8	7	7	5	3	2	1	1	1	0	0
%	100%	100%	97%	90%	90%	87%	83%	77%	73%	73%	70%	70%	67%	63%	53%	50%	47%	43%	37%	30%	27%	23%	23%	17%	10%	7%	3%	3%	3%	0%	0%

S - Single | F - Few (2-5) | M - Many (5-20) | A - Abundant (20+)

8.5 Scavenging Rates (Detail)

Day old chickens					
Date	**21**	**22**	**24**	**25**	**44**
21/04/08	*2*	*2*	*2*	*3*	*2*
22/04/08	2 whole	2 whole	1 whole + 1 overlooked	3 whole	1 whole, 1 missing
23/04/08	1 whole, 1 missing	2 whole	1 whole	3 whole	1 whole
24/04/08	1 whole, 1 missing	2 whole	1 whole	3 whole	0
25/04/08	1 whole	2 whole	1 whole	2 whole, 1 missing	0
26/04/08	1 whole	2 whole	1 whole	2 whole	0
27/04/08					
28/04/08	1 whole	2 whole	1 foot remaining	1 whole	0
29/04/08	1 whole	2 whole	0	1 whole	0
30/04/08	0	1 whole, 1 half rotten	0	0	0
1/5/2008	0	1 whole, 1 half rotten	0	0	0
2/5/2008	0	Both mostly decomposed	0	0	0
3/5/2008	0	2 x feather spot	0	0	0
1/2 Grown Chickens					
Date	**21**	**22**	**24**	**25**	**44**
21/04/08	*2*	*1*	*2*	*2*	*1*
22/04/08	2 whole	1 whole	1 whole + 1 1/4 eaten	1 whole + 1 head missing	1 whole
23/04/08	1 whole, 1 1/2 eaten	1 whole	1 1/4 eaten + 1 1/2 eaten	1 1/4 eaten + 1 head missing	3/4 eaten
24/04/08	1 1/2 eaten, 1 only feet and wing	1 whole	1 3/4 eaten + bones & feathers	1 wings, legs & vertebrae + 1/4 eaten	only major bones and wings
25/04/08	2 x bones and wings	1 1/2 eaten	1 feather spot, 1 winds and legs	1 wing and feathers, 1 3/4 eaten	only major bones and wings
26/04/08	1 bones & wings, 1 just legs	feather spot	1 feather spot, 1 winds and legs	1 just legs, 1 legs, wings & ribcage	bones and wings
27/04/08					
28/04/08	2 x feaher spot	feather spot	2 x feather spot	1 just legs, 1 legs, winds & rib cage	feather spot
29/04/08	2 x feaher spot	feather spot	2 x feather spot	2 x feather spot	feather spot
30/04/08	2 x feaher spot	feather spot	2 x feather spot	2 x feather spot	feather spot
1/5/2008	2 x feaher spot	feather spot	2 x feather spot	2 x feather spot	feather spot
2/5/2008	2 x feaher spot	feather spot	2 x feather spot	2 x feather spot	feather spot
3/5/2008	2 x feaher spot	feather spot	2 x feather spot	2 x feather spot	feather spot

8.6 Field Data Sheets

Te Apiti Windfarm **Tower Number:**.. **Page Number**..

Tower Search Datasheet (All carcasses, avian and terrestrial)

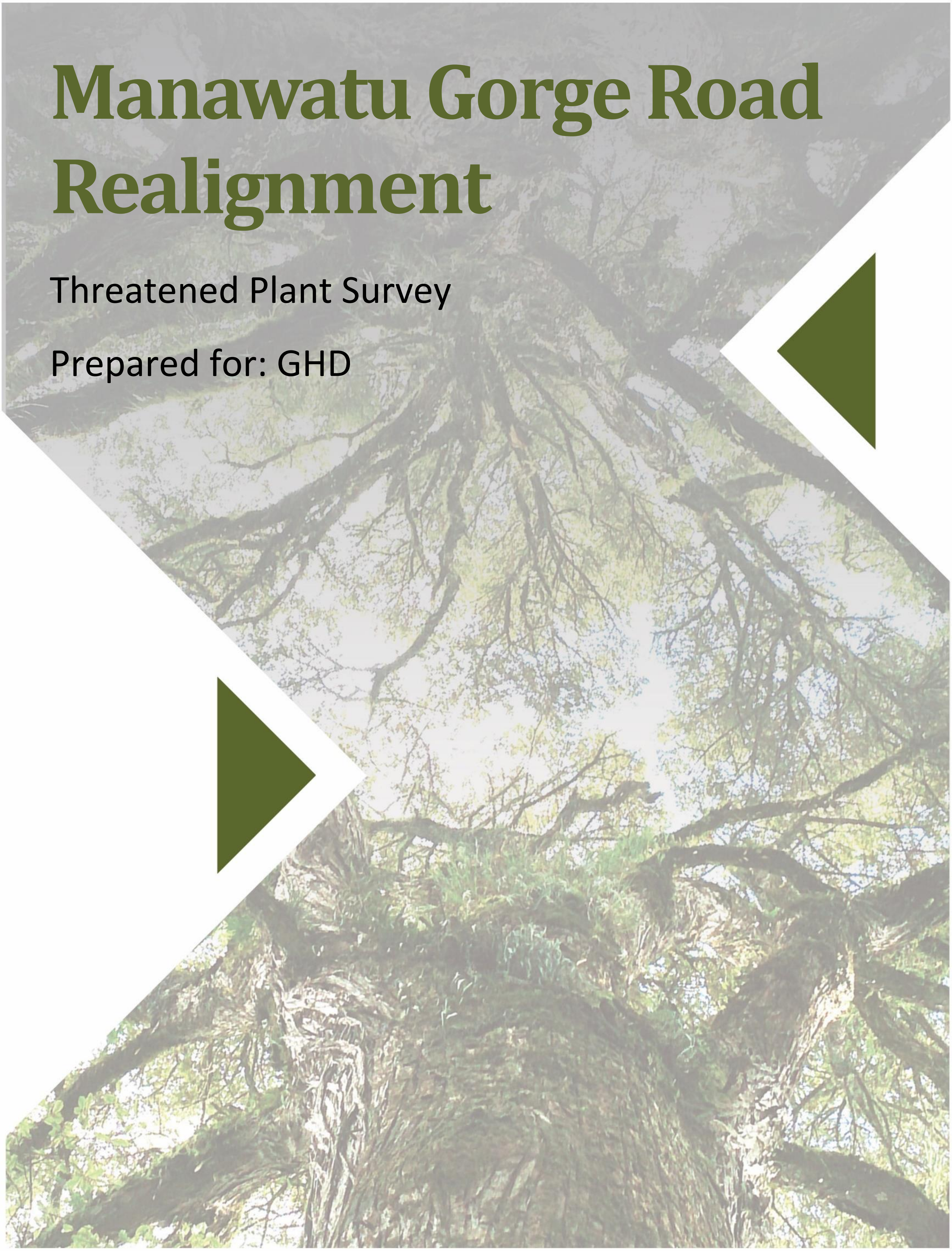
Find Number			
New / Repeat			
Species			
Body (Yes / No)			
Feather spot (Yes / No)			
Age (juv / adult)			
Sex			
Estimated time of death			
Distance to tower			
Bearing to tower			
Scavenged (Yes / No)			
Detailed description of carcass			
Notes (number of photos)			

Age: U = unknown, I = Immature, A = Adult, Sex: U = unknown, F = Female, M = Male
Estimated time of death: 1 = Unknown (write description of flesh and feather in description), **2** = Fresh Kill (Several days old, describe "freshness" in description), **3** = Actual time estimate (based on blood, other rationale, give in description), **4** = Not applicable (i.e. Feather spots)

TURBINE NO.	Date	Start Time	End Time	Carcass located?	Turbine Activity
MONDAY					
21					
22					
23					
24					
44					
TUESDAY					
21					
22					
23					
24					
44					
WEDNESDAY					
21					
22					
23					
24					
44					
THURSDAY					
21					
22					
23					
24					
44					
FRIDAY					
21					
22					
23					
24					
44					
SATURDAY					
21					
22					
23					
24					
44					

Turbine activity: 0, none. 1, Slowly turning. 2, Normal/ fast moving

6.A.G
THREATENED PLANT SURVEY



Manawatu Gorge Road Realignment

Threatened Plant Survey

Prepared for: GHD

Nicholas Singers Ecological Solutions
Innovation in conservation

NSES Ltd report :2017/18

Author(s): Nicholas Singers and Christine Bayler for
Nicholas Singers Ecological Solutions Ltd
Date: March 2018

Contents

1. Introduction

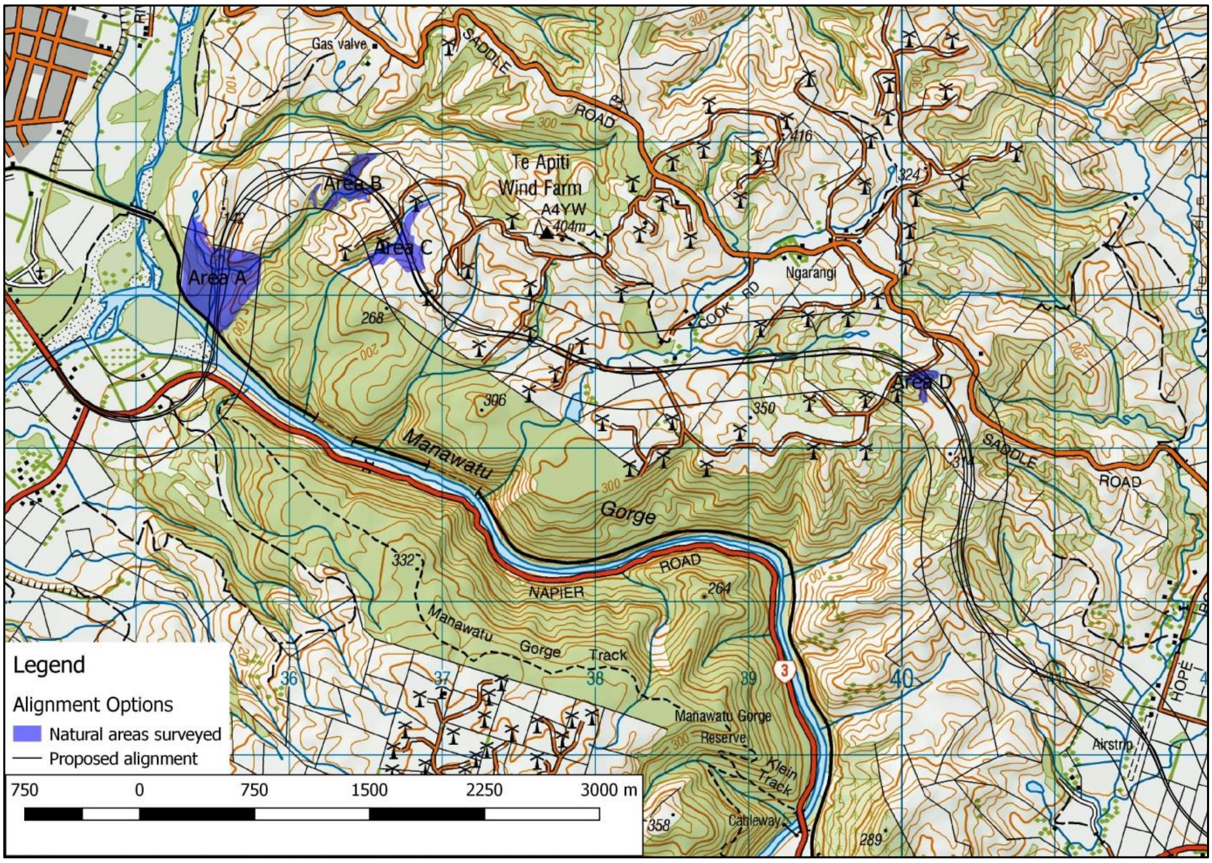
As part of the Manawatu Gorge project, the NZ Transport Agency has engaged suitably qualified ecologists to undertake initial species and habitat surveys for the 2017/2018 summer season. This survey focuses on rare or threatened flora that would only be present or detectable within the project area during the summer period.

The purpose of this survey was to establish potential presence, absence and distribution of rare or threatened flora within the preferred corridor and areas affected by this (e.g. stormwater receiving environments) to inform the future Assessment of Ecological Effects for the project. Four areas were identified as potential habitat of threatened plants based on advice from Dr Adam Holdsworth and a review of spatial data.

The proposed alignment is located on the north side of the gorge and rises from approximately 80 m a.s.l near the Manawatu River at Ashhurst to a height of 300m on the summit. The original vegetation would have been almost entirely tawa dominant forest with occasional to common podocarp and northern rata emergent trees — somewhat similar to the most intact areas within the Manawatu Gorge Reserves. At lower altitude titoki was likely co-dominant with tawa. Nikau palm is also a notable feature in this area and is locally abundant in gullies. On the windswept summit kamahi is also present and was common within the canopy and sub-canopy. The gorge environment also includes; smaller areas cliff and steep slopes with shrubland and wharariki flaxland, riparian areas dominated by species tolerant to periodic flooding. Remnant, mostly modified, examples of these habitats occur on the proposed alignment.

To focus surveying to likely threatened plant habitat and improve the probability of finding any species present, an office-based review was conducted.

Figure 1: Natural Areas surveyed for threatened plants (highlighted in blue)



2. Office-based review

An initial office-based review of the habitats present and associated rare and threatened plants known to have been recorded or that potentially could be present within the habitats was undertaken. This utilised the following resources to develop a potential candidate list of rare and threatened plant species, previously recorded within the Manawatu Gorge area and other species which could potentially be present.

Information sources included the following information:

- Plant Species Lists by A.P. Druce for the Manawatu Gorge and Envions and the Totara Reserve (Pohangina Valley).
- Review of threatened plants from de Lange *et al.* (2010) and the de Lange *et al.* (2013)
- Review of species distribution information from herbarium records from the Australasian Virtual Herbarium data and species list information from the New Zealand Plant Conservation Network website, for selected species identified from de Lange *et al.* (2010) and de Lange *et al.* (2013).
- Knowledge and previous experience of species that potentially could be present considering the known habitats within the preferred alignment.

Tables 1 – 3 identify the candidate list of nationally threatened and regionally rare plants. The Horizons Region does not have a published list of regionally rare plants though some plants known to be uncommon or at a distribution limit were additionally considered for survey (Table 3). These are not nationally threatened but also need to be considered due to their regional rarity or importance.

Table 1: Threatened Plants listed by de Lange *et al.* (2013) recorded at the Manawatu Gorge and nearby

Species Name	Common Name	Threat class	Site recorded
Adiantum formosum	Giant maidenhair, Plumed maidenhair	At Risk - Relict	Manawatu Gorge in a stronghold for this Australasian species. First collected by William Colensoi (WELT.P002459). Still locally abundant within reserves.
Epilobium hirtigerum	hairy willowherb	Threatened - Nationally Critical	Collected by Alan Esler in 1960 (AK219328) and also recorded by Druce.
Epilobium insulare	willowherb	Data Deficient	Recorded on APD 'Manawatu Gorge and environs' plant species list.
Libertia peregrinans	New Zealand iris, mikoikoi	Threatened - Nationally Vulnerable	Collected by on a dry cliff within the gorge in 1937 by Lucy Moore (CHR33682).
Solanum aviculare var. aviculare	poroporo	At Risk - Declining	Recorded on APD 'Manawatu Gorge and environs' plant species list.
Teucridium parvifolium	Teucridium	At Risk - Declining	Recorded by A.P.Druce within 'shrub-grassland habitat' (CHR471574)
Urtica perconfusa (syn. *U.linearifolia*)	swamp nettle	At Risk - Declining	Recorded on APD 'Manawatu Gorge and environs' plant species list.

Table 2: Threatened Plants listed by de Lange *et al.* (2013) that occur in the lower North Island and potentially suitable habitat maybe present in the Manawatu Gorge

Species Name	Common Name	Threat class	Closest location
Anogramma leptophylla	Annual fern	Nationally vulnerable	Eastern Wairarapa to central Hawkes Bay growing on exposed, dry cliffs (WELTU 6559). Similar habitat present in gorge.
Brachyglottis kirkii	kohurangi	At Risk - declining	Epiphytic shrub formerly common on large emergent trees throughout lowland to montane areas. Recorded from northern Tararua Range (AK35326).
Bulbophyllum tuberculatum		At risk - Naturally uncommon	Known from near Wanganui (CHR400997). Suitable habitat and host species present.

Daucus glochidiatus	native carrot	Nationally vulnerable	Potentially present on open cliffs. Occurs on exposed greywacke cliffs at Eastern Wairarapa Taipo's and also recorded in Ruahine Range Phillips Turner (AK105136).
Drymoanthus flavus	little spotted moa (orchid)	At Risk - Naturally Uncommon	Described in 1994, limited information known about distribution. Known from near Ohau River, Horowhenua, often grows on titoki & rewarewa, both trees present.
Korthalsella salicornioides	dwarf mistletoe	At Risk - Naturally Uncommon	Historically known from near Fielding & Halcombe (CHR107898). Closest extant location near Marton. Hemi-parasitic on kanuka and manuka.
Spiranthes novae-zelandiae	laddies tresses (orchid)	Nationally vulnerable	Wetland plant known from Whitiau & Whangaehu. Needs disturbance in wetlands.

Table 3: Regionally uncommon species with distributions including the Manawatu Gorge

Threatened Plants within lower North Island and potential habitat exists			
Species Name	**Common Name**	**Threat class**	**Closest location and habitat information. Herbarium voucher in brackets.**
Ileostylis micranthus	Green mistletoe	Regionally uncommon	Formerly common and prior to the 1960's widespread in Manawatu including Pohangina Valley (Totara Reserve). Threatened by possum browse and recovery now occurring nationally with sustained possum management.
Pittosporum cornifolium	Hanging kohuhu	Regionally uncommon	Epiphytic shrub formerly common on large emergent trees. Collected near Palmerston North by Petrei in 1894 (WELT.SP035592).
Scandia geniculata	Native aniseed	Regionally uncommon and northern limit in Manawatu Gorge	Recorded by A.P. Druce in 1971. Regionally important as this location is the northern limit for this species.
Syzygium maire	Swamp maire, maire tawake	Regionally uncommon	Principally would have occurred on the margins of wetlands and on poorly drained river terraces. Known from Pohangina and Manawatu River.

The office-based review also mapped habitats targeted for survey using QGIS. Vegetation communities were mapped into broad classes which were visible from aerial imagery to help assist surveying of suitable habitats of the known or potential threatened plant species present.

3. Field survey

The proposed alignment has been located to avoid (as best as possible) areas of significant indigenous vegetation. The alignment does traverse through several small natural areas, including three which contain mature tawa forest, of which two are legally protected by an open space covenant. Other areas of indigenous vegetation affected are dominated by early successional tress including mahoe, kaikomako, pate, houhere, kanuka and manuka. Small wetland areas occur in several locations. A targeted threatened plant survey concentrated within and immediately adjoining the proposed alignment in four specific areas (Figures 1 & 2). Information was also gathered for specific areas, such as wetlands outside of the proposed alignment including summarising community vegetation composition.

Area A

On the western side of the gorge, the proposed alignment dissects through an area which is a mosaic of vegetation communities including; native forest, wetland, secondary scrub and rough pasture, and mixed exotic/native scrub (Figure 2).

The area of indigenous forest vegetation is dominated by tawa (*Beilschmiedia tawa*), titoki (*Alectryon excelsus* subsp. *excelsus*) forest. Also present within this remnant are rewarewa (*Knightia excelsa*), matai (*Prumnopitys taxifolia*), occasional hinau (*Elaeocarpus dentatus* var. *dentatus*), ribbonwood (*Plagianthus regius* subsp. *regius*), white maire (*Nestegis lanceolata*) and several large mature pukatea (*Laurelia novae-zelandiae*) and a large kahikatea (*Dacrycarpus dacrydioides*) on a stream terrace. Common understorey trees include kaikomako (*Pennantia corymbosa*), mahoe (*Melicytus ramiflorus*) and houhere (*Hoheria sexstylosa*). The remnant is grazed by sheep and cattle, however due to the steepness of some slopes several areas are relatively unaffected by stock. On the steep terrace riser two divaricating shrubs are particularly common; *Coprosma areolata* and taurepo (*Rhabdothamnus solandri*) along with several ground ferns including common maidenhair fern (*Adiantum cunninghamii*), Hooker's spleenwort (*Asplenium hookerianum* var. *hookerianum*) and *Polystichum wawranum*.

No threatened plants were located within this remnant. Suitable habitat exists for several species including;

- *Adiantumn formosum* and *Teucridium parvifolium* especially on the terrace riser amongst taurepo and *C. aerolata*.
- *Brachyglottis kirkii*, *Bulbophyllum tuberculatum*, *Drymoanthus flavus* as well as the regionally rare species *Pittosporum cornifolium* and *Ileostylus micranthus* as epiphytes or parasites on some of the larger host trees.

Of additional significance is that effective possum control is occurring, and canopy condition was observed to be high with no obvious browse on palatable species.

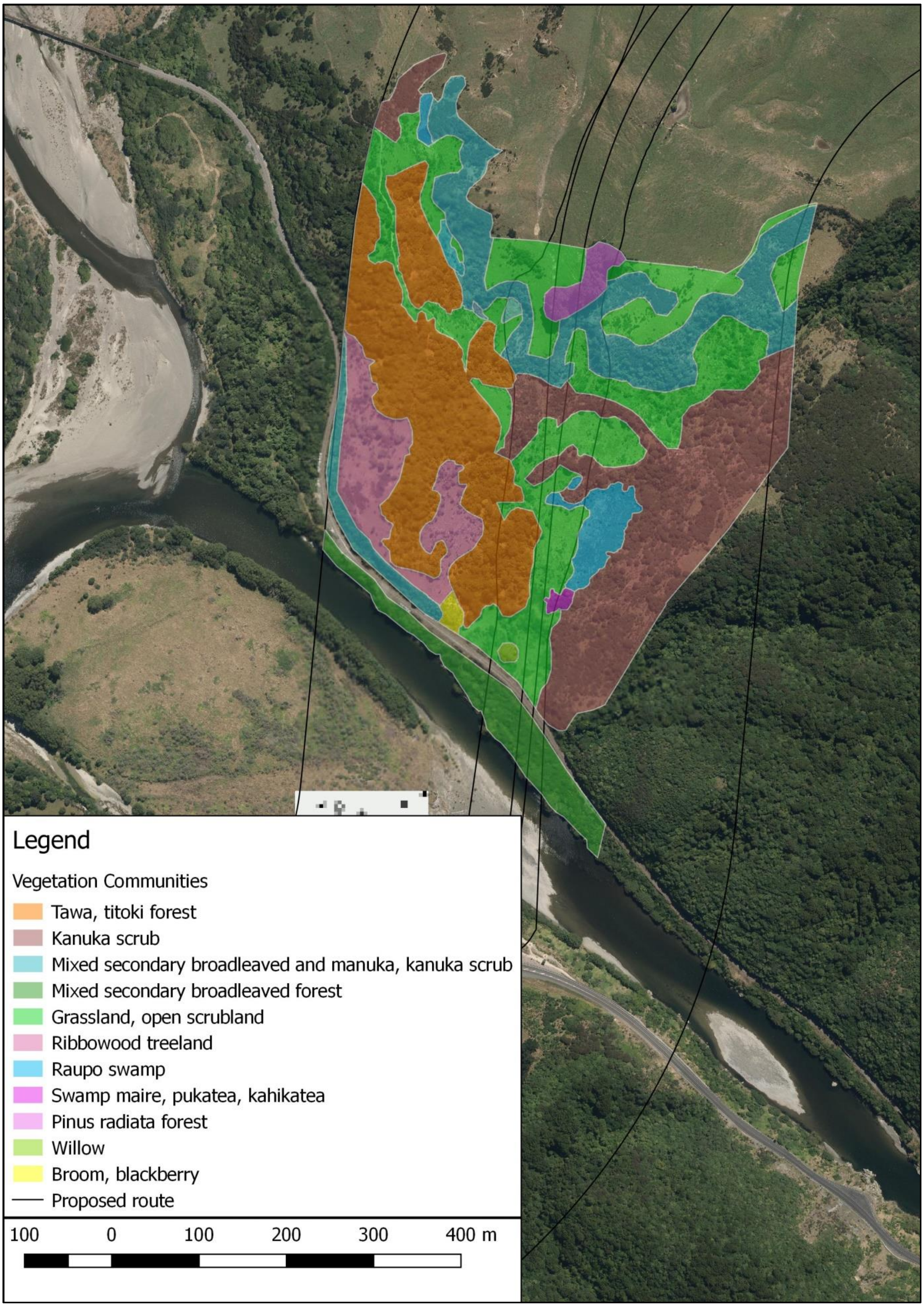


Figure 2: Vegetation communities present within Area A

Figure 3: Raupo reedland on the eastern side of the proposed alignment (looking south)

Several discrete areas of wetland vegetation are also present within area A. The largest area, which is approximately 0.6 ha occurs on what appears to be a landslip at the base of a very steep slope (Figure 3). Raupo is the dominant species and has a cover of approximately 75%, while scattered manuka and occasional karamu occur. The water table of this wetland was, in most areas, below the surface and the understorey vegetation was dominated by exotic species of which goat's rue (*Galega officinalis*), lotus (*Lotus pedunculatus*), tall fescue (*Lolium arundinaceum* subsp. *arundinaceum*) and water pepper (*Persicaria hydropiper*) were abundant. These species are often found in damp pasture as well as dryland vegetation types. Apart from raupo, native herbaceous species were relatively uncommon, though *Carex secta* and *C. maorica* were present in areas of high water table. The penny wort (*Hydrocotyle pterocarpa*) was found in one location. Near the lower edge of the wetland, vegetation was grazed to a short turf by sheep and in this area three small native species occurred; dwarf bog rush (*Schoenus maschalinus*), *Hydrocotyle moschata* and *Dichondra brevifolia*.

The low water table is unusual for raupo reedland vegetation, which typically occurs in permanently saturated wetlands, often with 10-30cm of standing water. The low water table is likely to be a cause for the dominance of exotic species beneath raupo. Consequently, the low water table and the dominance of exotic plants are probably make this habitat unsuitable for swamp nettle (*Urtica perconfusa*) and other threatened wetland plant species to be present.

Of most significance in Area A was a small remnant of fourteen swamp maire (*Syzygium maire*) trees in association with several pukatea and a single kahikatea tree. Swamp maire is now rare in the Manawatu with two other small populations known, one in the Pohangina Valley and the other north of Palmerston North. These trees were particularly healthy and were flowering heavily, an indicator of low possum browse (Figure 4).

Figure 3: Flowering swamp maire

Area B

The proposed alignment crosses two tributaries of Area B which are protected through QEII open space covenant (Figure 5). This area encompasses two steeply incised streams, which have eroded through deep layers of gravels to create near vertical canyons of 5–10 m high. In some areas the fence line is located very close to the canyon edge, while elsewhere it is buffered by forest on steep hillslopes. Vegetation is relatively sparse on the canyon walls and composition is variable dependent on light and moisture availability. Where seepages occur kiokio (*Parablechnum novae-zelandiae*), parataniwha (*Elatostema rugosum*), gully fern (*Pneumatopteris pennigera*) and locally kiekie (*Freycinetia banksii*) are common. Vegetation is sparser on most of the canyon walls and includes meadow grass (*Poa anceps*), taurepo (*Rhabdothamnus solandri*), tank lily (*Astelia hastata*), shining karamu (*Coprosma lucida*), puka (*Griselinia lucida*), climbing rata (*Metrosideros perforata*), Easter orchid (*Earina autumnalis*) and nini (*Austroblechnum chambersii*) in shaded locations.

On the western side of the largest tributary, tawa is the dominant canopy tree above the canyon with approximately 70% cover while rewarewa occupies 10% (Figure 6 & 7). Several miro are also present. On the eastern side of the main tributary and on both sides of the southern tributary, forest vegetation is dominated by secondary broadleaved forest, which lancewood (*Pseudopanax crassifolius*) and rewarewa are dominant with approximately 45% and 35% cover respectively. Also present are tarata (*Pittosporum eugenioides*), puka, houhere, locally mamaku (*Cyathea medullaris*) and kanuka (*Kunzea robusta*). South of the alignment is a stand of nikau palm (*Rhopalostylis sapida*), which kereru were feeding in during the site visit. Understorey vegetation is relatively sparse beneath this community and changes with respect to the proximity to the canyon. Close to the fence line, hangehange (*Geniostoma ligustrifolium* var. *ligustrifolium*) is most common with hen and chicken fern (*Asplenium gracillimum*) and shining spleenwort (*A. oblongifolium*) the most common ferns present. Deeper into the canyon mahoe is also present in the canopy with kawakawa (*Piper excelsum* subsp. *excelsum*) and occasional nikau palm the most common understorey species.

Kanuka forest occurs on a narrow ridge that separates the two tributaries. Beneath this vegetation community understorey is dominated by *Coprosma rhamnoides*, tall mingimingi (*Leucopogon fasciculatus*) and occasional turutu (*Dianella nigra*) and *Asplenium* ferns.

No threatened plants were recorded in this area, though habitat is suitable for several species including the green mistletoe (*Ileostylis micranthus*) and the dwarf mistletoe (*Korthalsella salicornioides*). Tall canopy trees present had relatively small epiphytes communities, which are not particularly suitable for kohurangi or *Pittosporum cornifolium*. While not included in the candidate list, the areas of secondary lancewood forest would also be ideal habitat for *Dactylanthus taylorii*, which the nearest populations of are Mangaweka and Mt Bruce.

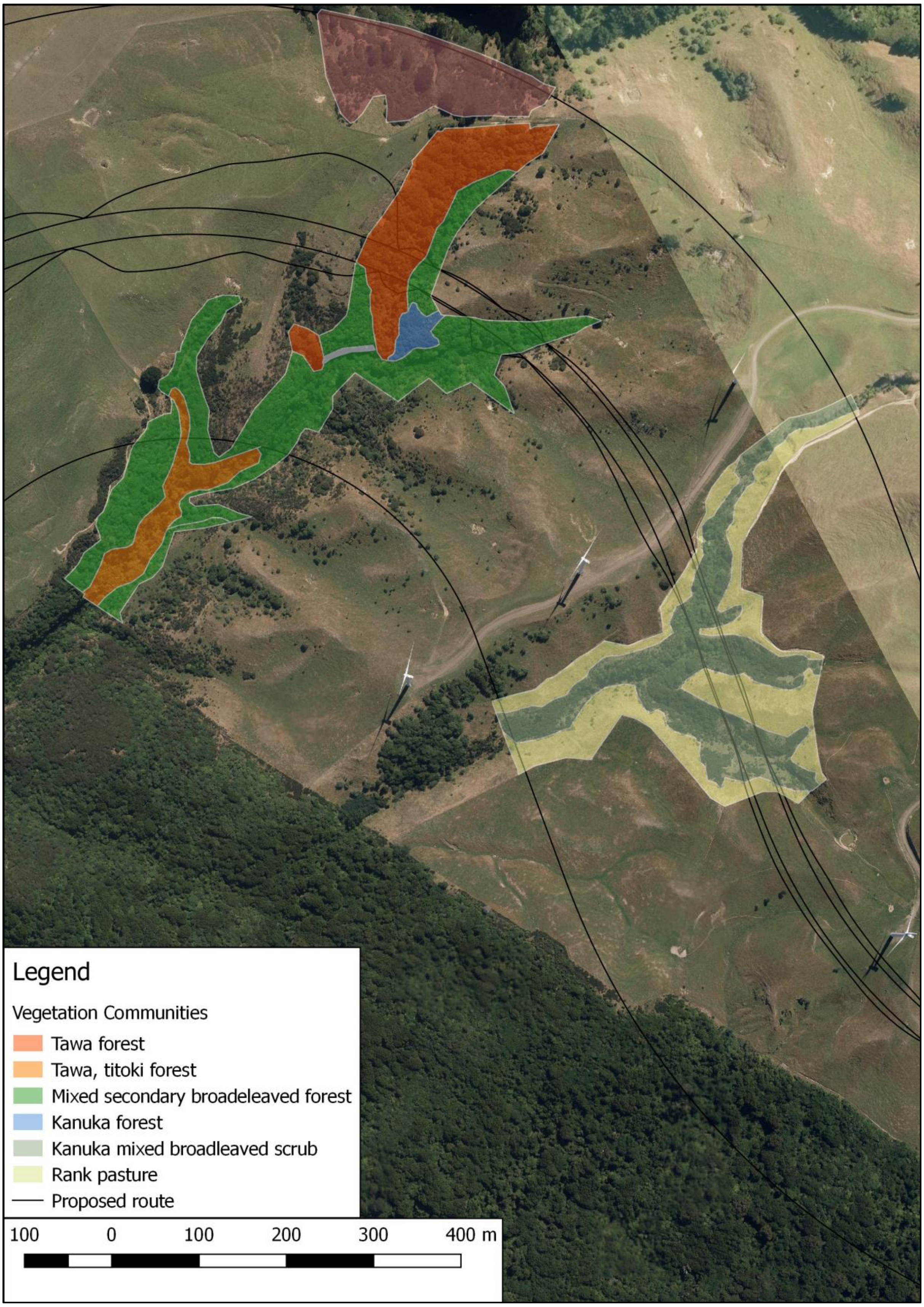


Figure 5: Vegetation communities of Areas B & C

Figure 6: Overview of area B.

Figure 7: Tawa forest on the western side of Area B and mixed secondary broadleaved forest in the fore-ground.

Area C

A rapid survey was undertaken to assess this habitat which is protected through QEII open space covenant (Figure 5). Upon observation of this area it was determined to be not suitable habitat for threatened plants within the canopy except potentially for mistletoes; dwarf mistletoe and green mistletoe. Vegetation present is dominated by young kanuka and manuka (*Leptospermum scoparium* var. *scoparium*) with small broadleaved trees including rewarewa and tree ferns restricted mainly to the steep gully (Figure 8). Vegetation was surveyed for the presence of mistletoes with none being found.

Figure 8: Overview of area C

Area D

A rapid survey was undertaken to assess whether the habitat present was suitable for threatened plants, especially the valley floor for wetland plants. Upon observation this area was confirmed to be wet pasture with small areas of cutty grass (*Carex geminata*) were not suitable for threatened wetland plants such as swamp nettle. The surrounding hillslopes were dominated largely by mahoe and locally mamaku, which likely had regenerated from gorse and broom (Figure 9). Recent aerial herbicide application had also impacted some of this vegetation.

Figure 9: Overview of area D

4. Discussion and recommendations

One plant of significance was found — fourteen swamp maire trees on the margin of the small raupo wetland. Swamp maire is a regionally rare tree in the Manawatu with very few populations remaining. This species is however soon to be classified as critically threatened (Data poor) in the next threatened plant list (de Lange *pers.com.*). The proposed change in threat rank is because swamp maire is expected to be severely impacted by myrtle rust (*Austropuccinia psidii*) which has the local extinction of some plant species in Australia, and heavily impacted some related *Syzygium* species in Australia, such as *S. hodgkinsoniae* and *S. corynanthum*, have been (Pegg *et al.* 2017). While this recommendation may be overly cautious, it does highlight how significant the Department of Conservation views the threat of myrtle rust on swamp maire, given that containing spread of the disease and managing population impacts will be extremely difficult, if not impossible. Further, whether natural resistance is present in populations or whether the climate suitability across the variable climatic areas of New Zealand is not known. The following recommendations have been made on the assumption that myrtle rust will not deleteriously affect this population of swamp maire and these may need to be reviewed in future.

The location of the proposed road alignment will directly impact the swamp maire population and will require the clearance of most trees for a probable roadside embankment (Figure 2). Remaining trees not cleared could also be impacted by adjoining construction activities, such as root damage and post construction changes in site hydrology.

While it would be prudent to investigate design options to avoid removing these trees, there is limited space to move the road westward. Shifting the road westward could result in more tawa-titoki forest also being impacted, so this would also need to be considered. Measures taken such as constructing a steep wall (instead of a fill) should however be investigated. Given the proximity of the road to the trees, and potential changes in hydrology, this option may not be successful to effectively protect these trees.

For these reasons it is strongly recommended that species specific mitigation measures be undertaken in addition to any potential design improvements. Of highest priority is to collect seed from these trees this season in order to ensure the genetic contribution of this population is not lost. As these trees were flowering heavily during field work in February, this action should occur soon ensuring that seed is collected from every tree.

Ideally the progeny cultivated should be planted in one or more ecologically appropriate locations which are expected to be permanent. Appropriate locations would firstly need to be environmentally suitable to ensure survival of any planted seedlings and also long-term be suitable for natural regeneration. Swamp maire typically grows next to and in wetlands, such as on poor draining (seasonally flooded) soils on alluvial terraces. Conservation management would need to be undertaken to ensure their ongoing survival including exclusion of stock, and possum and weed control to ensure trees remain healthy. At least one translocation site should be in close proximity to the Manawatu Gorge. Other options could include using this species in riparian restoration projects to enhance water quality and potentially establishing an ex-situ population in an appropriate municipal reserve, which could be used in future for seed collection. Suitable habitat for this species may be available within the broader Project footprint, such as adjoining the raupo wetland or along streams where riparian or landscape planting may be required. Sites chosen would need to be hydrologically appropriate.

5. Conclusion

Surveying targeted likely habitat for a range of threatened plant species within the candidate list, which are either known from the Manawatu Gorge or for which suitable habitat potentially exists. No plants categorised as threatened within de Lange *et al.* (2013) were detected in this survey, though a small population of swamp maire was located within the Project's footprint which has been recommended to be classified as Nationally Critical in the next threatened plant list. It is my opinion, given the vegetation communities present, their management history and current state, the proposed route is unlikely to contain any nationally threatened plant species.

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6.C

FRESHWATER - ECOLOGICAL IMPACT ASSESSMENT

Boffa Miskell

Te Ahu a Turanga; Manawatū Tararua Highway Project

Freshwater – Ecological Impact Assessment
Prepared for New Zealand Transport Agency

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Cover photograph: Manawatu and Pohangina River confluence, © BML, 2018.

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Appendices

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1.0 Introduction

1.1 Background

The existing State Highway 3 ("**SH3**") through the Manawatū Gorge has been permanently closed due to repeated landslips and instability constraints. New Zealand Transport Agency ("**NZ Transport Agency**") has identified a preferred option to construct and operate a new State Highway route, to be known as Te Ahu a Turanga; Manawatū Tararua Highway Project ("**the Project**"). The proposed route is located further north of the existing State Highway, between Saddle Road and the Manawatū Gorge Scenic Reserve. An overview of the proposed designation corridor, within which the Project is to be constructed, is presented in Figures 1 to 3 (Appendix 6.C.1).[1]

The proposed corridor crosses several different catchments varying in size, as well as crossing the Manawatū River. Freshwater ecological values have been described and assessed across the Project as part of the Notices of Requirement ("**NoR**") process. This report provides an assessment of the sensitivity of the receiving environment and the potential level of adverse freshwater ecological impacts the project might have. It has informed the design parameters of the Project, including its location and the proposed designation boundaries.

The assessment also forms part of a wider assessment, undertaken in conjunction with other technical specialists, of the Project's effects on the natural character of watercourses and their margins.

The NZ Transport Agency will seek resource consents at a later stage, once detailed design of the Project has been carried out, including for any in-stream works. An updated report and assessment will be required for that phase of the Project.

1.2 Scope of this report

As such, the purpose of this freshwater ecological report is to assist with understanding the sensitivity of the freshwater ecology within the Project area and feed into the natural character assessment, and inform the location of the designation by:

- Describing and assessing existing freshwater ecological values present under the corridor;
- Discussing the likely and potential effects on the ecological values present from the Project (operation); and
- Provide preliminary recommendations for appropriate avoidance, remediation and/or mitigation of adverse effects from the Project on the freshwater ecological values present.

[1] Note that these figures depict a previous iteration of the proposed designation area; three relatively small areas relating to unformed access tracks, unrelated to water courses, have since been added.

2.0 Methods

2.1 Desktop analysis

All available literature and aerial imagery was reviewed to assist in identifying freshwater ecological values present over the designation corridor. The Manawatū-Wanganui Regional Council's ("**Horizons**") One Plan was reviewed to identify and assess if any recognised freshwater ecological areas were present across the Project.

The desktop analysis was also used to determine appropriate sampling locations that would best characterise the aquatic biodiversity and habitat condition. The area is extensive and not all waterways in all locations could be surveyed within the time constraints of the current phase of the Project. Habitat grouping, to best sample representative habitats and stream reaches, was used to identify sampling locations and included parameters such as natural flow path, River Environment Classification ("**REC**"), stream order, riparian cover, location and likely gradient. Sampling site locations are provided in Figures 1 to 3 (**Appendix 6.C.1**).

A freshwater fish survey was completed in early 2018 to assess fish values within a selection of waterways across (and adjacent to) the proposed designation corridor. The fish survey was conducted during summer to align with best practice protocols (with regard to seasonal timing), to assess fish values. The fish report is in **Appendix 6.C.2** and has been used to assist in the assessment of stream values described in this report.

2.2 Site visit

Fieldwork was conducted on 17th to 20th of July 2018. Weather conditions varied between mostly clear to cloudy and generally high winds. Approximately 9.5mm of rain had fallen in the preceding 48 hours of the site visit[2], while a further 8mm fell over the four days during the fieldwork period.

Aquatic ecological values were assessed across the waterways present within the designation corridor through representative sampling (conducted at eight locations) as well as a site walkover of non-sampled waterways, carried out in part to ensure the representativeness of the chosen sampling locations. The walkover was also used to map waterway pathways and provide qualitative habitat information.

Sampling conducted at each of the eight sampling sites included:

- An instream and riparian habitat assessment following protocol P1 methods outlined in Harding *et al*. 2009.
- A composite sediment sample collected from between five to ten pool/sediment deposition sites along the assessed reach. Samples were refrigerated before being sent to Hill Laboratories for analysis of heavy metals (lead, copper and zinc), total phosphorus and total nitrogen in the total sediment and <63 m sediment fraction.
- Collection of a single macroinvertebrate kick-net sample (from an array of instream habitats), following protocols C1 (hard-bottomed) and C2 (soft-bottomed) outlined in Ministry for the Environment 2001. Samples were preserved in ethanol and sent to a

[2] Rainfall data collected from an automatic weather station in Palmerston North and data downloaded from https://cliflo.niwa.co.nz/.

taxonomist to be analysed according to Protocol P1: coded abundance. Macroinvertebrate indices (MCI and SQMCI) were calculated for all samples (Stark & Maxted 2007) as well as species richness and number of EPT taxa.

- Collection of stream ecological valuation ("**SEV**") data following methods outlined in Neale *et al.* 2011. The data was entered into the SEV spreadsheet designed for use in the Auckland region. Spreadsheets V_{surf} and $V_{physhab}$ were modified to suit the Horizons region based on reference site data provided by Horizons. The system uses a set of reference site data to establish what an expected high SEV outcome is. There are currently limited Regional reference SEV data, but a value can be established using only physical parameters. Thus macroinvertebrate data was excluded from the SEV spreadsheet as data for the reference systems is limited.

In addition, a fish survey was completed at the downstream reach of site 7A (upstream of the Manawatū confluence) as this site was not surveyed earlier in the year due to access constraints. The fish survey was completed using an electric fishing machine and following methods outlined in Joy *et al*. 2013. All native fish caught were identified, measured, and released. It is acknowledged that the season in which the current survey was undertaken is less productive than spring or summer, however we consider the data to be adequate to reflect the fish species present.

2.3 Stream classification

For the purposes of this freshwater ecological assessment, we do not use the Horizons One Plan definitions as they do not differentiate between stream types (i.e. intermittent, permanent (otherwise termed perennial) or ephemeral). We instead have defined ephemeral, intermittent and perennial streams using definitions from the Auckland Unitary Plan (Auckland Council 2016), as per below (noting that ephemeral streams have not been mapped across the designation corridor):

<u>Ephemeral stream</u>: Stream reaches with a bed above the water table at all times, with water only flowing during and 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.

<u>Intermittent stream</u>: 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.

<u>Permanent river or stream (Perennial)</u>: The continually flowing reaches of any river or stream.

2.4 Assessment of ecological value and effects

This assessment of ecological effects follows the methods documented in the revised Ecological Impact Assessment Guidelines (EIANZ 2018). The method involves assessing the magnitude of the Project's adverse effects on the site's ecological values, before using a matrix to assess the level of ecological effects. **Table 6.C.1** describes the categories for the possible effect magnitudes, while **Table 6.C.2** provides a matrix in which to determine the level of the effect on the ecological values.

Ecological features were assigned values based on the attributes outlined in the Ecological Impact Assessment Guidelines ecological integrity of freshwater ecosystems including nativeness, pristineness, diversity and resilience. Results from the assessment were used to assist in assigning values.

Table 6.C.1: Magnitude of effects

Magnitude	Description
Very high	Total loss of, or very major alteration to, key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be fundamentally changed and may be lost from the site altogether; AND/OR Loss of a very high proportion of the known population or range of the element/feature.
High	Major loss or major alteration to key elements/features of the existing baseline conditions such that the post-development character, composition and/or attributes will be fundamentally changed; AND/OR Loss of a high proportion of the known population or range of the element/feature.
Medium	Loss or alteration to one or more key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be partially changed; AND/OR Loss of a moderate proportion of the known population or range of the element/feature.
Low	Minor shift away from existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances or patterns; AND/OR Having a minor effect on the known population or range of the element/feature.
Negligible	Very slight change from the existing baseline condition. Change barely distinguishable, approximating to the 'no change' situation; AND/OR Having negligible effect on the known population or range of the element/feature.

Table 6.C.2: Level of ecological effects

Level of ecological effects		Ecological value				
		Very high	High	Moderate	Low	Negligible
Magnitude	Very high	Very high	Very high	High	Moderate	Low
	High	Very high	Very high	Moderate	Low	Very low
	Moderate	High	High	Moderate	Low	Very low
	Low	Moderate	Low	Low	Very low	Very low
	Negligible	Low	Very low	Very low	Very low	Very low
	Positive	Net gain	Net gain	Net gain	Net gain	Net gain

3.0 Freshwater ecological description, condition and values

There are eight catchments (excluding Manawatū River) across the designation corridor that are affected (directly or indirectly) by the Project. **Figures 1 to 3** of **Appendix 6.C.1** provide an overview of the waterways within the designation corridor, including the intermittent and perennial reaches. Watercourses have been numbered on the figures for ease of reference. Generally, all relevant watercourse networks flow in a southerly direction and eventually discharge into the Manawatū River. In some instances, particularly for headwaters, a conservative approach has been taken and the waterways have been classified as perennial, but this may not be reflective of summer conditions.

3.1 Watercourse network one

Watercourse one is located towards the eastern end of the survey extent and includes two stream reaches that are bisected by the Project. The main stem (1A) flows in a southerly direction adjacent to Woodlands Road before flowing beneath Napier Road (SH3). The main stem begins further north within the rural catchment. A tributary (1B) to the main stem is located approximately 100m to the west of the confluence with the main stem immediately south of Napier Road.

Within the designation corridor, the perennial main stem has been straightened and follows a defined channel. The channel is approximately 0.5m wide for the most part, although it is near 2m wide immediately upstream from Napier Road. During the fieldwork period, water depth varied between 0.15 and 0.5m. The waterway network consists of marginal instream habitat values with mostly uniform hydrologic conditions. Habitat is limited to macrophytes and some overhanging rank grass vegetation, although cobble habitat does exist further downstream towards Napier Road. The substrate was dominated by fine sediment.

Tall riparian vegetation is absent, with vegetation consisting of pasture grasses to the stream edge. Aquatic vegetation is common along the stream edge and includes monkey musk (*Erythranthe guttata*), watercress (*Nasturtium officinale*), and duckweed (*Lemna* sp.), and covered approximately 25% of the wetted width. A culvert is present within the waterway to provide for stock access. Stock were excluded from the waterway. **Images 6.C.1 and 6.C.2** show the main stem.

The tributary has poor instream ecology values with low habitat abundance and diversity, and slow flowing uniform hydrologic conditions over a silt substrate. The tributary consists of a thick cover of macrophytes and pasture species across the channel/depression area. Riparian vegetation consists of pasture grasses, and stock are not excluded from the tributary. Multiple culverts are present along the tributary. The tributary is likely to be intermittent as grass covers the entire channel in places. **Images 6.C.3 and 6.C.4** show the tributary.

Image 6.C.1: Straightened channel of the main stem (1A).

Image 6.C.2: Downstream extent of the main stem (1A) before flowing beneath SH3.

Image 6.C.3: Tributary (1B) with dense macrophyte and grass cover.

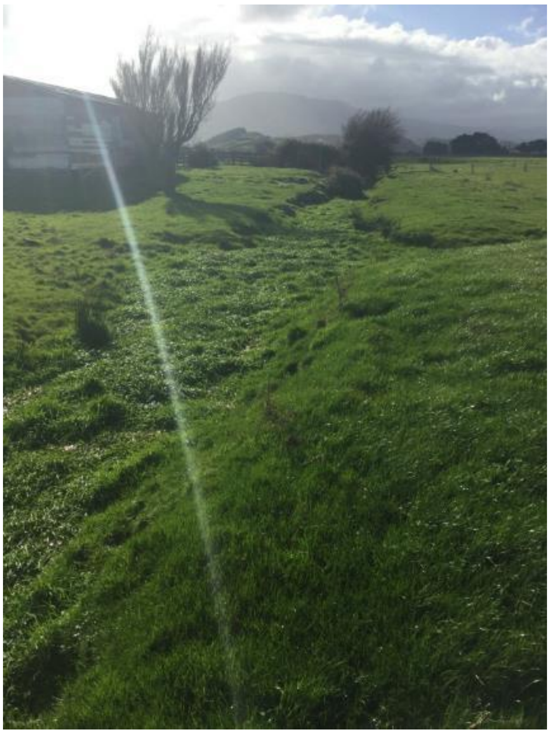


Image 6.C.4: Upstream reach of tributary (1B) with dense macrophyte and grass cover.

3.2 Watercourse network two

Watercourse two is located towards the eastern end of the Project and includes a main stem (2A) and three tributaries (2B, 2C and 2D) that flow into the main stem at various points near the designation corridor. Other tributaries also flow into the main stem, but these are unlikely to be affected by the Project, and are therefore not discussed further. The main stem (2A) flows in a southerly direction at the base of the hill, and slopes towards the west before eventually flowing beneath Napier Road and into the Mangapapa Stream.

Within the corridor, the perennial main stem follows a mostly sinuous channel that varies in width from 3.4m to over 6m in places. Water depth is also variable, ranging from less than 0.1m to over 0.6m. The main stem is assessed as having sub-optimal to optimal instream ecology values with a mixture of hydrologic conditions. Habitat consists of riffles, pools, undercut banks and cobbles, but there is a noticeable lack of wood debris and overhanging vegetation. The substrate is dominated by a mix of silt/sand, and varying sized gravels and cobbles.

Riparian vegetation is mostly absent, consisting of pasture grasses to the stream edge and occasional large exotic conifers further back from the stream edge. Pampas (*Cortaderia* sp.) is also present in the true left bank in places. No macrophytes were observed within the assessed reach, but periphyton (mats) is common in places. Stock are not excluded from the waterway, and there is evidence of bank slumping and erosion. **Images 6.C.5 and 6.C.6** show the main stem.

Image 6.C.5: Upstream end where the designation corridor bisects the main stem (2A).

Image 6.C.6: Main stem (2A). Note the steep banks in places and the lack of fencing to prevent stock access.

The perennial tributary flowing in from the eastern side of the main stem (2B) consists of a straightened farm drain where it bisects the designation corridor, although the waterway is more sinuous further upstream and downstream. The tributary consists of a thick cover of macrophytes (watercress and to a lesser extent duckweed) covering a large proportion of the channel. Stock can access the waterway and there is evidence of erosion and bank slumping in places. The tributary's instream ecology values are assessed as poor, with limited habitat diversity and slow flowing uniform hydrologic conditions. **Images 6.C.7 and 6.C.8** show the tributary.

Image 6.C.7: Straightened channel of tributary (2B). Note the dense macrophyte cover.

Image 6.C.8: Tributary (2B) upstream of designation corridor.

The southernmost tributary flowing in from the western side of the main stem (2C) is located at the base of a steep gully with several different smaller side branches, some of which are likely to be intermittent and ephemeral. For the purposes of this assessment, only the likely affected waterway reaches have been described. The tributary, including the upper headwater branch, follows a sinuous flow path. Instream habitat varies along the waterway and is influenced by stock access, bank gradients and riparian cover. Incised reaches with some canopy cover are generally not able to be accessed by stock and provide sub-optimal habitat with a mix of hydrological conditions. Substrate within these reaches consist of a mix of silt/sand, gravel and cobbles, whereas less steep reaches that stock can access consist of reduced habitat diversity and often lack riparian cover. These reaches are also typically dominated by a silt/sand substrate, as well as macrophyte cover (watercress and duckweed). In heavily pugged areas the waterway channel is less defined, and bank slumping is common. The tributary's instream ecology values are assessed as sub-optimal marginal. **Images 6.C.9 and 6.C.10** show the tributary.

Image 6.C.9: Tributary (2C) with minimal riparian cover and stock access. Note the less defined channel.

Image 6.C.10: Tributary (2C) with partial riparian cover and reduced stock access.

The northernmost tributary flowing in from the western side of the main stem (2D) is located at the base of a steep gully and consists of several small branches making up the headwaters. Only the headwaters have been described in this report, although downstream reaches are likely to have similar characteristics to the southernmost tributary described previously (2C). The headwater tributaries follow a sinuous flow path and are incised with steep banks on both sides. Instream habitat diversity and hydrologic values are assessed as optimal while substrate consists of a mix of silt/sand, gravel and cobbles. The riparian margin consists of mostly native vegetation providing optimal shade over the waterway. **Images 6.C.11 and 6.C.12** show the tributary.

Image 6.C.11: Tributary (2D) flowing over bedrock.

Image 6.C.12: Tributary (2D) flowing at the base of a steep sided gully with riparian cover.

3.3 Watercourse network three

Watercourse three is located towards the eastern end of the Project and includes a main stem (3A) and tributary (3B). There are likely to be other tributaries that flow into the main stem, but these are unlikely to be affected by the proposed corridor and are not discussed further in this report. The main stem flows in a southerly direction at the base of a steep gully on the north-eastern edge of the Manawatū Gorge Scenic Reserve and discharges into the Manawatū River.

The headwaters of the main stem consist of three intermittent branches that are located within the designation corridor. Constructed ponds are located at the upstream extent of two headwater branches. Water was flowing within all three branches at the time of the fieldwork, however grass was dominant across some flow path extents (as well as *Glyceria* sp.). A channel was not evident for large segments of the pathways, with habitat mostly resembling boggy areas. Stock are not excluded from these sites with pugging and grazing evident. Vegetation consists mostly of grazed pasture as well as gorse (*Ulex europaeus*), rushes (*Carex* and *Juncus* spp.), and pampas.

The waterway appears to become perennial at the confluence of the three intermittent waterways, with a more defined channel. Approximately 50m downstream from the confluence, the riparian cover becomes more prominent. At this point, the stem follows a natural flow path, with the channel becoming more incised as the banks and gradient become steeper. The main stem within the forested reach was assessed as providing optimal fish and macroinvertebrate habitat with a mixture of hydrologic conditions. Instream habitat consists of riffles, pools, undercut banks, woody debris and cobbles. The substrate is comprised of a mix of silt/sand, and varying sized gravels and cobbles. Riparian vegetation consists of mostly native vegetation and no macrophytes were found where the stream reach was observed. Vegetation and the steep topography prevent stock from accessing the majority of the reach. Instream habitat is assessed as optimal in the forested reaches and poor within the upstream agricultural areas. **Images 6.C.13 and 6.C.14** show the main stem.

Image 6.C.13: Main stem (3A) within the forested reach. Note the waterfall likely reducing fish passage.

Image 6.C.14: One of the three intermittent streams in the headwaters of the main stem (3A).

The tributary flows into the main stem on the eastern side and has similar characteristics to the headwaters described in the main stem. There are two branches, both of which begin as intermittent waterways that follow pathways consisting of both defined channel and boggy reaches. Grass is present across the width of the silt/sand channel and boggy areas in many sites with pugging and grazing evident. Riparian vegetation consists mainly of grazed pasture as well as gorse and rushes, although more shade is provided on the eastern branch with low stature vegetation present (i.e. blackberry (*Rubus fruticosus*) and tree ferns (*Cyathea* and *Dicksonia* spp.) as well as pines (*Pinus* sp.). A more contiguous channel is present once the waterways flow into the forested areas downstream and the stream appears to become permanent. Habitat diversity improves downstream and gravel and cobbles are found within the channel. Instream habitat is assessed as optimal in the forested reaches and poor within the upstream agricultural areas. **Images 6.C.15 and 6.C.16** show the headwaters of the tributary.

Image 6.C.15: Western branch of the eastern tributary (3B).

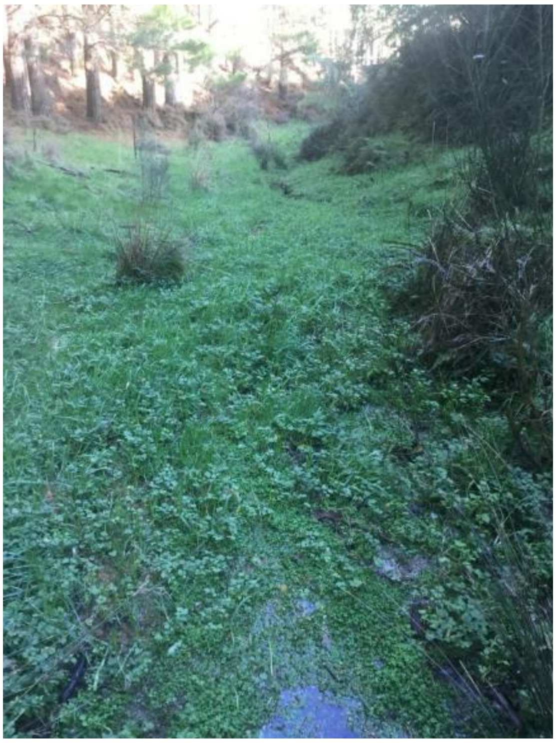


Image 6.C.16: Eastern branch of the eastern tributary (3B).

3.4 Watercourse network four

Watercourse four is located towards the central part of the corridor and includes a main stem (4A) and six tributaries (4B, 4C, 4D, 4E, 4F and 4G) that flow within or partially within the corridor and join the main stem at various points. There are other tributaries that flow into the main stem, but these are unlikely to be affected by the proposed corridor and are not discussed further in this report. The main stem begins at the downstream end of two created ponds. The stream flows west for over a kilometre before flowing in a southerly direction and into a second created pond before eventually flowing into the Manawatū Gorge Scenic Reserve.

Within the corridor, the perennial main stem consists of straightened reaches and natural flow paths. The width of the assessed reach varies between 1.3m to nearly 3m while water depths as observed ranged from less than 0.1m to nearly 0.7m. Further upstream, channel widths are less and water depths are lower. The instream values at the surveyed reach are assessed as optimal. Habitat consists of a mix of hydrologic conditions including riffles and pools as well as other instream habitat such as undercut banks, wood and cobbles. The substrate is dominated by a mix of silt/sand, and varying sized gravels and cobbles.

Tall riparian vegetation is mostly absent, consisting of pasture grasses to the stream edge. There are pockets of mixed native and exotic riparian vegetation providing some cover over the stream. Macrophytes were observed in certain reaches but were not dominant over the waterway. Species consist of duckweed, watercress, starwort (*Callitriche stagnalis*), Canadian pondweed (*Elodea canadensis*) and *Glyceria* sp. Periphyton (mostly mats) is common in places. Stock are excluded from small sections of the main stem but grazing and erosion, as well as bank slumping, was observed over most of the reach. **Images 6.C.17 and 6.C.18** show the main stem.

Image 6.C.17: Typical view of the upper reach of the main stem (4A).

Image 6.C.18: Downstream reach of the main stem (4A). Note the erosion and lack of riparian cover and fencing.

The six tributaries all share similar characteristics with waterways found in the base of small gullies that drain into the main stem or the upstream ponds. None of the waterways are fenced off from stock with grazing and pugging evident across all tributaries. The majority of the waterways are intermittent although there appear to be perennial reaches within tributaries 4C and 4D, with a defined contiguous flow path and small pools present. Flow paths over the remaining reaches are either not well defined, particularly where pugging is extensive, or consist of a combination of saturated soils and small reaches of defined flow paths. The tributaries are assessed as having poor instream ecology values with limited habitat diversity and slow flowing (in some cases stagnant) uniform hydrologic conditions. Silt/sand is the dominant bed substrate and riparian vegetation is generally limited to grazed pasture grasses. Pasture is present across the channel and boggy areas over large proportions of the tributaries, while rushes are also present in areas. Some macrophytes are present including *Glyceria* sp. **Images 6.C.19, 6.C.20, 6.C.21 and 6.C.22** show typical characteristics of the tributaries.

Image 6.C.19: Tributary (4B) flowing through a created depression before connecting to the main stem.

Image 6.C.20: Tributary (4C) flowing through more of a wetland /boggy area at the base of a gully.

Image 6.C.21: High level of pugging affecting the stream channel of the tributary (4E).

Image 6.C.22: Less defined channel of tributary (4F).

3.5 Watercourse network five

Watercourse five is located towards the central part of the corridor and includes two main stems (5A and 5B) that are bisected by the corridor. The confluence of the two stems is located downstream within the Manawatū Gorge Scenic Reserve. Each main stem branches out further upstream of the designation corridor crossing, into smaller headwater gullies which are unlikely to be affected and are not discussed further in this report. Both main stems flow in a southerly direction, before coming together and eventually flowing into the Manawatū River.

An assessment was conducted within the eastern main stem (5A), however the two perennial stems share similar characteristics consisting of sinuous flow paths within an incised gully. The width of the assessed reach varies between 0.5m to nearly 2m, while water depths ranged from less than 0.05m to nearly 0.3m. The waterway at the surveyed reach is assessed as having sub-optimal instream habitat values and optimal hydrologic conditions. Habitat consists of riffles, pools, undercut banks and cobbles with a noticeable absence of wood debris. The substrate is dominated by a mix of silt/sand, varying sized gravels and cobbles and bedrock.

Riparian vegetation is variable across the assessed reach, consisting of grazed pasture grasses to the stream edge as well as more contiguous patches of trees and shrubs providing cover. There is far less riparian cover over the adjacent main stem (5B). Macrophytes were not observed within the waterway and periphyton (mats) were sparse. Stock are excluded from small sections of the eastern stem where steep banks prevent access. Grazing and pugging, as well as bank slumping, was observed over large proportions of both reaches. **Images 6.C.23, 6.C.24, 6.C.25 and 6.C.26** show the two main stems.

Image 6.C.23: Eastern main stem (5A) flowing at the base of the gully.

Image 6.C.24: Eastern main stem (5A). Note the steep sided true right bank and pugging on the true left bank.

Image 6.C.25: Gravel and cobble substrate within the western main stem (5B).

Image 6.C.26: Bank slumping along the western main stem (5B).

3.6 Watercourse network six

Watercourse six is located towards the western end of the corridor and includes a main stem (6A) and two smaller side tributaries (6B and 6C) that are bisected by the corridor. The two tributaries share similar characteristics with the main stem. The perennial waterway is similar to the main stems of watercourse five, consisting of sinuous flow path within an incised gully. The main difference is that watercourse six has more contiguous riparian vegetation, and stock have been excluded. The main stem flows in a southerly direction, into the Manawatū Gorge Scenic Reserve before discharging into the Manawatū River. An assessment of the stream was conducted at the upstream extent of the waterway within the Manawatū Gorge Scenic Reserve.

The width of the assessed reach varies between 0.6m to 2.3m, while water depths ranged from less than 0.05m to nearly 0.2m. The waterway at the surveyed reach was assessed as containing optimal instream habitat values and optimal hydrologic conditions. Habitat consists of riffles, pools, undercut banks, cobbles and wood debris. The substrate is dominated by varying sized gravels and cobbles with some silt/sand and bedrock.

Riparian vegetation was intact over the assessed reach, consisting of mature native bush. Upstream, outside of the Scenic Reserve, vegetation is mostly contiguous and comprised of regenerative native forest species. Pasture is present in some places near the stream edge, however it did not appear to be grazed. Macrophytes were absent from the waterway while periphyton (mats) were sparse outside of the Scenic Reserve (absent within the reserve). Pugging was absent along the stream bank, although there was occasional bank slumping where stock had previous access to the stream edge. **Images 6.C.27, 6.C.28, 6.C.29 and 6.C.30** show the watercourse and two tributaries.

Image 6.C.27: Main stem (6A) flowing through the DOC reserve.

Image 6.C.28: Main stem (6A) close to where the designation corridor bisects the waterway.

Image 6.C.29: Tributary (6B) flowing through a mix of pasture and early succession vegetation.

Image 6.C.30: A reach of tributary (6C) with a more intact understory.

3.7 Watercourse network seven

Watercourse seven is located towards the western extent of the corridor and includes a main stem (7A) and two tributaries (7B and 7C) that flow within or partially within the corridor and join the main stem. There are other tributaries that flow into the main stem, but these are unlikely to be affected by the proposed corridor and are not discussed further in this report. The main stem flows in a southerly direction, adjacent to the Manawatū Gorge Scenic Reserve, before discharging into the Manawatū River. Assessments of the stream were conducted at the upstream and downstream extents of the waterway.

The upstream reach of the perennial main stem shares characteristics with watercourse five and six, consisting of a sinuous flow path within an incised gully. The width of the upstream assessed reach varied between 0.35m to 1m with water depths ranging from less than 0.05m to 0.08m. The waterway was assessed as containing optimal instream habitat and hydrologic conditions, consisting of riffles, pools, undercut banks, wood and cobbles. The substrate was dominated by varying sized gravels and cobbles.

Riparian vegetation is intact over the assessed reach, consisting of a mix of mature and regenerating native bush. Macrophytes are absent from the waterway, while periphyton (mats) is sparse. Stock are excluded from the waterway, although a deceased cow was found within a particularly incised reach. Pugging and bank slumping were not observed.

The assessed downstream reach of the main stem is less incised, and there is a greater connection to the floodplain. The stem follows a natural flow path, with channel widths varying between 0.8m to 4.8m and water depths ranging from less than 0.05m to 0.15m. The waterway is assessed as containing optimal instream habitat and hydrologic conditions, consisting of riffles, pools, undercut banks, wood and cobbles. The substrate includes varying sized gravels and cobbles as well as silt/sand.

Riparian vegetation is sporadic over the assessed reach, consisting of patches of regenerating native bush and grazed pasture. Macrophytes are absent from the waterway while periphyton (mats) is sparse. Stock was not excluded from the waterway with pugging and grazing evident to the stream edge as well as numerous sites where stock cross the stream. Bank slumping was also evident within the downstream reach. Partial fish passage barriers are present near the confluence with the Manawatū River. There are two barriers associated with the railway that bisect the stream (perched culvert and additional structure upstream) as well as a natural barrier which appears to be as a result of root mats from riparian vegetation. **Images 6.C.31, 6.C.32, 6.C.33 and 6.C.34** show the upstream and downstream reaches of watercourse seven.

Image C.6.31: Upstream reach of the main stem (7A). Note the incised stream bed.

Image C.6.32: Upstream reach of the main stem (7A). Note the steep true left bank.

Image 6.C.33: Downstream reach of the main stem (7A). Note the differences from the upstream reaches.

Image 6.C.34: Downstream reach of the main stem (7A). Note the stream flowing over a retaining wall structure reducing fish passage.

The downstream reach of tributary 7B shares similar characteristics to the downstream reach of the main stem including in terms of bed substrate, instream habitat, hydrologic conditions, riparian vegetation, stock access and subsequent pugging and erosion. A barrier to fish passage is present near the pine trees with an approximately 5m waterfall. The pine trees also mark a change in upstream habitat quality. The upstream extent of the tributary includes poor instream habitat values with reaches where the channel is not always defined and appears to be intermittent in places. There is a high proportion of silt/sand covering the streambed, and grazed pasture is present to the stream edge with pugging and bank slumping also observed. Macrophytes are more common and include mostly watercress and duckweed. **Images 6.C.35 and 6.C.36** show the tributary.

Image 6.C.35: Downstream reach where stock frequently cross tributary (7B).

Image 6.C.36: Upstream reach of tributary (7B) within area used for grazing.

Tributary 7C is predominantly wetland with a flow path through the centre. The waterway is slow flowing and instream habitat values were assessed as marginal to poor. Silt/sand is the dominant bed substrate, and riparian vegetation is mostly wetland species (i.e. rushes and sedges) with some shrubs and trees present. Grazed pasture is present to the stream edge in places, more so in the upper reaches, with pugging also observed. **Images 6.C.37 and 6.C.38** show the tributary.

Image 6.C.37: Pugging within and adjacent to tributary (7C). Note the lack of channel.

Image 6.C.38: Slow flowing reach of tributary (7C).

3.8 Watercourse network eight

Watercourse eight is located towards the western end of the survey extent on the southern side of the Manawatū River and includes an intermittent reach that is bisected by the corridor. The intermittent stream (8A) flows in a northerly direction from within mostly pine forest before flowing west parallel along the southern edge of Napier Road. The waterway then flows south via a culvert into adjacent farmland, where the stream channel turns into what appears to be saturated/boggy farm paddock.

The intermittent stream within and adjacent to the corridor follows a straightened channel. The channel is approximately 0.5m for the most part and water depth varied between approximately 0.1m to 0.3m. The waterway network was assessed as containing poor instream habitat with mostly uniform hydrologic conditions. Habitat is limited to occasional macrophytes including watercress, duckweed and *Glyceria* sp., although there is evidence that macrophytes are regularly sprayed. Grass was present within sections of the channel and the substrate consisted of fine sediment.

Riparian vegetation was absent where the waterway flows adjacent to the road and in the agricultural area, although mixed native and exotic trees and shrubs provide some shading towards the upstream end of the observed reach. Stock are not excluded from the boggy area within the farmland. **Images 6.C.39 and 6.C.40** show the main stem.

Image 6.C.39: Tributary (8A) flowing through a garden area before eventually turning into a roadside drain.

Image 6.C.40: Tributary reach (8A) that flows into a paddock and the channel becomes less defined.

3.9 Manawatu River

The Manawatū River flows in a westerly direction to the south of the designation corridor. The river flows through the Manawatū Gorge, which runs almost parallel with the Project before the proposed alignment bridge crossing at the southern end of the Gorge. The river varies in width through the Gorge, from approximately 20m to almost 100m at the widest point. Depth is likely to be variable from shallow river margins and riffle areas to pools, which are likely to be over several meters deep.

Observations of the Manawatū River through the Gorge and adjacent upstream and downstream reaches show the waterway consists of optimal instream habitat and hydrologic conditions. Habitat consisted of riffles, pools, undercut banks, cobbles, woody debris and overhanging vegetation. The substrate appeared to be dominated by varying sized gravels and cobbles, although sand/silt is likely to be present in slower flowing reaches.

Riparian vegetation consisted of regenerating and more mature native forest present within the Manawatū Gorge Scenic Reserve, although exotic species are also likely to be present. The railway corridor and closed road (SH3) have caused a reduction in riparian vegetation along both banks of the river. No macrophytes were observed, although they might be present in slower flowing reaches.

Macroinvertebrate data from 2017 was provided by Horizons for three state of the environment monitoring sites, including Manawatū River at the upper Gorge and Teachers' College, and Pohangina River at Mais Reach. Data can be found in **Appendix 6.C.3**.

Macroinvertebrate populations from the three samples were dominated by *Deleatidum* sp., Elmidae (beetles) and *Hydropsyche* sp. (caddisflies from Aoteapsyche group). *Deleatidum* sp.

are sensitive taxa commonly found in waterways with high water quality, while *Hydropsyche* sp. (and to a lesser extent Elmidae) are more tolerant of lower water quality.

Caution should be used when interpreting macroinvertebrate indices for large rivers as they are intended for wadeable streams. However, MCI and QMCI scores indicate good water quality in the upper Gorge and excellent water quality in the Pohangina River. Manawatū River at Teachers' College was indicative of good (MCI) and excellent (QMCI) water quality.

3.10 Ponds

Various sized ponds are present within and adjacent to gullies across the designation corridor. The ponds are often small and located in the headwaters of gullies. They are man-made, generally for the purpose of supplying water for agricultural use (i.e. stock water), with a bund created at the downstream extent. Most ponds have some connectivity to the downstream watercourse, however in some cases there are partial or complete barriers to fish passage. There are two ponds across the designation corridor that are noticeably larger in size relative to the other ponds. These are located along watercourse four, towards the upstream extent and immediately upstream of where the watercourse flows into the Manawatū Gorge Scenic Reserve.

Other than likely supporting populations of eel and potentially bully species, the ponds provide poor habitat and are of limited aquatic ecological value.

3.11 Sediment quality

A summary of the sediment quality data is provided below in **Table 6.C.3**. All analysed heavy metal concentrations, for both total sediment and the less than 63 m fraction, were below the ANZECC low interim sediment quality guidelines indicating a low potential for biological harm to instream fauna.

Total nitrogen and phosphorus measures were variable across the sampled sites, with no obvious trend relating to concentrations of nutrients in the sediment and predominant land cover. There are no guidelines for which to compare nitrogen or phosphorus concentrations within sediment.

Table 6.C.3: Sediment quality results

Site	**TS / <63 m**	**Total (recoverable)**				
		Copper	Lead	Zinc	Total Phosphorus	Total Nitrogen
		mg/kg dry wt				g/100g dry wt
1	TS	5.1	8.8	50	290[3]	0.09
	<63 m	9.8	15.7	85	630	0.25
2A	TS	3.7	7.1	32	280	<0.05

[3] While there are no national guidelines or indicators of problematic levels, these values are low by comparison with other sediment phosphorus studies (e.g. Ostrofsky 2012 measures of lake sediment total phosphorus were greater than 750 g/ g sed. dry wt.).

Site	TS / <63 m	Total (recoverable)				
		Copper	Lead	Zinc	Total Phosphorus	Total Nitrogen
		mg/kg dry wt				g/100g dry wt
	<63 m	6.0	11.0	44	500	0.07
2D	TS	3.3	5.9	31	280	<0.05
	<63 m	7.1	11.9	46	470	0.13
4	TS	3.6	5.7	33	230	<0.05
	<63 m	6.8	10.8	48	530	0.19
5	TS	3.0	5.7	26	184	0.08
	<63 m	5.2	8.1	36	290	0.12
6	TS	4.0	5.8	25	138	<0.05
	<63 m	8.5	15.1	43	420	0.16
7A US	TS	5.5	7.4	30	210	<0.05
	<63 m	8.0	11.0	40	370	0.12
7A DS	TS	3.9	5.2	26	230	<0.05
	<63 m	5.7	6.9	39	410	0.07
ANZECC guidelines						
ISQG - Low		65	50	200	-	-
ISQG - High		270	220	410	-	-

3.12 Macroinvertebrate assemblage

A summary of the macroinvertebrate data is provided in **Table 6.C.4** below. Full macroinvertebrate results are provided in **Appendix 6.C.4**. Sampling sites are displayed on **Figures 1 to 3, Appendix 6.C.1**.

Mayfly larvae *Deleatidum* sp. and *Zephlebia* sp. were the most dominant taxa across sites 2A, 2D, 5, 6, 7A (upstream) and 7A (downstream), featuring a high proportion of one or both taxa. These species are relatively sensitive to degraded water quality and habitat modification (especially loss or reduction in periphyton supporting hard substrate). Samples from sites 1 and 4 contained a high proportion of *Potamopyrgus antipodarum*, Oligochaete worms, *Paracalliope* sp. and *Austrosimulium* sp. These species are more tolerant of poor water quality and habitat modification (preferring/requiring substantive macrophyte cover common to soft substrates and higher nutrient waters).

Sites 2A, 6 and 7A (upstream) contained the highest number of EPT taxa, as well as the highest percent EPT abundance. It should be noted that EPT taxa recorded from the Site 2A sample were generally more sensitive species, compared to those recorded at sites 6 and 7A (upstream). Site 7A (upstream) is somewhat of an anomaly, with high value indicator macroinvertebrates, but a low species richness suggesting a small area of simple, but good quality habitat. Site 1 contained the least amount of EPT taxa with just one and the lowest percent EPT abundance. Macroinvertebrate indices were variable across the eight samples. MCI results showed site 1 was indicative of poor water quality, sites 2A, 4 and 5 were indicative of fair water quality, sites 2D, 6 and 7B were indicative of good water quality and site 7A (upstream) was indicative of excellent water quality. SQMCI results showed differences with sites 2A, 5, 6, 7A (upstream) and 7A (downstream) indicative of excellent water quality, site 2D was indicative of good water quality, and sites 1 and 4 were indicative of poor water quality.

The SQMCI score considers the relative abundance of each taxa in the sample, and is calculated using the proportional abundance of each scoring taxa. It is thus a better index of a community's composition, whereas the MCI is strongly influenced by rare taxa, which contribute to the MCI score disproportionally to their abundance.

Table 6.C.4: Macroinvertebrate results

Sampling site	Macroinvertebrate parameter				
	Taxonomic richness	**No. of EPT taxa**	**Percent EPT abundance**	**MCI**	**SQMCI**
1A	13	1	7.7	63	2.58
2A	19	8	42.1	92	6.29
2D	9	2	22.2	110	5.52
4A	21	5	23.8	81	3.54
5A	17	5	29.4	94	6.63
6A	17	7	41.2	115	7.55
7A US	9	4	44.4	120	7.06
7A DS	20	6	30.0	111	7.38

3.13 Stream Ecological Valuation

A summary of the SEV data is provided in **Table 6.C.5** below, with sampling sites displayed on Figures 1 to 3, **Appendix 6.C.1**.

SEV values (function values can vary between 0 (poor) and 1 (optimal)) varied across the assessment sites ranging from 0.36 within watercourse 1A to 0.86 within watercourse 6A (located within the Manawatū Gorge Scenic Reserve). Generally, assessment sites over the designation corridor scored better with some degree of canopy cover. Some SEV scores, particularly the reaches north of the Manawatū Gorge Scenic Reserve, were affected by the naturally incised gullies and associated steep banks. This caused a disconnect from the floodplain and riparian zone and had effects on fish spawning habitat. Site 6A had a noticeably low score with regard to fish fauna intact. No fish species were recorded within the assessed reach, which may be due to a natural barrier preventing fish passage further downstream or potentially a perched culvert preventing fish passage where the railway corridor bisects the stream, as observed at the downstream extent of Site 7.

Table 6.C.5: Overview of Stream Ecological Valuation data and results

SEV function	Site							
	1A	2A	2D	4A	5A	6A	7A US	7A DS
Natural flow regime	0.23	0.71	0.79	0.75	0.76	0.93	0.83	0.96
Floodplain effectiveness	0.03	0.08	0.52	0.17	0.26	0.84	0.60	0.44
Connectivity for natural species migrations	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Natural connectivity to groundwater	0.62	0.81	0.91	0.79	0.82	0.97	0.93	0.97
Hydraulic function mean score	0.47	0.65	0.81	0.68	0.71	0.94	0.84	0.84
Water temperature control	0.32	0.24	0.80	0.24	0.42	0.80	0.80	0.68
Dissolved oxygen levels maintained	0.68	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Organic matter input	0.00	0.10	1.00	0.10	0.40	1.00	1.00	0.70
In-stream particle retention	0.20	0.74	0.88	0.70	0.70	0.96	0.90	0.98
Decontamination of pollutants	0.77	0.49	1.00	0.61	0.64	1.00	1.00	0.90
Biogeochemical function mean score	0.39	0.51	0.94	0.53	0.63	0.95	0.94	0.85

SEV function	Site							
	1A	**2A**	**2D**	**4A**	**5A**	**6A**	**7A US**	**7A DS**
Fish spawning habitat	0.05	0.50	0.68	0.50	0.49	0.90	0.43	0.43
Habitat for aquatic fauna	0.39	0.56	0.97	0.56	0.69	0.98	0.95	0.82
Habitat provision function mean score	0.22	0.53	0.83	0.53	0.59	0.94	0.69	0.63
Fish fauna intact	0.40	1.00	0.87	0.40	0.80	0.00	0.87	0.87
Riparian vegetation intact	0.05	0.03	0.32	0.07	0.21	0.80	0.27	0.32
Biodiversity function mean score	0.23	0.52	0.60	0.24	0.51	0.40	0.57	0.60
Overall mean SEV score	**0.36**	**0.56**	**0.83**	**0.53**	**0.63**	**0.86**	**0.81**	**0.77**

3.14 Fish and koura survey

A summary of the fish survey data is provided in **Table 6.C.6** below. The fish survey report, conducted at the beginning of 2018, is provided in **Appendix 6.C.2**. Fish surveys were conducted within representative waterways across the proposed designation corridor. Fish surveys were targeted using similar parameters used to guide the survey data collected as part of this assessment (i.e. natural flow path, **REC**, stream order, riparian cover, location and likely gradient) as well as trying to conduct a survey within each of the affected sub-catchments. A fish survey location figure (Figure 4) is provided on the following page.

A total of four fish species were recorded from the survey across the eight sampling sites, including one *At Risk (declining)* species, longfin eel (Dunn *et al.*, 2018). No site had numerous fish abundances, and given the extent of the survey, fish presence must be considered uncommon. Site two was the only surveyed reach which contained all the species. All other sites recorded either one or two species with site six the only site to record no fish species. In addition, koura were found across six of the eight survey sites.

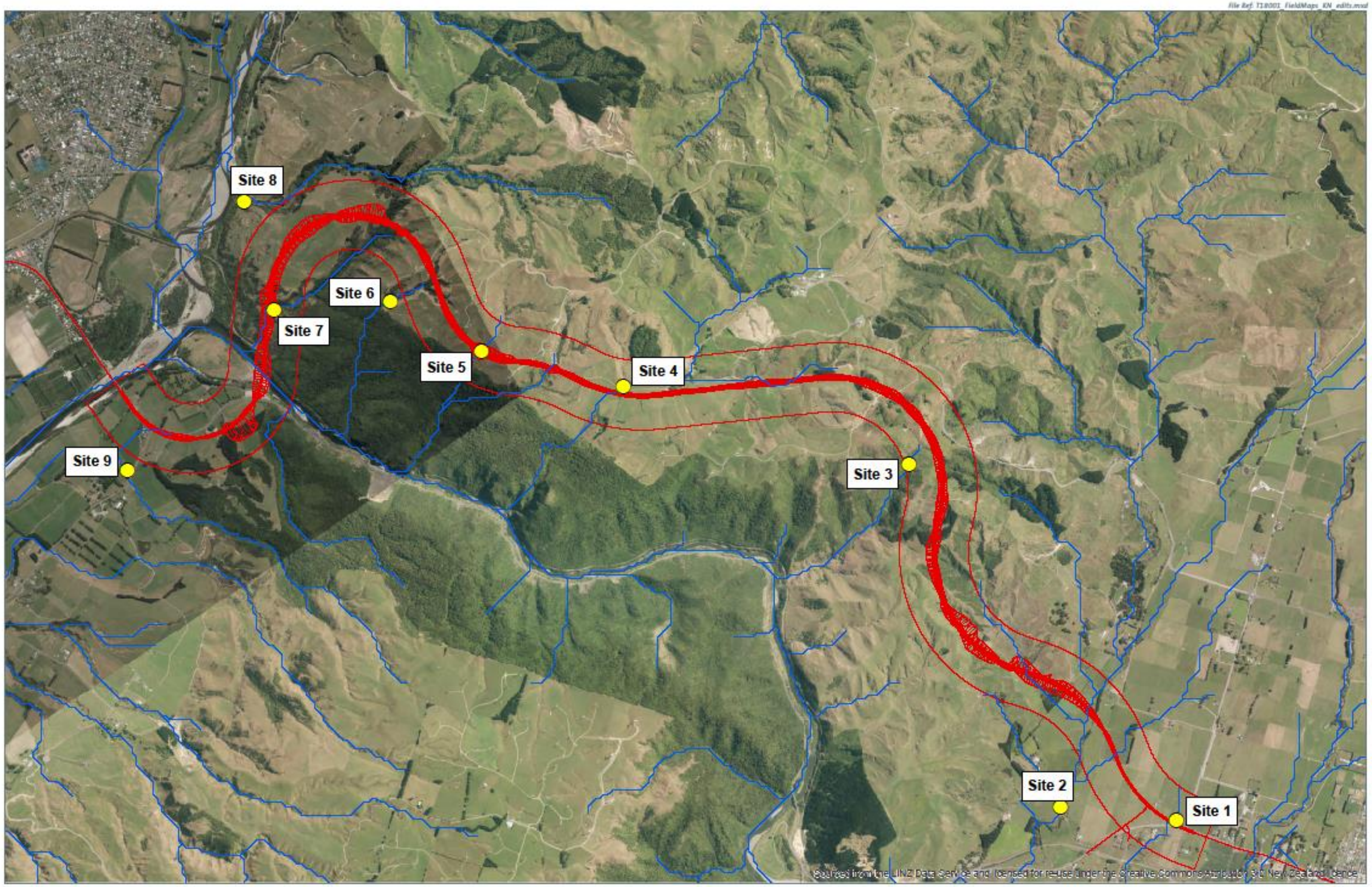
There are more than 40 freshwater fish database records for the Manawatū River, Pohangina River and connecting gully systems, within an approximate 10km radius from the designation corridor. The records included five additional native fish species not recorded during the fish survey including upland bully, torrentfish, brown mudfish, common smelt and dwarf galaxias. In addition, other native species such as shortjaw kokopu, giant kokopu, banded kokopu, koaro, lamprey, crans bully and giant bully have been recorded within the Manawatū River and connecting gullies near Palmerston North. There appears to be only two records within or adjacent to the designation corridor. Fish species recorded included shortfin and longfin eel and koura.

The results from the fish survey across the designation corridor showed reduced diversity, compared to species recorded from the freshwater fish database in the main river and connecting tributaries. This is likely due to several factors including reduced habitat quality and quantity in low-lying streams and barriers (natural and man-made) preventing, or partially preventing, fish passage from the Manawatū River.

Table 6.C.6: Summary of fish survey results (number in parenthesis indicates the size range in mm)

Species	**Site**							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8 (9)**
Redfin bully		1 (50)						
Longfin eel		3 (250-400)	1 (250)		2 (400-450)		2 (400-500)	
Shortfin eel	21 (180-400)	2 (200-250)		3 (400-800)			2 (120)	12 (250-800)
Common bully		4 (40-60)						27 (30-70)
Koura		2 (40-50)	2 (30-40)	13 (30-50)	20 (10-50)	6 (10-50)	3 (10-40)	

Species	Site							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8 (9)**
Eel sp		6 (80-100)					9 (80-120)	8 (200-400)
Bully sp								6 (20-30)



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Legend

MANAWATU GORGE SUMMER ECOLOGY

Figure 1: Freshwater Survey Locations

Date: 19 March 2018 | Revision: 0
Plan prepared for NZ Transport Agency by Boffa Miskell Limited
Project Manager: Sharon.DeLuca@boffamiskell.co.nz | Drawn: KN | Checked: KMi

3.15 Ecological significance

None of the waterways across the designation corridor have been identified as "Natural State" or "Sites of Significance – Aquatic" under the Horizons One Plan. However, the definition of Natural State includes "sections of rivers and their beds that have sources in, and flow within, Public Conservation Land (land held under the Conservation Act 1987 or administered by the Department of Conservation)". This is not a proxy for condition, but assumes protection and reduced use will reflect a better biodiversity. Many of the waterways crossed by the Project have reaches downstream of the Project that fall under this criterion as they flow through the Manawatū Gorge Scenic Reserve. However, as further discussed under the assessment of potential effects, the downstream reaches are unlikely to be directly affected by the Project (i.e. the activity is unlikely to directly diminish the natural state values of the waterways). There may be indirect effects on natural state values, such as sedimentation, which is also addressed further in the document. The Manawatū River also meets the "Natural State" definition within the Gorge.

If considering the fauna present, the functional role and conservation values, it is unlikely any of the waterways, individually or collectively, can be considered "significant habitat for indigenous fauna".

That said, the Horizons One Plan also provides reference to maintaining and enhancing (where degraded) the existing life supporting capacity of rivers and their beds with regards to surface water quantity and quality, and provides water quality targets for specific water management zones.

3.16 Freshwater ecological values

The waterways across the designation corridor vary in size, morphology, instream fauna, function and riparian characteristics, which all affect the overall value of that respective waterway.

Table 6.C.7 provides a summary of the characteristics from each of the waterways that may potentially be directly or indirectly affected by the Project. Ecological values vary across the Project from negligible/low to high value.

The Manawatū River, specifically the Gorge area where the designation corridor crosses over it, is considered to have very high ecological value. This is due to the optimal instream habitat and hydrologic conditions, sinuous flow path, general high macroinvertebrate indices and high diversity of native fish species.

Table 6.C.7: Waterway characteristics and associated ecological values

Site	Waterway type	Ecological integrity components										Ecological value
		Nativeness		Pristineness				Diversity		Resilience		
		Native fish species	Presence of invasive macrophytes	SQMCI	Fish IBI	Sediment quality	Riparian cover	Macroinvertebrate taxonomic richness	Instream habitat	SEV score	Percent EPT taxa	
1A	Perennial	Shortfin eel	Monkey musk, Watercress, Duckweed	2.58 (Poor)	24 (very poor)	Good	Absent	13	Marginal	0.36	8	Low
1B	Intermittent	Comparable to 1A	Watercress	Comparable to 1A	Comparable to 1A	Comparable to 1A	Absent	Comparable to 1A	Poor	Comparable to 1A	Comparable to 1A	Low - Negligible
2A	Perennial	Shortfin eel Longfin eel Common bully Redfin bully	-	6.29 (Excellent)	70 (excellent)	Good	Minimal	19	Sub-optimal	0.56	42	High
2B	Perennial	Comparable to 1A	Watercress, Duckweed	Comparable to 1A	Comparable to 1A	Comparable to 1A	Absent	Comparable to 1A	Poor	Comparable to 1A	Comparable to 1A	Low
2C	Perennial	Comparable to 3A	Watercress, Duckweed	Comparable to 2D	Comparable to 3A	Comparable to 2A / 2D	Partial	Comparable to 2D	Sub-optimal / marginal	Comparable to 2A / 2D	Comparable to 2D	Moderate
2D	Perennial		-	5.52 (Good)		Good	Well	9	Optimal	0.83	22	High
3A	Intermittent	Natural barrier downstream	Glyceria Watercress	-	-	-	Minimal	-	Poor	-	-	Low - Negligible
	Perennial	Longfin eel	-	Comparable to 2D	48 (moderate)	Comparable to 2D	Well	Comparable to 2D	Optimal	Comparable to 2D	Comparable to 2D	High
3B	Intermittent	-	Glyceria, Duckweed, Watercress	-	-	-	Minimal	-	Poor	-	-	Low - Negligible
	Perennial	Comparable to 3A (perennial)	-	Comparable to 2D	Comparable to 3A (perennial)	Comparable to 2D	Well	Comparable to 2D	Optimal	Comparable to 2D	Comparable to 2D	High
4A	Perennial	Shortfin eel	Duckweed, Watercress, Starwort, Canadian pondweed, Glyceria	3.54 (Poor)	24 (very poor)	Good	Minimal	21	Optimal	0.53	24	Moderate
4B	Intermittent	Comparable to 4A	Glyceria, Duckweed, Watercress	-	Comparable to 4A	-	Absent	-	Poor	-	-	Low - Negligible
4C	Perennial / Intermittent			Comparable to 1A		Comparable to 1A	Absent	Comparable to 1A	Poor	Comparable to 1A	Comparable to 1A	Low

4D	Perennial / Intermittent					Comparable to 1A	Absent		Poor			Low
4E	Intermittent			-		-	Absent	-	Poor	-	-	Low - Negligible
4F	Intermittent			-		-	Absent	-	Poor	-	-	Low - Negligible
4G	Intermittent			-		-	Absent	-	Poor	-	-	Low - Negligible
5A	Perennial	Comparable to 5B	-	6.63 (Excellent)	Comparable to 5B	Good	Partial	17	Sub-optimal	0.63	29	High
5B	Perennial	Longfin eel	-	Comparable to 5A	48 (moderate)	Comparable to 5A	Minimal	Comparable to 5A	Sub-optimal	Comparable to 5A	Comparable to 5A	High
6A	Perennial	None recorded	-	7.55 (Excellent)	0 (no native fish)	Good	Well	17	Optimal	0.86	41	High
6B	Perennial	Comparable to 6A	-	Comparable to 6A	Comparable to 6A	Comparable to 6A	Partial	Comparable to 6A	Optimal	Comparable to 6A	Comparable to 6A	High
6C	Perennial		-				Partial		Optimal			High
7A	Perennial	Longfin eel Shortfin eel	-	7.06 / 7.38 Excellent	52 (moderate)	Good	Well	9 / 20	Optimal	0.77 / 0.81	44 / 30	High
7B	Perennial / Intermittent (upstream)	Natural barrier downstream	Duckweed, Watercress, Glyceria	Comparable to 1A	-	Comparable to 1A	Absent	Comparable to 1A	Poor	-	Comparable to 1A	Low
	Perennial (downstream)	Comparable to 7A	-	Comparable to 7A	Comparable to 7A	Comparable to 7A	Partial	Comparable to 7A	Optimal	Comparable to 7A	Comparable to 7A	High
7C	Perennial		-	-			Partial	-	Marginal / Poor	-	-	Low
8A	Intermittent	Shortfin eel Common bully (downstream)	Glyceria, Duckweed, Watercress	Comparable to 1A	-	Comparable to 1A	Partial	Comparable to 1A	Poor	Comparable to 1A	Comparable to 1A	Low - Negligible

4.0 Assessment of potential effects

The Project will involve the construction and operation of a new road and associated infrastructure (e.g. fill disposal sites, stormwater treatment swales, erosion and sediment control ponds, etc). This section provides an initial assessment, based on the information currently available, to inform an overall assessment of the Project's effects on the freshwater ecology (it also contributes to the Natural Character Assessment through provision of biotic components), and to inform the location of the proposed designation. As noted above, the NZ Transport Agency is currently seeking to enable works within the designation corridor, and the detailed design of the Project is yet to be undertaken, or regional consents sought for any in-stream works.

The type (and magnitude) of effects are thus subject to change with refinements and further detail guiding the final design of the alignment and proposed construction methods. In the interim, for the purposes summarised above, we have provided what we consider to be the likely effects on freshwater ecology values based on a realistic 'worst case' assessment of the Project based on the location and extent of the proposed designation, the likely roading layout shown as an indicative alignment within that corridor, and our prior experience with similar roading projects. The indicative alignment within the corridor has continually been refined with both small and large-scale adjustments. A significant change includes the replacement of an embankment, on the true right bank of the Manawatū River and immediately north of the river crossing, with a viaduct as the preferred option based on the potential ecological effects of an embankment option.

Note that our assessment excludes the potential effects of construction activities on watercourses, over and above the permanent effects of stream change and loss and some consideration of long term sedimentation. Conditions can be imposed on the resource consents to avoid and mitigate many of the potential effects identified.

Activities and effects associated with the construction and operation of the alignment and related to freshwater ecology within or adjacent to the site may/are likely to include:

- watercourse modification across numerous streams and tributaries including:
    - stream loss and new stream path creation (waterway diversions);
    - aquatic habitat loss or replacement of aquatic habitat with culverts or armouring;
    - potential modification / barrier to species passage;
- instream works within Manawatū River including permanent and temporary structures;
- earthworks sediment related discharges to water; and
- discharge of stormwater (operational).

Specific construction effects have not been included as part of this assessment (i.e. effects from the construction of a haul road, laydown areas and other associated infrastructure or specific sites), other than to mention that there are likely to be earthworks and sediment related discharges to water.

We have assumed that wherever the designation corridor bisects a waterway, a culvert will be installed, and that there will be a stream diversion where the designation corridor runs parallel and close to a waterway. We have assumed culverts will be to the width of the outer boundaries of the indicative roading alignment, taking into account the proposed batter slopes shown in the drawings. Waterway length modifications are approximate only.

4.1 Description of potential adverse effects

4.1.1 Watercourse modification

The Project will result in the removal and diversion of intermittent and permanent waterways across the alignment. **Figures 1 to 3, Appendix 6.C.1**, show the designation corridor in relation to the waterways present, while **Table 6.C.9** provides an overview of the freshwater values and lengths of waterway modification. These lengths are indicative only and based on the designation corridor and the assumptions described earlier. Actual waterway modification (including specific sites and extents) will need to be reviewed and revised with the development of a more detailed alignment, and regional resource consents will need to be sought for those activities.

Overall, the Project may result in approximately:

- 1190m of high value waterway being culverted,
- 30m of high value waterway being bridged,
- 670m of moderate value waterway being culverted,
- 780m of moderate value waterway being diverted,
- 560m of low value waterway being culverted,
- 630m of negligible to low value waterway being culverted, and
- 130m of negligible to low value waterway being diverted.

Waterway loss will result in the loss of habitat as well as the potential death and/or injury to native fish, including longfin eel, which have a conservation status of *At risk (declining)*.

The magnitude of effects will be variable across the waterways, as different waterway extents and locations will be affected. The magnitude of an effect is judged on the individual stream catchment areas and the effect in terms of linear length of a waterway relative to the total linear length within each sub-catchment. In some instances, wetted area is the measure for describing the quantum of effect, but linear length is the better proxy to assess and manage the quantum of effect, with the caveat that when, and if, it comes to offsite mitigation, the different wetted width dimensions that may exist between affected and mitigation systems are accounted for. The linear length is used to determine the scale of effect, along with how the activity affects the habitat. A description of what constitutes the different magnitude of effects (e.g. negligible, low, moderate, high, very high) is provided in **Table 6.C.1**.

In determining the potential magnitude of effects, a scaled approach has been used to provide more clarity and consistency with regard to the proportion of linear habitat loss/modification from proposed stream diversions and culverted reaches. The site context, regarding the extent of waterway affected relative to the size of the sub-catchment, is different for each sub-catchment. The extent has been guided by the highest order stream affected within the sub-catchment, downstream to the confluence of where the stream order increases. The extent of each sub-catchment has been described below:

- Watercourse networks one and two: All linear waterway upstream of the respective confluences with the Mangaatua Stream.
- Watercourse networks three, four, five, six and seven: All linear waterway upstream of the respective confluences with the Manawatū River.
- Watercourse eight: All linear waterway upstream of the confluence with an unnamed tributary of the Manawatū River (identified on the figure within **Appendix 6.C.1**).

The following approach has been used to determine magnitude:

- From an activity perspective, all culverts and diversions (high impact activities) will have at least a low magnitude effect as the change will be discernible and result in at least a minor shift away from existing baseline conditions.
- Moderate magnitude effect: between 5 to 20% of the linear stream length within the sub-catchment is affected.
- High magnitude effect: between 20 to 50% of the linear stream length within the sub-catchment is affected.
- Very high magnitude effect: more than 50% of the linear stream length within the sub-catchment is affected.

The following table (**Table 6.C.8**) aims to provide more context and clarity as to the quantity of available resource (linear length of stream) within each of the sub-catchments and the percentages that have been used to guide the scale of the magnitude of effect. The approximate linear length of freshwater habitat has been calculated for each of the sub-catchments and includes both perennial and intermittent stream habitat. Length has been calculated based on the fieldwork. However, the REC database has been used to calculate the linear length where sub-catchments are extensive (sub-catchments two and four), as it is impractical to confirm the habitat extents of these sub-catchments without further assessment.

Table 6.C.8: Approximate linear length of existing stream habitats and the correlating percentages associated with the scale of effect.

Sub-catchment	Approximate linear length of existing stream habitat (m)	5% of stream habitat (m)	20% of stream habitat (m)	50% of stream habitat (m)
1	4,000	200	800	2000
2	35,500	1,775	7,100	17,750
3	3,500	175	700	1,750
4	9,700	485	1,940	4,850
5	4,500	225	900	2,250
6	2,300	115	460	1,150
7	3,100	155	620	1,550
8	1,300	65	260	650

4.1.2 Manawatū River crossing

A bridge is proposed over the Manawatū River at the western extent of the designation corridor. The final design of the bridge as well as the proposed construction methods will determine the type, extent and magnitude of effects on the Manawatū River. A worst-case scenario will require buttressing on one or both banks as well as piers within the river. This would result in the permanent loss of instream habitat along the modified banks and where the piers are located, as well as changes to riparian habitat. Loss of instream habitat (and other changes) will be discernible but are likely to be localised and small in magnitude relative to the extent of the Manawatū Gorge.

The construction of the bridge could potentially result in the temporary loss of habitat as temporary staging is set up to construct the permanent bridge. This would also result in the deposition and re-suspension of sediment in the Manawatū River, particularly when temporary and permanent piers are installed.

These effects are speculative only and based on previous projects and experience. Some of these effects may be reduced or may not eventuate depending on the final design and construction methods.

4.1.3 Erosion and sedimentation

Earthworks over the site have the potential to reduce temporarily the water quality of the surrounding waterways (including the Manawatū River) through erosion and sediment runoff. At this stage, erosion and sediment control measures have not been developed, and further detail will be provided as the Project progresses. However, the magnitude of effect on aquatic ecological values from erosion and sedimentation, in our experience from other large-scale roading projects, is likely to be low against the background, even though a substantial amount of sediment may be discharged. This is provided by a robust and enforced erosion and sediment control plan designed and implemented to the permitted standards outlined in section 8 of the “Erosion and Sediment Control Guidelines for the Wellington Region” dated September 2002, as described under the Horizons One Plan. As explained below, the final design of the alignment will impact the freshwater effects from construction and operation of the Project and subsequently, the necessary management of erosion and sedimentation. For example, at the downstream end of Watercourse seven, a longer bridge option will have less effects than an earth embankment option.

4.1.4 Stormwater discharge

Stormwater entering the waterways from the completed development (operational phase effect) has the potential to reduce the water quality of the watercourses across the site through the input of impermeable roading contaminants (e.g. copper, lead, zinc, hydrocarbons, etc). This effect is still speculative, as the surface area delivering potential contaminants is relatively small, and treatment methods that eventually get developed will affect any assessment.

At this stage, stormwater treatment measures have not been developed and further detail will be provided as the Project progresses. However, it is assumed, based on our experience with similar NZ Transport Agency roading projects, stormwater from the alignment will be treated using a combination of bio-retention devices such as treatment wetlands and swales before being discharged into adjacent waterways. There is reasonable evidence that these systems supply a treatment effect of around 70% (Birch *et al*. 2005; Maine *et al*. 2006). In addition, the alignment may reduce the amount of nutrients currently entering waterways across the site.

The magnitude of effect on aquatic ecological values from stormwater discharge is predicted to be negligible, provided the stormwater treatment systems are designed to treat stormwater to the permitted rules and standards outlined in the Horizons One Plan.

It should also be noted that stormwater flowing into the receiving environment will likely have a higher quality, relative to the existing SH3 through the Manawatū Gorge (when it was operational) and the Saddle Road diversion. These two roads do not have any existing stormwater treatment.

4.2 Level of Project effects

This is an initial assessment based on the indicative design detail available including a viaduct option at the western end of the alignment (at the downstream end of Watercourse seven). The type and magnitude of effects (and level of ecological effects) are subject to change depending on the final design of the alignment and proposed construction methods.

The level of the adverse effects on the ecological values present on site from the designation corridor are variable. Adverse effects are variable, ranging from low to high and are dependent on how discernible the change is and the extent of loss and alteration to key features of existing baseline conditions, and how post-development composition and attributes will be fundamentally changed (i.e. loss of instream habitat).

The level of ecological effect is dependent on the ecological values being affected, which is variable, and the magnitude of the effect. The magnitude has two components, scale and type. **Table 6.C.9** provides an envelope of the scale of an effect as it applies to determining the magnitude with a threshold of 20% of the resource affected being a high magnitude of effect. Where the scale can be brought below the 20% scale of effects then the level of effect will likely to be below high. Please note that construction effects are not included as part of this assessment.

As noted above, the refinement of the proposed designation corridor has included different options for crossing the Manawatū River and area over the river which is at the downstream end of catchment seven. This report refers to an earth embankment option (which has been discarded on ecological grounds – see Technical Assessment 6), and an option to extend the bridge crossing part-way up the downstream end of catchment seven. In comparison to the earth embankment option, the option to extend the bridge at the downstream end of catchment seven will likely reduce the construction and operational effects of the Project on the freshwater ecological values within this area relative to large scale infilling to create an embankment.

We recommend that the loss of permanent and intermittent habitat (including stream diversions) along the alignment be mitigated. This is recommended in situations where the level of the effect is moderate or higher. This is recommended with the recognition that an aim should be to ensure that there is no net loss of aquatic habitat, but is tempered by the current quality (functionality) of the waterway and its realistic potential condition given the current landuse.

It is noted that there is an ongoing local, regional and national level drive to reduce the amount of tributary and headwater aquatic habitat reduction due to continued small scale loss. While the process we follow (EIANZ 2018) suggests that effects which are low and very low should not normally be of concern, very low equating to “less than minor” and not requiring mitigation, the emphasis is still on minimising adverse ecological effects and on a target of “no net loss” in the quantum of onsite aquatic habitat.

The assessment in this report will be updated as more detail is provided on the Project. This will allow a more accurate measure of both construction and operational effects on the existing freshwater ecological values to inform the resource consent applications. This will also provide more guidance as to how adverse effects can be appropriately mitigated. Resource consents will be required at a later date and it is during this process that adverse effects on freshwater ecological values and associated mitigation will be addressed.

Stream replacement and enhancement will likely be required as part of the Project to mitigate for the loss/modification of habitat, however there may be other mitigations options or amendments to the design to reduce/avoid adverse impacts on ecological values (i.e. constructing bridges as opposed to culverts). There is potential for mitigation (i.e. stream enhancement) to be conducted within the affected sub-catchments within the designation corridor. However, mitigation will also likely be required outside the designation corridor.

Table 6.C.9: Overview of waterways affected by the Project (based on the viaduct option and as it stands at report writing), the likely magnitude (scale) of effect and level of ecological effect.

Waterway & chainage	Ecological value	Effects	Impacted length (m)	Affected habitat in sub-catchment (%)	Magnitude of effect	Level of ecological effect
1A 13900 - 14000	Low	Culvert	160	5-10	Moderate	Low
1B 13700 - 13800	Low - Negligible	Culvert	50			Very low - Low
2A 12900 - 13000	High	Bridge	30	0-5 (excl. bridge)	Low	Low
2B 13100 - 13200	Low	Culvert	50		Low	Very low - Low
2C 11200 - 13000	Moderate	Diversion	560			Low
		Culvert	530			Low
3A 10100 - 10500	Low - Negligible	Culvert	110	5-10	Moderate	Very low - Low
		Culvert	40			Very low - Low
3B 10900 - 11100	Low - Negligible	Culvert	120			Very low - Low

Waterway & chainage	Ecological value	Effects	Impacted length (m)	Affected habitat in sub-catchment (%)	Magnitude of effect	Level of ecological effect
4A 7800 - 9300	Moderate	Diversion	220	5-10	Moderate	Moderate
		Culvert	140			Moderate
4B 8300 - 8400	Low - Negligible	Culvert	60			Very low – Low
4C 8800 - 8900	Low	Culvert	100			Low
4D 9000 - 9100	Low	Culvert	100			Low
4E 9300 - 9400	Low - Negligible	Culvert	100			Very low – Low
4F 9600 - 9700	Low - Negligible	Culvert	90			Very low – Low
5A 7300 - 7500	High	Culvert	170	5-10	Moderate	High
5B 6800 - 7000	High	Culvert	190			High
6A 6000 - 6300	High	Culvert	160	15-20	Moderate	High
6B 6200 - 6400	High	Culvert	70			High
6C 6300 - 6500	High	Culvert	140			High
7A 3900 - 5900	High	Culvert	140	15-20	Moderate	High
		Culvert	190			High

Waterway & chainage	Ecological value	Effects	Impacted length (m)	Affected habitat in sub-catchment (%)	Magnitude of effect	Level of ecological effect
7B 4700 - 5200	Low	Culvert	80			Low
7B 4200 - 4400	High	Culvert	130			High
7C 4300 - 4400	Low	Culvert	70			Low
8A 2800 - 3300	Low - Negligible	Diversion	130	10-15	Moderate	Very low - Low
		Culvert	60			Very low - Low

As discussed, the overall effects on the Manawatū River from the Project will be dependent on the final design of the bridge and associated structures and the construction methods. **Table 6.C.10** provides an overview of the effects and the magnitude of those effects on the ecological values of the Manawatū River under the worst-case scenario.

Table 6.C.10: Overview of the likely magnitude of effect and level of ecological effect on the Manawatū River

Waterway	Ecological value	Effects	Magnitude of effect	Level of ecological effect
Manawatū River	Very high	Permanent loss/ modification of instream habitat	Low	Moderate
		Temporary loss/ modification of instream habitat	Low	Moderate
		Erosion and sedimentation in river	Low	Moderate

5.0 Conclusion

There are eight catchments across the designation corridor (excluding Manawatū River) and each of the watercourses varies in morphology, riparian cover, function, macroinvertebrate assemblage and fish diversity. This creates different freshwater ecology values across the designation corridor. Stream incision is common across many of the watercourses, particularly through the central part of the designation corridor, which causes a disconnect from the floodplain and riparian margins. Many waterways have also been subject to grazing pressures, which limits riparian cover and creates erosion and bank slumping issues.

The Manawatū River, specifically the Gorge area where the designation corridor crosses over, is considered to have very high ecological value. This is due to the optimal instream habitat and hydrologic conditions, sinuous flow path, general high macroinvertebrate indices and high diversity of native fish species.

The Project will involve the construction and operation of a road and associated infrastructure. Activities and effects associated with the construction and operation of the alignment are likely to include watercourse modification/diversion, instream works within Manawatū River and stormwater and sediment related discharges to water. The type and magnitude of these effects (and level of ecological effects) are subject to change, depending on the final design of the Project and proposed construction methods.

Stream replacement and enhancement will likely be required as part of the Project to mitigate for the loss/modification of habitat. There may however, be other mitigation options that can be explored. Resource consents will be required at a later date and it is during this process that adverse effects on freshwater ecological values and associated mitigation will be addressed.

6.0 References

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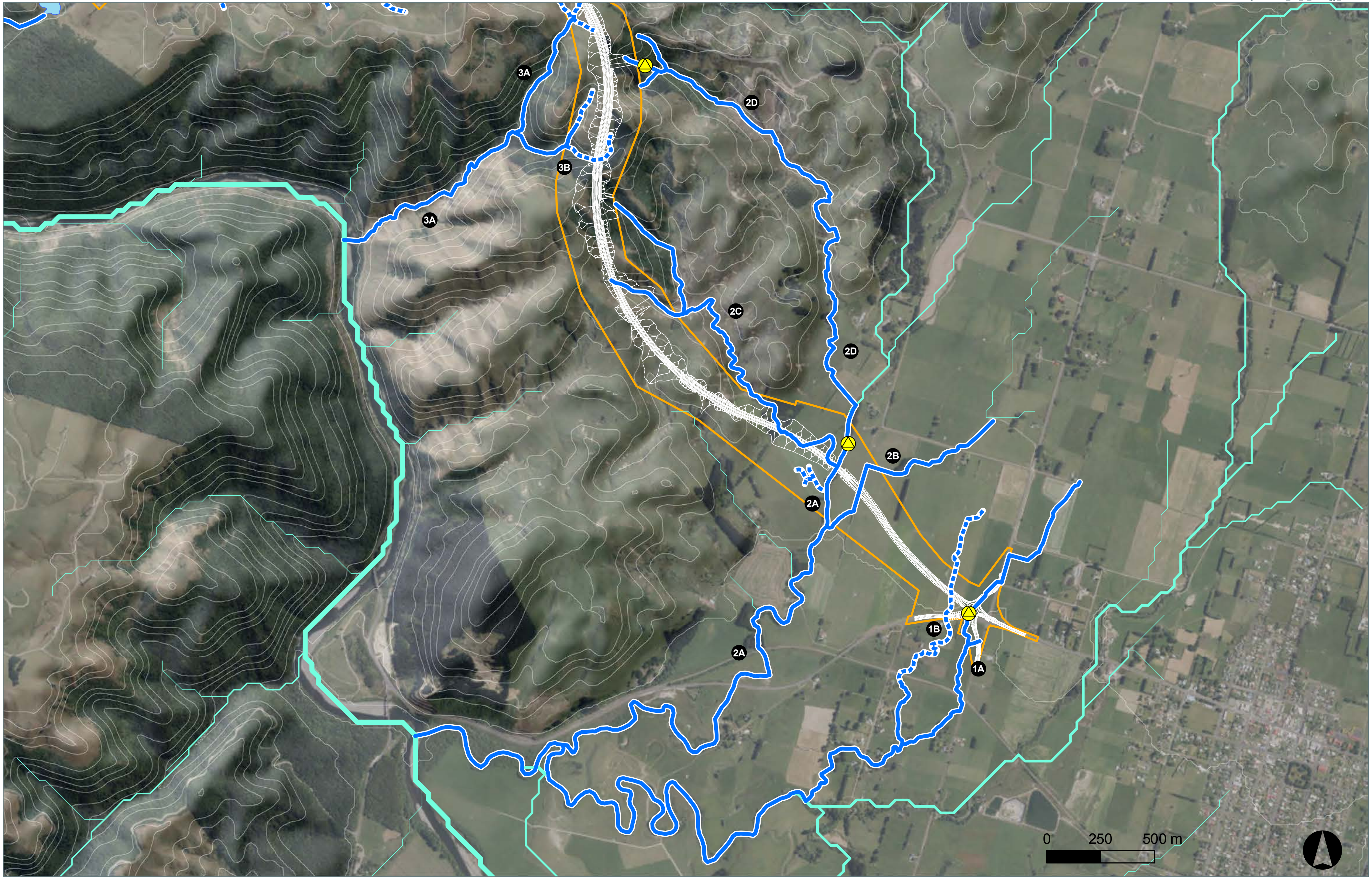
6.C.1
FIGURES 1 TO 3



Waterways

- Intermittent
- Permanent
- River (REC2)

Sampling Site

Data Sources: Horizons RC, MDC, PNCC, TDC, DoC, LINZ, BML

Projection: NZGD 2000 New Zealand Transverse Mercator

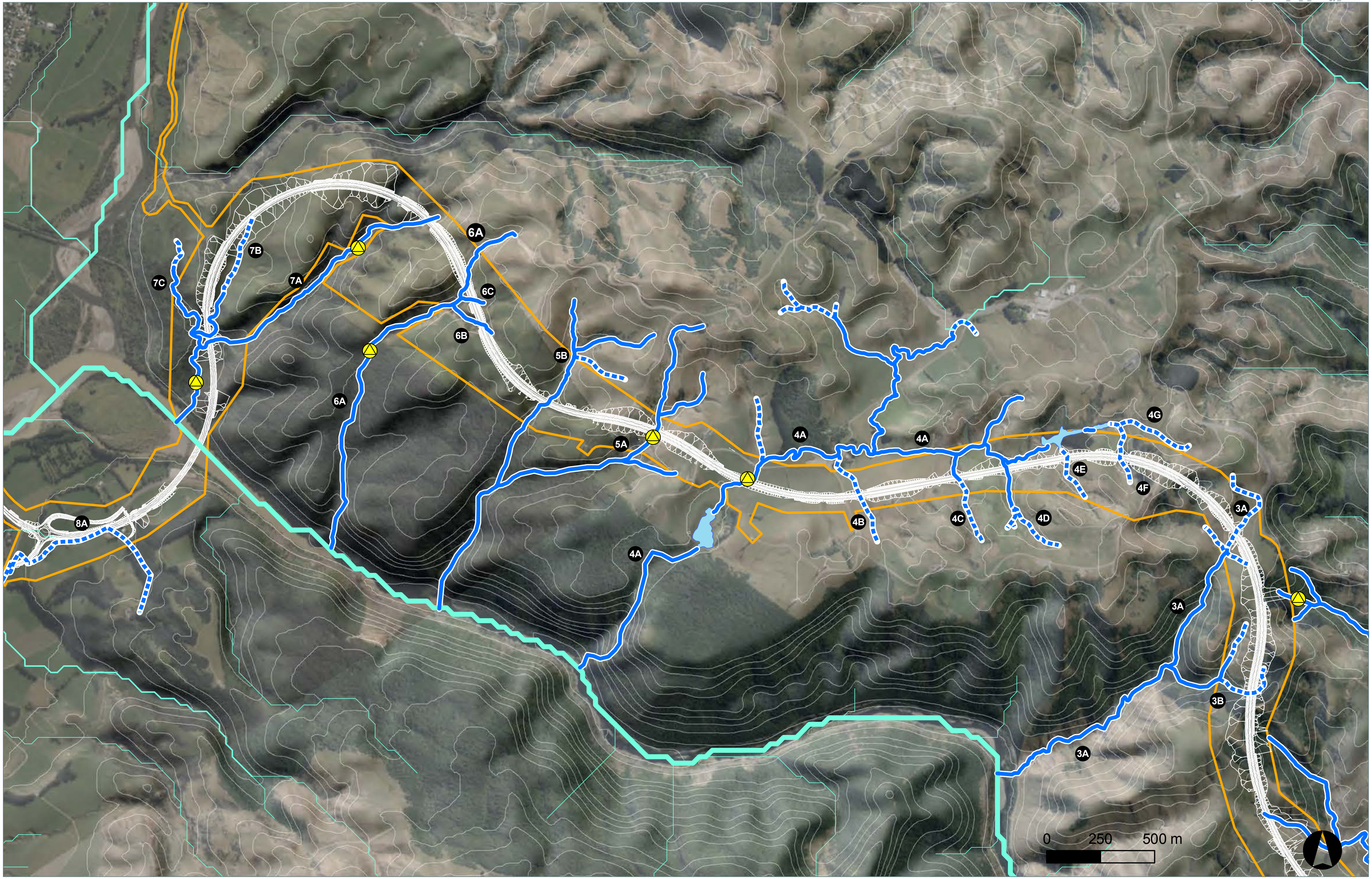
TE AHU A TURANGA PROJECT

Ecological Monitoring - Sheet 1 of 3

Date: 03 October 2018 | Revision: 0

Plan prepared by Boffa Miskell Limited

Project Manager: **boyden.evans@boffamiskell.co.nz** | *Drawn:* HHu | *Checked:* BEv



Waterways

- Intermittent
- Permanent
- River (REC2)
- Sampling Site

Data Sources: Horizons RC, MDC, PNCC, TDC, DoC, LINZ, BML

Projection: NZGD 2000 New Zealand Transverse Mercator

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TE AHU A TURANGA PROJECT

Ecological Monitoring - Sheet 2 of 3

Date: 03 October 2018 | Revision: 0

Plan prepared by Boffa Miskell Limited

Project Manager: boyden.evans@boffamiskell.co.nz | *Drawn:* HHu | *Checked:* BEv

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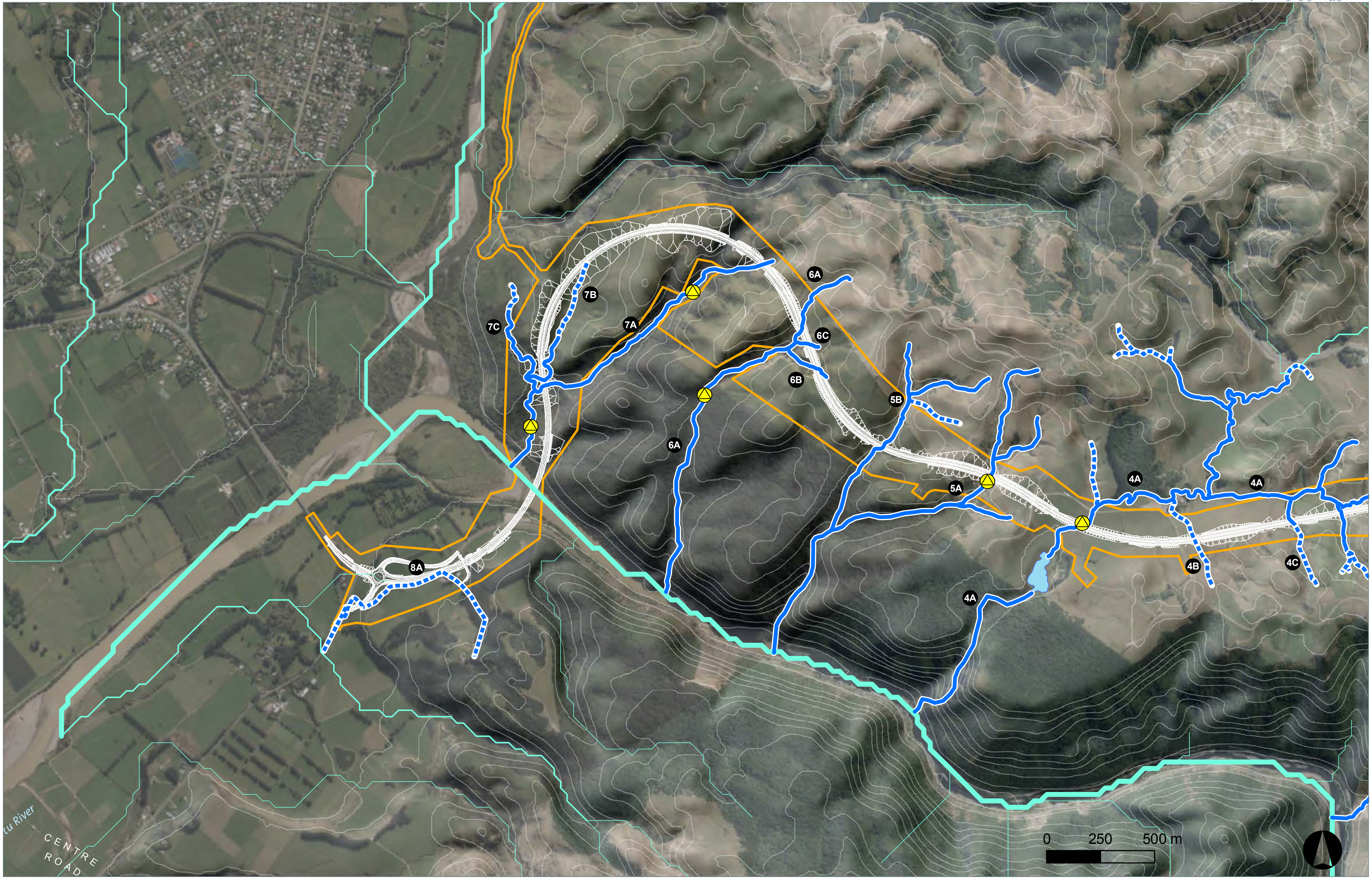

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Data Sources: Horizons RC, MDC, PNCC, TDC, DoC, LINZ, BML

Projection: NZGD 2000 New Zealand Transverse Mercator

Waterways

- Intermittent
- Permanent
- River (REC2)
- Sampling Site

TE AHU A TURANGA PROJECT

Ecological Monitoring - Sheet 3 of 3

Date: 03 October 2018 | Revision: 0

Plan prepared by Boffa Miskell Limited

Project Manager: **boyden.evans@boffamiskell.co.nz** | *Drawn:* HHu | *Checked:* BEv

6.C.2
FISH SURVEY REPORT

Manawatu Gorge SH3

Summer Ecology Survey - Freshwater
Prepared for GHD and the New Zealand Transport Authority

21 March 2018

Document Quality Assurance

Bibliographic reference for citation: Boffa Miskell Limited 2018. *Manawatu Gorge SH3: Summer Ecology Survey - Freshwater*. Report prepared by Boffa Miskell Limited for GHD and the New Zealand Transport Authority.		
Prepared by:	Katie Noakes Ecologist Boffa Miskell Limited	
Reviewed by:	Sharon De Luca Associate Partner/ Ecologist Boffa Miskell Limited	
Status: FINAL	Revision / version: 1	Issue date: 21 March 2018
Use and Reliance This report has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use for the purpose for which it is intended in accordance with the agreed scope of work. Boffa Miskell does not accept any liability or responsibility in relation to the use of this report contrary to the above, or to any person other than the Client. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate, without independent verification, unless otherwise indicated. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.		

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Cover photograph: Manawatu River, Boffa Miskell, 2018.

Contents

1.0 Introduction

New Zealand Transport Agency (NZTA) with GHD Ltd commissioned Boffa Miskell Ltd (BML) to undertake summer ecology surveys of the freshwater fish communities for the preferred proposed new alignment of SH3. The purpose of the surveys is to identify fish species present, and their distribution, within representative waterways, across the preferred corridor and proposed associated infrastructure to inform future ecological assessments.

2.0 Methodology

A desktop assessment and review of waterways (River Environment Classification REC) indicated 11 stream/waterways could be directly impacted by the preferred designation, with additional indirect effects on five other waterways (e.g. erosion sediment control and stormwater discharges). The sites selected to be surveyed in the field were considered to be representative of the 16 potentially affected waterways. These sites were categorised into nine stream networks across the preferred option with nine survey sites identified prior to entering the field (Figure 1).

One site (site 7) was not able to be surveyed due to lack of access when assessed in the field.

The NIWA Freshwater Fish database was searched for any previous surveys had been undertaken in the area and in other waterways within the catchment.

The Fish communities were surveyed by BML on 21st and 22nd February 2018 using Joy *et al*. 2013 New Zealand freshwater fish sampling protocols. Methods were modified for each waterway, involving either netting or electric fishing[1].

Site 1 was surveyed using 1 x fyke net and 7 x Gee's minnow traps. The fyke net and traps were set on the evening of the 21st of February and left in situ overnight. Nets were checked the following morning where fish were identified and measured (fork length, mm) before being returned alive to the stream.

The remaining sites were surveyed using a Kainga EFM 300 backpack mounted electric fishing machine (NIWA Instrument Systems, Christchurch). Fish were captured in a downstream push net or in a hand (dip) net and temporarily held in buckets. All fish were then identified, counted and measured (fork length, mm) before being returned alive to the stream.

Photographs for each stream were taken. However, due to equipment failure, photos are not available for sites 4-6.

[1] Boffa Miskell has the required authority and permits to conduct fish surveys (including electrofishing) throughout New Zealand.

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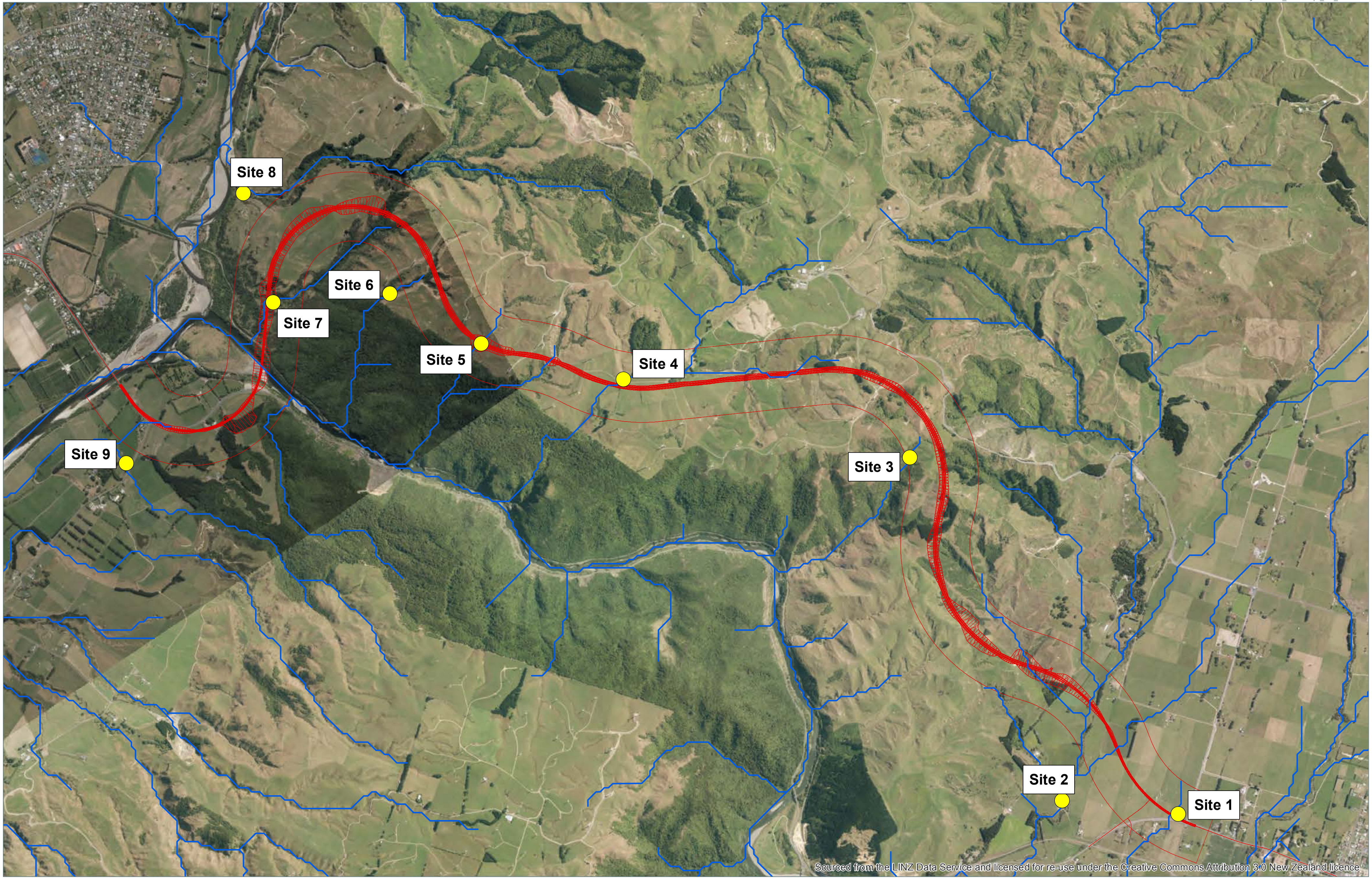

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Data Sources: Land Information New Zealand, Crown Copyright Reserved
Projection: NZGD 2000 New Zealand Transverse Mercator

Legend

MANAWATU GORGE SUMMER ECOLOGY

Figure 1: Freshwater Survey Locations

Date: 19 March 2018 | Revision: 0

Plan prepared for NZ Transport Agency by Boffa Miskell Limited

Project Manager: **Sharon.DeLuca@boffamiskell.co.nz** | *Drawn:* KN | *Checked:* KMi

3.0 Results

3.1 Freshwater fish database records

NIWA's Freshwater fish database indicated previous freshwater fish surveys had been undertaken within the Manawatu River and adjoining waterways but none within the stream networks surveyed and potentially affected by the proposed alignment. Species recorded in previous surveys in the Manawatu River are shown in Table 1 below.

Table 1: NIWA Freshwater Fish Database records for the affected catchment.

Common name	**Scientific name**	**Threat Status** [2]
Upland bully	*Gobiomorphus breviceps*	Not threatened
Common bully	*Gobiomorphus cotidianus*	Not threatened
Koura	*Paranephrops* spp.	*At Risk* - Declining
Longfin eel	*Anguilla dieffenbachia*	*At Risk* - Declining
Torrentfish	*Cheimarrichthys fosteri*	*At Risk* - Declining
Brown trout	*Salmo trutta*	Introduced and Naturalised
Redfin bully	*Gobiomorphus huttoni*	*At Risk* - Declining
Perch	*Perca fluviatilis*	Introduced and Naturalised
Shortfin eel	*Anguilla australis*	Not threatened
Brown mudfish	*Neochanna apoda*	*At Risk* - Declining
Common smelt	*Retropinna retropinna*	Not Threatened
Dwarf galaxias	*Galaxias divergens*	*At Risk* - Declining
Unidentified salmonid	*Salmo* spp.	

[2] Freshwater fish classification as from Goodman et al., 2014. koura classification from Grainger et al., 2014.

3.2 Fish survey results

Table 2 provides a summary of the freshwater fish species captured during the 2018 summer surveys across the 8 sites. A total of 160 individuals across eight species were captured.

Table 2: Total number of fish caught (or seen) at sites surveyed in February 2018. Size ranges (mm) are shown in parentheses.

Species	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 8	Site 9
Redfin bully		1 (50)						
Longfin eel		3 (250-400)	1 (250)		2 (400-450)			
Shortfin eel	21 (180-400)	2 (200-250)		3 (400-800)			2 (200)	12 (250-800)
Common bully		4 (40-60)					1 (60)	27 (30-70)
Koura		2 (40-50)	2 (30-40)	13 (30-50)	20 (10-50)	6 (10-50)		
Eel sp		6 (80-100)						8 (200-400)
Bully sp							11 (30-40)	6 (20-30)
Brown trout							7 (50-90)	

3.3 Site Locations

3.3.1 Site 1

Site 1 is located in low lying farmland (Photo 1). The waterway is choked with macrophytes, predominantly monkey musk (*Erythranthe gutta*), with minimal areas of open water. There was no visible flow and electric fishing was deemed unsuitable. This was the only site where trapping methods were used. Shortfin eel (Not threatened) were the only species.

Photo 1: Site 1 looking downstream.

3.3.2 Site 2

This waterway has a wide riparian zone (Photo 2), dominated by exotic species such as willow (*Salix sp.*). Cobble substrate, overhanging vegetation and undercut banks provide abundant habitat for native freshwater fish. This site had the highest fish diversity with six species caught, including the *At Risk* (Declining) species (longfin eel and redfin bully). Other species caught at this site included common bully, shortfin eel and koura.

Photo 2: Site 2 looking downstream.

3.3.3 Site 3

Site 3 is located in a steep gully surrounded by native forest (Photo 3). The substrate was comprised primarily of bedrock, with several cascades and steep waterfalls along the reach. Due to lack of safe access only 50m of the stream reach was able to be surveyed. Longfin eel and koura were caught at this site.

Photo 3: Site 3 looking upstream.

3.3.4 Site 4

Site 4 is located within open farmland. The waterway has little riparian cover with margins consisting of pasture grasses. Substrate is a mix of fine sediment/ clay and small cobbles. Downstream of the survey location is a large pond, created by a man-made dam. The dam provides a barrier to fish passage. Two species were found at this site (shortfin eels and koura).

3.3.5 Site 5

Site 5 is located in a gully network within agricultural land. The riparian margin is a mix of pasture grasses and sparse native trees. The substrate is dominated by cobbles and the waterway had little flow relative to other sites. Instream habitat consists mostly of shallow, rocky pools. Longfin eel and koura were recorded at this site.

3.3.6 Site 6

Site 6 is located in the upper reaches of a gully network. The stream is narrow, shallow and is dominated by large cobbles and boulders with small rocky pools (Photo 4). Koura were the only species found at this site.

Photo 4: Site 6 looking upstream

3.3.7 Site 7

Site 7 was not surveyed as the waterway is located in a deep and steep sided gully that could not be safely accessed. Due to the proximity to the Manawatu River, and based on results from similar sites in this survey, this waterway is likely to have fish species present.

3.3.8 Site 8

Site 8 was slightly upstream of the confluence with the Pohangina River, one of the main tributaries of the Manawatu River. This site had a relatively open canopy and cobble substrate. A ford ran through the middle of the survey reach and remnants of a concrete track were scattered throughout in the waterway reach surveyed (Photo 5). A total of four species were found at this site including brown trout, common bully, shortfin eel and juvenile bullies that were too small to be identified to species level.

Photo 5: Site 8 looking downstream.

3.3.9 Site 9

Site 9 was the only site surveyed on the southern side of the Manawatu River. The site is located in low lying farmland with riparian margins consisting of pasture grasses and exotic plants (Photo 6). The substrate was predominantly soft bottomed, predominantly silt. This site had the highest abundance of fish caught including common bully, shortfin eel and juvenile bullies.

Photo 6: Site 9 looking downstream.

4.0 Summary

The fish survey was conducted over nine waterways with varying substrate, size and available habitat. A total of eight species were caught during the survey, including seven native freshwater species and one exotic species. Of these species caught, koura, longfin eel and redfin bully have a threat status of *At Risk*- Declining.

5.0 References

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6.C.3
HORIZONS REGIONAL COUNCIL MACRO-INVERTEBRATE DATA

HRC SoE 2017		Pohangina at Mais Reach	Manawatu at Upper Gorge	Manawatu at Teachers College
Date	MCI	9-Mar-17	9-Mar-17	26-Apr-17
Mayflies				
Austroclima sepia	9	3	-	-
Coloburiscus humeralis	9	7	2	3
Deleatidium sp.	8	180	88	170
Nesameletus sp.	9	7	-	-
Stoneflies				
Austroperla cyrene	9	1	-	-
Zelandoperla decorata	10	2	1	-
Dobsonflies				
Archichauliodes diversus	7	4	1	-
Beetles				
Elmidae	6	49	151	49
Hydraenidae	8	1	-	-
True Flies				
Aphrophila neozelandica	5	1	-	-
Austrosimulium spp.	3	-	6	2
Empididae	3	1	-	-
Eriopterini	9	2	-	-
Orthocladiinae	2	7	3	-
Tanytarsus spp.	3	9	1	-
Caddisflies				
Costachorema xanthopterum	7	-	1	-
Hydrobiosis parumbripennis	5	1	-	-
Hydrobiosis spp.	5	1	6	-
Hydrobiosis umbripennis	5	-	1	-
Hydropsyche - Aoteapsyche grou	4	50	82	11
Olinga spp.	9	2	-	-
unidentified Hydroptilidae	2	-	1	-
Psilochorema leptoharpax	8	1	1	-
Psilochorema spp.	8	1	-	-
Pycnocentria evecta	7	2	-	-
Pycnocentrodes sp.	5	6	-	-
Crustacea				
Paracalliope sp.	5	-	1	-
Oligochaeta	1	1	4	-
Platyhelminthes	3	-	1	1
Snails				
Potamopyrgus antipodarum	4	2	-	-
Number of taxa		24	17	6
Number of individuals		341	351	236
%EPT richness		58.33	47.06	50.00
%EPT abundance		77.42	51.85	77.97
MCI		127	104	110
QMCI		6.79	5.88	7.35

6.C.4
MACRO-INVERTEBRATE RESULTS

General Group	Taxa	Common Name	MCI Score HB	MCI Score SB	Site 1A	Site 2a	Site 2d	Site 4A	Site 5A	Site 6A	Site 7a US	Site 7a DS
Hydrozoa	Hydra sp.		3	1.6	5 (C)			1 (R)				
Platyhelminthes	Platyhelminthes	Flat Worm	3	0.9	1 (R)			1 (R)				1 (R)
Gastropoda	Latia sp.	Freshwater limpet	3	6.1				20 (A)				
Gastropoda	Physa sp.	Freshwater snail	3	0.1	20 (A)							
Gastropoda	Potamopyrgus antipodarum	Estuarine snail	4	2.1	500 (VVA)	5 (C)		100 (VA)	5 (C)	1 (R)	1 (R)	1 (R)
Gastropoda	Pseudosuccinea columella	FW snail (introduced)	5	1.2	5 (C)							
Bivalvia	Sphaeriidae	pea mussel	3	2.9				1 (R)				
Oligochaeta	Oligochaeta	Oligochaete worms	1	3.8	20 (A)	5 (C)		20 (A)	5 (C)	1 (R)		
Collembola	Collembola	Springtails	6	5.3	1 (R)	1 (R)	1 (R)	1 (R)	5 (C)	1 (R)		5 (C)
Isopoda	Oniscoidea	Isopods Terestrial	5	4.5			1 (R)					
Amphipoda	Paracalliope	hoppers	5	5	100 (VA)	5 (C)	5 (C)	20 (A)	1 (R)			5 (C)
Amphipoda	Talitridae	Amphipod (family)	5	5				5 (C)	5 (C)	5 (C)	5 (C)	
Decapoda	Paranephrops planifrons	Freshwater crayfish (Koura)	5	8.4						1 (R)		
Ostracoda	Ostracoda	Ostracods	3	1.9	1 (R)			1 (R)	1 (R)			
Copepoda	Copepoda	Copepods	5	2.4								1 (R)
Insecta	Limonia sp.	Crane fly larvae	6	6.3			5 (C)	1 (R)				
Ephemeroptera	Acanthophlebia	Mayfly larvae	7	9.6								1 (R)
Ephemeroptera	Coloburiscus humeralis	Mayfly larvae	9	8.1						1 (R)		5 (C)
Ephemeroptera	Deleatidium	Mayfly larvae	8	5.6		100 (VA)		1 (R)	100 (VA)	100 (VA)	20 (A)	100 (VA)
Ephemeroptera	Zephlebia sp.	Mayfly larvae	7	8.8			5 (C)		100 (VA)	20 (A)	5 (C)	20 (A)
Plecoptera	Acroperla sp.	Mayfly larvae	5	5.1		1 (R)		5 (C)	1 (R)	1 (R)		1 (R)
Plecoptera	Zelandobius sp.	Stone fly	5	7.4		1 (R)						
Hemiptera	Microvelia macgregori	Waterskaters	5	4.6								5 (C)
Megaloptera	Archichauliodes diversus	Toe biter	7	7.3						1 (R)		1 (R)
Coleoptera	Elmidae	Riffle Beetle	6	7.2		20 (A)						1 (R)
Coleoptera	Hydraenidae Larvae	Beetle larvae	8	6.7			1 (R)					
Diptera	Eriopterini	crane fly	9	7.5		1 (R)			1 (R)	5 (C)		1 (R)
Diptera	Muscidae	Fly larvae	3	1.6			1 (R)					1 (R)
Diptera	Orthocladiinae	midges	2	3.2	5 (C)	5 (C)		20 (A)	20 (A)	1 (R)		1 (R)
Diptera	Sciomyzidae	marsh flies	3	3								1 (R)
Diptera	Aphrophila sp.	Crane fly	5	5.6		1 (R)						
Diptera	Austrosimulium	sandflies	3	3.9	20 (A)	20 (A)		20 (A)	1 (R)			
Diptera	Corynoneura	non-biting midges	2	1.7	1 (R)							
Diptera	Hexatomini sp.	Crane fly larvae	5	6.7							1 (R)	
Diptera	Molophilus sp.	crane fly	5	6.3					1 (R)			
Diptera	Paralimnophila sp.	crane fly	6	7.4				1 (R)				
Diptera	Polypedilum	non-biting midges	3	8		1 (R)		1 (R)	1 (R)	1 (R)	1 (R)	1 (R)
Diptera	Tanytarsini sp.	Midge fly larvae	3	4.5		1 (R)						
Trichoptera	Hudsonema amabilis	Case caddis	6	6.5		1 (R)						
Trichoptera	Hydrobiosella	Free-living caddis	9	7.6						1 (R)		
Trichoptera	Hydrobiosis sp. (juveniles)	Free-living caddis	5	6.7	1 (R)	5 (C)		1 (R)				
Trichoptera	Hydrobiosis umbripennis	Free-living caddis	5	6.7	1 (R)	5 (C)		1 (R)	1 (R)			
Trichoptera	Hydropsyche-Aoteapsyche	net-spinning caddis	4	6		1 (R)	1 (R)	1 (R)	5 (C)	1 (R)		
Trichoptera	Hydropsyche-Orthopsyche	net-spinning caddis	9	7.5						1 (R)	1 (R)	1 (R)
Trichoptera	Oxyethira albiceps	Axe-head caddis	2	1.2		1 (R)		1 (R)				
Trichoptera	Psilochorema nemorale	Free-living caddis	8	7.8							1 (R)	
Trichoptera	Pycnocentrodes	stony cased caddis	5	3.8		5 (C)						
Arachnida	Acarina	Mites	5	5.2			1 (R)	1 (R)	1 (R)	1 (R)	1 (R)	1 (R)
	MCI HB					**92**	**110**	**81**	**94**	**115**	**120**	**111**
	SQMCI HB					**6.29**	**5.52**	**3.54**	**6.63**	**7.55**	**7.06**	**7.38**
	MCI Soft Bottom				**63**							
	QMCI Soft Bottom				**2.58**							

7. TE AHU A TURANGA

IN THE MATTER OF	The Resource Management Act 1991
AND	
IN THE MATTER OF	Notices of requirement for designations under section 168 of the Act, in relation to Te Ahu a Turanga; Manawatū Tararua Highway Project
BY	**NZ TRANSPORT AGENCY** Requiring Authority

TE AHU A TURANGA; MANAWATŪ TARARUA HIGHWAY PROJECT

TECHNICAL ASSESSMENT

TANGATA WHENUA VALUES

INTRODUCTION

1. I am Associate Professor Jonathan Procter. I have a PhD in Earth Science and lead a number of national research projects focused on Matauranga Māori, natural hazards and cultural landscapes. Notably I designed and compiled the GIS data that assisted in this assessment.

2. This document has had contributions from Paul Horton, Environmental Advisor, and Siobhan Lynch-Karaitiana, the Resource Manager Planner for Te Ao Turoa Environmental Centre of Tanenuiarangi Manawatū Incorporated, an entity of Rangitāne o Manawatū. Paul holds a BSc in Ecology and a Post Graduate Diploma in Zoology. Whilst Siobhan holds a BSc in Ecology and Environmental Science and a Postgraduate Honours Degree in Plant and Aquatic Ecology and Energetic Interactions from Massey University.

3. This document has also had input from one of our esteemed Rangitāne Kaumātua Matua Manahi Paewai who is the Co-Manager of the Cultural and Political Services for Rangitāne Tamaki Nui-ā-Rua and has whakapapa connections to both Rangitāne o Manawatū and Rangitāne Tamaki Nui-ā-Rua. Matua Manahi may also assist me in presenting evidence today.

4. This document therefore is submitted on behalf of Rangitāne o Manawatū (RoM) and Rangitāne Tamaki Nui-ā-Rua (RTNaR).

Qualifications and Experience

5. I, Jon have the following qualifications and experience relevant to this assessment:

   (a) PhD in Earth Science;

   (b) Ngāi Tahu and Muaūpoko descent as well as Ngāti Tauira, a hapū of Ngāti Apa and Rangitāne; and

   (c) Worked for and advised Rangitāne for 17 years and provided advice on aspects of Kaitiakaitanga, Te Ao Turoa and Mātauranga related to a range of resource management developments that have environmental and cultural impacts.

Code of Conduct

6. I confirm that we have read the Code of Conduct for expert witnesses contained in the Environment Court Practice Note 2014. This assessment has been prepared in compliance with that Code, as if it were evidence being given in Environment Court proceedings. In particular, unless we state otherwise, this assessment is within our area of expertise and we have not omitted to consider material facts known to us that might alter or detract from the opinions we express.

Purpose and Scope of Assessment

7. This assessment of effects on tangata whenua values includes a historical account and values from a RoM and RTNaR perspective. This report shall not be used as a discussion document for review by other iwi or stakeholder groups. This is the RoM and RTNaR accounts of their respective history and values as tangata whenua.

8. Whilst it forms part of a suite of technical reports prepared in relation to the New Zealand Transport Agency's (the NZTA) Te Ahu a Turanga: Manawatū Gorge Replacement Route Project (the Project) it sits under its own mana and not as part of NZTA documentation. The purpose of this assessment is to inform the broader assessment of effects on the environment required to support the notices of requirement for a designation (NoRs) given under section 168 of the Resource Management Act 1991 (RMA) for the Project.

9. This assessment relates to the Notice of Requirement and a corridor (proposed designation) within which a road (and all associated infrastructure) is proposed to be built. Accordingly, the focus of the assessment has been to identify RoM and RTNaR issues that shall be impacted by the Project and to identify the RoM and RTNaR cultural values and other matters that shall need to be considered during the ensuing phases of the project. This assessment will inform the next phases of design development from a RoM and RTNaR perspective. The intention is to update and evolve this document which RoM and RTNaR see as a living document as part of this process of design development.

10. This assessment:

    (a) Documents the RoM and RTNaR cultural landscape of the wider project area, including inter alia the history, creation stories, waahi tapu, relationships with our taonga species, and our immense spiritual connections with the environment.

(b) Sets RoM and RTNaR cultural scene for the integration of our tangata whenua values into the project.

Assumptions and Exclusions in this Assessment

11. The assessment is confined to matters that are relevant to the NoRs. It is anticipated that RoM and RTNaR interests in freshwater and indigenous vegetation shall inter alia be addressed as part of a subsequent regional resource consent process and will reflect an on-going partnership approach to managing effects on RoM and RTNaR tangata whenua values.

12. This assessment is based upon traditional information and practices that have been preserved within RoM and RTNaR, recovered through our respective cultural redress under our Treaty Settlements, and archaeological investigations. This assessment does not seek to provide a definitive history or detailed archaeological assessment of the area subject to the Project but seeks to address the need for the broad RoM and RTNaR cultural context within and surrounding the proposed designation.

13. Opposed to the RMA description of a historical site being a specific set of coordinates, it is RoM and RTNaR cultural view that waahi tapu are highly interconnected. This generates a broad cultural landscape where travel routes, temporary and permanent shelters, large resource collecting areas, and urupā can be generally described within an area rather than specifically defined.

14. The authors and contributors of this assessment understanding of the proposed site designation is based upon attendance at a number mitigation hui facilitated by the NZTA and maps provided by the NZTA. It is also based on direct engagement with the NZTA through RoM/RTNaR and the NZTA hui over a period of several months.

EXECUTIVE SUMMARY

15. RoM and RTNaR trace their whakapapa back to the great migration from Hawaiki. Inter alia Rangitāne ancestors settled in the Manawatū,Tamaki and surrounding environs over 700 years ago and have an unbroken connection with the land and waterways since that time.

16. RōM who have settled their Treaty Claims reflected in the RoM Claims Settlement Act 2016 inter alia received Statutory Acknowledgements in their Treaty Settlement over the Manawatū River and its tributaries, Gorge Scenic Reserve, and within the Ruahine Forest Park. Attached at Appendix A is the Historical Account, Crown Acknowledgements and Apology from RoM Treaty Settlement. Also in our settlement is the trigger for the creation of the Manawatū River Advisory Board which shall be a formal mechanism for Rangitāne and other iwi who settle who have interests in the river recognised by the Crown to assist in the management of the river and its tributaries.

17. Whilst RTNaR who have also settled their Treaty Claims reflected in their Claims Settlement Act 2017 inter alia received a Statutory Acknowledgement in their Treaty Settlement over the Manawatū River as well. Attached at Appendix B is the Historical Account, Crown Acknowledgements and Apology from RTNaR settlement.

18. The area in the vicinity of the Gorge replacement route contains approximately fifty or so waahi tapu that have been identified and recorded by Tanenuiarangi Manawatū Incorporated (TMI), a RoM entity, who operate Te Ao Environmental Centre who are the party engaging on behalf of RoM in this process. This number of waahi tapu sites makes the possibility for accidental discoveries of RoM and also TNaR (together hereinafter referred to as Rangitāne) origin extremely likely. Adverse impacts shall therefore occur on Rangitāne waahi tapu, spiritual and environmental values as a result of the project. It is through Rangitāne involvement as a project partner, that through agreed processes these values can be protected, mitigated and provided for as part of the project. Furthermore, the incorporation of Rangitāne tangata whenua values into design development shall contribute to delivering a broad set of benefits to the Region.

19. Rangitāne thus far have developed a relatively positive, relationship with the NZTA officers and other parties working on the project and will continue to build on this moving forward in subsequent stages of the project. This is imperative as the face of Rangitāne landscape, waterways, taonga and waahi tapu are going to be impacted forevermore as a result of this project. Rangitāne have a duty to protect and enhance their landscape and waahi tapu as kaititaki for future generations.

PROJECT DESCRIPTION

20. The project consists of 11.5km of new State Highway road and associated infrastructure. A four-lane bridge will cross the Manawatū River at the western end of the route, the proposed designation will progress through a number of extremely high value ecosystems, tributaries, and historic cultural travel routes and food collecting areas of Rangitāne that will be deeply affected. It will cut through the Ruahine Ranges north of the Manawatū Gorge and south of the Saddle Road. The road will emerge onto the existing State Highway 3 near Woodville.

21. The Manawatū Gorge and surrounding Ranges represent a significant connective route between communities East and west of the Ranges. It is proposed that this new roadway will inter alia provide a resilient, lasting connection for local communities and national commuters.

RANGTĀNE HISTORY, CULTURAL LANDSCAPE AND CULTURAL VALUES

Rangitāne Tangata Whenua History and Heritage

22. Rangitāne have an over 700 year unbroken occupation of and connection to the Manawatū and Tararua Districts. Rangitāne was recognised as mana whenua prior to European settlement and remain recognised as mana whenua to this day of the area the subject of this project. Rangitāne came to settle the Manawatū River catchment on both sides of the Ranges, and settlement was predominantly on the margins of the River and its many tributaries. The river was inter alia the main route for travel and communication and provided abundant resources. The plains were covered by dense forests and swamps that were impenetrable in places and could only be accessed by tracks created and used by Rangitāne. J. McEwen (1986) provides a description of Rangitāne settlement and occupation of the area, which is set out in the following paragraphs.

23. The ancestors of Rangitāne arrived in Aotearoa aboard the Kurahaupō waka. Whatongā, a Captain of the waka settled in Heretaunga. Whatongā explored a large part of the southern North Island or Te Ika a Maui. Whatongā is attributed to discovering and exploring the Manawatū River catchment area both East and West of the Ruahine and Tararua mountain, chain. He named the great expanse of bush cover Te Taperenui o Whatongā or the great district (food supply/resources) of Whatonga.

24. The name 'Manawatū' was bestowed on the River by a Tohunga over six hundred years ago, his name was Haunui a Nanaia. Whilst searching for his wife Wairaka, Haunui travelled down the West Coast of Te Ika a Maui crossing and naming many waterways on his travels. On reaching the now Manawatū river exit to the sea, the sheer width of the river mouth essentially took his breath away (stand still) hence manawa(breath), tū (to stand still).

25. Tanenuiarangi (Baptismal name of Rangitāne the ancestor) was the grandson of Whatonga whose descendants moved from Heretaunga, Hawkes Bay, south to Southern Hawkes Bay, Dannevirke,Wairarapa and Manawatū areas.They also occupied other areas of the lower North Island and the top of the South Island. The descendants of Tanenuiarangi during this time became known as Rangitāne. During initial settlement of the Manawatū, Rangitāne encountered earlier occupants who had arrived

with our ancestor Kupe and settled here, they were known as Ngatiara. Rangitāne took possession of the land and waterways from these whanaunga and occupied the Region. These whanau were largely assimilated into Rangitāne around 600 years ago.

26. Over time Rangitāne expanded its population and the number of their settlements. To maintain the natural resources needed to sustain the iwi and protect them in times of warfare, Rangitāne developed a number of settlements (kāinga and Pā) in strategic locations. Pā were situated near their most valuable natural resources as well as in strategic positions to view oncoming invaders and explorers. Rangitāne occupied and defended hundreds of thousands of acres in the Manawatū and Tamaki Nui ā Rua areas, developing into a number of Whānau based hapū that were responsible for certain geographical areas and natural resources within their rohe.

27. RoM area of interest as defined in its Treaty Settlement is defined by the Rangitikei River upstream to Orangipango trig east to Te Hekenga trig following the summit along the Ruahine Ranges southwest to Tararua trig across to the mouth of the Manawatū River. It also includes Ko te Waewae Kāpiti o Tara rāua Ko Rangitāne Island. The rohe map is attached as Appendix C.

28. RTNaR area of interest as defined in its Treaty Settlement is attached as Appendix D.

Rangitāne Tangata Whenua Values and the Environment

29. The Manawatū River was central to Rangitāne cultural values system. It was created through the spirit of Okatia, who gave life to a tōtara tree growing on the slopes of the Puketoi Range in the Hawkes Bay. The tōtara made its way to the mountain Ranges of Ruahine and Tararua and forced its way through these Ranges. It created the Manawatū Gorge, i.e., Te Āpiti, giving the river the ability to make its way out to sea. For Rangitāne, traditional legends such as this represent the significant links between the cosmological world and the tangible world.

30. The most significant quality that flows through the Manawatū River is its mauri which binds the physical, traditional, and spiritual elements of all things together, generating, nurturing, and upholding all life. This mauri is the most crucial element that binds Rangitāne with their tangible and intangible surroundings. The interconnected waterways of the Manawatū

River catchment form a dendritic pattern across the landscape. The mauri supplied from the mountains, forests, scrub, wetlands and the Gorge is transported through the waterways to nourish and feed the land and everything living on the land. Flooding was celebrated as part of this process.

31. For Rangitāne, the Manawatū River catchment is the main artery in this network containing the strongest and greatest amount of mauri. If an activity occurs that disrupts the natural actions of the waterway or pollutes the water, it is seen as having a negative impact on the mauri. Thus, the proposed project shall have a significant impact on the mauri of the River and Rangitāne shall be working through with the NZTA and other parties to the project to implement processes and actions to assist in mitigating impacts on the mauri of the River.

32. There are many Rangitāne kaitiaki or guardians of the river. These include Peketahi who has lairs both East and West of the Manawatū Gorge but presently resides at Kaitoki near Dannevirke and Whangaimokopuna who lived near Motuiti until he was banished for some bad behaviour. He now lives up in the hills at Raikatia East of Dannevirke. Whenever western Rangitāne people visit marae in the Dannevirke area, a mist descends on the Raikatia hills which is Whangaimokopuna weeping for his old friends.

33. Whilst it is traditionally abhorrent to disrupt or pollute the lifegiving waters of the Manawatū River or take more resources than one needs to provide for their hapū and manuhiri, today disruption, pollution and wide scale vegetation clearance is very sadly common. The need for proactive kaitiakitanga or guardianship has grown over time requiring the contemporary people of Rangitāne to immerse themselves in the protection, restoration and governance of the Manawatū River, its tributaries and natural ecosystems. As part of Rangitāne Deeds of Settlement, the relationship between Rangitāne, the Manawatū River and the Ruahine Ranges must be acknowledged in all RMA matters.

34. Rangitāne regard many species as taonga including those that were relied directly upon for food and other resources, but also for the important positions they held in the surrounding ecosystems. Rangitāne worldview deeply understands the interconnectedness among different aspects of the natural world. This is demonstrated in the whakapapa relationships between Atua of different domains. To give effect to Article 2 (Treaty of

Waitangi) and Sections 6, 7, 8 (RMA), all natural resources and taonga species belong to Māori until such times as they are disposed of.

Rangitāne Cultural Landscape, Sites and Places of Significance

35. A number of spiritual, ritualistic, and practical activities occurred at different times and locations within the Ruahine and Tararua Ranges, and the Manawatū River and tributaries. These sites have developed into tapu or waahi tapu. Many practices and sites disappeared during the breakdown of traditional Rangitāne society with European colonisation and expansion in the Region, the introduction of Christianity, and associated environmental change. However, the areas still hold the memories, traditions, stories and wairua of Rangitāne tupuna. Many locations therefore remain unknown to the wider public. In a modern day context, Rangitāne is reconnecting with these sites and re-establishing these cultural and spiritual practices.

36. Rangitāne cultural, spiritual and historical links with the Te Āpiti area continue to exist very strongly today. Resource gathering areas are under management plans for restoration, environmental monitoring and protection work occurs, Rangitāne sit on interagency bodies such as the Te Āpiti Gorge governance group and Rangitāne continue to hold wananga to teach Rangitāne history. Waahi tapu described below include those within the vicinity (~10 km) of the proposed designation. The inclusion of this information demonstrates the broad and interconnected Rangitāne cultural landscape that exists in the area.

a. **Ruahine Ranges**

It goes without saying the Ranges are immensely significant to Rangitāne as they go to our identity as to who we are and are recited as part of our Pepeha. One of Rangitāne cultural practices involves a purification ritual when a person's whare tapa wha is out of sync. The ritual, generated the saying 'Hokia ki ngāmaunga kia purea koe e nga hau a Tāwhirimātea' or 'Return to the mountains and there be cleansed by the winds of Tāwhirimātea. The Ruahine Ranges contain undisclosed burial grounds, sites where people have been killed in battle, special trees where placenta have been buried, include significant hunting/gathering grounds, travel routes connecting Rangitāne East and West, and include the significant Peaks of Rangitāne.The Ruahine Ranges are significant in that they represent both the divide and unity of whakapapa relationships within Rangitāne. Thus, Rangitāne are very much of the belief that some of the resting places of our tupuna are going to be disturbed when construction commences. Thus it is imperative there are the likes of Rangitāne Accidental Discovery Protocols as part of the consent conditions.

b. Whare-tītī

The spelling of this Peak on the Ruahine Range just north of the Manawatū Gorge has been hashed over the years and wrongly referred to variously as Wharite,Wharaiti,Warati and Whareiti among others. Rangitāne refer to this Peak as Whare-tītī (The house (home) of the mutton bird) which were abundant in the area in former times. All that remains of this resource however is the abundant mutton bird scrub (*Olearia*) which was food and a habitat for the mutton birds.

c. Oruahiore

Location of a signal fire within the Ruahine Ranges. The signal fire was one of many fires located along a transect of Peaks used to warn surrounding settlements of invasion and the need for help.

d. Te Āpiti

Te Āpiti, commonly referred to as the Manawatū Gorge, is of paramount importance to Rangitāne. Not only did Te Āpiti provide a means of crossing form East to West, but crucially it connected the Eastern and Western boundaries of Rangitāne: an area which the iwi has continuously occupied for over 700 years. Te Āpiti is the Rangitāne name for the Manawatū Gorge. Te Āpiti has many meanings including a split or cleft, to place side by side, or to have two of. It represents the two sides of the Gorge. The river and riparian margins through Te Āpiti were a significant route of transport and communication passageways between the Westerns and Eastern Rangitāne communities. The area is thus symbolic of connectivity between people, places and environments. Also, Te Āpiti is the meeting place of the two great forests of Whatongā, the Ruahine and Tararua Ranges. Thus, Te Āpiti represents and incites a number of significant and strong cultural feelings amongst Rangitāne.

e. Te au-nui- a- te-tonga

Ta au-nui-a-te-tonga (the great South current) is the name of the rapid in the middle of the Gorge sometimes referred to as White horse rapids.

f. Burial Caves

Located within Te Āpiti. Specific locations undisclosed.

g. Te Au Rere a te Tonga

This name, translated as 'the flowing current of the south', refers to that stretch of the river that plunges through the Gorge. .

h. Te Ahu a Turanga Peak

Above Te Āpiti, near the Saddle Road,sits a rock on a hilltop in the Ruahine Range named Te Ahu a Turanga(imua)-(the sacred mound of Turanga(the elder child). Turanga was a revered associate of the Rangitāne people both East and West of Te Āpiti.

Te Ahu a Turanga is a significant waahi tapu, culturally, spiritually and historically to Rangitāne. The site which is registered with the New Zealand Archaeological Association has the following narrative associated with it. Te Ahu Turanga: A Peak on the Ruahine Range. The West Coast connections of Rangitāne also have their source with the Aotea waka which made landfall at Aotea Harbour, just North of Taranaki. The Aotea waka was Captained by Turi,who settled in the Patea District of Southern Taranaki. He had a son named Turangaimua, or more commonly Turanga. Once old enough Turanga ventured back to where the Aotea had landed, and with a support party, set off to achieve victories over surrounding tribes. When they arrived in Turanganui a Kiwa (Gisborne) they not only clashed with the local iwi there but caught the attention of the women, with some women following them as they ventured on. The local Turanganui a Kiwa people quickly noticed some of their women were missing and followed Turanga and his support party. They were eventually overtaken at a saddle on the Ruahine Range just north of the Manawatū Gorge. This is where a fierce battle took place and Turanga was killed, along with several Rangitāne Chiefs who lent support to Turanga. Turanga was buried there and the waahi tapu site was subsequently named Te Ahu a Turanga, the mound of Turanga.

Thus this is an extremely significant area to Rangitāne. Subsequently it has been agreed with NZTA that the road shall not impact on this site in particular.

i. Sacred Rocks in the Gorge

Rangitāne tradition has it that a tapu rock resides in te-au-rere-a-te-tonga which along with its vicinity was the scene of an unfortunate killing in earlier times. Consequently, it is said that it is this rock, situated in the more Eastern reaches of the Gorge, if seen to be red in colour is a call for caution to all who pass by. Earlier generations of Rangitāne know this rock as Potaehinetewhaiwa but in more recent times has become commonly referred to as Wahine-potae or Hine-potae.

Another rock located more westerly through the Gorge is that which is referred to as Te Ahu a Turanga.

j. Te Waha o te Kurī

The Eastern entrance to the Manawatū Gorge has been known to the Rangitāne people of the area as Te waha o te Kurī since an early traveller named Tarāwhata passed through the Region in the 14th Century. He was accompanied by his famous dog Mahurangi who, after travelling from the North through the great dense forest of Te Tapere nui o Whatonga and later the Seventy Mile Bush, became seperated from his owner as they entered the Gorge entrance. An anxious Tarawhata, fearing the worst, located his beloved dog only after hearing his bark from among the forest trees that covered the flats at the Gorge entrance; hence the name Te waha o te Kurī referring to the voice (barking) of the dog.

k. Parahaki Island and Other Native Reserves in the Gorge

Parahaki Island is a riverbed Reserve. The Reserve is divided into two titles Parahaki No1 and Parahaki No 2. Hearings for this Reserve were held in Masterton, beginning April 14th 1880.Nireaha Tamaki of Rangitāne gave the following evidence."I belong to Ngati Muahi (Mutuahi),a hapu of Rangitāne. I claim through ancestry. My ancestors are buried on the land.A large number are buried there. It came into my possession through my grandfather. This is all I have to say. My fathers cultivated on the land. I have lived on it". Subsequently an order was made in favour of Nireaha Tamaki, Makere Te Pikihuia and Heketa Te Awe Awe in equal shares as tenants in common. Land to be made absolutely inalienable being a wahi tapu.

Two other Native Reserves exist in the Gorge vicinity on the Tararua side namely Te Potae and Te Rerenga o Whiro.

l. Otangaki Pā

Otangaki Pā was a Rangitāne defensive outpost and kainga situated at the present Ashhurst Domain on the upper terrace. The soil on the upper terrace is rich and would have supported kumara farming. Otangaki means to weed out, lending support to the potential for widespread gardening to have occurred.

m. Otangaki Urupā

On a low rise in Ashurst Domain, between the upper terrace and bush covered flats, is an urupa containing six unmarked graves. These are the graves of six Rangitāne people who drowned after their canoe sank in the Manawatū River around the 1850's/1860's. The urupa and nearby wetland is under threat of erosion as a result of changes in sediment accumulation around Parahaki Island.

n. Kopuanui Pā

Kopuanui Pā was a kainga and staging point for a number of trails traversing Te Āpiti ridge line and entering Pohangina Valley.

o. The following kainga were also located within a 10km vicinity of the proposed designation, along the lower stretch of the Pohangina River. The meaning of Pohangina is many night ovens. These Pā were included to further convey the Rangitāne significant cultural landscape within the area.

- **a.** Ahuriri;
- **b.** Keikeitangio;
- **c.** Tikorangi;
- **d.** Ka makoe;
- **e.** Pongaru;
- **f.** Waniepiwai;

g. Parimanakau;

h. Rapuruhe;

i. Te Pihu;

j. Rarokaikatea;

k. Te ponga;

l. Wairarapa; and

m. Wharau.

STATUTORY CONTEXT

Treaty of Waitangi

37. Mana whenua as defined by the RMA is the customary authority exercised by an iwi in an identified area. The authority is obtained through the relationship of the people and the resources of the land, and also the genealogy or lineage of those people being original people to occupy the area. Mana whenua then are those tangata whenua that have the say or right to be involved in decision making processes. This also in turn contributes to the rangatiratanga of the tribe as a whole.

38. It is important to note that at no time in Rangitāne 700 year association with its vast rohe has the Iwi ever relinquished or lost its status as mana whenua.

39. Under the Treaty of Waitangi Deed of Settlement for Rangitāne ō Manawatū, the Manawatū Gorge Scenic Reserve, Ruahine Forest Park and the Manawatū River (in the RTNaR settlement as well) and its tributaries each have the following acknowledgements:

    a. Crown acknowledgement of cultural, spiritual, historical, and traditional association.

    b. A deed of recognition for Crown owned and managed land and waterways, signed by the Minister for Conservation, the Director-General of Conservation, and Commissioner of Crown Lands, requiring consultancy with the governance entity and regard to views concerning the settling groups association with the area as described in the Crown acknowledgement.

c. A requirement that consent authorities, the Environment Court, and Heritage New Zealand Pouhere Taonga have regard to statutory acknowledgements.

40. Article 2 of the Treaty of Waitangi describes all taonga species as remaining in the possession of Māori for as long as they wish to retain them. Rangitāne have never disposed of their rights of Rangatiratanga over taonga species within their rohe.

Planning Documents

41. Te Ao Turoa Environmental Centre staff have reviewed Appendix One, Statutory Provisions (the legislation), provided by the NZTA, regarding national, regional, and district planning rules applicable to the project.

42. The legislation coupled with the Treaty of Waitangi, its principles and the Rangitāne Treaty Settlements Acknowledgements and Deeds of Recognitions requires the partnership of Iwi and Crown agencies in planning for the development and protection of natural resources within Rangitāne rohe. This legislation, albeit deficient in some areas regarding Iwi interests, provides the framework by which relationships are to be developed. However, the framework does not necessarily mean that this will guarantee Iwi active involvement at the decision-making table. Proactive relationships built on mutual trust and respect are key in Iwi being able to protect and enhance their interests to continue to support the sustainable development of resources in their rohe.

43. Rangitāne are in the process of developing their Iwi Environmental Management Plans (IMP). This process is set to be complete by July 2019. Rangitāne have been and will continue to be transparent in their resource management approach. However, once finalised the IMPs shall be referred to throughout the remaining duration of the project along with any of their other protocols and processes.

APPROACH TO ASSESSMENT

44. A suite of evidence was provided to Te Ao Environmental Centre staff to form this document, and also includes review and contribution from a number of other key authors. The evidence has come from a range of mana whenua sources, archaeological records, and information provided by the NZTA relating specifically to the project. The sources are as follows in no particular order:

a. Cultural Impact Assessments undertaken previously by Rangitāne within the proposed designation vicinity.

b. Court documents pertaining to prior and post Treaty Settlement periods.

c. A historical account of the alienation of Rangitāne land in the Manawatū, commissioned by TMI.

d. Historical records from Rangitāne Tamaki-Nui-ā-Rua.

e. A book written by J.M. McEwen providing an account of Rangitāne tribal history.

f. Verbal presentations and notes presented by a Matua Manahi Paewai at hui with the NZTA.

g. An Inventory of Rangitāne Heritage sites in Palmerston North City.

h. Environmental Assessments provided by the NZTA.

i. Through participation in design/mitigation workshops, and Rangitāne/NZTA hui kanohi ki te kanohi.

45. This technical document has been circulated for feedback around a number of Rangitāne mana whenua, and signed off by Danielle Harris O.N.Z.M., LLB, Chief Executive of TMI.

PROJECT SHAPING

46. The NZTA contacted Rangitāne mid2017 to begin to meet around the project. This included sharing four replacement options for the Manawatū Gorge Road. Rangitāne have had the opportunity to advise the NZTA of the location of our significant waahi tapu where the development of a road and associated infrastructure would be unacceptable to RoM. Te Ahu a Turanga was identified in the path of Option 3, South of the Saddle Road, along with the significant cultural landscape within the designation. Option 3 was identified as the most unacceptable by Rangitāne as this option was then presented.

47. Option 3 was chosen as the best option for the replacement of the Manawatū Gorge Road, however the proposed designation was shifted so not to impact on Te Ahu a Turanga and its mauri which is acceptable to Rangitāne now,as mitigations in respect of this site were addressed by NZTA to Rangitāne satisfaction.

48. Parahaki Island was also identified within the proposed designation of options 1, 2 and 3. The designation has been narrowed so to avoid any physical contact with Parahaki Island. The proposed designation is however still in close proximity to Parahaki Island and Rangitāne understand that the NZTA are working with the current Trustees of Parihaka Island around mitigation opportunities.

49. Option 3 cuts through a number of significant indigenous ecosystems. Rangitāne interests in indigenous vegetation removal, water quality concerns, and aquatic taonga species will be addressed in subsequent Regional resource consent applications.

50. Rangitāne and NZTA are continuing to meet to explore other avenues, processes, methodologies and actions to mitigate and address other Rangitāne concerns in respect of the project. It is suffice to say that thus far these discussions have been robust, open and transparent and Rangitāne shall continue such discussions in good faith and in the spirit in which they have occurred and expect the same from the NZTA under the Treaty of Waitangi.It goes without saying there shall be disagreements and differences of opinion going forward but the parties have agreed mechanisms to seek to address these differences.

ASSESSMENT OF EFFECTS ON RANGITĀNE TANGATA WHENUA VALUES

Introduction

51. The project will have both positive and negative impacts on Rangitāne tangata whenua values. It will be necessary to mitigate and offset negative impacts on environmental values, and the bridge adjacent to Parahaki Island will require careful design development. There is the opportunity however, to promote, enhance and continue to recognise Rangitāne cultural values and share some of Rangitāne history with the wider community.

Project Benefits

52. Te Āpiti Reserve is a significant sized remnant of indigenous vegetation, with a range of management challenges. It contains taonga species, ecosystem types, waahi tapu and mauri spiritually significant to Rangitāne. The Manawatū Gorge Replacement Project offers a unique

opportunity to invest in the protection and enhancement of Te Āpiti environment for the benefit of Rangitāne and the wider public.

53. The project offers Rangitāne the opportunity to share aspects of our history and environmental values with the wider community. Rangitāne have been integral in guiding the incorporation of cultural designs, historical narratives and original names within the project to date. This will enhance the understanding of Rangitāne within our local community and further afar. It may also have a positive effect on the wider culture of New Zealand and contribute positively to our global image.

Effects on Waahi Tapu

54. It is Rangitāne cultural view that waahi tapu are highly interconnected with the surrounding area and thus a very integral part of the landscape and waterways. This generates a broad cultural landscape where effects can be present despite the external location of the proposed development. The project will impact the interlinked nature of the cultural landscape described in the cultural landscapes, sites, and places of significance section. Certain prohibitions applied to these areas. People either had to stay away from them, or refrain from doing things which would break their tapu, such as taking food.

55. Direct effects on waahi tapu are detailed below:

a. Ruahine Ranges

The Ruahine Ranges are an especially significant waahi tapu. Human development and associated environmental pollution within the Ranges shall disturb the mauri of this whenua. The traditional ara or pathway that crossed both the top and bottom of the Ruahine will be impacted, as well as traditional hunting/gathering grounds.

b. Whare-tītī

Whare-tītī is a biodiversity hotspot. Indigenous wildlife are sensitive to noise and light pollution.

c. Oruahiore

The location of Oruahiore is strategic in that one can clearly see the surrounding landscape and other signal locations. The proposed project will impact on the visual relationship with the surrounding landscape from this point and impact the ability for Rangitāne to host noho/wananga at this location.

d. **Te Āpiti**

The proposed four lane bridge will visually impact Rangitāne relationship with Te Āpiti. The loss of access through the Gorge has affected a seven-hundred-year long tradition of travel through Te Āpiti and will change features reminiscent of ancient Ruahine.

e. **Te au-nui- a- te- tonga and the Sacred Rocks**

As discussed previously, Rangitāne have used the Te Āpiti Gorge route for travel for many hundreds of years. Losing access to Te Āpiti as a result of safety concerns has resulted in the significant loss of cultural connections with many waahi tapu.

f. **Burial Caves**

Te Āpiti burial caves are located at an undisclosed location to protect koiwi. Previously the public has had no access to the site however the project development may result in a higher risk of the public finding and accessing the burial caves, tuahu (alter), or paeapae used for customary rituals. The site has been placed under a very old and long rahui to protect those who rest in peace there. The concern is also what the vibration effects will have on the cave(s), including erosion of the walls and surrounding landscape on the caves and lesser grave sites in close proximity.

g. **Te Au Rere a te Tonga**

The proposed four lane bridge will visually impact on these waahi tapu and kaitiaki. The unnatural structure will impact on the flow of mauri through the waters of the Manawatū River, given that a foreign body is essentially contamination.

h. **Te Ahu a Turanga Peak**

The proposed designation passes close to Te Ahu a Turanga Peak. Earthworks, vibration from road activities, increased loading, erosion, public access and pollution associated with the life of the project each has the potential to impact on Te Ahu a Turanga.

i. **Te Waha o te Kurī**

With the reduction in traffic this area may become a more popular spot for camping.

j. **Parahaki Island**

The placement of the proposed four lane bridge across the Manawatū River will no doubt impact on erosion/accumulation dynamics around Parahaki Island. We acknowledge however it is the domain of the Parahaki Trustees to work through this with the NZTA.

k. **Otangaki Pā**

This Pa site may also experience some impact.

l. **Otangaki Urupā**

Erosion/accumulation dynamics around the proposed bridge and Parahaki Island could further impact Otangaki Urupā.

m. **Kopuanui Pā**

This Pa may also be impacted by the Project.

Effects on Environmental and Spiritual Values

56. The proposed designation is set within two nationally and regionally threatened ecosystem types including old growth forest and wetland and progresses through a number of significant and lower value tributaries of the Manawatū River containing secondary forest and scrub. Rangitāne have witnessed the near totality loss of indigenous forest and scrub, taonga species, and drainage of wetlands within their rohe. Any further loss of indigenous vegetation, impact on wildlife, or modification to wetlands will further significantly impact the mauri of the area, will result in the loss of taonga, and will cause irrevocable spiritual harm to Rangitāne tangata whenua and Rangitāne Kaitiaki.

57. Sediment released during construction works, the construction of culverts, gully filling (and associated loss of freshwater habitat), and ongoing release of contaminants in storm water (human rubbish, fossil fuels and sediments) will impact upon freshwater communities within the tributaries and will also thus impact the mauri of the Manawatū River.

Effects on Accidental Discoveries

58. Earthworks have the potential to disturb archaeological evidence of early human occupation and koiwi. However, this also presents the opportunity to obtain historic information on the lives of Rangitāne ancestors, their activities, resource use, and structures. It is of utmost importance that the dignified and appropriate cultural management of such sites and remains be upheld and managed by Rangitāne mana whenua and Kaumātua.

SUMMARY OF EFFECTS

59. Negative effects on waahi tapu, environment, and disturbance of accidental discoveries shall occur but mitigation to various levels can be provided for through agreed processes with the NZTA. Negative effects at this stage are perceived to be able to be worked through, however it should be noted that impacts discussed are only those that are foreseen at this stage of the project. Negative impacts on waahi tapu may come to our attention as mana whenua become more familiar with the project designation and the kaupapa is further circulated among Rangitāne elders. The project benefits described have the potential to offset some impacts on cultural, spiritual and environmental values within the Region.

60. Culturally responsive and adaptive environmental management will be key to reducing the negative impact on Rangitāne relationships with the landscape. Rangitāne have developed a positive, proactive relationship with NZTA and will continue to build on this moving forward in subsequent stages of the project. Rangitāne will nevertheless always maintain other mechanisms and options to address issues where they cannot be resolved between the parties.

PROCESSES TO AVOID, REMEDY OR MITIGATE ACTUAL OR POTENTIAL ADVERSE EFFECTS ON TANGATA WHENUA VALUES

Project Partnership

61. At a governance level a Memorandum of Partnership is being developed to manage the relationship at the governance level between Rangitāne and NZTA.

62. Whilst at the operational level another agreement is being finalised to address how Rangitāne will be involved in the project in terms of cultural, spiritual and environmental processes to assist in mitigating the matters raised in this document and others that may come to the surface as the project continues to unfold.

Accidental Discovery Protocol

63. It has been agreed that an accidental archaeological discovery protocol will be included in the designation conditions.

64. This protocol details an acceptable way to reduce effects on accidental discoveries and protect the wairua of Rangitāne ancestors.

Environmental and Cultural Design Framework

65. Rangitāne tangata whenua values are imbedded in the Environmental and Cultural Design Framework (ECDF).

66. The recognition and provision for Rangitāne Mana, Whakapapa, Taiao, Mauri Tu, Mahi Toi, Tohu, and Ahi Kaa in the ECDF establishes pathways for addressing and reducing effects on Rangitāne spiritual and cultural connections with the environment within and externally to the proposed designation.

a. **Mana/Whakapapa**

The development of a Treaty based relationship between the NZTA and Rangitāne has resulted in the involvement of Rangitāne in the project design process. The development of trust between the two parties which is continuing to grow has allowed Rangitāne to share world views, tikanga, and cultural narratives with confidence that they will be protected, respected and incorporated into the future design of the project, for the benefit of Rangitāne and the wider community. A true partnership approach will mean that effects on waahi tapu can go some way towards to being mitigated and provided for during planning design and addressed as future issues arise.

b. **Taiao/Mauri Tu**

As described previously Rangitāne have a significant cultural connection to the environment within and surrounding the proposed designation. The commitment to minimise environmental harm and provide for significant offset and environmental enhancement with input from Rangitāne at the planning and operational level is a best possible outcome in contributing to mitigating the environmental and spiritual effects of the project.

c. **Mahi Toi/Tohu/Ahi Kā**

The opportunity to have ancestral names, tohu, taonga species, and narratives weaved into the project represents an opportunity for tangata whenua to share and build on their valuable skills. This will support the obligation tangata whenua have in upholding tiakitanga of the whenua and culture for future generations.

CONCLUSION AND RECOMMENDATIONS

67. Rangitāne have been open to the partnership relationship that is beginning to develop during the planning phases of the project to date with the NZTA. We have very real and very genuine concerns around environmental effects and impacts on waahi tapu that need to be addressed in the coming phases of design development, mitigation planning, and public management. We thus recommend that the NZTA continue to work in partnership under the Treaty of Waitangi with Rangitāne to find processes to honour our cultural heritage, involve us at all levels of the process and continue to find ways to mitigate our concerns.

68. Our recommendations center around the use of a living Cultural Impact Assessment that is to be undertaken and implemented as part of the process. This document will be used and implemented by the parties in assessing the need for and success of adaptive approaches to reduce cultural impacts throughout the entire project life and beyond. This does not in any way take away from the need to consult with mana whenua face to face regarding management approaches that arise but shall be used to assess the overall success of the suite of cultural mitigation tools that have been developed to date and will continue to be developed as part of the project.

69. As a literal translation Te Āpiti means connection. The area of Te Āpiti, the Gorge and Te Ahu a Turanga are places where Rangitāne connected from East to West joining up the great basket of Whatongā, one of our most prominent ancestors. It was also an area where we connected with Tawhirimatea and with the backbone of the great fish of Maui and where the Tararua connects with Ruahine recognising the connection between our ancestors sIt is a place of great spiritual significance where the waters from the East connects with the active mountain Ranges, Te Ahu a Turanga and continue to flow West fertilising the plains and wetlands of the Manawatū. It is this connection to a variety of Rangitāne cultural values, concepts and unbroken history we immensely value, respect and honour. We thus see this new proposed road as a 21st Century of that connection. So finally, as an overall recommendation we must see these values being incorporated into this journey we are embarking on with the NZTA and other stakeholders. A journey that shall forevermore change our landscape and waterways as we traverse up and over an actively rising mountain Range

which our Awa surges and meanders through and is for Rangitāne a place where we can experience Rangi and Papa truly connecting.

7.A

RANGITĀNE DEED OF SETTLEMENT HISTORICAL CLAIMS

APPENDIX A

RANGITĀNE DEED OF SETTLEMENT HISTORICAL CLAIMS

2. HISTORICAL ACCOUNT

2.1 The Crown's acknowledgements and apology to the settling group in part 3 are based on this historical account.

Rangitāne o Manawatū Before 1840

2.2 Rangitāne o Manawatū trace their origins back to Whātonga, one of three rangatira who commanded the Kurahaupō waka as it sailed from Hawaiki to New Zealand. After landing at Nukutaurua, a small bay on Māhia Peninsula, Whātonga eventually settled at Heretaunga in Hawke's Bay. Whātonga and his second wife Reretua had a son called Tautoki, who married Waipuna, a great granddaughter of the navigator Kupe. Rangitāne o Manawatū take their name from the son of Tautoki, their eponymous ancestor Rangitāne.

2.3 The descendants of Whātonga explored the lower North and upper South Islands, and settled in Wairarapa, Te Whanganui a Tara, Wairau, and the Marlborough Sounds. A considerable number of Rangitāne continued to reside at Heretaunga.

2.4 In the sixteenth century two brothers, Tawhakahiku and Mangere, led a party of Rangitāne from Heretaunga to Manawatū. Initially they followed a route through Te Āpiti (the Manawatū Gorge), as Whātonga had done during his exploration of the lower North Island. However, after meeting resistance from another iwi, Tawhakahiku and Mangere entered Manawatū via a route near the Pahiatua track, passing through what is now known as Aokoutere to settle along the Manawatū River.

2.5 As the Rangitāne o Manawatū population grew, they established pā, kainga, and mahinga kai sites along the Manawatū River and exerted control over resources in the area. Their customary rohe follows the Manawatū River, extending north as far as the Rangitikei River, from the Tararua and Ruahine Ranges to the West Coast, south to the Manawatū River mouth. A number of neighbouring iwi also had interests in parts of this area. Rangitāne o Manawatū pā and kainga included Hotuiti, Tokomaru, Paparewa, Raewera, Puketotara, Tiakitahuna, Te Kuipaka, Awapuni, Te Motu o Poutoa, and Te Wi.

2.6 Rangitāne o Manawatū lived largely peacefully until the 1820s, when musket armed iwi migrating from the north arrived in Manawatū. Rangitāne o Manawatū suffered disruption as a result of battles with the northern iwi and their movements into and through their area.

New Zealand Company Purchases and the Spain Commission, 1839-1844

2.7 The New Zealand Company was a private land-settlement company established in London in May 1839. In late August 1839 the British Government dispatched Captain William Hobson to negotiate with Māori for the cession of New Zealand to the British Crown. One of the instructions given to Hobson was to establish the Crown's sole right to purchase land (pre-emption). The Company sent representatives to New Zealand ahead of Hobson to purchase the land it desired before pre-emption was established.

2.8 In October 1839, the Company entered into the Kāpiti deed of purchase with another iwi. Through this deed, the Company purported to purchase vast tracts of the upper South and lower North Islands, including the Rangitāne o Manawatū rohe. Rangitāne o Manawatū did not sign this Company deed.

2.9 In January 1840 the Crown issued three proclamations. The third established pre-emption and announced the Crown would create a Commission to investigate earlier land transactions between Māori and private parties.

2.10 In May 1840 the Crown proclaimed sovereignty over the North Island of New Zealand based on the Treaty of Waitangi and over the South Island on the basis of discovery. Although Crown representatives took the Treaty to Manawatū in May 1840, it was not signed by Rangitāne o Manawatū rangatira.

2.11 In September 1841 the Crown waived pre-emption in certain areas, including a defined area of Manawatū. The Company could then make additional payments to Māori in order to complete transactions it had begun before pre-emption was proclaimed. In February 1842, the Company signed a Deed of Purchase with another iwi at Te Papangaio pā at the Manawatū River mouth, conveying an area of land between the Tararua Ranges and the Rangitikei and Horowhenua Rivers. Rangitāne o Manawatū did not participate in the sale. When New Zealand Company surveyors arrived in Manawatū in early 1842 Rangitāne o Manawatū and another iwi objected to the survey. Rangitāne o Manawatū burnt down the surveyors' huts.

2.12 In December 1841, Land Claims Commissioner William Spain arrived in New Zealand to investigate the Company's land claims. In 1843 and 1844 Spain heard evidence from Company officials, European settlers, and other iwi about the Company's Manawatū transactions. In 1872 a rangatira from another iwi testified that Commissioner Spain was told in 1844 that Rangitāne o Manawatū had not agreed to the sale of their lands and were not present when the lands were purportedly sold. Spain did not seek evidence from Rangitāne o Manawatū witnesses.

2.13 In his 1845 report, Commissioner Spain found the New Zealand Company's claims in Manawatū failed aside from a 100 acre block at Horowhenua secured by way of further compensation, paid to other iwi in 1844. The Commissioner recommended, in light of the previous attempt to purchase the land, the Company be given a right of pre-emption to the lands between the Rangitikei and Horowhenua Rivers so that, with the permission of the Crown, they might complete the purchase at a later date.

2.14 There were no further land purchases in the Rangitāne o Manawatū rohe until the 1850s, by which time the Company had gone out of business. Nevertheless the Crown still considered itself responsible for providing land to settlers who had purchased land from the Company before it had purchased the land from Māori.

Crown Purchase of the Te Awahou Block, 1859

2.15 In 1858 legislation was enacted providing that settlers who held Company land orders in Manawatū would be entitled to be granted land in this region when Māori titles had been extinguished. In 1859 the Crown purchased approximately 37,000 acres in the Te Awahou block on the lower north bank of the Manawatū River. The chief who sold the land later agreed that others should have been included in the sale. As a result, some Rangitāne o Manawatū received a share of the purchase money from the vendors of the block. In 1873 the Native Land Court awarded some Rangitāne o Manawatū individuals 76 acres at Iwitekai, just south of Moutoa, which had been reserved from the purchase.

Te Ahuaturanga Purchase, 1864

2.16 In 1850 the Crown had initial discussions with Rangitāne o Manawatū regarding the acquisition of what became the Te Ahuaturanga block. However, no boundaries were discussed and negotiations did not resume until 1858. At this time, a Rangitāne o Manawatū rangatira, Te Hirawanui Kaimokopuna, offered to sell the Te Ahuaturanga block, estimated by Crown officials to be 170,000 acres, to the Crown. Rangitāne o Manawatū wanted to encourage European settlement in northern Manawatū so they could participate in the developing settler economy.

2.17 The Crown purchase agent wanted to negotiate using a rough sketch of the block as a guide to the area under discussion. However, Te Hirawanui told the Crown agent that "before the land could be sold that it must be surveyed all round the Boundaries and then paid for at the rate of 30/- per acre – that [the] land was of immense extent and that it should not be sold in the dark." Te Hirawanui understood that the Crown had already promised to have the land surveyed before sale.

2.18 The Crown refused to negotiate a per acre price for the land, and sought instead to negotiate on a lump sum basis. Negotiations for the sale broke down by late 1859, after Te Hirawanui rejected Crown offers of first £5,000 and then £6,000 for the block.

2.19 In 1862 the Crown, under the Native Lands Act 1862, established the Native Land Court to determine the owners of Māori land “according to native custom”, and to provide these owners with titles derived from the Crown. The Act waived the Crown’s right of pre-emption, allowing the owners identified by the Native Land Court to sell their land “to any person or persons whomsoever.”

2.20 The Crown still wanted to acquire land to pass on to settlers who held New Zealand Company land orders in Manawatū. The Crown therefore exempted a defined area of Manawatū, including the Te Ahuaturanga and Rangitikei-Manawatū blocks from the operation of the 1862 Act. The exemption of these lands from the 1862 Act meant the Native Land Court did not have jurisdiction to investigate land ownership in Manawatū, and onl the Crown could purchase Rangitāne o Manawatū land.

2.21 In April 1862, the Governor authorised the superintendent of the Wellington Provincial Council to purchase land on behalf of the Crown and, in 1863, the Crown resumed negotiations for Te Ahuaturanga with Rangitāne o Manawatū. The Crown purchase agent told Rangitane o Manawatū that he considered the previous Crown offer of £6,000 ‘insufficient’ and promoted the benefits of rapid Pākehā settlement ‘provided that the Reserves were ample and well selected’. The Te Ahuaturanga deed of sale was signed on 23 July 1864 and transferred approximately 250,000 acres to the Crown. The purchase price of £12,000 was paid to Rangitāne o Manawatū on 19 August 1864. The Te Ahuaturanga block extended from just north of present day Tokomaru to the headwaters of the Oroua River, bounded to the east by the Tararua and Ruahine Ranges and to the west by the Oroua River to just above Feilding, then cutting a line just west of the Taonui Stream and across the Manawatū River.

Te Ahuaturanga Reserves

2.22 At the outset of the Te Ahuaturanga negotiations the Crown instructed its purchase agent to be on guard against Rangitāne o Manawatū requests for high prices and large reserves, and to urge them to sell as much land as possible. In September 1858 a Crown purchase agent proposed that 5,000 acres be set aside as reserves. However, after meeting Rangitāne o Manawatū at Puketotara on 27 October, he reported that ‘we arranged anew the reserves, reducing them very much in extent’.

2.23 The Crown surveyed the reserves over a year later, in November 1859. They totalled 2,570 acres. At the request of Te Hirawanui the Crown set aside a 200 acre reserve at Wairarapa, on the west bank of the Pohangina River. The other reserves were at Te Wi, 650 acres on the west bank of the Manawatū River near Raukawa Pā; at Hokowhitu, 890 acres on the west bank of the Manawatū River between the river and the northern end of Papaioea clearing; and at Te Kairanga, 830 acres on the east bank of the Manawatū River.

2.24 The Te Ahuaturanga deed of 1864 attached a plan showing the boundary of the land sold, and the boundaries of the reserves for Rangitāne o Manawatū. The reserves were not described in the body of the deed.

2.25 The Crown issued grants to Rangitāne o Manawatū for these reserves between 1873 and 1879, after the Native Land Court had determined their ownership. At the request of Rangitane o Manawatū rangatira the Hokowhitu reserve was subdivided into seven sections between Rangitane o Manawatū hapū and awarded to 54 individuals. A further 43 Rangitane o Manawatū people were registered by the Native Land Court, under section 17 of the Native Lands Act 1867, as having an interest in the reserve. The Te Wi and Wairarapa reserves were granted to 3 and 8 people respectively.

2.26 The location of reserves caused much discontent for Rangitāne o Manawatū for several years after the Te Ahuaturanga sale, as they excluded wāhi tapu such as Raukawa Pā, Awapuni lagoon and kainga, Te Motu o Poutoa, Maraetarata and Tiakitahuna. In 1866 Rangitāne o Manawatū sought unsuccessfully to have the Crown include Raukawa Pā and Awapuni lagoon in their reserves.

2.27 In November 1866 the Wellington provincial government auctioned the first sections of the Te Ahuaturanga block. Sections were offered at higher prices than the shilling per acre the Crown paid Rangitāne o Manawatū two years earlier. Between 1866 and 1873 Rangitāne o Manawatū participated in auctions of the Te Ahuaturanga block to re-acquire several of their kainga. Their acquisitions included 105 acres at Awapuni (which became a principal settlement of Rangitāne o Manawatū until the 1920s and the site of their marae Kikiwhenua); 168 acres at Karere (including Tiakitahuna kainga), 100 acres on the Manawatū River opposite Tiakitahuna, and small plots in the town of Palmerston North. In 1879 Hoani Meihana told the Native Land Court that he purchased Tiakitahuna 'on behalf of the people'. While Rangitāne o Manawatū repurchased some wāhi tapu, other sites of significance such as Raukawa Pā were sold to settlers and not subsequently repurchased.

Papaioea Clearing

2.28 The Papaioea clearing, later the site of Palmerston North, was located within the Te Ahuaturanga block. It had been the pā site of the Rangitāne o Manawatū rangatira Rakaumaui and was a significant site for Rangitāne o Manawatū.

2.29 In August 1865, after the sale of Te Ahuaturanga, Rangitāne o Manawatū rangatira, Kerei Te Panau and Huru Te Hiaro, proposed that a part of the Papaioea clearing be made a Rangitāne o Manawatū reserve so that their land at Hokowhitu could be adjoined to Papaioea and held 'in one piece'. They proposed exchanging the reserve at Te Wi for land at Papaioea. The Crown did not act on the proposal. This was likely because the Crown had identified Papaioea as a good site for a township. In late 1866 the Wellington Provincial government began auctioning the Papaioea land.

2.30 In 1867, the Crown did not consult with Rangitāne o Manawatū before purchasing 71 acres of the Papaioea clearing from the Wellington provincial government so that it could be given to another iwi as part of an exchange including land outside Manawatū. The block, located in central Palmerston North, is now valuable commercial and residential real estate.

Rangitikei-Manawatū Purchase, 1866

2.31 From the 1840s, Rangitāne o Manawatū, alongside other iwi, leased out large tracts of land between the Rangitikei and Manawatū Rivers to settlers. In 1863 a dispute arose among several iwi, including Rangitāne o Manawatū, over the distribution of rental proceeds from leases of around 80,000 acres between the Rangitikei and Manawatū rivers. The Crown intervened when the dispute threatened to escalate into armed conflict.

2.32 In 1863 the Crown held hui with the three principal iwi party to the dispute, including Rangitāne o Manawatū. At these hui Crown agents offered to refer the dispute to the Governor or to resolve the matter through arbitration. However, neither solution could be agreed upon by all parties. At a hui on 16 January 1864 one of the iwi with interests in the block offered the land for sale to the Crown. On 27 January 1864, the superintendent of Wellington province secured agreements from all parties that rents from the block would be suspended until the dispute was settled. Rangitāne o Manawatū and another iwi favoured arbitration to resolve the disagreement, and wrote to Governor Grey and the superintendent protesting the proposed sale of the land.

2.33 At a hui with the superintendent and a number of other rangatira at Whārangi in October 1864, Hoani Meihana, a Rangitāne o Manawatū rangatira, consented to the sale of the block. However other Rangitāne o Manawatū rangatira were not present.

2.34 In 1865 the Native Lands Act 1862 was repealed and replaced by the Native Lands Act 1865. The new legislation retained the clause excluding the Manawatū block from the operation of the 1862 Act. As before, the land could only be acquired by the Crown, and the Native Land Court had no role in determining its customary ownership.

2.35 Late in 1865 the superintendent travelled to Manawatū and met with Rangitāne o Manawatū and the other iwi with interests in the block. He said to a rangatira of another iwi that the exclusion of the block from the Act prevented what he called the "farce" of a Native Land Court investigation, given its ownership was so strongly disputed. At a meeting at Puketotara Te Peeti Te Awe Awe, a Rangitāne o Manawatū rangatira, told the superintendent he had not attended the Whārangi hui in October 1864 where the chiefs agreed to sell the land. Te Awe Awe said that he refused to sell and that he wanted the rents to be released because Rangitāne o Manawatū were "living upon" them. Hoani Meihana repeated his preference to sell the Rangitikei-Manawatū block, but opposed the further sale of any land east of the Oroua River, later known as the Aorangi block, saying that:

2.36 We must keep it as a reserve for our children, and for their children after them. We must have it partitioned and get Crown grants for it. My determination to sell is confined to the disputed lands.

2.37 The Superintendent offered to distribute the suspended rents if the involved iwi could reach a unanimous decision on their release and division, but no consensus was reached.

2.38 In April 1866 representatives of the three principal iwi in the dispute met to discuss terms of sale. Te Peeti Te Awe Awe and Kerei Te Panau now consented to the sale on behalf of Rangitāne o Manawatū. The price agreed for the block was £25,000, and the superintendent called upon the iwi to determine the division of the money before signing a deed. Reserve areas would be determined on the completion of the purchase. Rangitāne o Manawatū believed the purchase money should be divided equally and paid directly to the three principal iwi in the block with their share given to Te Peeti Te Awe Awe.

2.39 When the iwi gathered at Parewanui on 5 December 1866, the allocation of the purchase money had not been agreed. Before the hui the superintendent outlined to the Native Minister a proposed division of the purchase money that would have given Rangitāne o Manawatū £5,000. At the Parewanui hui, Rangitāne o Manawatū expressed their preference for an equal distribution of the purchase money among the three principal iwi. When this was not agreed to, Rangitāne o Manawatū supported a further proposal which would have seen them receive £5,000. No consensus could be reached for this proposal either. After lengthy discussions Rangitāne o Manawatū informed the superintendent that they had entered an arrangement with one of the other principal iwi. This iwi would represent Rangitāne interests and allocate them a share of the purchase price.

2.40 The deed of sale for the approximate 241,000 acre block was signed at Parewanui on 13 December 1866. Approximately 96 Rangitāne o Manawatū signed the purchase deed. The Crown paid £15,000 of the purchase money to the iwi from whom Rangitāne o Manawatū had arranged to receive payment. Rangitāne o Manawatū received only £600 despite having consistently sought at least £5,000 for their interests.

Rangitikei-Manawatū Reserves

2.41 No reserves were defined in the Rangitikei-Manawatū deed, despite the Native Minister's recommendation that they be included, in line with established practice. The purchase had been completed on the basis that reserves would be allocated after sale. However, in the years following the sale, the provision of reserves to Rangitāne o Manawatū from the Rangitikei-Manawatū block became intertwined with their protests over the payment of the purchase money.

2.42 In January 1867 a large gathering of Rangitāne o Manawatū met with the superintendent at Puketotara Pā, extremely angry with their share of the payment from the Rangitikei-Manawatū sale. Rangitāne o Manawatū sought his assistance in securing what they considered their full share of the purchase money. Te Peeti Awe Awe requested the superintendent to "make good the loss" by giving Rangitāne o Manawatū a reserve of 3,000 acres at Puketotara. The superintendent said that he sympathised with Rangitāne o Manawatū, but refused to intervene in the dispute. He offered Rangitāne o Manawatū a 1,000 acre reserve at Puketotara as compensation. The superintendent also indicated that the government had identified a site where a township could be established within the reserve. He suggested Rangitāne o Manawatū establish the town themselves for their own benefit.

2.43 Rangitāne o Manawatū initially refused the offer of 1,000 acres and repeated their request for 3,000 acres. In March 1867, however, Te Peeti Te Awe Awe accepted the offer of 1,000 acres at Puketotara. The memorandum of agreement signed by Te Awe Awe and the superintendent assigned the 1,000 acres as a 'tribal reserve' and included a provision that gave the Crown the right to build public roads through the reserve. The Puketotara reserve did not end Rangitāne o Manawatū protests and over the following decade they unsuccessfully petitioned the Crown on more than twelve occasions to have their concerns about the purchase payments addressed and a further payment made.

2.44 The conclusion of the purchase left the matter of the rent that had been suspended since 1864. In November 1869, the superintendent, acting as land purchase commissioner, reported that, unable to reach an agreement, the vendors of the Rangitikei-Manawatū block resolved to leave the apportionment of the suspended rents, totalling £4,699, in his hands. Rangitāne o Manawatū wanted the rents to be apportioned equally. When the Crown distributed the rents in late 1869 Rangitāne o Manawatū received £525, rather than the equal share they sought. The land commissioner told Rangitāne o Manawatū that £300 of the payment represented compensation for what the Crown considered the unfair payment they received for the Rangitikei-Manawatū purchase.

2.45 In November 1870, Rangitāne o Manawatū rangatira sought an additional 10,000 acres of reserves in lieu of the £4,400 they said had not been received from the Rangitikei-Manawatū purchase. The Minister of Native Affairs conceded that Rangitāne o Manawatū appeared to "have suffered great loss." He awarded further reserves. These included a further 1,100 acres at Puketotara for the "Rangitane tribe," 100 acres on the west bank of the confluence of the Oroua and Manawatū Rivers (that included Puketotara pā), and three small sections to individuals along the west bank of the Oroua River totalling 56.5 acres and covering urupā and eel fisheries. Hare Rakena Te Awe Awe had not consented to the sale, and was awarded a 500 acre reserve at Puketotara. In 1871 the Minister of Native Affairs described the greater portion of the reserves he created for Māori in the Rangitikei-Manawatū block as being composed of "sand hills, swamp, and broken bush".

2.46 Between 1871 and 1874, Rangitāne o Manawatū sought, unsuccessfully, to have the Crown increase the size of their Oroua River reserves. One of the reserves encompassed 35.5 acres on the bank of the Oroua River and included part of the lagoon at Te Awa a Pūnoke, which was an important eel fishery for Rangitāne o Manawatū. In 1872 Hoani Meihana asked the Native Minister to add old cultivations at Te Awa a Pūnoke to the reserve. The Crown declined this request after a Crown surveyor was unable to find any cultivations and considered the area Hoani had identified to be about 1,000 acres. In 1874 the Crown declined a request by Hoani to expand the reserve to include the whole lagoon.

2.47 In the mid-1870s Rangitāne o Manawatū continued to feel aggrieved over the Rangitikei-Manawatū sale and felt their claims had not been satisfactorily addressed by the Crown. As European settlement on the Rangitikei-Manawatū block neared areas of

Rangitāne o Manawatū occupation, some Rangitāne o Manawatū individuals began to obstruct the survey and development of the land.

2.48 In 1876 Rangitāne o Manawatū opposed the survey and drainage of a large block of land encompassing a number of swamps and lagoons, including Te Awa a Pūnoke. Rangitāne o Manawatū occupied the block in protest. Hoani Meihana told a Crown official that Rangitāne o Manawatū were "anxious lest the Awapunoke be drained and their eels thereby be destroyed." A Crown official commented sympathetically that "every attempt to drain [the swamps] has been opposed by the Natives, who argue with some show of reason that to open out these swamps would destroy the object for which these reserves were made".

2.49 Rangitāne o Manawatū rangatira Hoani Meihana and Te Peeti Te Awe Awe linked the protest and occupation to their wider grievance over the money paid to Rangitāne o Manawatū in the Rangitikei-Manawatū purchase. In 1877 the Crown laid charges against two Rangitāne o Manawatū individuals who had occupied the disputed block but later dropped the prosecution and the survey proceeded.

2.50 In the late 1870s the Crown granted Hoani Meihana 1,473 acres adjacent to the Rangitane o Manawatū reserve at Puketotara in recognition of the grievance over the draining of Te Awa o Pūnoke. This grant generated protest among other members of Rangitane o Manawatū who considered that the land should be the property of the whole iwi for their remaining grievances over the Rangitikei-Manawatū sale.

2.51 Rangitāne o Manawatū continue to believe they were inadequately compensated by the Crown for the loss of their land in the Rangitikei-Manawatū block.

Rangitāne o Manawatū and the Taranaki Campaign, 1866-1869

2.52 Rangitāne o Manawatū, like some other iwi, voluntarily joined the native military contingent in 1866 at the request of the superintendent of Wellington province. Under the command of Major General Trevor Chute and Major Kemp they fought in the Taranaki Campaign and in the 1868-1869 campaign against Titokowaru.

2.53 The Crown recognised the contribution of Rangitāne o Manawatū in these wars by awarding Te Peeti Te Awe Awe a sword of honour and the Tanenuiarangi Flag. Rangitāne o Manawatū believe their rangatira fought in order to protect their remaining land from alienation.

Rangitāne o Manawatū and the Native Land Court

2.54 From the late 1860s to the early twentieth century, land in Manawatū which had not already been purchased by the Crown passed through the Native Land Court. The

Native Land Court, under the Native Lands Act 1865, was to determine the owners of Māori land “according to native custom” and to convert customary title into title derived from the Crown.

2.55 The native land laws introduced a significant change to the Māori land tenure system. Customary tenure was able to accommodate multiple and overlapping interests to the same land, but effective participation in the post 1840 economy required clear land boundaries and certainty of ownership. The Native Land Court was not designed to accommodate the complex and fluid customary land usages of Māori within its processes, because it assigned permanent ownership. In addition, land rights under customary tenure were generally communal but the new land laws tended to give rights to individuals, instead of hapū and iwi.

2.56 The Crown aimed, with these measures, to provide a means by which disputes over the ownership of lands could be settled and facilitate the opening up of Māori customary lands to Pākehā settlement. It was expected that land title reform would eventually lead Māori to abandon the tribal and communal structures of traditional land holdings.

2.57 Under the native land laws individuals could submit claims to the Court without reference to their whānau or hapū. If awarded title by the Court, individuals held that title as their own property. They were free to dispose of their title, subject to the various native land acts. It was not until the 1894 that legislation provided for title to be held by iwi as corporate bodies.

2.58 The Native Lands Act 1867 gave the Governor discretion to refer claims to the Rangitikei-Manawatū block to the Native Land Court. However, claims could only be received from persons who had not signed the 1866 Deed of Sale. As most Rangitāne o Manawatū rangatira had signed the Deed of Sale, they were prevented from bringing claims regarding the Rangitikei-Manawatū block before the Native Land Court.

2.59 However, from the late 1860s through to the early twentieth century, Rangitāne o Manawatū rangatira participated widely in Court investigations of ownership for other Manawatū land. In total, the Native Land Court awarded Rangitāne o Manawatū owners almost 12,000 acres, primarily in the Aorangi, Taonui–Ahuaturanga, and Tuwhakatupua blocks.

2.60 After the large Crown purchases of the 1860s, Rangitāne o Manawatū sought to retain their remaining lands acquired through the Native Land Court for their own support. In 1873, shortly after the title hearing of the Aorangi block where Rangitāne o Manawatū were awarded the southern portion (Aorangi 3), Hoani Meihana informed the superintendent of Wellington province that:

2.61 Rangitane’s portion of Aorangi is 5,200 acres. This is my word to you. I will never consent to the sale of this piece, it must be left for maintenance for ourselves and children. If the Government purchase I will never give my consent to sell.

European Settlement and the Alienation of Remaining Land

2.62 By the end of the 1880s Rangitāne o Manawatū held approximately 20,000 acres in reserves from Crown purchases, land they had been awarded by the Native Land Court, and land they had repurchased in the Te Ahuaturanga block. After acquiring the Rangitikei-Manawatū block, the Crown made few further purchases from Rangitāne o Manawatū. In 1876, the Crown purchased a small strip of land across the Aorangi 3 block for the Foxton Light Railway. In 1890 the Native Land Court awarded the Crown 300 acres from the same block to pay its survey costs. In 1897 the Crown purchased the 1,026 acre Tuwhakatupua 1A block on the southern bank of the Manawatū River.

2.63 From the early 1870s the Crown assisted significant numbers of European settlers to immigrate and settle in the upper Manawatū. In 1870 a block of 3,000 to 4,000 acres was made available to settle Scandinavian immigrants near Rangitāne o Manawatū settlements at Awapuni and Te Wi. Large virgin forests and swamps such as Taonui, Makurerua and Moutoa, which once provided a rich resource to Rangitāne o Manawatū, became over time fertile farmland and towns. The arrival of these settlers and the development of rural and urban areas in Manawatū brought many changes to Rangitāne o Manawatū and their rohe. As the region’s agricultural economy developed, settlers and speculators began purchasing land from Rangitāne o Manawatū. From the late nineteenth century private purchasing accounted for the alienation of the majority of the remaining land of Rangitāne o Manawatū.

2.64 Except to a limited extent at Puketotara, the Rangitāne o Manawatū reserves in the Te Ahuaturanga and Rangitikei-Manawatū blocks were too small and fragmented to sustain either traditional subsistence or modern agriculture. The four original Te Ahuaturanga reserves had been leased out by Rangitāne o Manawatū to generate income for hapū and whānau. On their wooded Hokowhitu reserve, Rangitāne o Manawatū had entered into a joint venture with a European sawmilling company. By 1900 these reserves had all been sold to private interests, along with most of the land that had been repurchased. Reasons given for selling the Hokowhitu reserve included the erosion of the block by the Manawatū River and to pay debts owed to the Crown on the Aorangi 3 block. The effect of these sales was to leave only a small area of land in Rangitāne o Manawatū ownership in the core of their traditional rohe.

2.65 During the 1880s and 1890s, the Native Land Court partitioned much of the land it awarded Rangitāne o Manawatū in the Aorangi and Taonui-Ahuaturanga blocks, into smaller blocks which were then sold by their owners. This included over 2,500 acres of Aorangi 3 which was located in the middle of the Taonui swamp, away from road and rail lines.

2.66 By 1900 over 10,000 acres in total, more than half of the remaining land held by Rangitāne o Manawatū had been alienated.

2.67 The Puketotara reserve (two blocks totalling 2,178 acres) remained intact until the early twentieth century. In 1876 Te Peeti Awe Awe and Hoani Meihana had title to Puketotara issued, under the Rangitikei-Manawatū Crown Grants Act 1873, to ten grantees who acted as trustees on behalf of 100 owners. This arrangement lasted until 1902 when a case was brought before the Native Land Court to establish ownership of the Puketotara reserves beyond the ten original grantees. As a result, in 1904 the number of owners to Puketotara was greatly expanded. Between 1908 and 1920 many of the new owners sought to partition out their individual interests, resulting in the Native Land Court ordering as many as 74 partitions. During the twentieth century most of the Puketotara reserve was sold.

2.68 Between 1900 and 1910 the number of private purchases fell dramatically. After 1910 this trend was reversed; over the next twenty years Rangitāne o Manawatū alienated, by way of private sales, 3,756 acres. By 1930 Rangitāne o Manawatū had been reduced to 2,903 acres. The remaining land was gradually eroded by further sales until the area of land owned by the iwi fell below 1,000 acres by 1990.

Conclusion

2.69 The Crown's purchases prior to 1866 left Rangitāne o Manawatū with very little land. Further Crown purchases and private sales of reserves left Rangitāne o Manawatū virtually landless by the early twentieth century. In spite of their social and economic marginalisation, Rangitāne o Manawatū have continued to contribute extensively to the cultural and economic development of Palmerston North and the Manawatū Region.

3. ACKNOWLEDGEMENTS AND APOLOGY

ACKNOWLEDGEMENTS

3.1 The Crown acknowledges that until now it has failed to address the longstanding grievances of Rangitāne o Manawatū in an appropriate way. The Crown hereby recognises the legitimacy of the historical grievances of Rangitāne o Manawatū and makes the following acknowledgements.

3.2 The Crown acknowledges that when it investigated the New Zealand Company claims in Manawatū in 1843-1844, it did not seek the views of Rangitāne o Manawatū about the transactions affecting their land.

3.3 The Crown acknowledges that between 1859 and 1866 it acquired most of the land in which Rangitāne o Manawatū held customary interests by purchasing over 500,000 acres in the Te Awahou, Te Ahuaturanga and Rangitikei-Manawatū blocks.

3.4 The Crown acknowledges that when it opened negotiations for the Te Ahuaturanga block, Rangitāne o Manawatū sought to have the boundaries of the block surveyed and the purchase conducted on a price per acre basis, but the Crown was only prepared to offer a lump sum payment for the land under negotiation.

3.5 The Crown acknowledges that:

3.5.1 in 1865 and 1866, after the sale of the Te Ahuaturanga block, it declined requests from Rangitāne o Manawatū to have sites they used and occupied, such as Raukawa Pā and Awapuni lagoon, included in their reserves;

3.5.2 between 1866 and 1873 Rangitāne o Manawatū re-purchased several hundred acres of Te Ahuaturanga land, including wāhi tapu and kāinga; and

3.5.3 when purchasing the Te Ahuaturanga block the Crown failed to adequately protect the interests of Rangitāne o Manawatū by ensuring that adequate reserves were set aside for Rangitāne o Manawatū and this failure was in breach of the Treaty of Waitangi and its principles.

3.6 The Crown acknowledges that:

3.6.1 it did not act on a proposal by Rangitāne o Manawatū in 1865 to add land from the Papaioea clearing to their reserve at Hokowhitu in exchange for their reserve at Te Wi;

3.6.2 in 1867 it purchased land from the Papaioea clearing for individuals from another iwi; and

3.6.3 this purchase has remained a considerable grievance for Rangitāne o Manawatū to the present day.

3.7 The Crown acknowledges that:

3.7.1 the manner in which it conducted its purchase of the Rangitikei-Manawatū block in 1866, including not defining reserves prior to the purchase deed being signed, gave rise to one of the deepest grievances of Rangitāne o Manawatū; and

3.7.2 Rangitāne o Manawatū repeatedly sought redress from the Crown following the sale for what Rangitāne o Manawatū considered an insufficient payment and the Crown's response to those requests failed to alleviate this major grievance for Rangitāne o Manawatū. In particular, reserves created by the Crown in response to Rangitāne o Manawatū protests did not fully encompass those areas Rangitāne o Manawatū wanted to retain. As a consequence, the Rangitikei-Manawatū purchase has remained a major source of bitterness for Rangitāne o Manawatū down the generations to the present day.

3.8 The Crown acknowledges that the operation and impact of the native land laws on the remaining lands of Rangitāne o Manawatū, in particular the awarding of land to individual Rangitāne o Manawatū rather than to iwi or hapū, made those lands more susceptible to partition, fragmentation, and alienation. This contributed to the erosion of the traditional tribal structures of Rangitāne o Manawatū. The Crown failed to take adequate steps to protect those structures and this was a breach of the Treaty of Waitangi and its principles.

3.9 The Crown acknowledges that:

3.9.1 by 1900 over half of the land still available to Rangitāne o Manawatū for their support and maintenance following the Te Ahuaturanga and Rangitikei- Manawatū purchases had been alienated, including much of their reserved land from those blocks;

3.9.2 by 1992 only a fraction of the former lands of Rangitāne o Manawatū remained in their ownership;

3.9.3 the cumulative effect of the Crown's acts and omissions, including the Te Ahuaturanga and Rangitikei-Manawatū purchases, the operation and impact of the native land laws, and private purchasing has left Rangitāne o Manawatū virtually landless; and

3.9.4 the Crown's failure to ensure that Rangitāne o Manawatū retained sufficient land for their present and future needs was a breach of the Treaty of Waitangi and its principles. This hindered the social, cultural and economic development of Rangitāne o Manawatū as an iwi.

3.10 The Crown acknowledges that its actions have undermined the ability of Rangitāne o Manawatū to access many of their traditional resources, including rivers, lakes, forests, and wetlands. The Crown also acknowledges that Rangitāne o Manawatū has lost control of many of their significant sites, including wāhi tapu that they wished to retain, and that this has had an ongoing impact on their physical and spiritual relationship with the land.

APOLOGY

3.11 The Crown recognises the struggles of the ancestors of Rangitāne o Manawatū in pursuit of redress and justice for the Crown's wrongs and makes this apology to Rangitāne o Manawatū, to their ancestors and to their descendants.

3.12 The Crown is deeply sorry that it has not always lived up to its obligations under the Treaty of Waitangi in its dealings with Rangitāne o Manawatū and unreservedly apologises to Rangitāne o Manawatū for its breaches of the Treaty of Waitangi and its principles.

3.13 The Crown sincerely apologises for the cumulative effect of its acts and omissions which left Rangitāne o Manawatū virtually landless. The Crown greatly regrets that on a number of occasions it failed to protect Rangitāne o Manawatū interests when purchasing land in their rohe. By 1866 Rangitāne o Manawatū had been alienated from many of their traditional kainga, taonga and wāhi tapu, and were left with insufficient reserves. Despite the efforts of Rangitāne o Manawatū to retain and reacquire these lands, many have been lost forever. The Crown is deeply remorseful about the lasting sense of grievance its acts and omissions have caused Rangitāne o Manawatū.

3.14 The Crown profoundly and deeply regrets that over the generations the Crown's breaches of the Treaty of Waitangi undermined the social and traditional structures of Rangitāne o Manawatū, and compromised the autonomy and ability of Rangitāne o Manawatū to exercise its customary rights and responsibilities.

3.15 The Crown deeply regrets its failure to appropriately acknowledge the mana and rangatiratanga of Rangitāne o Manawatū. Through this apology and by this settlement, the Crown seeks to atone for its wrongs and begin the process of healing. The Crown looks forward to re-establishing its relationship with Rangitāne o Manawatū based on mutual trust, co-operation, and respect for the Treaty of Waitangi and its principles.

7.B
RANGITĀNE O TAMAKI NUI Ā RUA DEED OF SETTLEMENT HISTORICAL CLAIMS

APPENDIX B

RANGITĀNE O TAMAKI NUI Ā RUA DEED OF SETTLEMENT HISTORICAL CLAIMS

2 HISTORICAL ACCOUNT

2.1 The Crown's acknowledgement and apology to Rangitāne o Wairarapa and Rangitāne o Tamaki nui-ā-Rua in part 3 are based on this historical account.

Rangitāne o Wairarapa, Rangitāne o Tamaki nui-ā-Rua

2.2 Rangitāne trace their descent from the explorers Kupe and Whātonga. Whātonga was a rangatira (chief) of the Kurahaupō waka and the grandfather of the eponymous ancestor Rangitāne. The traditional area of interest of Rangitāne spans the regions of both Wairarapa and Tamaki nui-ā-Rua.

2.3 Tamaki nui-ā-Rua comprises the old Seventy Mile Bush and the eastern or coastal area from Cape Turnagain to Mataikona (Castlepoint). The Wairarapa region comprises the area east of the Tararua Ranges and south of Tamaki nui-ā-Rua, to the southern coast at Palliser Bay and Cape Palliser. Together these regions comprise approximately 2.5 million acres.

'NGĀ PĀKEHĀ RĪHI WHENUA ME TE KĀWANA': THE LEASEHOLD ECONOMY AND CROWN PURCHASING PRE-1865

2.4 In the early to mid-1840s, Wairarapa Māori experienced the Crown's authority mostly sporadically and indirectly. In May 1845, a group of Wairarapa Māori appeared in the Hutt Valley in support of other Māori groups who were in dispute with the Crown over land issues. Governor Grey's 1846 declaration of martial law in response to these Hutt Valley tensions applied south of a line between Wainui and Castlepoint. The reverberations of this conflict were felt in Wairarapa. When Māori groups in conflict with the Crown appeared in Wairarapa they were opposed by Wairarapa Māori, while some settlers were said to have taken refuge in Māori communities.

The early leasehold economy

2.5 Wairarapa Māori welcomed Pākehā settlers to the region from the mid-1840s, leasing them large 'runs' to graze stock in return for annual rentals. Important relationships developed between Pākehā runholders and rangatira including Te Korou at Kaikōkirikiri (Masterton) and Te Pōtangaroa at Mataikona (north of Castlepoint).

2.6 The Crown opposed this emerging leasehold economy, insisting on its pre-emptive right of purchase under the Treaty. It intended to purchase Māori land at low prices, for on-sale to settlers at a profit, with proceeds from sale ('the Land Fund') being used to help pay for government administration, economic infrastructure, and immigration. It is not clear that Wairarapa Māori understood Crown pre-emption as disallowing all direct Māori-settler land transactions, such as leases.

2.7 The Native Land Purchase Ordinance 1846 reaffirmed the Crown's view of pre-emption. The Ordinance stipulated that all direct land dealings between Māori and settler were illegal, including leases, except where a license from the Government was obtained. The Ordinance authorised the prosecution of settlers who contravened its provisions. Notwithstanding this, the number of lease arrangements in the Wairarapa continued to grow through the second half of the 1840s.

2.8 In 1847, Governor Grey wrote to Wairarapa rangatira stating that the Crown wished them to sell their land, promising 'ample reserves' if they did so. Grey warned that if they did not sell the Crown would intervene to end leasing and cause the Pākehā leaseholders to leave the Wairarapa district.

2.9 With the Crown's support, the New Zealand Company made several purchase attempts in the period 1847 to 1849. Purchase agents recorded how they maintained 'constant pressure' on chiefs to induce them to sell, including emphasising the benefits of organised settlement and the government's power to remove the squatters and deprive Māori of their rents. Government gazettes issued in October 1847 and October 1848 formally reiterated the threat of prosecution of settlers – the latter with specific reference to the Wairarapa purchase negotiations.

2.10 Wairarapa Māori were divided on whether to sell. Some sought to retain their lands and maintain the leasehold arrangements while others were prepared to sell. In November 1848, a New Zealand Company official noted that at a meeting at Otaraia the view was expressed strongly that 'they had held the land; and would do so still. It had belonged to their forefathers, and was theirs now: the land was in fact their great parent, to surrender whom would be death to themselves and their children … [they said] the white man could occupy land as the squatters were now doing, without buying it'. In 1849, Rangitāne at Kaikōkirikiri (Masterton area) protested against the Government's clampdown on leasing. These 1840s purchase attempts were ultimately unsuccessful.

2.11 In the early 1850s, the Crown's land purchase agent in Wairarapa and Tamaki nui-ā-Rua, Donald McLean took steps to prevent the spread of leasing by threatening the use of the Ordinance in a few instances where Pākehā were in the process of taking up new runs. He directed a recent arrival in the Castlepoint area to abandon the land and may have encouraged rents to be withheld from Māori in another case.

2.12 Generally, however, the Crown did not intend to move existing runholders off their leased land, but instead sought their support for Crown purchase plans. The Crown assured settlers that they would be able to obtain secure possession of their runs once the Crown had purchased the land from Māori. At the same time Wairarapa Māori were told that they must sell as the leasehold system was coming to an end. In doing so the Crown limited Māori ability to choose the terms of their own economic development. Governor Grey at one time considered the formal regulation of leasing but eventually decided, in part based on instructions from England, to pursue a Crown purchase policy of acquiring large areas at low prices and reserving areas for Māori.

2.13 Many Wairarapa Māori leaders, however, wished to retain the leasehold system as it enabled them to earn a regular income from rentals and trade and still remain owners of the land. By the early 1850s, Wairarapa Māori were receiving approximately £1,200 in total rentals per annum for an area estimated at between 300,000 and 400,000 acres. The Crown's purchase agent estimated that Māori trade with the settlers 'must be very considerable, if not quite equal to the rents they are receiving'. Rangitāne had also made lease commitments to settlers that they felt honour-bound to uphold.

2.14 In 1851, McLean rode through Wairarapa with satchels full of Crown sovereigns, on his way to negotiate purchases in Hawke's Bay province. He met with Wairarapa leaders and it was later said that he showed the coins to those interested. Crown representatives, including McLean, considered that by purchasing in Hawke's Bay the

Government might encourage Wairarapa runholders to move there, leaving the Wairarapa squatter-free and Māori more inclined to sell.

2.15 McLean also used the Hawke's Bay purchases, especially Waipukurau, to cultivate relationships with a leading rangatira of another iwi who he hoped would assist the Crown's efforts to purchase Wairarapa land. McLean proposed to this rangatira that Wairarapa chiefs, including Te Pōtangaroa, should receive some of the purchase price for the Waipukurau block. The rangatira agreed, paying them £100, 'in satisfaction of all their claims to this block', McLean recorded. He wrote further that this 'pleased the two chiefs very much, and I have no doubt that it will have a favourable effect in reference to the sale of their land. They are both sensible men.' Neither of the Wairarapa chiefs signed the Waipukurau sale deed.

Castlepoint and the komiti nui

2.16 In 1852, Te Pōtangaroa and others corresponded with the Crown about sales of Castlepoint and other Wairarapa land. In March 1853, Govenor Grey discussed a Castlepoint or Whakataki purchase with Wairarapa Māori while travelling through the Wairarapa.

2.17 In June 1853, McLean concluded the Castlepoint purchase with Wairarapa and Tamaki nui-ā-Rua rangatira during a large public hui. Three-hundred people signed the deed, including a significant number of woman and some children. Before the hui, a sketch plan of the block was prepared and boundaries were described. The Crown paid £2,500 for a block estimated at the time to be 275,000 acres but later found to be closer to 485,000 acres.

2.18 The Crown and rangatira agreed to reserve a number of areas for Māori in the Castlepoint block. The reserves, 10 in number, ranged from 5 acres to over 17,500 acres in size, covering a total area of approximately 28,000 acres, or approximately 10 percent of the estimated purchase area. The extent of reserves made in Castlepoint was large in comparison with reserves agreed in later purchases.

2.19 In August 1853, Governor Grey and Donald McLean convened a large assembly or 'komiti nui' of Wairarapa rangatira, at Tūranganui in southern Wairarapa, in a further effort to persuade Wairarapa Māori to sell their lands to the Crown. Evidence suggests that Grey personally emphasised the benefits flowing from sale to the Crown, including Pākehā settlement and trade, and repeated his longstanding promise of ample reserves for Māori, these associated benefits being 'the real payment' for land sales. Grey's status probably meant that Rangitāne and other Wairarapa Māori had very high levels of faith in Grey's promises and expected the Crown to act honourably to meet these commitments. Clauses in a number of purchase deeds of southern Wairarapa land immediately following the komiti nui made financial provision for schools, medical services, annuities for chiefs, and other kinds of ongoing benefits. These 'five percent' or 'koha' clauses were most likely held out by Grey at the komiti nui as additional inducements to sell land.

2.20 Grey reported following the meeting that the Wairarapa rangatira 'eventually' consented, indicating the persuasion required to obtain their agreement to Crown purchase.

2.21 Within six months of the komiti nui, McLean and other Crown agents acquired a further 1 million acres through around 40 individual purchases. Together with Castlepoint, the Crown's purchases comprised an estimated three-fifths of Wairarapa and Tamaki nui-ā-Rua, approximately 1,500,000 acres, acquired within the space of 8 months.

2.22 While some rangatira were willing to negotiate with McLean, Ngātuere was reported to be fighting hard to persuade others not to sell their land and McLean noted that it was only 'after a very obstinate persistence on the part of Ngātuere and his followers' that he 'at last succeeded in getting a very fair block of land'.

2.23 The Crown paid a total of £23,500 for these purchases. This may have been equivalent to about 10-15 years income from leases and trade under the leasehold economy. Rangitāne had been reluctant to sell because of these benefits.

Crown purchase process

2.24 In the 1853-54 purchases following the komiti nui, the Crown negotiated purchases quickly and often relied on descriptions of boundaries and sketch plans without the boundaries of the block having been walked and marked out. In some cases, the Crown began surveying the new Wairarapa towns for Pākehā settlement before any surveying of the surrounding purchases from Māori. Only in 1871 did the Wellington Chief Surveyor compile all the 1853-54 Crown purchases in map form. At the time the purchases were conducted, the lack of surveys or clear visual representations of the blocks sold made it difficult for Rangitāne and other Wairarapa Māori to grasp easily the total picture of lands sold and retained.

2.25 Following the Castlepoint purchase and the komiti nui, the Crown generally conducted purchases with smaller groups of vendors. A number of rangatira appeared in multiple deeds. The Crown in some instances appears to have granted reserves to individual rangatira to secure their agreement to Crown purchase. A number of 'deed receipts' were signed alongside or instead of actual purchase deeds. In the case of the Manawatū block purchase in 1853, McLean first paid a number of people, including Rangitāne chief Wī Waaka, under a receipt in October 1853, and then entered into a purchase deed a couple of months later with a largely different group of people. As part of this second transaction in December 1853, Wī Waaka managed to secure a 1,000 acre reserve.

2.26 In January 1854, at Wellington, the Crown negotiated a purchase deed for the Tautāne block of approximately 92,000 acres, located north of Castlepoint and south of Porangahau. Thirty-two Māori signed the deed. A number of owners were not present at the negotiations, including the rangatira Hēnare Matua from the Tautāne area. On learning of the transaction, Matua and some resident owners opposed it vigorously. The rangatira Te Rōpiha threatened to 'cut off the noses' of the selling chiefs.

2.27 Hēnare Matua and other non-sellers came under pressure to accept the purchase as the Crown viewed the initial purchase deed as binding, despite the deed negotiations not including rights holders such as Matua. In March 1858, four years after the first Tautāne transaction, the Crown secured the signature of Matua and 89 others to a second deed of sale for the block. The deed provided for two reserves comprising a total of 1,050 acres. In 1867 Hēnare Matua and Hoera Rautu received a Crown grant for these reserves.

2.28 On 22 April 1858, the Crown paid £100 to Rangitāne chiefs for the Ngaawapurua block estimated at 100,000 acres, located approximately east and south of the Manawatū Gorge, in the southern part of Seventy Mile Bush. Te Hirawanu Kaimokopuna, a Rangitāne rangatira prominent on both the eastern and western sides of the Manawatū Gorge, and other Rangitāne people resident at Pahiatua, opposed the sale of the Ngaawapurua land. Te Hirawanu protested that a leading western Rangitāne chief had sold Ngaawapurua despite the opposition of residents. Te Hirawanu did not object to sale at a future point and expressed interest in selling his interests in land west of the Ruahine ranges (or west of the Manawatū Gorge), land that was later included in the 1864 Te Ahuaturanga purchase.

2.29 In 1858 the Crown made a further payment of £25 towards purchase of the Ngaawapurua block, but acknowledged that, because of the numerous claims to the block, it would take some time to finalise the purchase. Negotiations for the Ngaawapurua area did not resume until the late 1860s, when the Crown renewed efforts to purchase the Seventy Mile Bush.

2.30 In October 1859, at Mataikona (Castlepoint), Donald McLean arranged a deed of sale for the Makuri block after what he described as a large meeting. The Makuri land sat on the opposite side of the Puketoi range, and some 30 kilometres, from the signing location at Mataikona.

2.31 Leading rangatira of coastal Wairarapa and Tamaki nui-ā-Rua signed the October 1859 deed at Mataikona, including Te Pōtangaroa, Hēnare Matua and Hoera Rautu. Te Hirawanu Kaimokopuna was apparently not present and did not sign. The map on the sale deed had Te Hirawanu's name shown to the west of the Makuri block.

2.32 In 1871, the Crown included the Makuri block nominally in its wider purchase of the Tamaki blocks, renaming the Makuri block Puketoi numbers 4 and 5. In 1874, the Crown made a final payment to settle an old claim to Puketoi numbers 4 and 5. Apart from this payment, it did not pay any further sums for the Makuri area.

2.33 Rangitāne complained on various occasions about the purchase prices they were paid for their lands by the Crown. One official commented in 1861 that Wairarapa Māori considered 'they must take the price offered by Government or they cannot sell'. In 1870, it was complained that in the early Crown purchases Mr McLean 'invariably fixed the price for each block and not the sellers'. Rangitāne were also aware that their lands were on-sold by the Crown at a significant 'mark-up'. The Crown used the profits from on-sale (the Land Fund) to finance infrastructure and settlement. In 1853, Donald McLean commented that he had acquired a block from Wairarapa Māori 'at a wonderfully cheap rate'. McLean paid £100, and then expected to sell the land to the existing Pākehā runholder at the standard rate of 10 shillings per acre, leaving the Crown with a £300 profit.

The koha or five percents

2.34 The Crown agreed to 'koha' or five percent clauses in a number of purchase deeds it negotiated with Rangitāne rangatira between August 1853 and January 1854. The first Wairarapa deed to contain a five percent clause (for Turakirae, or the west side of Lake Wairarapa) provided that the Crown was to collect five percent of the proceeds from on-selling the land, which it would then 'pay' to the Māori vendors 'for the forming of schools to teach our children, for construction of flour mills for us, for the construction of

Hospitals and for Medical attendance for us, and also for certain annuities to be paid to us for certain of our Chiefs…'.

2.35 The Turakirae deed stipulated further that all expenditure on schools, hospitals, and mills was to be discussed by Māori and Crown representatives in committee, while the Governor alone was to determine payments to individual chiefs. The Māori text of the koha clause in some deeds simply provided that the koha of the block would be paid to or arranged for the Māori vendors.

2.36 The Crown did not set up a committee to consult Māori about expenditure or to jointly manage the fund with them. Crown officials faced difficulties administering the fund. One official noted, for example, that payments were often made without being tagged to a particular block. The fund diminished over time as sales slowed and fund monies were paid out.

2.37 In 1870, 1873, and 1881, the Crown conducted public hui as a means to make distributions of the accumulated funds. Māori sometimes requested full accounts detailing the land sold, monies received by the Crown, and sums advanced from the fund. Some accounts were eventually provided but may not have satisfied the beneficiaries' requests. Specific infrastructure projects including a school at Pāpāwai and the operation of Crown-provided mills did not yield great benefit for Wairarapa Māori.

2.38 At various times, Rangitāne questioned the extent or lack of benefits received from the koha fund. Following the February 1881 distribution hui, Erihapeti Whakamairū (the sister of Rangitāne leader Karaitiana Te Korou) wrote to Native Minister Rolleston about the five percents on her lands at Mākōura (near Masterton). She complained about unsatisfactory services provided by the Government's medical doctor and spoke of 'discontent' due to the promised schools, churches, hospitals and flour mills not being established.

2.39 Other evidence suggests some Rangitāne understood the koha fund as perpetual. In 1886, Rangitāne rangatira Wī Waaka Kahukura and others wrote from Te Oreore (Masterton) inquiring why koha on their land had only been paid twice even though Donald McLean had said that koha 'will be continually paid to you for ever and ever'. Rangitāne leaders, Huru Te Hiaro, Nireaha Tamaki and Marakaia Tawaroa, also wrote in 1886 requesting further koha payments.

2.40 However after 1881 the fund received minimal amounts from Crown land sales. By 1899, the approximately £250 remaining in the koha fund was paid out.

Reserves from pre-1865 Crown purchases

Adequacy of pre-1865 reserves

2.41 Following the 1853 komiti nui, it is probable that Rangitāne expected 'ample reserves' to be set aside out of the Crown's early purchases. Providing sufficient reserves for the present and future needs of Māori was an important part of the Crown's policy, shaped by Governor Grey, to purchase large areas of Māori land at nominal prices. Crown representatives realised that if Māori land was to subsidise the Crown's Land Fund and organised Pākehā settlement, it was reasonable for Māori to obtain 'advantages fully equal' to those they had lost in relinquishing ownership of large areas of land.

2.42 Approximately 100 reserves were associated with pre-1865 Crown purchases. These reserves comprised approximately 62,500 acres, being about 4 percent of the total pre-1865 Crown purchases of 1,500,000 acres. McLean sought to limit the extent of reserves. In his 1853 instructions to a surveyor, McLean stated that he believed local Māori would demand 'extravagant reserves at Ōpaki, Mākoura, Kō[h]angawareware and other plains within the valley', near Masterton. He instructed that it was 'necessary to confer with me before acceding to any beyond what you may consider essential for their welfare'.

2.43 Rangitāne do not consider that these reserve arrangements adequately reflected the promise of 'ample reserves' especially as the Crown pursued an ongoing policy of actively seeking to purchase remaining Rangitāne lands after 1865. In 1870, the total estimated Wairarapa Māori population was 850 men, women and children, while the estimated Tamaki nui-ā-Rua population was several hundred. Regardless of the population size at this period, Rangitāne consider that reserves comprising only 4 percent of the overall pre-1865 Crown purchases were unlikely to be sufficient for the present and future needs of Rangitāne communities.

Delays in Surveying and Crown grants of reserves

2.44 Of the approximately 100 reserves associated with the Crown's pre-1865 purchases, of which about 90 were referred to directly in deeds of purchase, the Crown purchased approximately 14 reserves before they had been surveyed and granted. Most of these purchases were made within a few years of the original Crown purchase. By 1855, for example, McLean had purchased four of the Castlepoint reserves, Porotāwhao, Puketewai, Taurangawaiō (near Akitio) and Whakataki (with the last including a right of repurchase).

2.45 By 1858, disputes had arisen over boundaries of purchase blocks and reserves which had not been surveyed on the ground at purchase. A thorough surveying process for the early purchases of 1853-54 only began in 1859.

2.46 In 1860, during the Kohimarama conference in Auckland, the prominent rangatira Ngātuere wrote to the Governor requesting that McLean settle grievances over reserves. Leading Rangitāne rangatira, Karaitiana Te Korou and Wīremu Waaka, also wrote to the Governor and complained that Crown Grants had not been issued for their reserves. Additionally, in many instances the Crown did not prioritise the survey of areas reserved in purchase deeds. This had resulted in the Crown selling some areas to settlers before they were created or defined on the ground for Māori.

2.47 The complaints of Te Korou and Wī Waaka reflect an expectation on the part of many leading Wairarapa chiefs that reserves would be formalised or protected by survey and Crown Grant. It is probable that this expectation was based on discussions had with Grey and McLean during the komiti nui and purchase negotiations. A number of rangatira negotiated individual reserves that were recorded in purchase deeds. In fact, out of a total of approximately 100 reserves from pre-1865 Crown purchases, the Crown made about 24 grants under the Crown Grants Act 1862, mostly to individual rangatira. Most of these grants were not made until 1863 and 1864, some 10 years after the original Crown purchase in many cases.

2.48 Other evidence suggests a more widespread concern among Wairarapa Māori about obtaining Crown granted titles to portions of land they had previously sold. In at least 17 instances, Wairarapa Māori individuals purchased back portions of the wider Crown purchase block. In these cases, Māori usually purchased back the land at the going rate for purchase of Crown land, a price many times greater than the Crown had paid them for the wider block (a difference that reflected the Crown's Land Fund policy). Many of these 17 sections had been sold on the open market to Pākehā settlers by 1900.

2.49 In 1855, the Crown purchased the Whakataki reserve, one of 10 reserves provided for in the Castlepoint purchase. The 1855 purchase deed included an express clause allowing Māori to repurchase the land within a two year period. The deed recorded that the sale and right of re-purchase was intended, 'kia whakamutua nga ritenga maori mo runga i taua whenua', translated as, 'to put an end to our native customs relative to that piece of land'. In about 1858, some resident hapū members did re-purchase a small section of Whakataki.

2.50 In 1874, the Crown introduced legislation – the Whakataki Grants Act 1874 – to confirm grants totalling 6,620 acres more or less to various individuals and hapū in the Whakataki reserves. In the meantime, the Crown sold a desirable portion (85 acres) of the reserve adjoining the Whakataki river to a settler. In 1874 the Crown paid an additional sum to settle a boundary dispute concerning the Whakataki block (possibly relating to the area sold to the settler). Under the 1874 legislation, the Crown gifted back the largest of the reserve blocks, no. 10, of 6,298 acres on the basis of a promise made by the Wellington provincial superintendent that the reserve be given back 'for the support and maintenance' of the original owners. In 1881, the Crown finally issued grants for 6,620 acres of reserves, 28 years after the original Castlepoint transaction had reserved the land.

2.51 When the Native Reserves Commissioner visited the Wairarapa in 1879, a number of Māori complained about 'lost' reserves. In 1881, a Royal Commission held meetings in Masterton over a two-to-three week period to investigate Wairarapa native reserves. The Commission listed about 90 reserves made out of pre-1865 Crown purchases. It tallied 10 of these reserves as sold to the Crown, eight as missing (or possibly set aside elsewhere), and three fishing reserves as remaining undefined.

2.52 The Crown, in response to reserve issues in Wairarapa and other regions, introduced legislation that became the Native Reserves' Titles Grant Empowering Act 1886, enacted primarily to complete the granting of legal title to Māori for a number of Crown purchase reserves from the pre-1865 period. The Act empowered the Governor to execute warrants for the issuing of titles and to impose restrictions on alienation. Approximately 30 reserves in Wairarapa and Tamaki nui-ā-Rua, about a third of all pre-1865 purchase reserves in the region, were awarded title under the Act.

2.53 In the three decades between the reserves being made in Crown purchase deeds and titles being granted under the 1886 Act, reserves had been left unprotected and some had been sold to settlers. The 1881-82 Royal Commission found that the Takapūai reserve had never been surveyed and that Pākehā settlers had occupied the area where it should have been. In the 1890s various Māori applied for succession orders in the Native Land Court, but there was no reserve to succeed to. Eventually the Crown provided substitute land on the Waihoki stream (Aohanga blk 5, sec 7), as opposed to the original location on the Mataikona river. Title for 150 acres was finally issued in 1910 to the individuals identified by the 1882 Royal Commission.

2.54 The commission also reported that the fishing reserve at Waimīmiha, a reserve in the 1853 Castlepoint transaction, had never been surveyed. Although descendants of the Māori owners petitioned several times in the early 1900s for a larger area, various parliamentary and Crown departmental investigations concluded that only a small fishing place was intended. This was eventually surveyed in 1907 at less than an acre. Another Castlepoint reserve, Waitutu, was never surveyed and was probably included in land on-sold to settlers.

2.55 The Crown did not survey or define on the ground a reserve known as Whatakai, reserved in the 1853 Whareama south (no. 2) purchase. The Crown sold this piece of land to a settler around 1861. In 1875, the Crown paid the Māori owners £150 in compensation for this lost reserve. Cultivations reserved at Mangapiu in the Whareamu south purchase were eventually awarded under the 1886 Act and provided for in the adjoining Waikaraka block reserve also known as Mangapiu. Another reserve in the Whareama south purchase, Te Ruru, does not appear to have ever been surveyed.

2.56 About 28 reserves remained as Māori customary land until Wairarapa and Tamaki nui-ā-Rua Māori obtained title to these areas under general native land legislation after 1865. Some of these were granted in the 1860s, while others received legal title in the 1880s and some as late as the early twentieth century. These titles were mostly awarded under the ten-owner system or to a few individual owners.

Alienation of pre-1865 reserves

2.57 By 1930, 29 percent of the large Whakataki no. 10 block reserve at Castlepoint remained in Māori ownership. Today, only 4.5 acres is recorded as Māori land. Of all the Whakataki reserve blocks totalling some 6,620 acres in 1874, only about 92 acres (1.3 percent) remains today.

2.58 Of the other nine Castlepoint reserves, four were permanently alienated by 1900, three of those in 1855 and the Ngātāhuna reserve of 1,552 acres by 1881. Of the remaining five, two were very small (less than 10 acres). Only Mataikona, comprising 17,768 acres, remained almost entirely intact and is now incorporated as the Aohanga Incorporation.

2.59 By 1900, about a third of the pre-1865 purchase reserves had been sold, leaving just 3 percent of the entire Crown purchase area reserved for Māori, about 44,000 acres. Today, approximately 22,000 acres are retained, about 1.5 percent of the total Crown purchase area. The bulk of this area is concentrated at Aohanga (17,684 acres) and the other 4,500 acres scattered over the wider region.

'TE TAPERE-NUI-O-WHĀTONGA': NATIVE LAND COURT AND 70 MILE BUSH TRANSACTIONS

The Court and the native land laws

2.60 In 1862 and 1865 the Crown promoted legislation that established the Native Land Court. The Court was to determine the owners of Māori land, effectively converting customary ownership of land into individualised legal titles derived from the Crown. The Crown's pre-emptive right of land purchase was also set aside, enabling Māori to lease and sell their lands to private parties.

2.61 The Native Lands Acts introduced a significant change to the native land tenure system at a time when there was no direct Māori representation in parliament. In particular, land rights under customary tenure were generally communal but the legislation gave ownership rights to individuals, including the legal right to sell without reference to the community.

2.62 In addition, the Native Lands Act 1865 provided that a certificate of title could be ordered to no more than 10 persons. This became known as the 'ten-owner rule'. It also provided that a tribal title could be awarded in blocks of over 5,000 acres, however in practice the Court awarded title to ten or fewer owners regardless of the size of the block. One effect of the ten-owner rule, therefore, was to exclude many customary owners from legal title to blocks. It was expected in many cases that the named owners would act as representatives for the wider community, however they were under no legal obligation to do so.

2.63 An 1867 amendment to the land laws enabled the Court to register all interested parties on certificates of title, however in practice this provision was little utilized. There was no effective collective title option for Māori until the 1894 Native Land Court Act, which provided for the incorporation of owners.

2.64 The Otawhake or Kopuaranga reserve of 259 acres at Opaki was created out of the December 1853 Manawatū block purchase. The reserve contained cultivations and urupā of the Hāmua hapū, and 20-30 people resided on the land. In 1873 it was sold by the sole owner named in the Crown Grant. The Trust Commissioner operating under the Native Lands Frauds Prevention Act 1870, Charles Heaphy, on discovering that the reserve was intended for the hapū initially refused to endorse the sale. Heaphy had some doubts about his authority to do this but said that 'I felt that even if I exceeded my legal power, it was necessary to arrest, decisively, the consummation of an act of improvidence and injustice.' However, since there was only one name on the title document, that owner had the legal right to sell. Heaphy was obliged to endorse the sale to the private buyer, which he did in September 1874.

2.65 Wairarapa and Tamaki nui-ā-Rua Māori sent several petitions to Parliament in the 1870s. The petitions called for abolition of the Court or major reform of the land laws, and sought more authority for Māori communities to decide their own land questions. They canvassed other pressing issues, including the costs of survey, court fees, grant fees, and lawyers and interpreters' fees; and the lack of attention to creating proper reserves for the ongoing occupation and livelihood of Māori owners.

2.66 Survey and court charges involved in securing title through the Native Land Court could be considerable. Some owners may have been left with little option but to sell land to repay these costs. In addition to these direct costs were the indirect costs of attending court sittings sometimes over extended periods, costs which could include accommodation and food costs and loss of income while attending court. In addition, once an application was made to the Court, non-applicant parties with interests in land blocks could feel compelled to attend court to protect their interests even though they were opposed to the application being made in the first place.

2.67 In the case of the Okurupatu block, adjacent to the Te Oreore block north of Masterton, various Ngāti Hāmua hapū contested the block's ownership in the Court. Court costs were incurred over several rounds of protracted hearings, rehearings and appeals. Survey charges were significant, at least £490 over the period 1881 to 1895.

Accommodation and food costs increased with the repeated hearings. Additional expenses were incurred from travel to Wellington to petition authorities. Rangitāne customary owners also incurred considerable costs in the title process for the Ākura and Kopuāranga blocks. Owners sometimes used their interests as security for debts – mostly survey costs – and this could lead to sale of portions of blocks (as in the case of the Ākura block). In other instances, settlers advanced money to cover survey and court costs on the understanding that they would receive formal leases once titles had been obtained.

2.68 The succession rules for native land (applying on the death of an owner) resulted in blocks with an ever-increasing number of owners. Over time, larger blocks were also partitioned to facilitate sales. At the same time, blocks in multiple ownership often made it difficult for owners to access capital or loans for land development.

2.69 Te Oreore block (Masterton) illustrates the problem of title fragmentation. Originally subdivided into four blocks during an 1869 title investigation, the largest of the subdivisions, Te Oreore no. 3 of 460 acres, was awarded to ten owners of Hāmua descent, including Karaitiana Te Korou, without restrictions on alienation. Over the next 30 years, individual interests were partitioned out of the no. 3 block and sold. By 1900 only a tenth of the original block remained in Rangitāne ownership. The land remaining in Te Oreore no. 3 today consists of small blocks of marae reserves and urupā, and long thin 'bowstring' blocks. The largest block is just under 20 acres and the smallest 0.1 acres. The effect of many partitions and subdivisions over time is evident from blocks such as Te Oreore 2C Sec 3 (48.87 acres, 35 owners), and Te Oreore 1E1B No 2 (10.43 acres, 48 owners).

Purchasing 'Tamaki' or the northern Bush

2.70 In mid-1868, the Crown renewed efforts to acquire the Seventy Mile Bush, conducting a large hui at Waipawa in southern Hawke's Bay. At the hui, it was agreed to sell an area of land between 'Te Ruataniwha and Wairarapa' and a survey of the land commenced but was not completed.

2.71 Between 1868 and 1871, the Crown made small advance payments to various rangatira it considered had interests in the Bush. The Crown conducted negotiations at Napier, Waipawa and Waipukurau, some distance north of the Bush. The advances it paid facilitated initial surveys, in anticipation of the Native Land Court determining the title.

2.72 By April 1870, the Crown secured agreements to purchase three large areas described as Te Ahuaturanga, Maharahara and Puketoi, comprising the bulk of the northern Bush. Rangitāne rangatira Hohepa Paewai, Manahi Paewai, Huru Te Hiaro, Nireaha Matiu (Tamaki), and Wirihana Kaimokopuna were among the signatories to these agreements. They agreed to apply to the Native Land Court for title to this land and to afterwards sign a deed conveying the land to the Crown.

2.73 In April 1870, the Crown purchase agent reported to Donald McLean that local Māori had applied to the Court for the 'whole of the Manawatū bush from Ruataniwha to Wairarapa'.

2.74 Some Tamaki nui-ā-Rua rangatira opposed the Crown's purchasing activity. In August 1870, a Crown purchase agent reported that 'Hēnare [Matua], Nopera, Paora, Hakara, old Āperahama [Rautahi] and others are the staunch opponents. The Rangitāne, Huru [Te Hiaro], Hohepa [Paewai] and others are as firm for the sale as ever and it is admitted they are the principal owners'. The Crown agent also commented on the emergence of 'a deep seated scheme… for making the Māori more united in their actions against the encroachment of the Europeans'. In this regard he thought 'Hēnare Matua is ambitious of being chosen as leader', adding 'Hēnare admits he has no claims [in the Seventy Mile Bush] but shall oppose all he can'. Despite this statement, Matua had been awarded an interest in the Mangatoro block – in the north-east part of the Bush – in an 1867 land court hearing. A meeting at Waipukurau also revealed that all the Porangahau Māori present opposed the sale of the Bush.

2.75 In early September 1870, the Crown convened another large hui at Waipawa to discuss the ownership and sale of the Tamaki area. The Crown purchase agent told those at the hui that the Crown wanted to open up the land for settlement, but that Māori should also hold on to large areas for themselves and their children for the future. Disagreements between Māori parties at the hui appear to have been mostly over who had rights to the land.

2.76 The Native Land Court began hearing the Seventy Mile Bush applications on 8 September 1870, at Waipawa. The Crown purchase agent produced for the Court a map of what he called 'the Manawatū Ngāherehere' application, apparently for the whole of Seventy Mile Bush. He informed the Court that 'on behalf of the applicants the whole of the portion surveyed was conducted under my direction'. The Crown surveyor gave evidence that he had met with some 'small' opposition to the survey from Āperahama Rautahi. He also stated that he 'did not complete the survey' but that a 'Crown Grant could be made from this plan, it would not require to go on the ground to separate the plans'.

2.77 On 10 and 11 September 1870, the Native Land Court awarded 17 northern Bush blocks to ten or fewer people under the Native Land Act 1865. Many other interested persons were referred to in evidence. Restrictions on alienation applied to two of the 17 blocks, Tamaki and Piripiri. Most of the awards were made to claimants affiliating as Rangitāne, including leading rangatira Huru Te Hiaro, Hōhepa Paewai, Te Wirihana Kaimokopuna (a nephew of Te Hirawanu Kaimokopuna), Nireaha Matiu (or Tamaki), and Karaitiana Te Korou.

2.78 The Crown set about finalising the purchase after the Court awarded title. The purchase price had been left unsettled until after the Court process had concluded. When negotiations recommenced, a group led by Hōhepa Paewai opposed sale for under £30,000. In April 1871, a receipt for £1300 of advances against sale of the northern Bush blocks and for survey, court and other expenses was signed by Karaitiana Takamoana and 23 other owners. An agreement to sell the northern Bush was signed on 1 June 1871 by 12 leading chiefs, including Takamoana, Hōhepa Paewai and Wirihana Kaimokopuna. The sale price was £16,000.

2.79 In August 1871, the Crown convened a public hui regarding sale of the northern Bush. On 16 August, the Crown secured signatures to a purchase deed for the 'Tamaki'. Thirty-nine signatures of named owners were obtained on 16 August, with others collected over the following weeks, and a few final signatures not obtained until 1881-1882. For a total price of £16,000, approximately 250,000 acres were conveyed, comprising 12 blocks whose ownership had been determined by the Native Land Court in 1870, namely: Puketoi no. 1 (37,000a), Puketoi no. 2 (28,500a), Puketoi no. 3

(33,400a), Puketoi no. 4 (31,000a), Puketoi no. 5 (15,500a), Te Ahuaturanga (21,000a), Māharahara (13,000a), Manawatū no. 1 or Umutaoroa (17,000a), Manawatū no. 3 or Te Ohu (20,600a), Manawatū no. 5 or Ngamoko (15,000a), Manawatū no. 6 or Tuatua (9,600a), and Manawatū no. 7 or Rakaiatai (8,200a).

2.80 A total of approximately 19,870 acres, were 'for ever' reserved from the northern Bush purchase area. These reserves were portions of Umutaoroa (4000a), Te Ohu (13,000a), Manawatū no. 6 (1370a), a 1000 acre reserve near Ngaawapurua in the Ahuaturanga block, and a 500 acre reserve ('Te Rotoahiri'), also in the Ahuaturanga block.

2.81 Several large blocks were not included in the 1871 Tamaki purchase, including five blocks, Tahoraiti, Kaitoki, Mangatoro, Otawhao and Oringi Waiaruhe, estimated 65,555 acres total area, that had ownership determined between 1867 and 1869. The Tamaki and Piripiri blocks, and the Manawatū number 4 and 8 blocks, whose ownership was determined by the 1870 Waipawa court, were also retained by Tamaki nui-ā-Rua Māori.

2.82 The northern Bush deed noted that £12,000 of the purchase money had been paid on the signing day, with 'the balance to be paid when the reserves are marked out and the purchase finally completed'. The Crown intended to use the remaining £4000 to induce a few 'dissentients' to accept the sale and encourage the sellers to put pressure on them. Reports a few days before the deed was signed suggested the main dissentients were from 'the Porangahau people', those connected with Hēnare Matua, who had earlier opposed sale. The Crown paid the final instalment of £4000 in December 1873.

2.83 In November 1874, Donald McLean paid £500 to rangatira of another iwi to extinguish their claims on the Tamaki block.

Persuading the 'non-sellers'

2.84 In 1870 and 1871, some Tamaki Māori of Rangitāne descent protested about the Court and sale process regarding the northern Bush, concerned that detailed surveys were not carried out on the ground, that some owners did not consent to sale, and that proper restrictions on alienation were not imposed on reserved blocks. A few complainants wanted a second investigation by the Native Land Court.

2.85 Some owners in the northern Bush blocks resisted putting their names to the 1871 sale deed. In 1877, four blocks awaited signatures: one signature for Maharahara, one for Te Ohu (Manawatū no. 3), four signatures at Rakaiatai (Manawatū no. 7), and one signature at Umutaoroa (Manawatū no. 1). In the 1880s, the Crown instructed agents to acquire final signatures, initially paying them £1 per day and £10 per signature, and later, £20 per signature.

2.86 In 1881, the Crown obtained the final signature in Maharahara. In 1882, the interests of Hōri Ropiha and the three other owners at Raikaiatai were partitioned out to enable the Crown to obtain title to the rest of the block. In 1882, Paora Ropiha, who had protested the title awards and the Crown's purchase in 1870, finally accepted £200 for his share in Te Ohu, while Maata Te Aopukahu finally accepted £400 as her share in Umutaoroa.

2.87 Crown agents applied considerable pressure to obtain these final signatures. One reported that he had told the owners that Crown grants for reserve areas would not issue until the Crown obtained their final signatures for the wider block. Maata was also threatened that if she did not sign, the Crown would apply to cut out her portion of the land, which would be indebted with an advance already paid to another rangatira for her share, together with interest on that advance and the cost of the agent's trips. The agent reported that Maata 'finally consented and signed the deed'. The Crown paid additional amounts above the original purchase price in the 1871 deed to complete the purchases of these blocks.

Purchasing the southern Bush

2.88 In 1870, the Crown proposed a new economic development policy. The main elements of this policy were a scheme to bring thousands of assisted immigrants to New Zealand and a programme of large-scale public works. The Crown financed this programme by large-scale borrowing and the purchase and on-sale of Māori land. The Immigration and Public Works Act 1870 authorised expenditure on large-scale railways and roading projects, and assisted immigration schemes.

2.89 In May 1871, the Wellington provincial superintendent wrote to the Colonial Secretary requesting that the government purchase the Wellington end of Seventy Mile Bush (that is, the southern Bush, below Manawatū Gorge), under section 34 of the Immigration and Public Works Act 1870. The Colonial Secretary requested the Wellington and Hawke's Bay provincial superintendents to work together, under the direction of the general government, in negotiating such purchase.

2.90 In July 1871, the Hawke's Bay provincial superintendent reported that principal owners of the southern Bush had made offers to sell. He expressed the hope that 'satisfactory arrangements' would be concluded.

2.91 Rangitāne rangatira applied to the Native Land Court for an investigation of title to the southern Bush. The Crown assisted with the preparation of initial survey plans for the Court process and the division into a number of blocks. Survey plans or tracings for Court appear to have been prepared in part from blocks already purchased in the southern portion of the Bush, including the Manawatū and Ihuraua blocks, and the southern Puketoi area, comprised in the earlier Makuri purchase.

2.92 In September 1871, the Court heard the claims. Some at the hearings asked that the blocks be withdrawn, but the Court carried on, being obliged by legislation to make a determination. It awarded the land in ten of the eleven blocks to ten or fewer owners per block, whose names were provided by Rangitāne. The owners represented a range of Rangitāne rangatira, some of whom had interests both east and west of the Manawatū Gorge. The eleventh block, Manawatū-Wairarapa no. 3 (also known as 'Mangatainoka'), was awarded to 56 named owners and any other 'natives who may be found to be members of the Rangitane tribe'. The Court added that 'the land be considered a tribal estate of the Rangitāne tribe', apparently utilising s 17 of the Native Lands Act 1867 that allowed for all tribal owners to be listed.

2.93 Nireaha Tamaki, a leading Rangitāne rangatira of the southern Bush, was absent from the Court sitting. Bad weather delayed the beginning of the hearing. After the hearing, Tamaki petitioned Parliament. In October 1871, Tamaki told the Native Affairs Committee that flooding prevented him attending the hearing. Crown witnesses queried this evidence. Tamaki objected to his land being awarded to 'strangers', while admitting the 'right of some' to be on the titles. A couple of the Committee members advised Tamaki to apply for a rehearing. Applications for a rehearing were declined.

2.94 On 10 October 1871, the Crown obtained Rangitāne signatures to a deed of sale for 10 of the southern Bush blocks, an area of 125,000 acres. Reserves totalled 4,069 acres and the purchase price was £10,000. The reserves were clearly marked on the plan in the deed of purchase. The large 'Mangatainoka' block estimated at 62,000 acres was not included in the purchase.

2.95 Leading Rangitāne rangatira signed the southern Bush deed, including Huru te Hiaro, Karaitiana Te Korou, Wī Waaka Kahukura, Mikaera te Rangiputara, and Wirihana Kaimokopuna. Approximately 60 individuals signed the deed up to August 1872.

The Mangatainoka block

2.96 In November 1871, the Crown promoted the enactment of the Railways Act 1871, which provided that the costs of railway construction in Wairarapa and Hawke's Bay be charged against Crown sales of recently acquired land in Seventy Mile Bush. In all, the legislation set aside 296,000 acres of the southern Bush and 147,800 acres of the northern Bush for the railway.

2.97 The legislation specifically included within the area set aside in the southern Bush, the 62,000 acre Manawatū-Wairarapa no. 3 (or Mangatainoka) block and the 7000 acre Mangahao no. 3 block, both referred to as subject to purchase negotiations. This was despite Rangitāne withholding the Mangatainoka block from sale only a month before the Railways Act was passed.

2.98 By 30 June 1871, the Government had spent over £1,300 on preliminary surveys for the Wellington to Seventy Mile Bush to Napier railway. This survey work predated the conclusion of the Seventy Mile Bush purchases. The Government had for some time intended to apply proceeds from resale of the Bush towards the costs of railway construction.

2.99 By mid-1872, a Crown agent believed that Rangitāne rangatira, Hoani Meihana, was reaching the view that sale would enhance the value of their reserves as it would lead to roading and Pākehā settlement. In March 1873, Meihana, Huru te Hiaro, Nireaha Tamaki, and Manahi Paewai, and about 15 other Rangitāne individuals, signed deeds of lien accepting loans secured against the Mangatainoka block, to be repaid as directed by the chiefs on a future purchase being negotiated. Although the lien wording anticipated a sale, there was no agreement to sell the block.

2.100 In February 1875, the Mangatainoka block was partitioned into six parts. Titles were ordered under section 17 of the Native Lands Act 1867, which provided for the names of all the interested parties to be determined. Approximately 165 individuals were granted interests in one or more of the six titles. One of the main objects of the 1867 Act was to ensure that all of the owners were protected, the main safeguard being that no sales of undivided land could occur and no partitioning could occur unless a majority of the owners first agreed.

2.101 Nireaha Tamaki (or Matiu) was awarded interests in four of the Mangatainoka partitions. Nireaha protested in *Te Wananga*, newspaper of the Repudiation movement, that his resident hapū were not awarded land whereas those without proper claims on the land had been admitted. Tamaki vigorously opposed sale. He wrote to Donald McLean demanding a rehearing, and threatened to resort to arms if his concerns were not addressed. McLean then met with Tamaki, which appears to have resolved matters.

2.102 Between the March 1873 deeds of lien and 1877, the Crown made a number of payments to a few Mangatainoka block grantees, only about four of whom were not parties to the 1873 deeds. The payment receipts were variously expressed as 'on account of purchase' or 'ngā moni utu', 'to be deducted from purchase money', and 'advance on the purchase of Mangatainoka block'. The receipts did not record any agreement on the amount of the block to be sold or the purchase price. Only a small minority – perhaps 24 – of the 165 owners received payments (including the 1873 lien payments).

2.103 In May 1877, Crown officials reported a meeting with Rangitāne in which leading rangatira conveyed the owners' decision to sell 37,000 acres, or about half, of the Mangatainoka block. Officials then 'demanded fulfilment of [the] written agreement', apparently a reference to the 1873 deeds of lien. In response to this demand, Rangitāne stated they would refuse to sell any portion of the block. Leading rangatira alleged they were misled by the translator of the 1873 deeds, 'and that they make themselves personally responsible for money advanced', implying they would personally repay the money, releasing the land from any liability. Officials tried to convince the meeting that the lien agreements meant Rangitāne had agreed to sell the block. The meeting broke up without a resolution.

2.104 Crown Minister, J D Ormond, wired the officials, referring to his disappointment at the stance of rangatira and instructing officials to communicate that the Crown would not allow the Mangatainoka owners 'to breach the agreement' with the Government. He denied there had been any misleading conduct on the part of the Crown's interpreter when the lien deeds were entered into. He refused to accept the offer by rangatira Huru te Hiaro and Peeti te Aweawe to assume personal liability for the lien payments. He threatened that the rangatira had better reconsider, in which case the 'Government will deal liberally with them', but if not, 'the land shall be tied up and reserved from sale or lease, and made liable for the advances'.

2.105 The Crown did not achieve an agreement to purchase Mangatainoka land through the remainder of 1877. In February 1878, the Crown proclaimed a monopoly over the Mangatainoka block, prohibiting all private alienation, including by sale, lease or otherwise. Although the 1875 partition had created six individual Mangatainoka titles, each with their list of grantees, the proclamation designated only the original block of Manawatū-Wairarapa no. 3 (or Mangatainoka). Of the approximately 24 individuals who had accepted lien debts or payments, none of them was an owner of the Mangatainoka 2B block of 3,170 acres. The proclamation therefore stated incorrectly that money had been paid or negotiations had commenced in respect of this block.

2.106 Between 1882 and 1884 the Crown purchased Mangatainoka interests, mostly by dealing with individuals rather than by convening hui of groups of owners or otherwise dealing with recognised leaders of Rangitāne. By 1884 the Crown had expended around £12,000 on acquiring interests in the Mangatainoka block. Incidental expenses amounted to just over £731.

2.107 By February 1885 the Crown had applied to the Native Land Court to have its interests in the Mangatainoka block defined, but Hoani Meihana asked the Government to withdraw its application. He sought instead a meeting with the Minister to discuss the matter. Meihana listed the chiefs who were 'ngā rangatira tiaki' or chiefs of the land on behalf of the tribe of 'Tanenuiarangi' (another name for Rangitāne), including Nireaha Tamaki, Huru Te Hiaro, and Wirihana Kaimokopuna. The Native Minister minuted the file that Meihana should be told that the Government had bought shares in Mangatainoka and would ask the Court to cut out its portion.

2.108 On 21 April 1885, the Crown's application regarding its interests in the Mangatainoka block was heard in the Native Land Court at Palmerston North. The Crown relied on the Native Land Amendment Act 1877, legislation that empowered the Court to award to the Crown the interests it had acquired in any block. Huru Te Hiaro stated to the Court that 'no satisfactory arrangement' had been reached with the Government over the land, 'although it has been under negotiation since the time of Sir Donald McLean.'

2.109 On 22 April 1885, Hoani Meihana testified in Court that Rangitāne held the block tribally and that a Rangitāne committee had decided which areas to cut out for the Crown and which to hold for Rangitāne. He said that the Government rejected this proposal because, in Meihana's view, it wanted to buy the whole block. Meihana complained that Native Minister Sheehan had not turned up at a meeting of 'all Rangitāne' in January 1879, although he had 'promised' to come. He stated that in 1882 Native Minister Bryce failed to attend another meeting requested by Rangitāne. Meihana gave evidence that Crown agents targeted individual owners in public houses to secure their signatures. He stated: 'I thought this could not be the work of the Government, but of a Company'.

2.110 When Meihana stated that Rangitāne held the land tribally the Court responded that the title was 'to individuals, not to a tribe'.

2.111 Hoani Meihana requested an adjournment of five months. He stated 'this is the last of our land. We have no more. We want five months to make private and tribal arrangements about its disposal or of as much as remains to us'. The Crown opposed such a long adjournment. Native Minister, John Ballance, telegraphed the Crown agent in Court the same day, instructing him to 'object to postponement'. The Court adjourned to the following day, while some Rangitāne, including Huru Te Hiaro and Nireaha Tamaki, left the Court to return to dying relatives.

2.112 When the Court reopened the day following, on 23 April, the Crown submitted to the Court that the case could proceed without hearing from all the Rangitāne owners. It submitted that it was not necessary for Nireaha Tamaki and others to be present on the partition matters as they had already been paid for their interests.

2.113 The Crown called Hoani Meihana to give evidence, but Meihana 'asked for time to think'. The case adjourned to the afternoon. When Hoani Meihana did not reappear, the Crown issued a subpoena to cause him to appear to give evidence. The Crown had earlier that day indicated its willingness to use subpoenas to obtain 'the evidence of some who are wilfully absenting themselves'. The Crown agent telegraphed Native Minister Ballance seeking instructions whether to serve the subpoena on Meihana. Ballance replied: 'If any probability [of] success push matters[.] Meihana has no right to refuse [to] give evidence after asking for adjournment of L[and] Court[.] If we have the Law with us [we] should not be trifled with'.

2.114 When the case resumed on 24 April, the Crown's agent had altered his position, stating that he had reflected on Meihana's words and that the deaths of 'two influential relatives' made it 'expedient' for him to delay the Crown's application.

2.115 The Court next heard the Crown's partition application in late June 1885. The Court's minutes show that the various orders were made without objection, usually an indication that the Crown agent and the non-sellers had reached agreement outside the Court as to how the partitioning would proceed.

2.116 The areas awarded to the Crown in 1885 were calculated by a Crown agent as 42,424 acres out of a total area of 66,395 acres (area revised from the original 1871 estimate of 62,000 acres). Over the following two years, the Crown purchased an additional 14,305 acres. The Crown acquired approximately 90 acres under public works legislation for the Ngaawapurua bridge. Other purchases followed. By 1890, the Crown had acquired some 58,000 acres, approximately 87 percent of the block. Rangitāne rangatira Huru te Hiaro, Nireaha Tamaki (or Matiu), Wirihana Kaimokopuna, and Peeti Te Aweawe, figured prominently in the list of remaining owners.

2.117 In 1877, Nireaha Tamaki and Huru Te Hiaro reached an agreement with the Crown allowing construction of a bridge across the Manawatū river, at the northern end of the Mangatainoka block. In return, the Crown agreed to pay them a subsidy of £25 per annum for continuing to operate a ferry service across the Manawatū river. In 1881, Nireaha and Huru entered into a new agreement with the Crown, relinquishing their rights to conduct the ferry crossing for a payment of £100. The Crown did not intervene later to enable free passage for Nireaha and Huru on the ferry service now run by the local council, contrary to the chiefs' expectations and protests. The Crown completed the Ngaawapurua bridge in 1885. Delays in compensating the owners of the land taken for the bridge were encountered while the relevant land was partitioned by the Native Land Court.

2.118 After 1890, most sales in Mangatainoka block were to private purchasers. Today, approximately 460 acres remain, representing less than one percent of the 66,000 acres in the original block.

'NGĀ TOHU O TE HAKI': EARLY LANDLESSNESS AND PROTEST MOVEMENTS

Crown-Rangitāne political engagement in 1860s

2.119 During the New Zealand Wars of the 1860s, many Rangitāne in Wairarapa and Tamaki nui-ā-Rua became adherents of the Kīngitanga (or King movement) in Waikato. In August 1861, a Crown official listed Rangitāne rangatira Wī Waaka, Retimana te Korou and Ihaia Whakamairu at Masterton/Ōpaki as among those sympathetic with the Kīngitanga. In 1868, official comments suggested that only a minority of Wairarapa Māori remained neutral or 'loyal' during the period of the 1863-66 conflicts in Waikato and Taranaki. The Pai Mārire ('good and peaceful') faith arrived in the Wairarapa in 1865 and many of the Kīngitanga adherents adopted this new movement that promised the achievement of Māori autonomy. Karaitiana Te Korou became a scribe of the Pai Mārire scriptures, the *Ua Rongopai,* while Wī Waaka and others fought with Pai Mārire inspired groups in Taranaki in the 1865-66 period, several dying in the conflicts. Some Wairarapa Māori expressed solidarity with Pai Mārire by adopting ancestral names. Wī Waaka, for example, adopted the name 'Rangiwhakaewa'. But despite several alarms throughout the decade – mostly local responses to conflicts in other regions – the Wairarapa and Tamaki nui-ā-Rua regions experienced no armed conflict.

Pāora Pōtangaroa

2.120 Pāora Pōtangaroa was a prophetic leader of Rangitāne descent affiliating to Te Hika a Pāpāuma and Ngāti Hāmua. In 1877, Pāora and others wrote from Āohanga on behalf of Te Hika a Pāpāuma referring to 'the teeth of these [native land] laws which are voracious in consuming people and land. It is because we the Māori people have seen the fault of decision making of this entity, the court, a stranger who owns the land, deciding in favour of the person who speaks falsehoods… We are not agreeable to these laws'.

2.121 In March 1881, Pōtangaroa hosted an important hui at Te Oreore (Masterton) at which he presented a flag divided into sections with stars in each, and with several other symbols including a korowai and an army tunic. He challenged the hui to interpret their meaning, but no-one could do so. Some weeks later Pāora eventually revealed his matakite (vision) to the people, declaring that Rangitāne and other Wairarapa Māori should not sell or lease their lands, and should not pay debts. It became apparent that the sections of the flag were the large blocks sold, while the stars were small reserves remaining in Māori possession. These were 'ngā tohu o te haki', the symbols of the flag of Pāora Pōtangaroa. Later it was reported that Pōtangaroa had declared at the hui that the island (New Zealand) was in mourning because the land and authority had been taken from Māori by the Pākehā (or Crown). He said the army tunic represented the authority by which the Kāwanatanga (Government or Crown) was devouring the land.

2.122 Pāora also held out hope for his people. He told them that, when their faith was strong, he would swim the ocean in a soldier's uniform to take the Treaty of Waitangi to Queen Victoria to ask her to honour it. Many people considered this prophecy to be fulfilled by the members of the Wairarapa Native Mounted Rifles who travelled to London in 1897 to attend Queen Victoria's Diamond Jubilee celebrations. Rangitāne communities, including hapū from Seventy Mile Bush attended the hui in 1881, indicating region-wide concern for the issues highlighted by Pōtangaroa.

2.123 Pōtangaroa took a leading role in establishing the whare rūnanga (meeting house) named Ngā Tau e Waru at Te Oreore marae. Rangitāne and other Wairarapa Māori continued to meet regularly, including at Te Oreore, to commemorate Pōtangaroa's prophecies. Today, Ngā Tau e Waru remains a focal point for Ngāti Hāmua and other Rangitāne people.

Problems with applying Equitable Owners legislation

2.124 In 1886, the Crown introduced legislation that became the Native Equitable Owners Act 1886. The Act was designed to remedy prejudice arising from ten-owner titles awarded under the 1865 native lands legislation, which had led to some grantees selling, leasing or mortgaging land without consulting the wider community of Māori with customary interests in the land. The 1886 Act empowered the Native Land Court to introduce new named beneficial owners to the titles of blocks that had previously been awarded to only ten grantees.

2.125 The Act did not resolve many of Rangitāne's grievances arising out of the ten-owner rule. On several occasions over the period 1890 to 1910, claimants to various reserve blocks in Seventy Mile Bush applied under the equitable owners legislation for their names to be introduced to the title. In the case of the Ahuatūranga, Umutaoroa (Manawatū no. 1) and Tuatua (Whiti-a-Tara) reserves, various courts ruled that they were unable to apply the 1886 Act or its successor legislation as the titles to these blocks had not been awarded under the Native Land Act 1865. Although in 1870 the Court determined who should be the owners of the parent blocks, it did not formally issue certificates of title under the 1865 Act before the Crown completed the purchase of the parent blocks in the 1871 northern Bush transaction. The Crown subsequently granted title to the reserves agreed in the 1871 sale under the Volunteers and Others Lands Act 1877 to the ten or fewer owners named in the 1870 Court decision. A judgment of the Supreme Court (as the High Court was then called) of 1906 confirmed that the Native Land Court had no jurisdiction to consider equitable owners claims as the Crown grant had been issued under the 1877 Act without reference to any title issued under the native land legislation.

2.126 Rangitāne claimants protested about this situation, including taking petitions to both Parliament and Ministers. Although the Crown made various attempts to address the situation, claimants were left without a legal remedy.

2.127 Applications under the Equitable Owners legislation for the Kaitoki, Mangatoro, and Oringiwaiaruhe blocks, awarded title in 1867, were unsuccessful because the legislation did not apply to blocks where land had already been sold. There was no legal remedy available to these claimants whereby their claims to the remaining portions of the blocks could be determined.

2.128 In some instances, applications under the Equitable Owners legislation did succeed. In 1892, the Native Land Court investigated the Piripiri block, awarded titled in 1870 under the Native Land Act 1865, and found that the original grantees held the land on trust in 1870 and 'owners have manifestly been omitted from the block'. From an original number of ten owners, the Court re-awarded title to 124 owners. In 1897, the Native Land Court re-awarded title to 74 owners in Tahoraiti no. 2 block. Additional names were also added to the Tahoraiti no. 1 block. The Tahoraiti block was originally awarded title in 1869.

Sale of reserves in Seventy Mile Bush

2.129 Following the Tamaki (or northern Bush) purchase of August 1871, five reserves were set aside at Umutaoroa, Te Ohu, Te Whiti-a-Tara (or Tuatua) and Ahuaturanga (two reserves) comprising an estimated 20,000 acres out of a total purchase area of 250,000 acres. The October 1871 purchase deed for the southern Bush referred to eight reserves comprising 4,369 acres out of a total area of 125,000 acres. Between 1872 and 1883, the Crown purchased six of these southern Bush reserves.

2.130 In August 1892, Rangitāne rangatira including Nireaha Tamaki and Huru Te Hiaro wrote to the Native Minister complaining of 'the evils under which Rangitāne are suffering', including ten-owner titles and 'the Reserves made in the blocks of land sold to the Gov[ernmen]t. It was thought by the Tribe that these Reserves were made for the occupation and maintenance of the Tribe, now it is seen that these Reserves are being sold'. They continued, saying '[h]ence the Tribe of Rangitāne are grieved as it appears that before long there will be no land at all for them to live on (except the sets of 10 persons who have got the land)'. The Crown filed this complaint 'until the matter crops up again'.

2.131 The remaining Seventy Mile Bush reserves were entirely alienated within two decades of the writing of this letter. Equitable owners legislation and other alienation restrictions did not ultimately preserve the reserves in Rangitāne ownership. By 1900, the Umutaoroa and Te Ohu reserves in the northern Bush were completely sold. The Te Whiti-a-Tara and Ahuaturanga reserves were both completely alienated by 1913 after owners offered to sell or applied to lift alienation restrictions, and after dismissals of the equitable owners claims made by parties outside the titles. In the southern Bush in 1908 and 1909, the Crown removed all remaining restrictions on alienation from the titles of the remaining Eketahuna and Pahiatua reserves and both the Crown and private parties acquired the reserves.

2.132 By 1913, therefore, all the reserves set aside in the two large Seventy Mile Bush Crown purchases of 1871 had been completely alienated. Rangitāne communities between Norsewood and south of Eketahuna were left with the remaining portions of the Mangatainoka block, a 20 acre reserve at Kauhanga (near the Manawatū Gorge), and with scattered and largely small areas in the northern Bush.

Nireaha Tamaki's Privy Council Appeal

2.133 In 1892, Huru te Hiaro and two others petitioned Parliament seeking compensation for a surveying error which they said deprived them of more than 5,000 acres between the Kaihinu and Mangatainoka blocks. In July 1893, the Crown offered for sale land that included the the area claimed by Huru te Hiaro.

2.134 In 1894, Nireaha Tamaki applied to the Supreme Court (as the High Court was then called) for a ruling that the disputed land was improperly offered for sale. He alleged that the land formed part of the Mangatainoka block retained by southern Bush Māori or, alternatively, was still customary land. On the questions of law being removed into the Court of Appeal, that Court found, in *Nireaha Tamaki v Baker* (1894), that it had no jurisdiction to consider the legality of Crown dealings with Māori land. This ruling was based on an earlier decision, *Wi Parata v the Bishop of Wellington* (1877), which saw these as unreviewable state actions.

2.135 Nireaha appealed to the Privy Council and succeeded, in *Nireaha Tamaki v Baker* (1901), on the legal point that the courts could review whether Crown dealings over Māori land were in accordance with statutory provisions that authorised Crown action. The Council also found that New Zealand legislation recognised the existence of native custom. It observed that a lack of survey was seemingly an important issue in the case. This decision allowed Nireaha to ask the courts in New Zealand to again try the question of whether the disputed 5,184 acres were in fact still owned by southern Bush Māori.

2.136 In response to the Privy Council's decision, the Crown negotiated a settlement with Nireaha Tamaki and promoted the Native Land Claims Adjustment and Laws Amendment Act 1901 to implement this and other settlements. The Crown agreed to pay £4566 to the former owners, to extinguish their claims to the land. The Native Land Court was to determine who these owners were. In 1904, after the various parties had reached agreement, further legislation was passed confirming that all legal actions relating to the matter were discontinued. The Crown also successfully managed through Parliament the Land Titles Protection Act 1902 to prohibit Māori from litigating land titles awarded more than ten years before the passing of the legislation.

Kotahitanga

2.137 In the 1890s, Rangitāne hapū and communities supported the Kotahitanga (tribal unity) movement, which in Wairarapa was centred on the paremata (parliaments) at Pāpāwai. Nireaha Tamaki and other Rangitāne rangatira played important roles in the Pāpāwai paremata. The Kotahitanga paremata, hosted around the North Island in the 1890s, garnered support from many iwi and sought official Crown recognition of their status as a decision making body for Māori.

2.138 In 1897, a Māori military unit that included some Wairarapa members aligned to Kotahitanga, the New Zealand Mounted Rifles, travelled with a New Zealand party to England to participate in Queen Victoria's Diamond Jubilee as a guard of honour. Captain Rīmene, of Rangitāne whakapapa, was a member of this party. The Kotahitanga contingent presented a petition to the British Parliament, seeking to retain the remaining 5,000,000 acres of Māori land nationally in iwi ownership. Kotahitanga Māori in Wairarapa saw this petition as fulfilling a specific prophecy of Pōtangaroa in 1881, in which Pōtangaroa would swim the ocean in a soldier's uniform to seek a remedy from the Queen for the ills of the land.

2.139 The petition was embarrassing for the Seddon Government. On his return from England, Seddon brought a Bill proposing reforms to the Native land laws to Kotahitanga hui at Pāpāwai. In 1900 the Māori Lands Administration Act 1900 and the Māori Councils Act 1900 were enacted. This legislation conferred a degree of control over land and other matters on local councils, although Māori opinion on its merits was divided. Māori involvement in the management of land, however, was curtailed by the Māori Land Settlement Act 1905. Section 5 of this legislation provided for three-member Māori Land Boards, of whom only one member needed to be Māori. Legislation in 1913 removed direct Māori involvement in land vested in Boards.

Wairarapa Moana

2.140 Wairarapa Moana, comprising Lake Wairarapa and Lake Ōnoke and their associated waterways and wetlands, supplied abundant kai and other resources for Rangitāne communities over many centuries, including the hapū Ngāti Hāmua and the aho-rua or shared hapū, Ngāi Tūkoko, Ngāti Hinetauira, and Ngāti Te Whakamana. The lakes were plentiful in tuna (eel), flounder, whitebait, kokopu, ducks, fern root and korau. Rangitāne tradition relates how Wairarapa Moana was named by a tōhunga (tribal expert) aboard the Kurahaupō waka, Haunui-ā-Nanaia. After the sun reflected off the lake making his eyes water, he named the lake 'Wairarapa', meaning flashing or glistening waters. The whakatauākī 'Ka rarapa ngā kanohi ko Wairarapa' is said to record this event.

2.141 In the early and extensive Crown purchases of 1853-1854, the Crown acquired four blocks surrounding the lakes, Turakirae, Tūranganui, Tauherenīkau, and Kahutara. The Crown on-sold much of this land to Pākehā settlers. Tension arose between settlers and Māori over the opening of the spit at Lake Ōnoke. The natural action of the ocean at Palliser Bay against the spit caused the spit to be completely closed for several months of the year. The closed spit allowed Wairarapa Māori to catch many tons of kai over the summer months. Tuna (eel) in particular would pool in huge numbers in the lower lake. The closed spit also led to flooding of low-lying land surrounding Wairarapa Moana. Settlers occupying and farming this land wished to open the Ōnoke spit to drain the Lakes system and reduce flooding.

2.142 Settlers and Māori asked the government for a solution. In 1876, the Crown attempted to purchase the lakes. However only some rights-holders were dealt with, and leading rangatira protested about this transaction. In November 1883, the Native Land Court awarded ownership of the Lakes to 139 Māori owners, and did not refer to its previous 1882 finding that the Crown had acquired 17 undivided interests (via the 1876 transaction). In 1890, the Crown established a Royal Commission in response to a petition by Wairarapa Māori about the lakes issues. In 1891, the Commission concluded that Donald McLean had promised Wairarapa Māori in 1853 that Wairarapa Moana would not be opened at Ōnoke. It found that Māori retained ownership of the lakes and the spit, and that they retained their fishing rights but were not justified in allowing the lakes to flood the land sold to the Crown. It recommended compensation for Māori over some land adjacent to the lakes that it found the Crown had not purchased in 1853-54. It also recommended solutions to the flooding problem.

2.143 The Crown did not adopt the Commission's recommendations. Instead, in 1896, the Crown and Wairarapa rangatira entered into an agreement in which Māori gifted or transferred the lakes in return for 'ample reserves' surrounding the lakes. The Crown paid compensation of £2000, apparently in lieu of court and other costs Māori had expended in the lake struggles. The Crown did not provide reserves in the vicinity of the lakes as the parties had agreed in 1896. After a convoluted bureaucratic process lasting some two decades, the Crown finally provided land north of Lake Taupō in substitution for reserve land near the lakes. Some Wairarapa Māori whānau eventually relocated to this southern King Country land, known as the Pouākani block. The Crown only provided formed road access to this remote area in the late 1940s.

'NGĀ TAU O TE KOREKORE': THE TWENTIETH CENTURY

Nineteenth century land loss and twentieth century landlessness

2.144 In 1886, a government return of Māori land for Wairarapa and Tamaki nui-ā-Rua showed that approximately 215,500 acres was reserved or made inalienable for Māori. In addition, there was customary land that had not passed through the Court, being a total of 95,442 acres for 'Wairarapa West' and a portion of northern Tamaki nui-ā-Rua, perhaps around 140,000 acres. Perhaps 450,000 acres or 18 percent, then, out of a total land area of approximately 2,500,000 acres, was still in Māori possession by the mid-1880s.

2.145 By the time of the Stout-Ngata Commission reports of 1908-1909, around 129,000 acres remained in Māori ownership in Wairarapa and the southern Bush, while approximately 124,000 acres remained in the northern Bush and coastal Tamaki nui-ā-Rua. In total, therefore, about 253,000 acres remained in Māori ownership by 1908, representing approximately 10 percent of the total region. Commission figures did not record any remaining customary land in the region.

2.146 In 1908, the Commission described Māori society and economy, observing that '[t]here appears to be very little actual farming among the Māoris [sic] in this district. Most of the younger people are working for Europeans, and the older ones are depending largely on rents for their livelihood'. They noted the desire of many Wairarapa Māori 'to begin farming on a proper basis' and underlined that 'the small remnant' of unalienated lands should be reserved for Māori occupation.

2.147 In its final report on native land generally, the Commission commented that many of the economic problems arising from under-utilised Māori land could have been solved long ago 'if the Legislature had in the past devoted more attention to making the Māori an efficient farmer and settler'.

2.148 Despite Rangitāne and other Māori in the region retaining only ten percent of their original land holdings by 1909, and despite the warnings of the Stout-Ngata Commission, the Native Land Act of 1909 removed many restrictions on alienation. In the years 1910-1919 alone, about another 13,000 acres was alienated within the Tamaki nui-ā-Rua takiwā. With such widespread alienation by the early twentieth century, Rangitāne communities increasingly eked out a precarious existence based on subsistence agriculture and labouring work for Pākehā-owned farms and businesses.

2.149 By 1939, approximately 3.5 percent of the Wairarapa and Tamaki nui-ā-Rua region remained in Māori land titles. The effect of almost total alienation by mid-century left Rangitāne communities impoverished and unable to engage in a meaningful way with a New Zealand economy based on the ownership of land and other forms of capital. This poverty contributed to human suffering and social ills, including educational underachievement, family violence and youth suicide.

2.150 Today, approximately only 2 percent of the region is owned under a Māori land title.

Public Works Takings

2.151 From the 1870s the Crown and local authorities used legislative powers to compulsorily take Rangitāne land for public purposes. There was limited, if any, consultation with Rangitāne or with Māori generally about the policy and enactment of public works legislation before the middle of the twentieth century. About 1,700 acres in total were taken from Rangitāne and other Māori over the whole region up until the year 1981. Direct consultation with all owners was uncommon until the second half of the twentieth century. In most cases it appears compensation was paid when it was due, though occasionally after significant delays.

2.152 In the 1870s and 1880s, there is no evidence of consultation with Māori owners prior to roads being constructed through the Whakataki reserve in the Castlepoint block.

2.153 The Crown compulsorily took approximately 587 acres from Rangitāne owners for railway purposes in the Seventy Mile Bush during the 1880s-90s period. Mangatainoka block railway takings alone totalled around 160 acres.

2.154 In 1888, the Crown took 16 acres of reserved land at Eketahuna for railway purposes. The Eketahuna reserve was one of the few reserves in the southern Seventy Mile Bush purchases. Compensation of £78 was paid in 1892.

2.155 In 1905, the local road board obtained a proclamation taking Māori reserve land in the Tautāne block for a road. The road was taken at the request of a neighbouring landowner, apparently to enable better access to his property from the main road (that also ran through the reserve). It appears the board did not notify or consult the Māori owners prior to the taking and did not advise the Crown's central roads department of its intentions. However it followed the statutory process set out in the public works legislation, meaning Crown officials were unable to intervene to prevent the taking. Compensation was finally paid some four years later.

Dannevirke takings

2.156 There were a number of public works takings of Māori land by both the Crown and local council in the vicinity of Dannevirke. These takings occurred mostly in the first half of the twentieth century and amounted to over 300 acres.

2.157 In 1900, the council took 3 acres for the Dannevirke gravel pit from Tahoraiti no. 2 block. Local Māori protested against the taking. Twelve years later compensation was paid to the Māori land owners. The land was not returned to Māori once the gravel pit was exhausted, and was disposed of to a private party in 1955. There is no evidence the original owners were ever approached about the return of the land, although the council was under no legal obligation to do so.

2.158 In 1904, the Crown took 10 acres of Māori land for a rifle range. There is no evidence that the Public Works Department notified the Māori landowners of its intention to take the land. The land was sold to a descendant of a former owner after 1956 when no longer required for defence purposes, even though the public works legislation of the time did not require the land to be offered back to the descendants of the original owners.

2.159 In 1911, the Crown took 38 acres at Mākirikiri for scenery preservation. Compensation was determined in 1912. In 1913, the Crown vested the reserve in the local council. Later some of the land was subdivided and leased by the council, and a small portion became a rubbish dump in 1951. Since reclassification in 1983, the land has been part scenic and part recreation reserve administered by the council.

2.160 Between 1933 and 1956, a Māori landowner, Eriata Nopera, leased 100 acres to the Dannevirke Airport Association for an aerodrome. During this period, central government agencies spent more than £13,000 developing the aerodrome. Towards the end of the lease, the council attempted to negotiate a purchase of the land, but the parties could not agree on price. The council moved to compulsorily acquire the land. The beneficial owner at that time, Muri Paewai, objected to the taking. She wanted to keep the land to farm for herself and her family. She protested that locals using the aerodrome for aerial top-dressing would benefit from the taking, rather than the public generally. The council took the land in 1956. Compensation of £10,000 was awarded. In the 1970s and 1980s, the council expanded the aerodrome, in two cases exercising a statutory power to exchange land with neighbouring property owners without first offering these portions back to the Paewai family. These events created significant grievance for the Paewai family and the wider Rangitāne community in the Dannevirke area.

'TE TAIAO ME TE TAONGA': IMPACTS ON ENVIRONMENT AND TAONGA

2.161 The settlement of Wairarapa and Tamaki nui-ā-Rua resulted over time in significant transformation of the environment.

2.162 Following the Crown's extensive purchasing in the Seventy Mile Bush in the later nineteenth century, much of the Seventy Mile Bush was cut down to make way for agricultural uses, roading and railways along with the new towns of Norsewood, Dannevirke, Pahiatua, and Eketahuna. The Crown provided for the settlement of immigrant communities in these new towns, many from Scandinavia.

2.163 At the same time, Rangitāne kāinga (villages), and food and medicinal sources, were detrimentally affected by this loss of Te Tapere-nui-o-Whātonga. The huia bird, highly-prized by Rangitāne, succumbed to this loss of habitat and died out. Other bird species declined in numbers. Rangitāne say their people suffered not just physically but also psychologically and spiritually from the loss of the forest and its taonga. The wildlife reserve at Pūkaha/Mt Bruce contains some of the last remnants of Te Tapere-nui-o-Whātonga.

2.164 The felling of forests and the draining of wetlands for settlement and agriculture also led over time to the degradation of rivers and lakes, and the loss or diminution of indigenous fish species, including eel. The large-scale forest clearance was followed by the introduction of exotic grasses, crops and animals. These changes affected adversely the traditional ways of life of Rangitāne communities, including traditional food-gathering and fishing, and contributed to the loss of ancestral knowledge and tikanga (custom).

2.165 The modification of the course of the Ruamahanga river and the opening of Wairarapa Moana outlet at Lake Ōnoke, coupled with the introduction of exotic fish species, impacted adversely, over time, on seasonal fishing resources. These changes also affected detrimentally the relationship of Rangitāne communities to many of their sacred sites, including urupā (burial places).

2.166 Changes to the environment occurred under management regimes set up by the Crown which did not, until the late 1980s, provide for the recognition of Māori cultural values and practices. In particular, Crown policy until the late 1980s did not require Māori needs and values to be taken into account in the management of rivers. Crown policy in general limited the ability of Rangitāne to exercise their kaitiakitanga over their natural environment and taonga.

'TŪ MAI RĀ, RANGITĀNE': RANGITĀNE IDENTITY AND RESURGENCE

2.167 The early Crown purchase deeds of 1853 to 1865 did not include references to the tribal identity of Rangitāne in Wairarapa and Tamaki nui-ā-Rua. Many deeds did make reference to another tribal identity.

2.168 In the 1870s and 1880s, the Crown compiled 'censuses' of the Māori population that reported on aspects of iwi affiliation. In these censuses there were few references to the tribal identity of Rangitāne in the Wairarapa and Tamaki nui-ā-Rua regions. Nevertheless many leading claimants to the Native Land Court from the 1860s to the 1910s identified as Rangitāne or made claims on the basis of their Rangitāne whakapapa. Rangitāne people continued to identify as Rangitāne in their own narratives and engagements with each other, as recorded in their own whakapapa records and Māori language newspapers.

2.169 Rangitāne identity remained visible in other ways throughout the nineteenth century in Wairarapa and Tamaki nui-ā-Rua. The *Nireaha Tamaki v Baker* litigation of the 1890s gave prominence to Nireaha Tamaki and Rangitāne throughout the country, the case being framed in part on the Native Land Court's 1871 award of title for the Mangatainoka block to 'the Rangitāne tribe'. Nireaha played an important role at the Pāpāwai parliaments of Kotahitanga and became an advisory counsellor of the Rongokako Māori Council.

2.170 As the Rangitāne land base dwindled by the early twentieth century, Rangitāne struggled to maintain their relationships with their whenua and their traditional ways of life. After World War Two, tribal populations moved to towns and cities seeking work and this posed additional challenges to maintaining traditional knowledge, ways of life, and Rangitāne identity. Urbanisation also resulted in pressures towards assimilation into the surrounding Pākehā culture.

2.171 Crown-run schools, for much of the twentieth century, made little allowance for te reo Māori (Māori language) or cultural expressions, leading to further Māori alienation from their culture. In some cases, Crown schooling inflicted significant cultural and psychological harm by discouraging the speaking of te reo Māori in the school environment.

2.172 The Pāpāwai and Kaikōkirikiri Trusts Act 1943 established a new board to manage properties granted to the Anglican Church by the Crown in 1853 for educational purposes. The Act made no reference to Rangitāne, despite Rangitāne tūpuna being among those who gifted the land for these purposes. This gift and the 1943 legislation were in part facilitated by the Crown. Rangitāne consider that scholarship applicants to the trust who referred to their Rangitāne whakapapa and affiliation were disadvantaged. Governmental and parliamentary inquiries over a number of decades identified inadequacies in administration of the gifted lands.

2.173 Rangitāne considers that up until the early twentieth century, Rangitānetanga (Rangitāne traditions and culture) remained strong, a reflection of the ongoing importance of te reo Māori and tikanga Māori (Māori custom) within Rangitāne communities. However the combined effects of rapid land loss, the destruction of Te Tapere-nui-o-Whātonga (Seventy Mile Bush), the decline in te reo Māori, urbanisation and other socio-economic circumstances probably contributed to the weakening of traditional knowledge among Rangitāne people. Rangitāne considers that this weakening of Rangitānetanga, particularly through the middle and later parts of the twentieth century, and the comparatively few references to Rangitāne identity in government records, are reasons why Rangitāne people emphasized other tribal affiliations in their dealings with the Crown.

2.174 The Māori cultural revival of the 1970s and 1980s led to Rangitāne people reasserting their identity as Rangitāne, creating intense debate within the region. Rangitāne people and marae worked to reassert their Rangitānetanga in social, cultural, political and government domains. Rangitāne consider that, during this period, some of their people felt excluded from some employment opportunities within government agencies, from access to marae and other Māori development funding, and from education scholarships and other opportunities because they identified as Rangitāne.

2.175 Despite these challenges, Rangitāne people, marae and other organisations have successfully re-established working relationships with government agencies, local government and other parties. Recent census figures indicate a resurgence of Rangitāne identity in the region.

3 ACKNOWLEDGEMENT AND APOLOGY

ACKNOWLEDGEMENT

3.1 The Crown acknowledges that it has failed to deal with the longstanding grievances of Rangitāne in an appropriate way and that recognition of these grievances is long overdue.

Crown Purchasing pre-1865

3.2 The Crown acknowledges that:

3.2.1 it threatened to end Pākehā settlement in Wairarapa unless Rangitāne sold land to the Crown and gave up the pastoral leases to settlers, which were providing Rangitāne with income and trade benefits in the 1840s and early 1850s;

3.2.2 it carried out an extensive series of purchases in the period 1853-1865 in Wairarapa and Tamaki nui-ā-Rua, and that in respect of these purchases it breached te Tiriti o Waitangi/the Treaty of Waitangi and its principles by:

(a) failing to obtain the consent of key rights holders in the Tautāne block purchase, including Hēnare Matua, rangatira at Tautāne, who wished to retain the land;

(b) failing to adequately discharge its obligations under the 'koha' or 'five percent' clauses that were incorporated into certain purchase deeds, under which the Crown set aside funds for Māori benefit derived from on-selling the land; and

(c) failing to properly survey, set aside or protect from being taken up by settlers, lands intended to be reserved from some purchases, or unreasonably delaying issuing grants of reserves where these were promised;

3.2.3 following the sale of their land to the Crown at low prices, Rangitāne did not receive all the educational, health, and economic benefits that the Crown had led them to expect from selling their land to the Crown and from the 'koha' fund.

The Native Land Laws

3.3 The Crown acknowledges that:

3.3.1 it did not consult Rangitāne before introducing native land laws that provided for the individualisation of Māori land holdings, which had previously been held in tribal tenure;

3.3.2 the Native Land Court title determination process carried significant costs, including survey and court costs, which at times contributed to the sale of Rangitāne land;

3.3.3 the operation and impact of the native land laws in the Seventy Mile Bush or Tamaki nui-ā-Rua region, and in Wairarapa, from 1865, in particular the awarding of land to individuals and the enabling of individuals to deal with that land without reference to the iwi and hapū, made the lands of Rangitāne and its constituent hapū more susceptible to partition, fragmentation and alienation. This contributed to the erosion of the customary tribal structures of Rangitāne and its constituent hapū, which were based on collective ownership or trusteeship of land; and

3.3.4 it failed to take steps to adequately protect the traditional tribal structures of Rangitāne and its constituent hapū and that this was a breach of te Tiriti o Waitangi/the Treaty of Waitangi and its principles.

3.4 The Crown further acknowledges that it breached te Tiriti o Waitangi/the Treaty of Waitangi and its principles by failing to provide a legal means for the collective administration of Rangitāne land until 1894, by which time the bulk of Rangitāne land had been alienated.

Te Tapere-nui-o-Whātonga (Seventy Mile Bush) post-1865

3.5 The Crown acknowledges that in some cases it applied unreasonable pressure to obtain signatures in favour of sale of certain northern Seventy Mile Bush blocks, actions that were in breach of te Tiriti o Waitangi/ the Treaty of Waitangi and its principles.

3.6 The Crown acknowledges that it pressured Rangitāne rangatira and hapū to sell their interests in Mangatainoka block in the southern Seventy Mile Bush by misrepresenting loan agreements as agreements to sell the block, and unreasonably imposing monopoly powers over the whole of Mangatainoka after rejecting a Rangitāne offer to sell more than enough Mangatainoka land to repay the Crown's advances. The Crown acknowledges that it did not negotiate in good faith, and failed to actively protect Rangitāne interests, and that its conduct of negotiations for Mangatainoka breached te Tiriti o Waitangi/the Treaty of Waitangi and its principles.

3.7 The Crown acknowledges that:

3.7.1 under the native land laws, most titles in Seventy Mile Bush were granted to ten or fewer owners;

3.7.2 Rangitāne hapū understood that, in most cases, these named owners were to act as trustees for the wider community, but the native land laws allowed the owners to sell the land granted to them without the consent of the wider community of customary owners and without their participation in the benefits of the sale;

3.7.3 although it introduced the equitable owners legislation in 1886 to remedy this situation by providing for the addition of other customary owners on legal titles, the Crown failed to ensure that this remedy could be applied to a number of blocks, including reserve blocks, in Seventy Mile Bush. These Crown actions and omissions caused prejudice to Rangitāne and breached te Tiriti o Waitangi/the Treaty of Waitangi and its principles.

Political Movements

3.8 The Crown acknowledges that:

3.8.1 Rangitāne rangatira and communities were involved in collective efforts to resist land sales and the loss of iwi and hapū integrity. These movements included the Repudiation movement, Pōtangaroa's prophetic movement, the Kotahitanga parliaments, and the efforts of Nireaha Tamaki to bring Crown dealings with customary title under court scrutiny; and

3.8.2 it did not always recognise these movements nor address the grievances they raised.

Wairarapa Moana

3.9 The Crown acknowledges that:

3.9.1 for Rangitāne hapū, the Wairarapa Lakes and their associated waterways and wetlands were a taonga and an abundant source of food and other customary resources;

3.9.2 in 1896 the Crown addressed settlers' concerns about the flooding of agricultural land by securing a transfer of the Wairarapa Lakes from Rangitāne and other Wairarapa Māori;

3.9.3 it failed to meet its obligations under the Lakes agreement to provide ample reserves in the vicinity of the Lakes and provided instead remote and inaccessible land north of Lake Taupō, at Pouākani, after a delay of two decades; and

3.9.4 its accumulated acts and omissions in relation to the Lakes agreement breached te Tiriti o Waitangi/the Treaty of Waitangi and its principles.

Public Works Takings

3.10 The Crown acknowledges that:

3.10.1 there was limited, if any, consultation with Rangitāne or with Māori generally about the policy and enactment of public works legislation before the middle of the twentieth century;

3.10.2 consultation with Rangitāne communities prior to some takings was negligible or absent;

3.10.3 land taken for public works was in some cases disposed of to a third party rather than offered back to the original Rangitāne owners; and

3.10.4 Rangitāne communities have suffered land loss through public works takings and these losses have in many instances created a sense of grievance within Rangitāne communities that is still held today.

Landlessness and Socio-economic Impacts

3.11 The Crown acknowledges that:

3.11.1 the cumulative effect of Crown purchasing, the native land laws, public works takings, and other forms of alienation, left Rangitāne with insufficient land by 1900 to engage meaningfully with the colonial economy or to provide for their future needs in the twentieth century;

3.11.2 Rangitāne communities are virtually landless today; and

3.11.3 its failure to ensure Rangitāne retained sufficient land for their socio-economic needs caused real and lasting prejudice to Rangitāne communities and was a breach of te Tiriti o Waitangi/the Treaty of Waitangi and its principles.

3.12 The Crown further acknowledges that Rangitāne communities have suffered from social deprivation and disadvantage for too long.

Loss of Environment or Taonga

3.13 The Crown acknowledges that:

3.13.1 Rangitāne consider their lands, mountains, rivers, wetlands and lakes as taonga, as part of their identity, as significant sources of food and other resources, and as integral to their spiritual and material well-being;

3.13.2 this Rangitāne environment has been degraded over time through deforestation, introduction of exotic species and pests, agricultural and industrial waste, road works and drainage works, and these changes have detrimentally affected the relationship of Rangitāne communities to many of their urupā (burial places) and sacred sites and have been a source of distress and grievance for Rangitāne; and

3.13.3 historic environmental legislation before the late 1980s did not provide for the recognition of Māori cultural values and practices and limited the ability of Rangitāne to exercise kaitiakitanga (or stewardship) over their natural environment or taonga.

Te Tapere-nui-o-Whātonga (or Seventy Mile Bush)

3.14 The Crown acknowledges that:

3.14.1 the ancient forest formerly covering the western part of the Tamaki nui-ā-Rua region and the north-western part of the Wairarapa region, and known as 'Te Tapere-nui-o-Whātonga', was a taonga of great significance to Rangitāne communities and was a key source of Rangitāne's spiritual and material well-being;

3.14.2 large-scale Crown purchasing and settlement in this area resulted in primarily agricultural land uses and the almost total loss of this forest taonga and resource, along with many indigenous species, among these the highly-prized huia bird; and

3.14.3 the loss of these taonga deprived Rangitāne of an important link to the tikanga and way of life of their ancestors, and has been a source of distress and grievance for Rangitāne.

Impacts on Culture and Identity

3.15 The Crown acknowledges that the Rangitāne experience of large-scale land loss in the nineteenth century, urbanisation in the twentieth century, and the state education system that discouraged the use of te reo Māori, contributed significantly to Rangitāne struggling to maintain their traditional marae communities and becoming alienated from their own cultural traditions and language.

3.16 The Crown acknowledges that:

3.16.1 it has been a source of distress and grievance for Rangitāne that they were not named in the 1943 legislation that governs the administration of land at Pāpāwai and Kaikōkirikiri that was gifted by Rangitāne and other Wairarapa rangatira to the Anglican Church for the purpose of schools; and

3.16.2 inadequacies in the administration of the gifted lands identified by various governmental and parliamentary inquiries were not remedied by legislative or other means for many decades, and these inadequacies and delays were an ongoing source of grievance in Rangitāne communities.

3.17 The Crown acknowledges Rangitāne as an iwi of Wairarapa and Tamaki nui-ā-Rua regions. The Crown acknowledges that its former limited recognition of Rangitāne contributed to the challenges experienced by Rangitāne in maintaining a distinct iwi presence from 1840 to the present. The Crown further acknowledges the efforts of Rangitāne, especially from the 1980s, to re-establish its identity in the region, including with Crown agencies and local authorities.

APOLOGY

3.18 The Crown recognises the efforts of the ancestors of Rangitāne in pursuit of redress and justice for the Crown's wrongs, and offers this apology to Rangitāne o Wairarapa and Rangitāne o Tamaki nui-ā-Rua, to their ancestors and to their descendants.

3.19 The Crown is deeply sorry for its many breaches of te Tiriti o Waitangi/the Treaty of Waitangi and its principles, and for the effect that these breaches have caused to generations of Rangitāne o Wairarapa and Rangitāne o Tamaki nui-ā-Rua.

3.20 The Crown sincerely regrets that on a number of occasions it failed to negotiate in good faith and actively protect Rangitāne o Wairarapa and Rangitāne o Tamaki nui-ā-Rua interests when purchasing land in their takiwā.

3.21 The Crown profoundly regrets that it failed to actively protect the tribal structures of Rangitāne o Wairarapa and Rangitāne o Tamaki nui-ā-Rua after it promoted native land legislation which individualised their previously tribal land tenure.

3.22 The Crown deeply regrets that Rangitāne o Wairarapa and Rangitāne o Tamaki nui-ā-Rua did not experience the prosperity the Crown led them to expect when it pressured them to sell large areas of land before 1865. The Crown sincerely apologises that it failed in its Treaty duty to protect them from being left virtually landless, and they have for too long experienced socio-economic deprivation and disadvantage.

3.23 The Crown deeply regrets the prejudice Rangitāne o Wairarapa and Rangitāne o Tamaki nui-ā-Rua have suffered from the degradation of lakes and rivers, the felling of Te Tapere-nui-o-Whātonga (the Seventy Mile Bush), and the loss of taonga such as the huia.

3.24 The Crown regrets that its former limited recognition of Rangitāne o Wairarapa and Rangitāne o Tamaki nui-ā-Rua contributed to the challenges experienced by Rangitāne o Wairarapa and Rangitāne o Tamaki nui-ā-Rua in maintaining a distinct iwi presence from 1840 to the present.

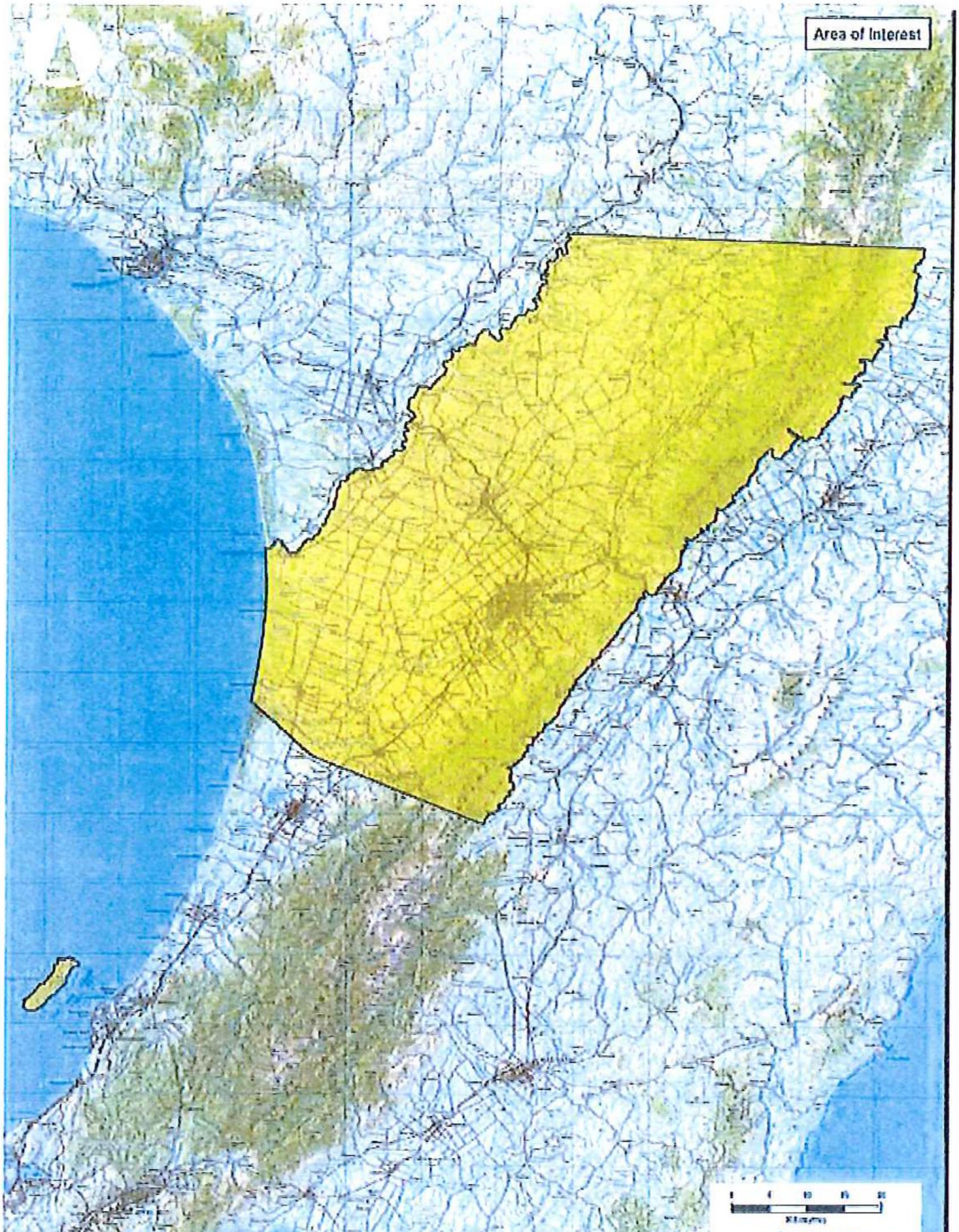
3.25 The Crown unreservedly apologises for not respecting the rangatiratanga of Rangitāne o Wairarapa and Rangitāne o Tamaki nui-ā-Rua and for not having honoured its obligations to Rangitāne o Wairarapa and Rangitāne o Tamaki nui-ā-Rua under te Tiriti o Waitangi/the Treaty of Waitangi.

3.26 Through this settlement and this apology, the Crown seeks to restore its honour and atone for its wrongs to the whānau and hapū of Rangitāne o Wairarapa and Rangitāne o Tamaki nui-ā-Rua by easing the burden of grievance that has been carried for generations. The Crown looks forward to developing a new relationship with Rangitāne o Wairarapa and Rangitāne o Tamaki nui-ā-Rua that has mutual trust and respect for te Tiriti/the Treaty and its principles as its foundation.

7.C
RANGITĀNE O MANAWATŪ AREA OF INTEREST

APPENDIX C

RANGITĀNE o MANAWATŪ AREA OF INTEREST



7.D
RANGITĀNE O TAMAKI NUI Ā RUA AREA OF INTEREST

APPENDIX D

RANGITĀNE o TAMAKI NUI Ā RUA AREA OF INTEREST

8. STATEMENT OF KAHUNGUNU KI TĀMAKI NUI-A-RUA TRUST

IN THE MATTER OF	The Resource Management Act 1991
AND	
IN THE MATTER OF	Notices of requirement for designations under section 168 of the Act, in relation to Te Ahu a Turanga: the Manawatū Gorge Replacement Route Project
BY	**NZ Transport Agency** Requiring Authority

STATEMENT OF POSITION: TE AHU A TURANGA PROJECT - ASHHURST TO WOODVILLE MANAWATU GORGE STATE HIGHWAY 3

IDENTIFICATION OF MATTERS RELEVANT TO
KAHUNGUNU KI TĀMAKI NUI-A-RUA TRUST

October 2018

Morry Black, Project Lead

Greg Carlyon, Project Planner

James Kendrick, Project Researcher

Hutia te rito o te harakeke kei hea te kōmako e kō
Kī mai kī ahua
He aha te mea nui o tēnei ao?
Māku e kī atu
He tāngata he tāngata he tāngata
Tihei Mauri Ora!

Tēnā koutou katoa. Me ō tātou aituā maha o te wā. Kotahi tonu te kōrero ki a rātou haere koutou I runga I te aroha o te Atua. Kāti, me waiho ratou ki a rātou. Tātou te hunga ora ki a tātou tēnā tatou katoa.

Ko ngā kupu e whai ake nei he whakarāpopoto I ngā aromatawai mō te wāhi o Tāmaki nui-a-Rua. Ko te tumanako ka whai hua te kaipānui i roto i ēnēi rārangi tuhituhi.
Mauri ora

SUMMARY

Following the loss of the State Highway 3 (SH3) Manawatu Gorge route due to catastrophic slope failures, New Zealand Transport Agency (NZTA) have been fast-tracking the development of the Te Ahu a Turanga project. The NZTA, supported by the consulting community, has undertaken an assessment of options for replacing the Manawatu Gorge route, and has recommended a best practicable option route following the foothills of the Manawatū Gorge, predominantly on farmland within and adjacent to Te Apiti Windfarm. The route proposes a bridge crossing at the western end of Manawatu Gorge, with the road climbing steeply before traversing east above the Gorge, to make a long descent prior to joining the existing roading network approximately 1km to the west of Woodville township.

The existing roading infrastructure to allow traffic between Ashhurst and Woodville (Saddle Road) and Palmerston North and Pahiatua (Pahiatua Track) is under severe pressure, with ongoing maintenance and upgrading occurring on the live network. The roading project is currently programmed to be completed within six years. The timeframe includes obtaining the notice of requirement (NOR), appropriate resource consents, and the construction and mitigation period. The pressure this has put on the project is considerable, with resulting impacts on planning and consultation requirements.

The Kahungunu ki Tāmaki nui-a-Rua Trust (the Trust) holds broad concerns that the cultural values of those they represent are put at risk because of the timing and pressures imposed by the project timeframes. However, the Trust acknowledges key matters:

1. The overall timeframe for project completion is appropriate when consideration of public safety, infrastructure impacts and broader environmental/cultural impacts are taken into account.
2. The Trust broadly supports the proposed alignment sought within the NOR process. However the potential impacts of the development of the project within the roading corridor, may have unintended impacts on cultural and environmental values critical to the Trust.

The NZTA has been constructive and supportive of the work undertaken by the Trust in order to prepare this statement, prepare a partnership

agreement, and has indicated support for its proposed field work and associated cultural monitoring and assessment.

With that support, the Trust has come to a position that its broad concerns could be addressed through the spectrum of opportunities within the NOR, the resource consent process and partnership agreement, but these are unlikely to be addressed through the NOR process alone.

The main reasons for this position are as follows:

- The project timing has not allowed the Trust to complete a comprehensive site assessment in respect of cultural, terrestrial and freshwater values;
- The separation of the NOR process from resource consenting (a determination made by NZTA for strategic reasons) has meant that key details that would allow for a determination provided by the NOR, are not available to inform that process. For example, the field checking and identification of cultural values, baseline freshwater assessments and peer review/agreement to offsetting proposals in respect of terrestrial/freshwater ecology.
- New or updated information is constantly being provided as the project develops and the ability to assess this from a cultural perspective is compromised due to lack of site access and time restrictions.

It is the authors' view that were the resource consents and NOR addressed in tandem, significant process efficiencies and critical outcomes could have been more effectively resolved. The Trust accepts the Agency's rationale for the process being undertaken, however is reliant on the partnership agreement between the parties to address outstanding concerns raised above.

While this paper includes preliminary articulation of the cultural values of the Trust, it is accepted by both the Trust and the Agency that a proper Cultural Impact Assessment is not able to be completed until further field work, baseline cultural assessment, and assessment of material yet to be prepared for the resource consents, is undertaken by the Trust.

It is recognised this raises a challenge for decision makers on the NOR in respect of Part 2 of the Act. The Trust welcomes the opportunity to speak to these matters alongside the Agency, before the hearing process. Equally, the Trust and its representatives welcome the opportunity to engage with consenting authorities in mediation or caucusing processes.

It is conceivable that the Trust will be in a position to provide further material to assist the hearing for these matters, with further project work planned through the early part of summer 2018-2019.

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KAHUNGUNU KI TĀMAKI NUI-A-RUA TRUST

1. The Tāmaki nui-ā-Rua Taiwhenua Trust was incorporated under the Charitable Trusts Act in April 1997, as one of 6 Taiwhenua under the umbrella of Ngāti Kahungunu Iwi Incorporated. In January 2009, the organisation was restructured and registered as Kahungunu ki Tāmaki nui-a-Rua Trust (the Trust). Although affiliated to the Iwi incorporation, it operates autonomously and is representative of Kahungunu interests within the Tāmaki nui-a-Rua rohe, which aligns approximately with the Tararua District.

2. In addition, the Trust Chair and several Board members are on the Board of Trustees for the Ngāti Kahungunu ki Wairarapa Tāmaki nui-a-Rua Settlement Trust, who are the mandated authority set up to receive Treaty settlement assets from the Crown. Treaty redress through this process will include land and forestry assets, cash compensation, cultural redress, an official apology from the Crown, and the right of first refusal over a substantial number of Crown properties, which will help set whānau and hapū on a pathway towards greater autonomy and prosperity. In addition, the Treaty settlement guarantees a new covenant "*He Kawenata Hou*", which will assist the Treaty Settlement Trust in building lasting relationships with a number of key Crown ministries and agencies.

TE AHU A TURANGA ROADING PROJECT

3. A significant slip in the Manawatu Gorge, during 2011, saw the closure of SH3 between Ashhurst and Woodville. The closure lasted a number of months, generating major impacts on the communities located close to the gorge. Major economic impacts were generated by the prolonged closure. While the Gorge Road was opened following remediation, ultimately further slips and specialist geotechnical evaluation led to a view from NZTA that maintenance of this roading corridor was impractical and unsafe over the long term. The Te Ahu a Turanga project (the project) has been designed to replace the existing highway route. It follows a multi-criteria analysis undertaken by NZTA of 18 potential routes, subsequently reduced to six viable options.

4. The implementation of the project is very much driven by parameters outside NZTA's control. The usual planning and engagement processes have been limited by the timeframe constraints for obtaining a designation for the route, preparing and obtaining resource consents and constructing the roading corridor within approximately six years. The project scope and approach taken by NZTA is well described in documentation appended to the NOR.

ENGAGEMENT WITH NZTA

5. The Trust has welcomed the recognition by the Crown agency, NZTA, of their mana whenua status at the earliest opportunity in the project.

6. Prior to the partnership discussions with NZTA, Trust members attended workshops where the various routes for the new road were assessed before the final choice for the NOR was confirmed. During the selection phase, NZTA was informed that it was more appropriate for the Trust to provide a cultural values or cultural impact assessment once the new route was confirmed. This avoided a resource intensive and time consuming exercise evaluating the large number of options then being considered.

7. Since confirmation of the route Trust representatives have attended hui with various NZTA staff and/or their contractors and attended mitigation workshops in Palmerston North where different consultants provided updates as the NOR process progressed. These have been helpful in terms of gaining a better understanding of the different parts of the overall project, and how some adverse effects from various activities may be avoided, mitigated or offset. In addition, a number of hui have been held with NZTA staff in Dannevirke and Woodville, as well as convening of the site visit (NOR walkover) mentioned below. NZTA has provided unfettered access to project materials and reports.

8. The separate hui between NZTA and the Trust have helped NZTA to gain some understanding of Kahungunu's cultural values and preferences. The key outstanding issues for the Trust, in respect of

the detail that would inform cultural impact assessments, is understood by NZTA.

9. With the support of NZTA and agreement from landowners on the designation route, Kahungunu personnel have been able to walk over four kilometres of the proposed corridor. However, there are still several kilometres that the Trust team have yet to inspect as part of a preliminary cultural assessment. The Trust managed to access around 40% of the proposed corridor from the Windfarm lookout on the eastern side of the Tararua Ranges near the 9400 chain marker down to the Manga-manaia Stream where it flows through the Bolton property.

10. During the initial field work several sites of cultural significance were identified which the Trust felt require further investigation, or extra care during any land disturbance activities. These sites are not identified in the public domain at present. The Trust is working with NZTA directly to have the site values recognised and protected where relevant.

11. In addition, when walking the proposed route up from the Bolton property, which borders State Highway 2 west of Woodlands Road, Trust researchers were able to view other parts of the proposed route. The researchers identified one site in particular, which they considered it was appropriate to avoid. The suggested re-alignment of the roading corridor to higher ground, rather than down through a gully (which would have required containment of approximately 300 metres of a stream beneath the new road), was taken up by NZTA.

12. NZTA has attempted to resolve or find mitigation responses to substantive suggestions made by the Trust. As previously identified, the relationship between the NZTA and the Trust is endorsed by a partnership agreement[1]. It is intended to address matters relevant to both resource management processes and broader cultural issues.

[1] Currently in draft form and yet to be agreed

CULTURAL CONTEXT

13. Historically the Crown's prioritisation of development as well as limited statutory protection has contributed to damage to or destruction of, many Ngāti Kahungunu heritage sites, including wāhi tapu, pā, urupā, mahinga kai, nohoanga, and archaeological sites. These include Ngā Rā ā Kupe (Kupe's Sail) and Mātakitaki Pā Site. Other sites of significance have suffered physical and cultural damage that is in some cases irreparable as a result of public works and other developments.[1] This context is the one in which the Trust engages to ensure their cultural values are not further undermined, and where possible, are restored and fully protected.

14. Kahungunu, the eponymous ancestor of Ngāti Kahungunu settled in Te Mahia around the 16th century and married Rongomaiwahine from which union Ngāti Kahungunu gradually became established. One of their sons Rakaihikuroa, travelled down into Heretaunga with many members of his whānau. His son Taraia (Kahungunu's mokopuna) eventually succeeded Rakaihikuroa as leader of this faction, and following his encounters with local hapū, Ngāti Kahungunu gradually asserted their dominance within Heretaunga over the local tribes Whatumamoa, Rangitāne, Ngāti Awa and Ngāti Tara. Although there were strategic alliances and marriages between Taraia's people and some locals, many were displaced following battles, and moved further south into Tāmaki nui-a-Rua and Wairarapa. As Ngāti Kahungunu hapū populations increased, they also moved further southward, again dominating local hapū and their affiliates.

15. Within the historical record of Heretaunga, there is reference to a 'Kōhanga o nga Rangatira, at Te Wheao near Te Hauke. Different factions from throughout the rohe of Ngāti Kahungunu would gather there for important hui and wānanga, coming from Ahuriri, Heretaunga, Waimarama and Takapau. At the time Rangikoianake, the tīpuna of Ngāti Rangikoianake was married to Kaihou, and they had 3 children, who were sent to be raised by various enclaves of Ngāti Kahungunu. One son, Te Kikiri-o-te-Rangi was raised near Takapau, eventually becoming their leader and warlord, the founder of Ngāi Kikiri-o-te-Rangi hapū, and protecting the southern and western boundary from

encroachment by other hapū/iwi. Te Karana was taken out to Waimarama to be raised by the Waimarama whanau, while Hawea te Marama, was brought into the Heretaunga Plains. His descendants became Ngāti Hawea. This process was later referred to as 'Nga Pou Mataara', symbolic of sentinels or guardians, there to watch over and protect various areas of interest and value to the hapū collectives of Ngāti Kahungunu. By the time of early European exploration into the South Pacific through to the signing of the Treaty of Waitangi, Ngāti Kahungunu were the dominant iwi within Wairarapa and Tāmaki nui-a-Rua. Over time, due to intermarriage and strategic alliances, many tangata whenua in Tāmaki nui-a-Rua now have whakapapa connections to two or more iwi, although they often affiliate more towards one.

16. Ngāti Kahungunu first encountered Pākehā in February 1770, when three waka came out from the east coast a little way North of Cape Palliser to meet Captain James Cook's *Endeavour*.[2] Local iwi again met Cook when he was forced inshore on the *Adventure* along the same stretch of coast in 1773.[3] Over the ensuing decades, the pigs and potatoes introduced to New Zealand by Cook were brought to Wairarapa where they quickly became well established food sources.[4]

17. In the 1830s, many Ngāti Kahungunu of Wairarapa and Tāmaki nui-a-Rua withdrew to the Mahia peninsula after warfare in the district escalated following the arrival of northern tribes armed with muskets.[5] Some Ngāti Kahungunu remained on their lands to maintain their ancestral rights.[6] Most however, took refuge with many others from related iwi at Nukutaurua, under the protection of Te Wera Hauraki. There they traded with resident Pākehā whalers to acquire muskets, tools and other goods.[7] During their residence at Nukutaurua, Ngāti Kahungunu were introduced to Christianity through Māori teachers and visits by missionaries to Turanganui-a-Kiwa (Gisborne), where a few moved to in the late 1830s.[8] They rapidly adopted Christianity and eagerly embraced other benefits brought by Pākehā, including literacy, new technology, and growing of new crops.[9]

18. By the mid-1830s Kahungunu began fighting to reoccupy their lands.[10] In 1838 Ngāti Kahungunu at Nukutaurua began their return home to

Tāmaki nui-a-Rua and Wairarapa. In 1839, 69 waka sailed from Nukutaurua arriving at Ahuriri. Many stopped for a time in the Hawke's Bay area with whānau before continuing on to Tāmaki nui-a-Rua and Wairarapa.[11] An enduring peace was then agreed with those who had briefly occupied their whenua in their absence. A boundary between Rangitāne o Manawatū and Ngāti Kahungunu was settled along the Rimutaka and Tararua ranges.[12]

Crown Purchasing in Tāmaki nui-a-Rua

19. A large area of Māori land between Wairarapa and southern Hawke's Bay was not included in the early Crown purchases. The district was known to Ngāti Kahungunu as Tāmaki nui-a-Rua and included the great forest of Te Tāpere nui-ā-Whatonga, known to Pākehā for a time as the "*Seventy Mile Bush*". In 1857 the Crown sought to open purchases in this area and initiated negotiations with Rangitāne in Manawatu for land in Tāmaki nui–a-Rua, but found that Rangitāne wished to conclude transactions for their Manawatū lands first, before dealing with land in Tāmaki nui–a-Rua.[13]

20. In 1858 the Crown paid an advance of £100 in Wellington to nine leaders of Rangitāne, for their assumed interests in the Ngā-awa-purua block (estimated to exceed 100,000 acres[14]) and it also made a separate payment to a second group.[15] This sparked opposition from Kahungunu hapū who actually lived on the land, who told the Crown of their opposition to the Ngā-awa-purua deed.[16] In September 1859 Donald McLean returned to the district to re-open negotiations there and in October 1859 the Makuri and Ihuraua deeds were arranged with Ngāti Kahungunu at Akitio, affecting about 72,000 acres in the Puketoi ranges west of the Castlepoint block. A reserve of 21 acres was made for a Ngāti Kahungunu individual.[17] By the early 1860s no further progress had been made with the purchase of the Ngā-awa-purua block.

21. Ngāti Pakapaka were among the resident owners of the Northern Bush and in 1861 Paora Rangiwhakaewa and other rangatira of Ngāti Rangiwhakaewa who opposed the sale of their land to the Crown by Rangitāne, took matters into their own hands and asserted their claims through the leasing of their land at Mangatoro to an early settler.[18]

Before the lease was arranged a komiti Māori inquired into its ownership resulting in the rights of the lessees being affirmed. The inquiry was presided over by Henare Matua and Karaitiana Takamoana, who were able to arbitrate, as they had connections to Ngāti Pakapaka and Ngāti Mutuahi, who also asserted interests in Mangatoro.[19] About 13,000 acres at Mangatoro was leased to the settler at an annual rental of £100.[20]

The Arrival of the Native Land Court in Tāmaki nui-a-Rua, 1867

22. On 14 January 1867 a group of five blocks in Tāmaki nui-a-Rua were brought before the Native Land Court sitting at Waipawa on the applications of Ngāti Rangiwhakaewa, who lived on the lands. The five blocks (Otawhao, Oringi Waiaruhe, Tahoraiti, Kaitoki, and Mangatoro) in the Dannevirke area had a combined area of 65,555 acres, and as the claims were not disputed the titles were each awarded to 10 or fewer of the claimants. On 4 September 1868 title to the Mangapuaka block (906 acres) was investigated by the Native Land Court at Waipawa and was awarded to a rangatira of Ngāti Rangiwhakaewa and four others claiming with him.[21]

23. The limit of 10 owners permitted on Native Land Court titles at this time meant that some owners were excluded from the titles. In 1870, some of those excluded from the Oringi Waiaruhe title sought a rehearing, which was not granted, and they protested that, "*we are being driven off that land*" and that they were "*very sorrowful about our land. We have been made to suffer by this work.*" The excluded owners wrote that this threat to their occupation of their land was a result of it being leased. A senior Crown official, acting in his private capacity was one of the lessees.[22]

Crown Dealings, 1868-1870

24. In July 1868 the Crown renewed its efforts to purchase land in Tāmaki nui-a- Rua. In August the Crown met with a large number of Māori at Waipawa who reportedly agreed to sell land in the Northern Bush, as a result of which a survey of Tāmaki nui-a-Rua began but it was not completed.[23] The survey was supported by those "*anxious to sell*," but was opposed by other Māori. Active opposition to the survey by

Aperahama Rautahi, a rangatira of Ngāti Rangiwhakaewa, was cited as a factor in suspension of the sale. A sketch plan of the unsurveyed Tāmaki nui-a-Rua district was instead compiled from existing plans of land in adjoining districts and was used for Native Land Court title investigations.[24]

25. In April 1870, the Crown began paying advances to those it identified as principal claimants. These advances were paid in expectation of applications being made to the Native Land Court, for survey and court expenses, and in some cases for provisions and accommodation.[25] By June 1871 a total of £1,290 had been advanced and charged against the proposed purchases, including £500 paid to the Hawke's Bay Provincial Government for surveys. These advances were intended as part payment for interests to induce recipients to selling land if they were awarded title. In 1879 the Native Minister ordered this practice to stop, by which time most of the Tāmaki nui-a-Rua lands had been purchased.[26]

26. Pre-title agreements for the Crown purchase of three large blocks (Te Ahu-a-Turanga, Maharahara, and Puketoi) were arranged by April 1870. Under the agreements the Māori signatories agreed to apply to the Native Land Court for title to the land and to then sell it to the Crown. An advance of £50 was paid on each block.[27] Some of the signatories did not live on the land. Some Ngāti Rangiwhakaewa did not sign and they and some of their kin in the wider Ngāti Kahungunu rohe, were "staunch opponents" of the Crown's proposed purchases.[28] Te Ahu a Turanga is the name of a land block but also of an ancient Māori trail that was named after Tūranga-i-mua, a powerful tohunga and tipuna of the Ngā Rauru tribe. Tūranga-i-mua was the son of Turi and Rongorongo, and married Rātiti, the daughter of Kauika, a tohunga who sailed on the Aotea waka with Tūranga-i-mua's father Turi. Tūranga's mother Rongorongo, was the sister of Rongokāko, the legendary figure who arrived in Aotearoa on the sacred waka Takitimu, and the father of Tamatea. While crossing the Ruahine with Kauika, Tūranga-i-mua and Kauika were slain by a party seeking utu for previous battles. He was buried on the track that now bears his name, but was later disinterred and taken back to Patea.

Investigation of the Northern Bush, 1870

27. On 6 September 1870 the Crown met with a large number of Māori at Waipawa to discuss the pending investigation of title of Tāmaki nui-a-Rua land blocks by the Native Land Court and the Crown's purchase of a large part of that land. In addition to Crown officials the meeting was also attended by the Native Land Court Judge who was to hear the land claims a few days later. Ngāti Kahungunu hapū attended the meeting as did Māori from other groups from inside and outside of Tāmaki nui-a-Rua.[29]

28. Discussions at the Waipawa meeting about customary interests in Tāmaki nui-a-Rua continued on into 7 September 1870 but were not conclusive, leaving the contending claims to be resolved in the Native Land Court which was to sit the following day. The meeting revealed a division between the hapū of Ngāti Rangiwhakaewa, Ngāti Pakapaka, and Ngāti Parakiore on the one hand and, on the other, Ngāti Mutuahi, who had engaged with Crown land purchasing and who were supported by an influential Rangitāne rangatira from the Manawatu who was related to them.[30] There was "*much quarrelling*"[31] at the meeting and Ihaia Te Ngārara, a rangatira of Ngāti Pakapaka, recalled two decades later that, as a result of the contestation at the meeting, there was "*a great fight outside the Court.*"[32]

29. On 8 September 1870, the first day of the Native Land Court hearing, Aperahama Rautahi appeared in court for the Ngāti Rangiwhakaewa counter-claimants to Te Ahu-a-Turanga but when his whakapapa evidence was challenged by witness for the claimants, he left the court abruptly and his claim was dismissed.[33] Ihaia Te Ngārara later recalled: "*The main contentions took place outside the Court, there was not a severe contest inside. People were afraid to speak in Court in those days*," adding that he was "*afraid of the Court in 1870*," as he was "*unacquainted with the procedures of the Court.*"[34] When some rangatira of Ngāti Rangiwhakaewa, Ngāti Pakapaka and Ngāti Parakiore were, two decades later better able to present evidence about their claims to the Native Land Court they referred to their whakapapa links to Ngāti Kahungunu.[35]

30. Very little evidence as to customary rights or occupation of the land was recorded in this or any of the other Tāmaki nui-a-Rua blocks investigated. The title investigations for the 17 blocks comprising about 290,000 acres were completed in four days and each title was awarded to 10 or fewer owners selected by the successful claimants. The Puketoi 6 case was adjourned and the title investigation was completed in 1890.[36]

31. Following the dismissal of their claim a few individuals of Ngāti Rangiwhakaewa were admitted to Tāmaki (34,098 acres), Piripiri (18,014 acres) and two of the smaller blocks, Tiratu (7,945 acres) and Otanga (5,033 acres).[37] Many others of Ngāti Rangiwhakaewa and others with interests in the land were referred to in evidence.[38] Restrictions on alienation were placed on Tāmaki and Piripiri as these were among the blocks that were not intended for Crown purchase. The titles to other Tāmaki nui-a-Rua blocks included a few individual Ngāti Rangiwhakaewa grantees, including the rangatira Hori Herehere who two decades later described himself as a "*non-seller*."[39] Some smaller titles included other Ngāti Kahungunu interests, such as Tuatua (9,600 acres) and Rakaiatai (8,200 acres). Wharawhara (2,180 acres) was awarded to Ngāti Parakiore and Ngāti Manuwhiri without contest.

32. The conduct and outcome of the September 1870 title investigations led to protests from some Ngāti Kahungunu whanau. In October 1870, Paora Ropiha Takou wrote to the Chief Judge of the Native Land Court that he "*strongly disapproved*" of the procedure of the court at the Tāmaki nui-a-Rua hearings. He described how Ngāti Rangiwhakaewa and Ngāti Parakiore had opposed the Crown's proposed purchases of much of the land and had been in a dispute for some time with those who were committed to sale.[40]

33. In 1871 Henare Matua wrote on behalf of the "*whole of the Runanga who conduct the business of Tāmaki*" to the Chief Judge of the Native Land Court to make similar complaints and to seek a rehearing of the blocks. Two men of Ngāti Rangiwhakaewa whose individual interests had been recognised in some of the 1870 titles also wrote to the Chief Judge to seek a rehearing. The court did not approve a rehearing.[41]

There was then no appellate court in the Native Land Court system to which this decision could be appealed.

34. In 1871 two petitions against the title investigation process and the Crown purchasing of the land were submitted to Parliament's Legislative Council. One was from Te Otene Matua and 73 others and the other was from Paora Rangiwhakaewa and 70 others of Ngāti Rangiwhakaewa and related hapū of Tāmaki nui-a-Rua.[42] They recalled how Aperahama Rautahi told the court during the 1870 Te Ahu-a-Turanga title investigation of his Ngāti Rangiwhakaewa ancestry, that he lived on and cultivated the land, and that his ancestors had lived on it for nine generations before him. Yet his claim failed when it was challenged by a rangatira of Rangitāne who said he was intent on selling, and as a result Aperahama stated that he was "*overthrown*" from his land.[43] The petitioners sought a rehearing, which was not granted.

35. The petitions were followed up by complaints to the 1873 Hawke's Bay Native Lands Alienation Commission about the Tāmaki nui-a-Rua titles and purchases. The Commission was established to investigate protests about numerous Hawke's Bay Native Land Court titles and their alienation. The testimony of Henare Matua on the Tāmaki nui-a-Rua complaints repeated and enlarged upon the concerns expressed by those who had earlier written and petitioned on these issues. The Commission did not uphold his complaints about Tāmaki nui-a-Rua. [44]

Crown Purchasing in Northern Bush, 1871-1882

36. Once the court awarded titles in September 1870, the Crown set about finalising its purchases of the Northern Bush titles. Karaitiana Takamoana of Ngāti Kahungunu was a leading figure in the purchase negotiations and had been included by resident Māori (to whom he was related) in the titles for his expertise in negotiating with the Crown.[45] Negotiations stalled for a time over the purchase price. At a hui at Waipukurau in April 1871 Karaitiana (elected in February as the Member for Eastern Maori) brokered a solution to the impasse, joining 23 other owners in acknowledging receipt of the £1,300 in pre-title advances paid on the titles. The final purchase price had yet to be agreed. On 1 June 1871, Karaitiana and 11 other leading title holders

signed an agreement to sell 12 of the 17 blocks for £16,000. During August 1871 the Crown secured the signatures of a further 69 title holders and paid out £12,000 of the purchase price.[46] The area purchased was estimated to be 250,000 acres but on survey this increased to 265,000 acres.[48] Five reserves comprising just under 20,000 acres were excluded from sale.[49]

37. Ngāti Rangiwhakaewa opposed the purchasing of lands in which they had interests. In July 1871 Ihakara Whaitiri and Nopera Kuikainga complained to the Native Land Court Chief Judge that their requests to exclude their interests from the purchases and to have them defined by survey had been ignored. In August Nopera Kuikainga wrote again to complain about the purchasing, telling the Chief Judge: "*The Maoris are in trouble about their lands within the whole lands of Tāmaki.*" Henare Matua also wrote on behalf of the runanga that had managed the Tāmaki nui-a-Rua titles to urge the suspension of purchase, "*as the arrangements for that land Tāmaki are in a very bad state.*"[50] Henare Matua and Ngāti Rangiwhakaewa followed these complaints up with two numerously-signed petitions to Parliament's Legislative Council opposing the purchasing but to no avail.[51]

38. When the purchase deed was signed in August 1871 the £4,000 balance of the purchase price was retained until the reserves were surveyed and the purchase completed. The Crown intended to use this balance of the payment to induce "*dissentients*" to the purchase to accept it and to encourage the sellers to put pressure on them. Reports suggest the main dissentients were "*the Porangahau people,*" being Ngāti Kahungunu associated with Henare Matua, who had earlier opposed the purchase. In December 1873, the Crown paid the final instalment of £4,000 to 64 signatories.[52] Even so, not all the title holders had then signed the deed. In addition, the interests of two Ngāti Kahungunu rangatira who had not been included in the title were recognised by the Crown in November 1874 when it agreed to pay them £500 for their interests.[53]

39. The five titles comprising 65,555 acres awarded in 1867 to Ngāti Rangiwhakaewa were not included in the 1871 purchase. Of the titles heard in 1870, the Tāmaki, Piripiri, Tiratu, Tipapakuku, Otanga, and

Wharawhara blocks comprising 69,827 acres were retained in the ownership of Tāmaki nui-a-Rua Māori.[54]

40. Not all of the title holders signed the 1871 purchase deed and it took until 1882 for all of the signatures to be obtained, or for the interests of those who refused to sell to be defined by the Native Land Court and cut out of the purchased blocks. In 1882 Hori Ropiha and others petitioned Parliament about their refusal to sell their interests in Rakaiatai and Te Ohu and complained that timber on their land was being logged without their authority. The Crown requested Henare Matua and another Ngāti Kahungunu rangatira to lobby the remaining owners to sell, but they refused to assist in the completion of the purchase.[55] In 1882, the interests of Hori Ropiha and three other owners of Rakaiatai who had not sold were partitioned out by the Native Land Court as Manawatu 7A of 3,000 acres, with the Crown awarded the balance of 4,350 acres.[56]

41. In 1881 the Crown sought the assistance of the Ngāti Kahungunu rangatira Henare Matua to persuade Maata Te Opekahu, the owner of one of the two unsold interests in Te Ohu and Umutaoroa to sell. Henare Matua declined to convince her to sell, but in 1882 the owner agreed to sell her share for £400, prompting her son Hori Herehere to urge his mother not to sign the deed. The Crown warned her that if the deed was not completed it would apply to the Native Land Court to define her interest, and would then seek to charge it with £130 already advanced against her interest and paid to another owner, plus interest, and travel and other expenses claimed by the Crown's purchase agent. In 1882 the two remaining unsold interests in Te Ohu and Umutaoroa were acquired, completing the Crown's purchases.[57]

20th Century Land Issues

42. By 1900 Ngāti Kahungunu retained less than 10 percent, or about 240,000 acres, of their land in Wairarapa and Tāmaki nui-a-Rua.[58] This land was fragmented across more than 600 titles. Crown and especially private land purchasing continued for another century. The lands remaining to Ngāti Kahungunu were difficult to manage and develop due to Native Land Court processes of partition and succession, that led to many small, fragmented, and uneconomic titles, large and

growing numbers of owners holding increasingly tiny shares, poor or non-existent road access, and lack of development finance.[59] Today Ngāti Kahungunu retain about 1.5 percent, or 35,000 acres, of the land they owned in 1840.[60] Half of this land is contained in the large, rugged Mātaikona block reserved from the Castlepoint deed in 1853.[61] The rest of this land is divided into more than 400 titles.

43. The limited extent of Ngāti Kahungunu's remaining lands was outlined in the 1907 Stout-Ngata commission of inquiry into Māori land holdings. It found that the majority of land was already leased to settlers. Other than three large blocks, the lands occupied by Māori were in very small subdivisions, comprising papakainga and reserves. The commission recommended all purchasing should cease with the exception of the Waitutuma blocks. It agreed with the owners of the Waitutuma blocks to sell that land in order to raise funds to buy more suitable farming land, recommending that the purchase proceeds be held in trust for this purpose.[62] The Commission also recommended that all future leases be subject to public auction, and that Māori receive training and assistance similar to that already provided to settlers to help them develop the "small remnant" of lands remaining. Ngāti Kahungunu sought to develop extensive farming and Stout and Ngata supported this "*laudable desire*". In its final report on native lands the Commission stated that some of the economic problems resulting from under-utilised Māori land could have been solved long ago "*if the Legislature had in the past devoted more attention to making the Maori an efficient farmer and settler.*"[63]

44. The Crown did not adopt the commission's recommendations, other than by its purchase of some portions of the Waitutuma blocks.[64] In 1909 the Crown promoted the Native Land Act 1909 removing all existing restrictions on land alienation and providing for District Land Boards to oversee land alienation as an intermediary between Māori and purchasers[65] In the years following, land purchasing resumed and by 1930 nearly half of the remaining Māori-owned land in Wairarapa and Tāmaki nui-a-Rua had been acquired by either the Crown or private purchasers.[66] Between 1930 and 1950 about 3,600 acres was purchased, with a further 22,000 acres purchased between 1950 and 1970.[67] Land purchasing continued through the rest of the twentieth

century, with about 6,000 acres acquired from Māori between 1970 and 1990.[68]

45. Only a few Māori could obtain development finance and assistance from the Crown, similar to that available to settlers from the 1890s.[69] This hindered Ngāti Kahungunu's ability to profitably use what little good land they retained. In 1911 Ngāti Kahungunu told Acting Prime Minister James Carroll they were committed to "*the work of improving and cultivating our lands*" and "*entreat of you to provide an assisting sum of money for this purpose.*" They offered their land as security for loans from the Crown to develop their lands.[70] However it was not until 1929 that the Crown began to provide finance and assistance under Native Land Development Schemes. These schemes were intended to assist Māori in developing land for commercial agriculture. Once Māori consented to a development scheme, the Crown required full control of the lands included. A senior Crown official characterised its complete control over the lands during development as a form of "*benevolent despotism*."[71] However, by this time there was very little Māori land in Wairarapa and Tāmaki nui-a-Rua remaining that was suitable for these schemes and little development occurred.

46. In 1937, the Crown established a development scheme for 806 acres at Mākirikiri intending to develop six dairy farms there. By 1941 four farms had been established on 400 acres of developed land but by 1944 the scheme was in "very poor" condition and still required significant development investment.[72] In the late 1950s one Māori and several Pākehā farmers were allocated leases of farms in the scheme.[73] In 1992 the scheme was still under Crown control.

47. The more substantial Homewood scheme began in 1940 and consisted of 2,500 acres across 26 titles to be developed and managed as a single farm.[74] In 1953, "in the face of marginal prospects and rising debt", the Crown and owners agreed to end the scheme and the land was leased out to a neighbouring Pākehā.[75] The Crown also brought individual farms within the provisions of development schemes. From 1938 the Crown supported a Māori farmer to develop land at Tahoraiti but the land later reverted to scrub before being developed by its owners without Crown assistance. The Crown also operated a

development scheme for a farm at Pirinoa from 1940. In 1952 the land was leased to a neighbouring Pākehā to discharge the development debt.[76] Other properties were leased to neighbouring farms or even sold as they lacked access.[77]A subdivision of Te Awaiti was sold in 1980 to create some return from the landlocked land. This followed the construction of a bridge and road in the 1960s that provided access to adjoining general land but which stopped 20 metres away from the boundary of Te Awaiti. About 20 percent of the titles retained by Ngāti Kahungunu are "land-locked", surrounded by land in private or Crown ownership, without access, such as frontage to a road. The Crown's acts or omissions contributed to a number of these titles becoming landlocked. In 1853 the Crown agreed to a reserve at Te Awaiti but did not issue title until more than thirty years later. During this period the land became landlocked.[78]

48. The Crown has promoted provisions in legislation since 1886 relating to access to Maori land.[80] However, whilst the Courts had the power to grant access between 1886 and 1975, the provision of access to landlocked Maori land through adjoining General or Crown land required the consent of the adjoining owner. In contrast, when access was sought to landlocked General or Crown land through adjoining Maori land, the consent of Maori land owners was not required. From 1975 access could be granted to landlocked Maori land without the consent of adjoining land owners but this provision has not been used as it requires Māori to initiate High Court litigation which Ngāti Kahungunu consider prohibitively expensive and of uncertain outcome.[81] Today the 80 landlocked titles, comprising 3,525 acres in Wairarapa and Tāmaki nui-a-Rua, represent a significant proportion of the lands remaining to Ngāti Kahungunu.[82] Lack of access has made it difficult for owners to develop economic opportunities, exercise their rights of ownership or their cultural obligations as kaitiakitanga of the land.[83]

Public Works Takings

49. A significant area of land was taken from some Ngāti Kahungunu land owners for public works.[84] From 1878 to 1981 the Crown and local bodies acquired more than 1,700 acres in Wairarapa and Tāmaki-Nui-ā-Rua across 50 separate takings, as well as 800 acres at Pouākani.[85]

The land taken included urupā, wāhi tapu, marae, papakāinga, and other lands of great cultural significance to Ngāti Kahungunu in the vicinities of Te Ore Ore, Kaitoke, Tahoraiti, Tautāne, and Te Uru o Tane.[86]

50. The Native land Act 1878 allowed the Crown to take up to five percent of land held under a Native Land Court title for public works without compensation for a period of up to 15 years from the date of title.[87] This was three times longer than under a similar rule applying to general land.[88] This "five percent rule" was not removed from Māori land titles until 1927.[89] It resulted in the loss of significant areas of Ngāti Kahungunu land for public works.[90] In some cases where this rule had expired, there is no evidence that the Crown paid compensation for land taken from Ngāti Kahungunu for roads.[91]

51. Prior to the middle of the twentieth century, it was uncommon for the Crown to consult Ngāti Kahungunu owners before compulsorily acquiring their land for public works.[92] There is no evidence of Crown consultation with owners prior to roads being constructed through the Whakataki Reserve in the 1870s and 1880s.[93] NOR is there evidence of the Crown notifying or consulting the owners of Tautāne reserve before part of their land was taken for a new road requested by a neighbouring land owner to provide better access to his property.[94] This lack of consultation led to protracted disputes and protests over some public works.[95] The Crown declined alternative methods of securing land it needed for public purposes, such as the leases offered by Ngāti Kahungunu.[96]

52. During the twentieth century the Crown acquired nearly 400 acres from Tahoraiti titles at Dannevirke for a wide range of public purposes, including a sewage plant, rubbish dump, gravel pit, rifle range, aerodrome, scenic reserve, and railways.[97] These takings and subsequent public works were effected despite the negative impacts of facilities such as a rubbish dump and sewage treatment plant on the adjacent Mākirikiri marae and papakāinga.

53. In 1911 the Crown took 38 acres at Mākirikiri for scenery preservation and vested the reserve in the local council in 1913. The council had

sought the land for a recreation reserve, but the land remained a scenic reserve despite the scenic value of the land being degraded by logging, fire, and stock damage.[98] The land was later subdivided and leased and in 1950 the scenic status was revoked over a small portion, which was added to the adjoining rubbish dump in 1951. In 1983 half of the scenic reserve was reclassified as a recreation reserve.[99]

54. In 1978 the Dannevirke Borough Council sought 14 acres of the Tahoraiti block for a new rubbish dump. When the owners declined to sell the council took steps to have the land taken under the Public Works Act. The Crown was concerned at Māori protests over such a taking and did not endorse this taking of land for public works. However, the Public Works Act 1928 had not been amended to reflect these policy positions and the Crown was legally obliged to proclaim the taking of the land, which it did in 1981.[100]

55. In some areas where land taken was later surplus to requirements, the Crown and local bodies did not offer the land back to the former Māori owners. Land no longer required for the gravel pit and aerodrome at Dannevirke was sold to local farmers without being offered to the former Māori owners.[101] Land taken for a gravel pit from Hurunui-o-Rangi pā was not offered back to Māori when the pit was exhausted. Instead, the land was sold to a third party who built an abattoir beside the Hurunui-o-Rangi urupā.[102]

Te Taiao: Environmental Issues

56. The settlement of Wairarapa and Tāmaki-nui-a-Rua resulted in significant transformation of the natural environment. From the 1860s, legislation provided for the Crown to exercise control over much of the natural resources in Wairarapa and Tāmaki nui-a-Rua, with the Crown then often transferring control to various local authorities.[103] The Crown prioritised and enabled economic development over environmental protection.[104] This restricted opportunities for Ngāti Kahungunu to exercise their traditional kaitiakitanga over the natural environment and the various taonga it contains, or to develop and use these resources themselves. It also failed to conserve areas at risk of being damaged by agricultural development, and diminished their access to highly valued resources.[105]

57. The environmental health of the region, particularly within the former Te Tāpere nui-ā-Whatonga, has since been degraded as a result of deforestation, erosion, drainage, river control works, and pollution of waterways.[106] The numbers of birds and fish important to Ngāti Kahungunu, have declined as a result of the introduction of new species, habitat modification, and new methods of hunting and fishing.[107] Most notably the huia, depleted by loss of habitat and introduced pests, was hunted to extinction by about 1900, despite the efforts of some Māori to place rāhui over its habitat in the Tararua Ranges as early as the 1870s.[108] Some of the mahinga kai (food gathering places) and rongoā (medicinal) gathering places revered by Ngāti Kahungunu, have been polluted or lost.[109] The loss of these resources also contributed to decline in associated knowledge and ritual connected to rongoā and crafts.[110]

58. Ngāti Kahungunu also continues to engage with the Waitangi Tribunal through various claims over freshwater resources, where our rights and interests have not been upheld (WAI 2357 and 2358). We are also joint claimants under the flora and fauna claim (WAI 262), citing mismanagement and the Crown failing to recognise and provide for our Treaty rights and interests in indigenous flora and fauna, and their various habitats.

59. With the growing scarcity of several indigenous fish species, retention of their habitat is a priority for hapū of Ngāti Kahungunu. These taonga species are more significant given the constant threat to their survival. It is hoped that the Te Ahu a Turanga project will provide leverage towards protection and enhancement for some of these iconic species.

CULTURAL VALUES

60. The Trust has determined that there is a suite of principles that are universally held by our whānau and hapū. They underpin Te Ao Māori from within our own tikanga processes. These principles apply throughout the whole of our rohe in terms of whānau and hapū, and our interaction with and reverence for the natural environment and what it provides.

61. It is important to note that an impact assessment associated with the cultural values identified below has not been completed. It is expected that this exercise will be undertaken as part of the baseline monitoring and completion of site assessment as further detail and access is provided by NZTA over the next six months. Cultural monitoring and assessment would need to be repeated throughout the duration of the project to ensure minimal disruption to species habitat and survival, along with enhancement and environmental offsets where habitat disruption/destruction is not able to be avoided.

62. Cultural values typically evolve from “tikanga” - that which is “tika” (true, just, right or proper). They emanate from within Wairuatanga (the Māori spiritual realm), contain elements of mātauranga Māori[111] and are informed and upheld by kawa.[112] Over successive generations, these values have expanded to include unique local knowledge and belief systems derived from customary practices, and these inform the way we practice kaitiakitanga. With colonisation and drastic changes to the landscape, the loss of much of the whenua and changes to land tenure, the traditional associations tangata whenua once had with the environment have diminished, although regular contact with flora and fauna has been maintained. For the last 50-60 years, relationships have mainly related to the harvesting of kai[113] and its preparation, recreational and instruction activities, wānanga and the gathering of plant material for rongoā (traditional medicine).

63. Gradually new laws and regulations have impacted on traditional relationships, with local and central government attempting to define in statute, the quality and extent of how tangata whenua relationships with the environment, and what Māori rights and interests should be.

This has often been with the intention of maximising resource abstraction and economic opportunity. Limits have also been imposed on freshwater and marine resources traditionally utilised by Māori. In some cases today, there is now a requirement for Māori as whānau, hapū or iwi, to prove their association with the marine environment to have their rights and interests recognised[114] in law.

64. What was once a broad range of customary and cultural values and traditional relationships and uses, have often been displaced by other values. In contrast, many New Zealanders of European descent have adopted views and aspirations that are similar to Māori cultural values, or overlap with them in terms of the environment. In general terms this has contributed to a groundswell of interest in and a movement towards, greater care for our environment.

65. There is often a duality within the Māori language (e.g. whenua, kura[115]) that is not always captured through interpretation of Māori terminology, particularly within statutory frameworks or regulation where there is usually a desire for a definition that is brief. For tangata whenua context is all important, and the following values are provided as a foundation for the cultural impact assessment and proper development of the environmental and cultural design framework.

Wairuatanga

66. Wairuatanga is the principle and action that enables the wairua, the spiritual value and benevolence from Io Mātua that penetrates into the physical realm, to direct and influence how tangata whenua engage with the natural world. Containing a strong ethical component, it guides behaviour and affects how tangata whenua interact with the environment, with each other, and towards manuhiri and other communities. For tangata whenua, it is reflected in a reverence for the environment and its constituent parts, and an appreciation for the interconnectedness within natural ecosystems. Wairuatanga finds expression through ritual and karakia, where it acknowledges the priority setting from the divine, down through the Atua, to the physical world and then to tangata whenua.

67. The reciting of karakia over an area or site to impose a state of tapu will resonate through time, while the invocation of rāhui (temporary spiritual and physical restriction), assists in upholding cultural values and traditional belief systems, and a time of healing or recalibration. Karakia can also be a blessing to guide actions when endeavouring to improve a natural resource. When it is part of a process learned from one's tipuna, karakia can be very empowering.

68. The mahi required for the NOR will require several years of co-ordination and co-operation between different agencies and groups, and appropriate acknowledgement of wairuatanga will be beneficial towards building cohesion between the spiritual and physical realms, help guide the physical activities involved, and ultimately assist in the success of the project. The concepts of tapu, rāhui and noa, are all part of Wairuatanga, and influence other cultural values including Mauri, Kaitiakitanga and Manaakitanga.

Implementation

69. Where archaeological sites are known to exist within the proposed roading corridor, or nearby, care should be taken during site preparation and operations, and during environmental mitigation or planting projects, both within the site itself but also around the periphery. Often archaeological sites or other culturally significant sites overlap with others nearby. If Māori artefacts or koiwi[116] are uncovered, notification of Kahungunu and Rangitāne kaumātua can be enabled, appropriate tikanga processes observed, taonga either re-interred or recovered and preserved in an appropriate manner, and adequate rāhui placed on the area.

70. Depending on the nature of the taonga, the rāhui could eventually be lifted or a permanent state of tapu invoked. Observance and inclusion of cultural practices associated with wairuatanga throughout the project will help to ensure both physical and spiritual safety. Cultural awareness and training for NZTA staff or personnel employed by contractors would be useful. Provision for appropriate acknowledgement of a culturally significant site should be included as part of the Environmental and Cultural Design Framework, and

direction for avoidance where the significance of a site is such that a slight deviation of the route will be required.

Atuatanga

71. Atuatanga is devolved from wairuatanga, but in practice it is the value that manifests in the relationship between tangata whenua and the Atua[117] and the children of the Atua[118]. It prescribes power and energy towards specific Atua, where each have responsibility for different realms in the physical world. Within the NOR corridor, Tāwhirimātea (Atua for weather, wind and storms), Tāne-Mahuta (Trees, forests and birds), Haumia tiketike (Wild food and plants), and Tumatauenga (War, hunting, fishing) prevail. Another Atua to consider is Rongo Mā Tāne (Cultivated plants and foods, Peace), particularly for environmental mitigation.

Implementation

72. Many of the plants brought in for transplanting as part of the environmental enhancement or offset package may be from outside the area. These are likely to be sourced from nursery stock with different origins. Plant stock should be locally sourced from plants that have adapted to local conditions. Haumia-tiketike holds domain over wild plants and resources that are used for food and/or medicine. Indigenous plant communities already exist near the NOR route, and the Trust supports the vision to create connecting corridors to join up with the Department of Conservation estate within the Manawatū Gorge. Conservation lands may provide source material suitable for propagation and mitigation.

73. The tributaries that flow from North of the NOR corridor bear names reflective of their significance to tangata whenua, which are not acknowledged in current NZTA ecological reports. Te Awa o te Atua, Manga-manaia and Manga-atua are taunaha (names of significance) left by our tipuna for specific reasons. It is difficult to reconcile commitment to a partnership approach and appreciation for iwi/hapū values with this lack of acknowledgment.

Whakapapa

74. Through Ranginui, Papatuanuku and their numerous offspring, the spiritual whakapapa linkages are acknowledged and reflected within tikanga Māori processes. The Whakapapa value is central to the Mana Atua-Mana Tangata relationship[119], providing a clear line of priority and direction. Whakapapa underpins both the spiritual and physical realms.

75. This value is particularly important where tangata whenua rights and interests are concerned, with Whakapapa defining both who we are and how we relate to each other, and our relationships with Papatuanuku and the whenua. Often when tangata whenua and manuhiri first meet, one of the first questions asked is "*Ko wai au? From where do your waters flow?*" The question enquires into one's Whakapapa, physical origins and rohe, but also their ancestral river. The process of inquiry helps determine how Māori relate to each other.

76. Whakapapa assists in determining mana whenua status. Many Māori today have whakapapa linkages to two or more hapū or iwi, but often identify with one main entity. They could be said to have two (or more) sets of rights; One set as tangata whenua and other rights defined through whakapapa connections to different iwi or hapū.

77. In terms of habitat and provision for species, whakapapa relates to connectivity on multiple levels. The Whakapapa of the water is expressed through the water cycle and the Ki Uta ki Tai[120] principle - the connectivity between freshwater environments, emerging from our Maunga (Mountains), supplemented by groundwater springs, and travelling down to the sea. Many indigenous freshwater fish species spend part of their life in the marine or estuarine environment, before heading inland to mature, then returning to the marine environment to migrate or spawn. Fish migration, recruitment and survival relies partly on the whakapapa of the waters in our rivers and streams remaining connected and intact.

78. Māori acknowledge a Whakapapa relationship between different species due to the familial connection between the Atua, and the symbiotic interaction that occurs between species, which in turn helps

to generate and strengthen mauri. The mauri of the whenua is directly related to the mauri of the waters which flow through and over it.

Implementation

79. The Whakapapa of indigenous species is closely aligned with the Maramataka (Māori lunar calendar), with sensitive life-stage development, seasonal migration and species behaviour often triggered by seasonal temperatures or events. Tangata whenua usually organise their interaction with natural resources in line with the seasonal abundance or health of species, or with climatic conditions that influence species behaviour.

Mauri

80. Mauri comes from the realm of the creator. It is a spiritual value that expresses itself within the natural world in a particular manner. In the Māori world-view, all natural things have Mauri, both animate and inanimate. Human activity can diminish or destroy Mauri, or assist in its regeneration and enhancement. Tangata whenua sometimes separate Mauri into different types depending on context, or the action it performs.[121]Mauri can be drawn inwards or towards, or emanate outwards. It can signal a level of protection towards something.

81. Within freshwater environments, the manifestation of Mauri[122] is seen in a healthy habitat including the water and associated natural resources, and from that, healthy and abundant taonga species – the insects, fish, plants and birds that are contained within or interact with that ecosystem. Mauri is transmitted as an energy flow, either towards or away from something as part of a natural cycle or process. Without knowing the detail of the environmental enhancement or off-set package for the new road corridor, Kahungunu is unable at this time to determine whether the off-sets provisions will be sufficient to assist with the rejuvenation of Mauri where it has been diminished by human intervention across the NOR area.

82. Mauri can also be considered within a construct of layers. For example, if the Mauri of a specific plant is looked after, then the individual plant will contribute to the well-being of the adjacent plant community. Over

time it provides habitat and sustenance for insects and birds, which feed on it or distribute its seeds over a wider area, thus spreading the Mauri from a healthy plant into adjacent locations.

Implementation

83. Kahungunu expect to play a leading role in various restoration or environmental offsetting projects. These will in reality, be assisting in the rehabilitation of the landscape through restoring and nurturing the Mauri within indigenous plants and the whenua, and the insect and avian communities they support. It is important that healthy plants are initially chosen for projects, with additional care to ensure their survival to adorn the whenua and contribute to overall aesthetic, community and cultural values. The interaction between plants, birds, fish and humans can also enhance Mauri due to the co-operation, synergy and goodwill that is built around positive action.

Kaitiakitanga

84. Kaitiakitanga is the action associated with the role of tangata whenua as kaitiaki. This includes the upholding of Mauri, so that the health of natural resources is sustained. Through Whakapapa, tangata whenua have inherited their kaitiaki roles over particular resources. In modern times this broadened to include a responsibility over all natural resources located within their rohe (tribal or hapū defined area). Before tangata whenua interact with a natural resource, we usually acknowledge the spiritual realm through karakia and/or ritual.

85. This value includes respectful use and interaction with various environments. Kaitiakitanga gives first priority to the natural resource itself, and what it requires to stay healthy in terms of habitat, and then progresses to species health and abundance. This acknowledges the need to care for mahinga kai sites and areas, and the food resources and other taonga they contain. The active protection and nurturing of natural resources is also an expression of mana and control. Aligned to this is the requirement for the Crown to have particular regard to Kaitiakitanga.

86. In the broader sense, Kaitiakitanga is a multi-generational approach to ensuring resource provision for now and for those generations yet to come. It is a long-term commitment that flows through successive generations, building on mātauranga Māori, seasonal ebbs and flows, and utilising and regulating cultural harvest when it is appropriate to do so.

Implementation

87. In the modern era, there is a growing assumption that all people can be kaitiaki, which is a misconception. One cannot be a true kaitiaki unless you are cognisant of and observe appropriate ritual or spiritual practices in accordance with tikanga Māori, as you can only uphold and restore Mauri if you believe in and truly understand it, and connect with its spiritual origins. NZTA recognise the clear role for Kahungunu as kaitiaki, and it is expected that this will be acknowledged throughout the life of the project and beyond, including monitoring, environmental off-setting and upkeep of mitigation planting.

Manaakitanga

88. This is the action of nurturing, of benevolence, of giving, caring, and hospitality. It is derived from "Mana-a-ki", emanating from the position of Mana, from power and prestige, and flowing outwards towards others. Strongly embedded within the Māori psyche, it expresses itself throughout the country in standard practice on our numerous marae, at many hui and cultural events.

Implementation

89. For the project it can be envisaged as actively contributing towards restoring the Mauri and well-being of the NOR corridor and its environs. The action of Manaaki will be mainly towards the whenua and freshwater environments. It can also be expressed through the interaction between different parties and how they interact with each other during the project duration. Often Manaakitanga will lead to reciprocity, although it is not an expected consequence.

Other Values

90. The following values are important considerations for decision making and implementation in respect of the roading project, but more broadly for the Trust. NZTA will see the Trust acting in accordance with these values.

Rautaki:	Providing visionary strategic leadership for Tāmaki nui-a-Rua that reflects the needs and aspirations of Marae / Hapū, Whānau and Communities;
Kotahitanga:	Uniting Māori within Tāmaki nui-a-Rua;
Ahuatanga:	Developing and maintaining our unique cultural strength and character;
Rangatiratanga:	Participating and forming partnerships with the Crown to reinforce their kawanatanga obligations, in particular their obligation to protect tino rangatiratanga.

ENVIRONMENTAL EFFECTS

91. NZTA has commissioned several reports to assess environmental effects associated with Te Ahu a Turanga, across the following topic areas:
    - Freshwater and aquatic biodiversity
    - Historic heritage
    - Landscape, natural character and visual effects
    - Terrestrial ecology

92. The reports have identified that there will be a range of environmental impacts associated with the project. These effects will range from minor through to significant. The authors of the reports have stated there are a range of options available to avoid, remedy, mitigate or offset these effects, some of which have already been incorporated into the current proposed road alignment and design e.g. avoidance of high value biodiversity areas, bridging across significant areas of habitat.

93. In contrast, where the effects have not been fully assessed, consultants for NZTA have identified that the broad package of responses are '*likely to address adverse effects and offset residual effects'*. The Trust accepts that the work undertaken by NZTA and its agents towards these outcomes has been thorough and considered. However, with the material produced by NZTA not having been conclusive regarding effects, it is problematic for the Trust to do the same in respect of impacts on cultural values, rights or interests. The reports have been derived from a purely western science paradigm, with those involved having access and opportunity to undertake their various surveys and studies. This is in contrast to the Trust representatives, who have yet to be given the same level of access and opportunity.

94. As indicated earlier in this statement there is a strong probability that these matters will be addressed through the further detailed planning and work yet to be undertaken, including preparation of a CIA, and through agreements reached in or as a result of the partnership agreement document.

STATUTORY MATTERS

95. The key relevant policies for decision makers have been assessed by Ms McLeod for NZTA. Ms McLeod's assessment is not repeated here, except for our emphasis on policies particularly relevant to the Trust's interests. These are:

- **National Policy Statement for Freshwater Management (2014, amended 2017)**
  - Objective D1 to provide for the involvement of iwi and hapū and to ensure that tangata whenua values and interests are identified and reflected in the management of freshwater, including associated ecosystems, and decision making regarding freshwater planning, including on how all other objectives of this NPS are given effect to (and associated policies D1, in particular clause c '*reflect tangata whenua values and interests in the management of, and decision-making regarding, freshwater and freshwater ecosystems in the region.*'
- **Horizons Regional Council One Plan**
  - Chapter 2 Te Ao Maori

    Objective 2-1 with its supporting policies and provisions identify a clear strong requirement for hapū and iwi to be engaged in resource management, including decision making, and to have their values recognised and provided for. Table 2.1 identifies issues of significance to hapū and iwi, and reflects on the relevant parts of the One Plan which give life to the resource issues. For the Trust, the values identified within their statement do not tie directly to Table 1, but are not in conflict. The analysis of policy impact and implementation will occur through the CIA.
  - Chapter 5 – Freshwater

    Objective 5.1:
    Surface water bodies and their beds are managed in a manner that safeguards their life-supporting capacity and recognises and provides for the values in Schedule B (and associated policy 5-1)

    Objective 5-2:
    Surface water quality is managed to ensure that:

(i) Water quality is maintained in those rivers and lakes where the existing water quality is at a level sufficient to support the Values in Schedule B

(ii) Water quality is enhanced in those rivers and lakes where the existing water quality is not at a level sufficient to support the Values in Schedule B

(iii) accelerated eutrophication and sedimentation of lakes in the Region is prevented or minimised

(iv) the special values of rivers protected by *w*ater conservation orders are maintained.

Groundwater quality is managed to ensure that existing groundwater quality is maintained or where it is degraded/over allocated as a result of human activity, groundwater quality is enhanced. (and associated policies 5.4.2)

Objective 5-3:

Water quantity is managed to enable people, industry and agriculture to take and use water to meet their reasonable needs while ensuring that:

For surface water*:*

(i) minimum flows and allocation regimes are set for the purpose of maintaining or enhancing (where degraded) the existing life-supporting capacity of *rivers* and their *beds* and providing for the other Values in Schedule B as appropriate

(ii) takes and flow regimes for existing hydroelectricity are provided for before setting minimum flow and allocation regimes for other uses

(iii) in times of *water* shortage, takes are restricted to those that are essential to the health or safety of people and communities, or drinking water^ for animals, and other takes are ceased

(iv) the amount of *water* taken from *lakes* does not compromise their existing life-supporting capacity

(v) the requirements of *water conservation orders* are upheld

(vi) the instream geomorphological components of natural character are provided for.

For the avoidance of doubt this list is not hierarchical.

For groundwater:

(i) takes do not cause a significant *adverse effect* on the long-term groundwater yield

(ii) groundwater takes that are hydrologically connected to *rivers*, are managed within the minimum flow and allocation regimes established for *rivers*

(iii) groundwater takes that are hydrologically connected to *lakes* or *wetlands* are managed to protect the life-supporting capacity of the *lakes* or *wetlands*

(iv) the significant adverse *effects* of a groundwater take on other groundwater and surface *water* takes are avoided

(v) saltwater intrusion into coastal aquifers, induced by groundwater takes, is avoided.

In all cases, *water* is used efficiently (and associated policies 5-4.3, 5-9, 5-10, 5-13)

Objective 5-4:

Beds of rivers and lakes

The *beds* of *rivers* and *lakes* will be managed in a manner which:

(i) sustains their life supporting capacity

(ii) provides for the instream morphological components of natural character

(iii) recognises and provides for the Schedule B Values

(iv) provides for *infrastructure* and flood mitigation purposes.

(and associated policies 5-22 to 5-27)

- Chapter 6 – Indigenous Biological Diversity, Landscape, Historic Heritage

  Objective 6.1:

  Protect areas of significant indigenous vegetation and significant habitats of indigenous fauna, and maintain indigenous biological diversity, including enhancement where appropriate (and associated policies 6.2, 13-4, 13-5)

  Objective 6.3:

  Protect historic heritage from activities that would significantly reduce heritage qualities (and associated policies 6-11, 6-12

- **Tararua District Plan (2012)**

  Treaty of Waitangi and Maori Resource Management Value

  2.10.3.1 Objective:

  To recognise and provide for Maori values in the management of the District’s natural and physical resources (and associated policy 2.10.3.2)

These plan provisions are the statutory foundation for consideration of the values held by the Trust (and associated impact on those values). They will be reported against as the Cultural Impact Assessment is completed.

FUTURE FOCUS FOR THE KAHUNGUNU KI TĀMAKI NUI-A-RUA TRUST

96. Kahungunu ki Tāmaki nui-a-rua Trust is committed to supporting the Te Ahu a Turanga project on the basis that its cultural values are fully provided for throughout the project. This requires the participation of the Trust and its advisors for the duration of the project, and particularly beyond the NOR. The future schedule of work for the Trust is as follows:

    1. Work with NZTA to ensure NOR process provides for cultural values
    2. Prepare an amended statement to reflect outcomes achieved in lead-up to public hearing process
    3. Undertake a Cultural Impact Assessment once detail on heritage, terrestrial biodiversity, and freshwater is complete.
    4. Represent Trust and broader Ngāti Kahungunu values in public hearing processes, as required
    5. Work with NZTA and other iwi, as appropriate, to develop an environmental and cultural design framework that represents the cultural values reflected in this report
    6. Undertake baseline freshwater cultural monitoring and assessment , and continue cultural monitoring through the duration of the project
    7. Prepare cultural values impact assessment for resource consent processes alongside NZTA

REFERENCES

Footnotes for Cultural Context

1 Waitangi Tribunal (WT), *The Wairarapa ki Tararua Report* pp.976-977.

2 J. C. Beaglehole, (ed.), *The Journals of Captain Cook on his Voyage of Discovery*, Vol. 1, (Cambridge, 1955): pp.284-285. Note: Ngāti Kahungunu have interests in the Cape Palliser area.

3 J. C. Beaglehole, (ed.), *The Journals of Captain Cook on his Voyage of Discovery*, Vol. 2, (Cambridge, 1961): pp.281-286; G. Mair, 'Maori Occupation in the Wairarapa during the Protohistoric Period', in B. F. Leach, and M. Helen, *Prehistoric Man in Palliser Bay*, (National Museum Bulletin 21, 1979), pg.11.

4 Waitangi Tribunal, *The Wairarapa ki Tararua Report*, pp.9-10. (Hereafter referred to as WT).

5 WT, pp.11-12.

6 WT, pp.11-12.

7 WT, p.13.

8 Francis Porter (ed.), *The Turanga Journals*, Wellington, 1974, pp.84-85 and 121-122.

9 Francis Porter (ed.), *The Turanga Journals*, Wellington, 1974, pp.84-85; M. J. Parsons, 'Jury, Te Aitu-o-te-rangi, ?–1854', *The Dictionary of New Zealand Biography*. URL: http://www.dnzb.govt.nz/; and, WT, pp.15-20.

10 WT, pp. 11-14.

11 WT, pp.11-14.

12 WT, pp.13-14.

13 Cooper to McLean, 29 March 1857. AJHR 1861, C-1, p.332.

14 Searanke to McLean, 5 July 1858, AJHR 1861, C-1, pp.275-276; see also P McBurney, Wai 863 #A47, p.64.

15 Ngawaapurua block, Wellington Deed 144. Turton's Deeds, pp.332-333, and; Searancke to McLean, 5 July 1858. AJHR, 1861, C-1, p.276; Ngawaapurua block, Wellington Deed 144. Turton's Deeds, pp.332-333.

16 Grindell journal, 14 June 1858. AJHR, 1861, C-1, pp.276-277.

17 Makuri and Ihuraua blocks, Wellington Deeds 160 and 161. Turton's Deeds, pp.353-355 and 465.

18 Referring to George Hamilton. See Ian McGibbon, 'Hamilton, George Douglas', DNZB
URL: http://www.TeAra.govt.nz/en/biographies/2h9/hamilton-george-douglas

19 George Hamilton, 1890. Puketoi 6 title investigation. Otaki MB 13, pp.390-427. See also Ian McGibbon, *A History of the Mangatoro Station and the Waitahora Valley*, Waitahora Centennial Committee, 2006.

20 AJHR, 1863, E-16, p.11, and; Ian McGibbon, 'Hamilton, George Douglas', DNZB

URL: http://www.TeAra.govt.nz/en/biographies/2h9/hamilton-george-douglas

21 Napier MB 2, pp.83-84. The rangatira concerned is Ihakara Whaitiri.

22 Napier MB 1, pp.238-252, and; WT, p.440.

23 Locke speaking at 6 Sep 1870 hui at Waipawa, in *Te Waka Maori o Ahuriri*, 20 Sep 1870, no. 14, vol 6, pp 59-61; translation P Meredith, 'Translations of Maori Newspaper Material', 2000, Wai 863 #A97, p 3.

24 WT, p.441; Napier MB 2, pp.170-173; Ballara & Scott, #A18, p 18 (citing Ormond to Col Sec, 4 Apr 1870); James Grindell to Lawson, nd, in MA 13/126/82(b), Archives NZ; see also Ballara & Scott, #A18, pp 34-35; and; Wai 863 #A47, pp.110-111.

25 WT, pp 447-448.

26 WT, pp.441 and 445-448; 2.70-2.71, and; Wai 863 #A47, pp.97-98.

27 Wai 863 #A47, pp.99-101; Paula Berghan's "Block Research Narratives of the Tararua, 1870 – 2000", Report Commissioned by Crown Forestry Rental Trust, 2002, p.8 referring 7 May 1870, Ormond to Nat Min, MA-MLP1 1870/668 in MA13/82a&b, NA, Supporting Papers, Vol.1 pp.341-2.

28 Locke to Ormond, 3 Aug 1870, AGG-HB3/5/18; see also Ballara & Scott, #A18, p 21.

29 WT, p.441; *Te Waka Maori o Ahuriri*, 20 Sep 1870.

30 Tawa Rautahi, Otaki MB 13, p.401.*Te Waka Maori o Ahuriri*, 20 September 1870, pp.59-61 (Wai 863 #A97), and; WT, pp.441-442. See also Tawa Rautahi, Puketoi 6 case, 1890. Otaki MB 13, p.401, and; Hoera Herehere and Ihaia Ngarara, Manawatu 4A (Tipapaku) case, 1894. Napier MB 32, pp.128 and 147.

31 *Te Waka Maori o Ahuriri*, 20 September 1870, pp.59-61 (Wai 863 #A97),

32 Tipapakuku, 1894. Mapier MB 32, pp.123-127.

33 Napier MB 2, pp.173-177, and; WT, p.443.

34 Tipapakuku, 1894. Napier MB 32, pp.123-127.

35 Hori Herehere, Puketoi 6, 1890. Otaki MB 13, pp.390-427.

36 Napier MB 2, pp.173-201; Otaki MB 13, pp.390-427, and; WT, pp.442-443.

37 As Manahi Paewai later noted: Napier MB 32, pp.113, 138, and 141.

38 Napier MB 2, pp.170-201, and; Wai 863 #A47 p.111.

39 Maata Te Opukahu, Hori Herehere, Ihaia Te Ngarara, Paora Ropiha, Karaitiana Takamoana, Te Otene Matua, and Te Watene Hapuku. See Napier MB 2, pp.170-201, and Otaki MB 13, p.394.

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41 WT, p.454.

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43 Te Rangiwhakaewa and others to Henry Russell, 29 August 1871, in AJLC 1871, No. 23, pp.5-6.

44 AJHR, 1873, G-7, pp.7 and 36.

45 WT, p 440; George Hamilton, Puketoi 6, 1890. Otaki MB 13, pp.390-427; Manahi Paewai, Tamaki, 1895. Napier MB 37, pp.1-134, and; Tamaki judgment, 1895. Wai 863 #A39 Docs, pp.5284-5288).

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49 Tamaki or 70 Mile Bush Deed, 16 August 1871, deed no. HWB 92, in ABWN W5279 8102 Box 360, Archives NZ; see also Turton, *Maori Deeds of Land Purchases in the North Island of New Zealand,* vol 2, Province of Hawke's Bay, pp 562-571 (Turton deed no. 48); see also Ballara & Scott, Wai 863 #A18, pp 9-10.

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51 AJLC, 1871, No's 23 and 24.

52 Tamaki or 70 Mile Bush Deed, 16 August 1871, Turton, *Maori Deeds of Land Purchases in the North Island of New Zealand,* vol 2, Province of Hawke's Bay, p 571; McBurney, #A47, pp 81-82; Ormond to Col Sec, 16 Aug 1871, MA 13/126/82(b), Archives NZ; see also Ballara & Scott, #A18, pp 38-42; (see Turton's Deeds, Hawke's Bay Deed No. 48, for number of signatories).

53 Turton's Deeds, Enclosure Two in Hawke's Bay Deed No. 48, p.571.

54 George Hamilton, 1890 (Puketoi 6 case). Otaki MB 13, pp.390-427.

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57 Wai 863 #A47, pp.130-132.

58 WT, pp. 601and 629; Tribunal, p. 558 [map].

59 WT, pp.608-610.

60 WT, pp. 558 and 629.

61 WT, pp. 613, 626, 629; 'Kei Mua I Te Roopu Whakamana I Te Tiriti O Waitangi', Closing Submissions of Ngai Tumapuhia-a-Rangi, Wai 863, #I13, p. 135; Steven Oliver, 'Tararua District: Twentieth Century Land Alienation Report', February 2004, Wai 863, #A78, pp. 47-48.

62 WT, p. 605; 'Interim Report of the Native Land Commission on Native Lands in Masterton, Featherston, Wairarapa South, Pahiatua, Eketahuna, and Castlepoint Counties', 19 December 1908, AJHR, 1909, G-1D, pp. 1-3, and; MA 78/17. Archives New Zealand. Wai 863 #A26 (59), p.469. The small amount of land remaining in the district was unoccupied

63 AJHR, 1908, G-R, p.1; AJHR, 1909, G-1G, p.10; WT, pp.604-607; Tony Walzl, 'Wairarapa Land Issues Overview 1900-2000', Nov 2002, Wai 863, #A42, p. 34.

64 Walzl, 'Wairarapa Land Issues Overview 1900-2000', p. 35, and; Stirling, 'Ngati Hinewaka Lands: 1840-2000', Wai 863 #A59, pp.284-294.

65 Native Land Act 1909, S 425.

[66] WT, pp. 558 [map], 605, 608; Walzl, 'Wairarapa Land Issues Overview 1900-2000', pp. 40-90.

[67] WT, pp. 608-609.

[68] WT, pp.608-609.

[69] Government Advances to Settlers Act 1894, and; Richard Boast, *Buying the Land, Selling the* Land, pp.260-261.

[70] Te Rina Purakau and 196 others, Papawai to Carroll, 31 March 1911. MA 1/1911/397. Archives New Zealand. Wai 863 #A51(c), pp.1472-1473.

[71] *Na To Hoa Aroha From your dear friend: The Correspondence between Sir Apirana Ngata and Sir Peter Buck, 1925-50*, (Ed.) M.P.K. Sorenson, Auckland 1988, vol.3, p.21.

[72] WT, p. 619; AJHR, 1941, G-10, pp.32 and 34; 13 July 1944, Report on Makirikiri No.s 1 & 2 blocks, MA 15/26/4, Hastings MLC, Supporting Papers Vol. 2 , pp. 628-633; in Walzl, p. 232; Bryan Gilling, 'Lands, Funds, and Resources. Aspects of the Economic History of Maori in Wairarapa ki Tararua since 1840', November 2004, Wai 863, #A118, pp. 215-16.

[73] see AAMK 869, 15/6/109, 15/6/116, and 15/6/117; and, ABRX 6880, 4/4/54 and 4/4/55. Archives New Zealand. Restricted.

[74] WT, p. 620; Walzl, 'Wairarapa Land Issues Overview 1900-2000', p. 241.

[75] WT, p.620.

[76] WT, pp.619-620; AJHR, 1938, G-10,p.73; AJHR, 1941, G-10, pp.32 and 34-35; 'Statement of Evidence of Herbert Tewa-Kite-Iwi Chase', Wai 863, #E6, pp. 3-5; Oliver, p. 30; Stirling, Wai 863, #A59, pp. 411-412. Archway references indicate Tahoraite assistance ended by 1955 but likely earlier than that (R17309764. Archives New Zealand).

[77] See, for instance, Wharaurangi, Ahirara, and Waipuna reserves (Walzl, Wai 863 #A43, pp.47-49, 51, 57-58, and 70-76). See also Ngatahuna, sold in 1880 due in part to being land-locked (Wai 863 #A49, pp.198-199); See also Wai 863 C43, pp.7-12.

[78] Stirling, 'Land-Locked Blocks', Ngati Kahungunu ki Wairarapa Tamaki Nui a Rua Trust/CFRT, 2014, p.12.

[79] Stirling, 'Land-Locked Blocks', Ngati Kahungunu ki Wairarapa Tamaki Nui a Rua Trust/CFRT, 2014, p.12; Stirling, 'Land-Locked Blocks – Te Awaiti Case Study', Ngati Kahungunu ki Wairarapa Tamaki Nui a Rua Trust/CFRT, 2014, p.4.

[80] Native Land Court Act 1886, ss 91 and 92; Native Land Court Act 1894, s 69; Public Works Act 1894, s 112; Public Works Amendment Act 1900 s 20; Native Land Act 1909, s 117; Native Land Amendment Act 1912, s 10; Native Land Amendment Act 1913, ss 48-53; Native Land Amendment and Native Land Claims Adjustment Act 1922, s 13; Public Works Amendment Act 1928 s 2; Public Works Act 1928 ss 124–128; Native Land Act 1931 ss 476–488; Maori Affairs Act 1953, s 415-419; Property Law Amendment Act 1975, s 129B; Te Ture Whenua Maori Act 1993, s 316, 317.

[81] Wai 863, I1(c), pp.46-47; Wai 863, C7, pp.6-7; Jacinta Ruru and Anna Crosbie, 'The key to unlocking landlocked Maori land: the extension of the Maori Land Court's jurisdiction' (2004) 10 Canterbury Law Review 318.

[82] Tribunal, pp.622-624 and 628; Stirling, 'Ngati Hinewaka Lands: 1840-2000'. Wai 863 #A59, pp.123-124, and, Stirling, 'Land-Locked Blocks', Ngati Kahungunu ki Wairarapa Tamaki Nui a Rua Trust/CFRT, 2014, p. 2, 3, 4.

[83] WT, p. 622.

[84] WT, p. 749.

[85] WT, pp.808-09.

[86] Palliser Bay Road takings included two urupā and the taking of Nga Ra o Kupe (The Sails of Kupe). The Matakitaki lighthouse taking included an urupā. A pā was taken at Kaitoke, while Dannevirke, Okurupatu, Tautāne, and Hurunuiorangi takings involved papakāinga land and the latter separated the marae from its urupā. See WT, pp. 490-493, 750-752, 761-763.

[87] Cathy Marr, Philip Cleaver, Lecia Schuster, 'The Taking of Māori Land for Public Works in the Wairarapa Ki Tararua District: 1880 – 2000 – A Report Commissioned by the Waitangi Tribunal: December 2002', Wai 863 #A32, p. 26. These are provisions under the 1878 Act as there were no takings before 1878.

[88] WT, p.746, and Marr, et al, Wai 863 #A32, pp.23-35.

[89] Cathy Marr, Philip Cleaver, Lecia Schuster, 'The Taking of Māori Land for Public Works in the Wairarapa Ki Tararua District: 1880 – 2000 – A Report Commissioned by the Waitangi Tribunal: December 2002', Wai 863 #A32, pp. 26-27.

[90] WT, p.746.

[91] Marr, et al. Wai 863 #A32, pp.120, 129, and 134.

[92] WT, p. 759.

[93] Marr, et al. Wai 863 #A32, pp.88-89.

[94] Marr, et al. Wai 863 #A32, pp.105-110.

[95] See, for instance, WT, pp.750-52 and 755.

[96] Ngāti Hinewaka offered to lease the Matakitaki farmland sought to support the Cape Palliser lighthouse keeper (Wai 863 #A59, pp.296-97). The Dannevirke aerodrome land was successfully leased for 23 years before it was taken (WT, pp.777-78).

[97] WT, pp. 772-781; Marr, Cleaver, Schuster, pp. 99-103, 211-220, 223-229, 231-251, 255-272, 276-309.

[98] WT, p.777, and; Marr, et al. Wai 863 #A32, pp.240-242 and 244.

[99] Marr, et al. Wai 863 #A32, pp.249 and 251.

[100] WT, pp.779-780, and; Marr et al. Wai 863 #A32, pp.276-311.

[101] Cathy Marr, Philip Cleaver, Lecia Schuster, 'The Taking of Māori Land for Public Works in the Wairarapa Ki Tararua District: 1880 – 2000 – A Report Commissioned by the Waitangi Tribunal: December 2002', Wai 863 #A32,

pp. 101, 269-270, 274; Certificate of title, HB 149/157, Hawke's Bay land district, LINZ.

[102] WT, pp.763-765; Cathy Marr, Philip Cleaver, Lecia Schuster, 'The Taking of Māori Land for Public Works in the Wairarapa Ki Tararua District: 1880 – 2000 – A Report Commissioned by the Waitangi Tribunal: December 2002', Wai 863 #A32, pp. 145, 166-168.

[103] WT, p. 851.

[104] WT, pp.843-880.

[105] For example, the construction of Oxidation Ponds at Pāpāwai and the management of industrial pollution in Carterton waterways. 'Statement of Evidence of Kingi Matthews on Behalf of the Claimants', Waitangi Tribunal, Wai 863 #C1, p. 5; 'Statement of Evidence of Hinepatokoriki Paewai on Behalf of the Claimants', Waitangi Tribunal, Wai 863 #C9, p. 13.

[106] WT, pp. 846-851,

[107] Cathy Marr, 'Wairarapa Twentieth Century Environmental Overview Report: Lands, Forests and Coast', August 2001, Wai 863 #A25, pp. 40-41.

[108] 'Summary of Evidence of Cathy Marr – Wairarapa Twentieth Century Environmental Overview Report: Lands, Forests and Coast', Waitangi Tribunal, Wai 863, #A25, p. 6; Cathy Marr, 'Wairarapa Twentieth Century Environmental Overview Report Lands, Forests and Coast', Waitangi Tribunal, August 2001, Wai 863, #A25, pp. 40-43; WT, p. 876. J D Enys, 'An Account of the Maori Manner of Preserving the Skin of the Huia, Heteralocha auctiostris, Buller', Transactions and Proceeding of the New Zealand Institute, 1875, vol 8, p. 204, in, WT, pp. 876-877.

[109] For example, see: 'Brief of Evidence Tawhao Ngatuere Katuhakoria Matiaha', Waitangi Tribunal, Wai 863, #C13, pp. 4-5, 7-8; 'Brief of Evidence of Frances Irene Reiri-Smith', Waitangi Tribunal, Wai 863, #C27, pp. 7-8, 11-12.

[110] 'Statement of Evidence of Titihuia Barclay Karaitiana', Waitangi Tribunal, Wai 863, #E7, pp. 3-4; WT, pp. 864-865.

Footnotes for Cultural Values

[111] Traditional Māori knowledge derived from customary use and learnings, often over many years

[112] Protocol and customs of the Marae and wharenui [traditional meeting house]

[113] Through regular interaction with the area as a mahinga mataitai – a coastal site or location used for the customary gathering of resources from the sea.

[114] Marine and Coastal Area (Takutai Moana) Act, 2011 process where Māori are required to register their interests that will then be decided by the Supreme Court

[115] Whenua – land, earth, soil; Whenua – afterbirth. Kura – red; Kura – school, place of learning.

[116] Human skeletal remains

[117] Within western thought processes, 'Atua' has been given equivalency to 'God', or 'Gods'. Within the Māori world view they are more spiritual guardians, the children of Ranginui and Papatuanuku and responsible for different realms within the physical reality

[118] Children of the Atua are the various life forms that manifest in the physical world, the insects, birds and fish, and includes the microscopic life within the seas (e.g. zooplankton), and the soils.

[119] Regarded by many tangata whenua as a natural progression of whakapapa that links us to the spiritual world

[120] Usually interpreted as applying from the mountains to the sea

[121] Mauri ti aki, Mauri whakahaere, Mauri here etc

[122] In some locations the word 'ira' is also used when referring to the life-force of the sea.

9. TE MANAWAROATANGA

Te Manawaroatanga

Executive Summary

Ngāti Raukawa have a long-term association with maintaining leadership and managing diplomatic relationships as a long-term strategy to live together. This is a complex landscape of multiple iwi within which Ngāti Raukawa's peacekeeping activities designed a future together.

Te manawaroatanga o Ngāti Raukawa ki te pupuri i te taonga, ara, ko te rangimārie ko te whakapono

The steadfastness of Ngāti Raukawa to hold onto the peace and faith

"Te manawaroatanga" means to be steadfast of heart and refers to a proverb based on one of Te Whatanui[1], a rangātira of Ngāti Raukawa, whose peace activities were legendary. This proverb was altered after an incident between Rangitāne, Whakatere (hapū of Raukawa), and Tūranga (hapū of Raukawa) which avoided battle and set the precedent for our rich and connected history. [2]

During the start of the 1819 Ngāti Raukawa defeated Rangitāne o Manawatū hapū and the first-hand account is documented by Rangitāne tūpuna Hoani Te Rangiotu Meihana[3]. "At that time mana whenua was taken by Ngāti Raukawa through Take Raupatu".

Beginning in 1820 and leading up to 1860, Rangitāne and Ngāti Raukawa forged a strong alliance with the remaining Rangitāne hapū. In particular Ngāti Hineaute, Ngāti Rangitepaea, Ngāti Mairehau, and Ngāti Mutuahi. This alliance was forged through a number of tatau pounamu, marriages, designed to keep the peace. Rangitāne and Ngāti Raukawa from time to time fought alongside each other in a number of battles, and famously during the raids of Rototara. This war was the event which lead to the naming

[2] https://teara.govt.nz/en/biographies/1t86/te-whatanui for a full account
[3] The Birth of Palmerston North. It was said by Hoani Meihana Te Rangiotu to J. O Batchelar (old owner of Karaka Grove and Massey during 1880s, This is from a 100 page supplement to the evening standard published as part of the Palmy centenary celebrations.

of Ngāti Mutuahi, after they suffered a defeat at the hands of their Ngāti Kahungunu relations.

At the time of the signing of Treaty of Waitangi the mana of region lay with Ngāti Raukawa. Their rohe continue to stretch across the Ruahine Ranges and Tararua Ranges, and within Te Ara Paepae and parts of the gorge.

Te Ahu-a-Tūranga is also the name of the block which was strongly contested by Ngāti Raukawa hapū and fellow iwi. These hapū and iwi include, but are not limited to, Ngāti Ihiihi (Wehiwehi), Ngāti Kauwhata, Ngāti Te Au, Ngāti Tūranga, Ngāti Rakau and several other hapū located within the region during the 1860s. In response to unjust selling of this block a large movement of non-sellers permeated Ngāti Raukawa to ensure we have never extinguished their relationship and mana whenua within Te Ahu-a-Tūranga, Ruahine Maunga, and Tararua ranges.

The proposed works will impact our relationship to the Ruahine Maunga and potentially Tararua. There is also a concern that activities may have an impact on our waterways, including but not limited to Manawatū, Pohangina, and Nga Mangaiti within potential designations agreed to by NZTA and Ngāti Raukawa, and land reserved to be returned in pending Treaty settlements.

The complexity and sophistication of this iwi landscape has recently been reduced to the singular blunt statutory instrument called a deed of settlement through a modern day "Treaty Settlement". This crude instrument in the last three decades has rewritten history, creating division amongst our people who live in these places. Chief Judge Taihakurei Durie refers to this as *pene raupatu*[4], a modern-day confiscation of Raukawa rights and interests beginning in the land sales of the 1850-1870s continuing through to today.

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[4] Pene Raupatu – confiscation of lands through written documentation includes Deed of Settlement legislation, planning documents, signage, Crown Land purchases
Rau = blade of the weapon, Rau = many, Patu = strike or kill

Crown agencies in seeking to give effect to the law regarding tangata whenua consultation, have deferred to these crude instruments, that in the Manawatū only celebrate a limited view of the iwi history of this land.

For multiple iwi on this proposed route of interest, Treaty rights within the region are protected in law, Ngāti Raukawa have fought for those existing rights, and legislation to be applied to our peoples. There are many iwi who belong to this place, and our peoples are like the river, our relationships flow and connect across the entire ranges and waterways.

We are grateful to have an opportunity to participate as rightful Treaty partners in a project and share our story, our sense of place and our connection to this project.

Purpose

The purpose of this document is to provide an initial statement of Ngāti Raukawa interests in this Notice of Requirement for the Project proposed. It provides a statement that articulates the Rūnanga o Raukawa position to works at Te Ahu a Tūranga.

This document seeks to provide information that will improve the quality and consistency of decision making in the RMA processes such as this notice of requirement application, and to build the capacity of local government and the Crown to make well informed and balanced decisions, by providing an initial iwi narrative, the caveat being it requires further investment given the limitation of time and the pace of this project's deadlines.

This paper submitted by Te Rūnanga o Raukawa on behalf of Ngāti Raukawa covers:

- PART ONE: Understanding of the project area
- PART TWO: Ngāti Raukawa high level narrative of the interest in the wider area and the area defined by the corridor and areas of significance
- PART THREE: RMA S 6e Matters and Ngāti Raukawa
- PART FOUR: Ngāti Raukawa and NZTA relationship
- PART FIVE: CIA

The key project impacts on Ngāti Raukawa were identified as follows:

Project Impact Known	Remedy/ Avoid/ Mitigate
Impact of Peace keeping treaties * The proposed project takes place in an area well-travelled by many iwi. Current engagement is poor with Kahungunu, Kauwhata, Wehiwehi and Raukawa, and a limited understanding has been demonstrated on whom to engage in the project.	**Remedy -** Invest in historically accurate works by iwi acknowledged historians of all iwi/ hapū who hold mana whenua namely Kahungunu, Rangitāne, Raukawa, Kauwhata, Wehiwehi and Whakatere. **Remedy -** To avoid differing interpretations of historical accounts, thereby ensuing accuracy, iwi historians will be funded to have a forum in which they will work together to create an account in which they are all happy to have, there may be multiple accounts. **Avoid** – In design works avoid icons, symbols and story boards that are offensive **Mitigate** – A lack of historical literacy informing local government and crown decision in this space can be mitigated. There is an opportunity to educate NZTA Council and other stakeholder partners in regards to multiple iwi interests by investing in a collaborative heritage destination work via iwi historians from these iwi associated in the project.
Political Impact of works Political risk to Te Rūnanga o Raukawa reputation. The limitation of time (less than a week) does not allow for effective engagement of input by hapū/ iwi members. There is a political risk for this organisation, as the lack of input from our key stakeholders is not ethical nor in line with our values of ensuring marae and hapū voices are heard in all decision making.	**Avoid –** NZTA using this document as the final definitive position over and above other iwi and hapū values that are yet to be ascertained **Mitigate -** NZTA actively pursue the recommendations listed under Time Constraints to ensure iwi/ hapū values properly inform the project. **Remedy** – NZTA invest time through the Hapū Integration Group with Raukawa to engage hapū **Remedy –** NZTA Invest in Kauwhata, Whakatere and Wehiwehi to engage Develop an inclusive model to define iwi interests that includes but not limited to cultural markers that denote tangata whenua/mana whenua such as: • Marae; • Kaianga; • Urupa; • Land tenure and ownership and occupation; • Historical associations
Time Constraints Section 6(e) RMA consideration for Raukawa may be limited and the effects not adequately identified due to the current lack of time to engage with our key impacted hapū for the important following matters • Ecology • Water Values • Heritage • Archaeology • Known Waahi Tapu	**Avoid -** Do not borrow iwi values from one iwi to apply to another iwi due to lack time. **Avoid -** The temptation of progressing works by deferring to an Environmental and Cultural Design Framework in which Raukawa values were not sought and therefore not reflected in that advice. **Avoid -** The temptation to regard advice from one iwi with a statutory acknowledge over other iwi who are still legally under the umbrella of the Treaty of Waitangi. **Mitigation -** Note this is a high-level iwi values statement only, and NZTA must commit to investing into Raukawa stakeholders to engage about project. **Remedy for Cultural Matters–** Invest in understanding cultural value frameworks workshops for our iwi **Remedy for Ecology/ Water/ Heritage and Archaeology/ Waahi Tapu** NZTA ensure additional time and conditions are provided to ensure Raukawa values are considered as part of continuing design in this corridor

PART ONE: Understanding of the project area

The existing State Highway 3 through the Manawatū Gorge has been permanently closed due to geotechnical instability. In response, the New Zealand Transport Agency (NZTA) is seeking planning approvals under the Resource Management Act 1991 to designate land for the purposes of an alternative State Highway route across the Ruahine Range. The corridor was identified from an earlier MCA process where 18 potential routes were assessed. Ngāti Raukawa were not engaged on any earlier MCA process therefore no discussion has occurred to assess any of the 18 potential routes.

We have not had an opportunity to provide input into the 'Environmental and Cultural Design Framework'.

On 19 October 2018 Te Rūnanga o Raukawa were engaged by NZTA to provide a high-level description of our iwi values within the proposed designation area, and to assess the associated actual and potential effects, and how those effects should be managed.

A copy of the project description is contained in the AEE report. This report informs the cultural assessment report and relates to s 6 (e) of the Resource Management Act 1991.

Section s6(e) RMA refers to the relationship of all Māori to their ancestral lands, wāhi tapu and taonga:

(e) the relationship of Māori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga:

PART THREE : RMA Section 6e Matters and Ngāti Raukawa

Ngāti Raukawa have seven hapū whom refer to Ruahine in their Pepeha, these hapū are our Northern hapū. Pepeha are our key identifiers of landscape, orientation and sense of belonging.

Beyond that Ngāti Wehiwehi (formally known as Ihiihi), Ngāti Whakatere, and Kauwhata. Kauwhata ki Aorangi have specific land interests, as do hapū who resided at Puketotara (Tūranga, Rakau and Te Au) and Parewahawaha, Pareraukawa, Huia, Ngarongo, and Takihiku in the upper Manawatū region referred to as Te Ahu a Tūranga.

In the area in relationship to this project there are:

- Whakapapa
- Historical Connections to land blocks
- Land loss
- Historical Treaties
- Waahi Tapu

The adverse cultural effects of this project are not yet fully known as we are at the initial stages of engagement, hapū/ iwi impacted wanted to engage with the CIA. We are aware that we have not had the time to sufficiently engage our members and have a concern that it may be premature to conclude that the cultural effects are adequately avoided, remedied, mitigated or offset.

Impact of Peace keeping treaties

At the outset it is known that the adverse effects of this project that require mitigation are the myriad of iwi relationships and indigenous treaties that are part of the known iwi histories by those who are literate in the history of this landscape. It is important to ensure any cultural symbolism is inclusive and ensures the history told is accurate and mana enhancing. Current works in the Manawatū gorge are dominated by one iwi, and this does not accurately reflect the reality of a place that was a transport route, a well-travelled path by multiple iwi.

Remedy

Mana Enhancing Stories that keep the peace

Ngāti Raukawa suggest ensuring peace keeping between iwi, historically accurate carvings, and artworks, and symbols that tell of our enduring relationship and peace keeping treaties are part of the design through the project corridor.

Ngāti Raukawa have tohunga whakairo whom can whakapapa to all the iwi grouping who we would like to be involved in a joint iwi carver wananga of artists to design of cultural works throughout this project corridor.

The designs will celebrate shared whakapapa and mana enhancing peace keeping stories that ensure all peoples whom whakapapa to this place are visible across this landscape.

Avoid

In design works

Offensive singular iwi designs that refer to other iwi as marauders or dismiss the presence of another iwi.

Time Constraints

We do have a concern that Section 6(e) RMA consideration for Raukawa may be limited and the effects not adequately identified due to the current lack of time to engage with our key impacted hapū. Our preliminary research of land block records from 1860's through to the 1870's indicates significant land claims and agreements for grouping of hapū, and land loss for others regarding the sale of Te Ahu a Tūranga block.

For NZTA to consider impacts on Raukawa tangata whenua and their ancestral and contemporary relationships with the lands, waters and taonga affected by the NOR additional time and conditions are needed to be considered as part of continuing design in this corridor.

Political Impact of works

Te Rūnanga o Raukawa do not want, in our agreement with NZTA, an alienation from our hapū and marae for not engaging in these works. Our position is that our entity ensures their voices, stories and values are championed, and given voice to in these RMA processes. It is our concern that what we can submit at this point may provide no clarity or transparency as to the nature of mitigation or offsetting, or whether it is adequate to address matters of significant importance to known hapū/ iwi constituents e.g. Kauwhata, Whakatere and Wehiwehi.

Ngāti Raukawa were made aware that Ngāti Kauwhata had been approached earlier when the Manawatū Gorge Road first closed, and Horizons RC, NZTA and MDC made approaches to Sir Mason Durie and Dennis Emery.

We are aware that lands had been set aside in the Government Landbank by OTS pending the Treaty Settlement phase in the Ashhurst Road section of the development.

Ngāti Kauwhata had visited the site but have not had the chance to contribute to some views which they could add into the NOR, environmental, land and ecology debates / outcomes.

Te Rūnanga o Raukawa input in to this Project to date has been limited despite early requests for engagement. Our concern is that this may incur for Te Rūnanga o Raukawa a political backlash in terms of confidence of our hapū membership around engagement.

There are several aspects of the proposal that are unorthodox in RMA terms and concern us:

No final agreement on cultural effects can be reached at this late stage with Te Runanga o Raukawa, nor have we had time to fully research the proposed route in terms of waahi tapu with hapū members.

Remedy

Engaging with hapū

NZTA Project Lead ensure engagement directly with Ngāti Wehiwehi, Ngāti Kauwhata, Ngāti Tūranga, Ngāti Rakau Ngāti Te Au and Ngāti Whakatere, and ensure in the design phases for cultural emblems that these hapū are engaged in co-designing.

In all works regarding planting, fishing and cultural monitoring Raukawa, Kauwhata, Whakatere and Wehiwehi are given the opportunity to inform the fishing methodology, or planting according to Maramataka.

Iwi Engagement and Council

In regards to Te Ahu a Tūranga, Manawatū Tararua Highway Project Notices of Requirement Horizons regional council has not engaged Raukawa in project regarding the Manawatū Gorge, nor has the crown agency "the Department of Conservation". In an audit of the Manawatū Gorge Biodiversity Project from 2016 to 2018, Ngāti Raukawa had not been engaged. In early October 2018 a phone call from DOC was received about undertaking a 1080 operation, the Area Manager was trying to inform us as an iwi as a public notification was being developed for the following week.

Communication has been inadequate in this space with our iwi. We agree to the provisions outlined in the One Plan and these comments are captured in appendix one.

Places of significance

Raukawa fondly recall the church which was erected on Tuwhakatupua called Te Ahu-a-Tūranga and our lay readers Peneaha Te Mahauariki of Ngāti Tūranga, and Henere Te Herekau who often held service here with Te Rangiotu. This was one of several churches that were established in the region. This church was later moved to Nga Hapa Karauna and renamed Te Kotahitanga to symbolize the strong relationships between Rangitāne and Raukawa at the time.

Waterways

There is also a concern that activities may have an impact on our waterways, including but not limited to Manawatū, Pohangina, and Nga Mangaiti within the potential designations agreed to by NZTA, and Ngāti Raukawa have not had the time with NZTA to understand how this will be mitigated.

Ngāti Raukawa identifies the Manawatū river and the Maunga as paramount importance to our identity.

Implications for NZTA and Raukawa

- Ngāti Raukawa is engaged with on an equal basis as the other two iwi claiming manawhenua status over the project area (Ngāti Kahungunu and Rangitāne)
- There is iwi-specific engagement where required.
- NZTA and local council invest in all cultural symbolism, and ceremonial works with Ngāti Raukawa alongside other iwi.
- There is iwi-specific cultural redress of identified adverse cultural and environmental impacts associated with the project, includes cultural monitoring works for all infrastructure and water ways.
- The high-level relationship matters as agreed to in the MOU between NZTA and Te Rūnanga o Raukawa are operationalised.
- The opportunities for social and economic investment in this iwi is explored as part of the project gains of this enduring development.

PART FOUR: Ngāti Raukawa relationship with NZTA

Ngāti Raukawa engagement with NZTA has been hard fought for by our iwi in each of the projects across our iwi landscape. In Otaki the hapū representative body engaged NZTA well in 2010, however as NZTA moved up the coastline on projects such as the Waitarere Curves (2013) and Whirokino Trestle replacement, concerns from our iwi began to mount.

Formally Te Rūnanga o Raukawa entered into discussions with NZTA to protect our hapū constitutions, in matters that impacted on their land and the maintenance of our iwi boundaries, such as in the project involving the Whirokino Trestle.

On 17 September 2017 Te Rūnanga o Raukawa entered a relationship with NZTA through an MOU which is the basis of our partnership. The Rūnanga identified that it was an incorporated society with charitable status created to promote, advance and assist the interests and aspirations of those hapū and iwi that traditionally identify and associate as Ngāti Raukawa (te au ki Tonga) and whose rohe is traditionally described as 'Mai i Waitapu ki Rangataua, mai i Miria te Kakara ki Kukutauaki'. Those areas recognise a relationship of the rohe of Ngāti Raukawa ki te Tonga that includes the districts of Kapiti, Horowhenua, Manawatū, Palmerston North and the Rangitīkei.

As at 2018 the Hapū/ Iwi members whom govern the body are as follows:

- Ngāti Hikitanga
- Ngāti Huia ki Katihiku
- Ngāti Huia ki Matau
- Ngāti Huia ki Poroutawhao
- Ngāti Kapumanawawhiti
- Ngāti Kauwhata
- Ngāti Kauwhata ki Aorangi
- Ngāti Kikopiri
- Ngāti Koroki
- Ngāti Maiotaki
- Ngāti Manomano
- Ngāti Ngarongo
- Ngāti Pare
- Ngāti Pareraukawa
- Ngāti Parewahawaha
- Ngāti Pikiahuwaewae ki Poupatate
- Ngāti Pikiahuwaewae ki Tokorangi
- Ngāti Rakaupaewai
- Ngāti Rangatahi
- Ngāti Takihiku
- Ngāti Te Au
- Ngāti Tukorehe
- Ngāti Tūranga
- Ngāti Wehiwehi
- Ngāti Whakatere

Ngāti Raukawa are committed to working with NZTA through our MOU to maintain our areas of cultural significance which is inclusive of, but not limited to the Te Ahu-a-Tūranga (Gorge). We have identified a need for greater planning, and CIA to ensure that our hapū are engaged and proactive from this point moving forward. The CIA is a proposed start to a suite of planning initiatives to be completed between NZTA and the Rūnanga o Raukawa for and with the affected hapū.

Part Five: **Cultural Impact Assessment**

"I mua ata haere, I muri whatiwhati waewae"

Hitiri te Paerata of Ngāti Te Kohera in reference to Orakau

Meaning is to be prepared or travel early so you are not rushed.

The cultural impact assessment (CIA) will be undertaken with Ngāti Raukawa hapū over a period of five months, and a report will be produced documenting our cultural values, interests and associations within the prescribed project area, and identify the potential impacts of a proposed activity on these.

It is our intent to ensure this planning tool that helps to facilitate our iwi members participation in the planning process. It should be treated as any other technical report, providing a resource consent applicant may commission a CIA and the report is regarded as technical advice.

The Cultural Impact Assessment should have informed the applicant’s Assessment of Environmental Effects for the Notice of Requirement, however we are happy to proceed given our recommendations in the executive summary.

Our concern remains whether given a timeframe of one week that we have in our information provided had enough time to indicate at a high level the following matters in this report:

- Identify the effects of a proposed activity on Raukawa cultural associations with the environment.
- Identify or assist identification and formulation of methods to avoid, remedy or mitigate adverse effects on cultural values and associations.
- Suggest what conditions of consent could be applied if consent is granted.

Within the timeframe of six days we have focussed on providing a high-level statement on interests but require the provision of comprehensive information to our iwi and hapū in kanohi kitea forums to ensure and improved understanding of the proposed activity.

The Cultural Impact Assessment will ensure time is invested in hapū and iwi meetings regarding the project and Archaeology, ecologists and planners regarding values identified.

Summary

Te Manawaroatanga[5] refers to the peace keeping activities of Ngāti Raukawa that has had the grave consequence of making us invisible in a landscape due to systematic Crown activity. Our indigenous treaties with iwi in the region were designed to bring harmony and secure prosperity. The peace treaties were initially undone by Crown armed destabilisation of our region, land the hunger of private companies and the crown for land. Ngāti Raukawa resistance was legislated against, and Māori custom and tikanga around land tenure used against Raukawa, by the crown to give land to other iwi who were not the rightful owners.

The second layer of treaties was genetically designed to hold the peace, those families for Ngarongo Iwikatea Nicholson referred to as Houhou rongo[6], or Takawaenga[7]. These lines of whakapapa are held by rangātira families, a "sacred marriage whose offspring enjoyed the respect of a number of iwi because their bloodlines, placed a responsibility upon them to reaffirm the original peace-making, and to ensure the survival of the future".[8] Such agreements are tapu.

Ngāti Raukawa are committed to working with NZTA through our MOU to maintain our areas of cultural significance which is inclusive of, but not limited to the Te Ahu-a-Tūranga (Gorge). We have identified a need for greater planning, and in particular CIA to ensure that our hapū are engaged and proactive from this point moving forward. The CIA is a proposed start to a suite of planning initiatives to be completed between NZTA and the Runanga o Raukawa for and with the affected hapū.

Kati au I konei
Let me here abide
As a canoe landing place,
And for the paddle splashing.

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[5] Manawaroa = stamina, dogged resilience

[6] Maori Customs and traditional practices, some examples: Houhou rongo, Takawaenga, Ngarongo Iwikatea Nicholson, Paper prepared for Mai I te Ata Hapara, Conference, Principles, Influence and relevance of Tikanga Maori in Otaki, 2000
Houhou = bind together, lash together, make peace

[7] Takawaenga = mediation
http://maoridictionary.co.nz/search?idiom=&phrase=&proverb=&loan=&histLoanWords=&keywords=takawaeng

[8] Ibid

This is an extract from a waiata by Rangi Topeora[9] and denotes we have come to an end of a journey

[9] Te Ahukaramu Royal chose as a title for his book, a collection of songs from Toarangatira, a Ngati Raukawa.

APPENDIX ONE:
WHAKAPAPA

APPENDIX ONE: Whakapapa

Everything has a whakapapa[10], soil, maunga, water, plants, insects, birds, animals. Whakapapa is a key concept for planning and process, as it dictates who belongs on the land and is a regulator of conduct. Whakapapa holds intergenerational responsibility, and shapes our view of the world, as it connects us with everything. Whakapapa ensures there is always consequence, and a balance.

There is no singular waka, nor singular iwi on this maunga, and in describing our relationship to her.

Tūranga-i-Mua was the eldest son of Turi Ariki and Rongorongo. Tūranga-i-Mua was from Ngāti Rongoteataikarahi people who were the stimulant of a civil war in Hawaiki. During a well documented quarrel with Uenuku, Turi Ariki feed Uenuku's child to him during a feast and boastfully said "A! tena pea ka ngaro ki roto ki te hoparanui a Toi!".

Tūranga-i-Mua's mother Rongorongo is the sister to Hoturoa's wife Whakaotirangi and therefore he is a first cousin to Ngāti Raukawa ancestor Hotuope. Rongorongo was also a sister to Kupe's wife Kuramarotini. Rongorongo overheard Uenuku casting a Matuku on Ngāti Rongoteataikarahi and encouraged Turi that it was time to leave Hawaiki. Kupe had recently returned with the navigational directions to Patea and advised of the relationship he had made with the people living there. Rongorongo's parents Toto and Pahia were responsible for making the Aotea waka. When the tree was felled it split into two, leaving enough totara to carve two waka. Thus, Aotea was born and its sister waka Ngatokimatawhaorua which was originally captained by Kupe.

This paper does not go into length about the journey of Aotea to New Zealand, however Tūranga-i-Mua was on board the Aotea waka along with his siblings, including one brother born during the journey. During the journey, the crew, like many other waka, stopped at Rangitahuahua before arriving at New Zealand. The Kurahaupo had been involved in an accident causing damage to the canoe.

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[10] (noun) genealogy, genealogical table, lineage, descent - reciting whakapapa was, and is, an important skill and reflected the importance of genealogies in Māori society in terms of leadership, land and fishing rights, kinship and status. It is central to all Māori institutions. There are different terms for the types of whakapapa and the different ways of reciting them including: tāhū (recite a direct line of ancestry through only the senior line); whakamoe (recite a genealogy including males and their spouses); taotahi (recite genealogy in a single line of descent); hikohiko (recite genealogy in a selective way by not following a single line of descent); ure tārewa (male line of descent through the first-born male in each generation).

One could link this incident on Rangitahuahu to the establishment of a long alliance and relationship between the people of Kurahaupo and Aotea waka. Kurahaupo's crew was halved, with one half going on board Mataatua waka and the other half, and its cargo going on board the Aotea. This act gave brith to the whakatauki "Aotea utanga nui mo te kai mo te korero" and Aotea te waka i puta ai ki waho te utanga o runga

The descendants of Tūranga-i-Mua have been woven into strategic alliances across the Hau-a-uru. On the arrival of the Tainui and Raukawa confederation Tūranga-i-Mua's decedents were involved in a series of battles with Ngāti Raukawa. In settling this dispute Ngāti Tūranga of Paranui Pa were arranged marriage across three generations to cement the relationship with the Tangata Whenua

Strategies of genetically designed relationships to keep the peace of always been the court of rangātira between iwi, and those from Aotea waka had many links to the Tainui Waka.

Ngāti Kauwhata and Wehiwehi descend from a famed beauty and chieftainess of Aotea, Rua-pū-tahanga whom Turongo (father of our eponymous ancestor Raukawa) had set his heart on to become his wife. His brother Whatihua through cunning strategy out maneuverer his brother and won the heart of Rua-pū-tahanga. From her son Uenuku-te rangi-hoka descend Ngāti Kauwhata and Wehiwehi whom have many interests and associations in this corridor of work.

Raukawa's heritage includes whakapapa to the Taikitumu waka through his mother Mahinarangi. There are also strong Kurahaupo links through both father Turongo, and mother lines. Hapū whom have an interest in these areas of works descend from those lines.

Our peace treaties are written in our landscapes, genetically designed in to certain genealogies, and were sacred. Locally domiciled iwi have been under the influence of our tikanga to uphold the pledges, treaties and word of our tūpuna.

Between Kurahaupo and Tainui, genetically designed peace treaties that impact on the Te Ahu a Tūranga block sale and the maintenance of our boundaries are the traditional takawaenga between the iwi of Rangiitane, Ngāti Raukawa and Ngāti Toa. They are the Te Aweawe or Larkin family of Rangiotu and the Durie family of Aorangi. These marriages strengthened the relationships between those three iwi.

As one of our fiercest champions of tikanga Ngarongo Iwikatea Nicholson observed

"The land courts of the 1860's and those that followed had no influence in designing, was an opportunity for many to deny much of the tikanga which had been practised. Many denied defeat, raupatau, on the grounds they had not been annihilated. An absolute non-sense! No chief would deliberately destroy all the local knowledge when invading another's territory by destroying all the people, even if it was a possibility."[11]

[11] Maori Customs and traditional practices, some examples: Houhou rongo, Takawaenga, Ngarongo Iwikatea Nicholson, Paper prepared for Mai I te Ata Hapara, Conference, Prinipcles, Influence and relevance of Tikanga Maori in Otaki, 2000. Ngarongo Iwikatea Nicholson June 2003 wai 207, wai 785

APPENDIX TWO: PAREKOHATU & WAITOHI

APPENDIX TWO

Parekohatu and Waitohi

Te Rauparaha was born in 1768 and is the last child of Werawera of Ngāti Kimihia a line of Ngāti Toa Rangātira and Parekohatu - a leadership line of Ngāti Huia. Te Rauparaha spent much of his childhood with his mother's (Parekohatu) people at Maungatautari. He was still in his teens when he married his first wife, Marore, of Ngāti Toa Rangātira. She was of high rank, and it was an arranged marriage. As children, they knew they were to be joined. He had more than one wife in his late teens and early twenties. He married three other women, Kahuirangi, Rangitamoana and Hopenui. His fifth wife became his principal wife. She was Te Akau, who was the widow of Ngāti Raukawa chief Hape Ki Tuarangi[12].

Te Rauparaha's sister Waitohi was instrumental in securing help from her whanaunga with holding these new territories. The leadership would not have come were it not for her skill in securing those agreements.

"Waitohi's emergence as a leader is recorded a few years prior to the migration south from Kawhia. A war party was headed for Kawhia. Waitohi recognised some of her relations in the war party and pleaded with them for peace. Waitohi's two children had recently been killed in a pakanga so her appeal carried great force and succeeded. The war fleet returned north. In the early 1820's after Ngāti Toa left Kawhia and established a base on Kapiti Island, Te Rauparaha called for his mother's whānau Ngāti Raukawa to join them. Supported by Waitohi he said, "If you return to Waikato bring my kinsfolk back with you – Ngāti Kauwhata, Ngāti Wehiwehi, Ngāti Werawera, Ngāti Parewahawaha and Ngāti Huia"

[12]Raukawa Oral History – 2017- Richardson citing Kereama, pp. 891996

APPENDIX THREE:
WAR ALLIANCES

APPENDIX THREE: **War Alliances**

Te Peeti Te Aweawe, Te Hirawanui te Kaimokopuna, and other Rangitāne joined the Raukawa ope taua to fight Te Atiawa at Haowhenua (1836). This was a great ope taua which was made up of Te Heuheu and Tuwharetoa, and Te Peehi Turoa of Whanganui.

This cluster also formed an alliance model which took part in a series of battles in Rototara in the Hawkes Bay. These chiefs had various scores to settle and travelled between Taupo, Hawkes Bay and through the Ruahine Ranges. Ngāti Raukawa were seeking revenge for a defeat at Puketapu. The big battles fought were Kau-uku in Mahia, Pa Horo, and Waimarama. A huge loss for Raukawa and Ngāti Te Kohera was the killing of Te Momo-a-Irawaru in 1824.

During this period, Ngāti Raukawa and a part of Rangiwhakewa caught and killed a relative to Te Hapūkunui-o-te-moana. This led to an attack by Hapūku of Ngāti-Kahungunu upon Ngatoto pa, a child of the local chief, Te Hirawanu, was captured. The name Ngāti Mutuahi arose from this event, mutuahi meaning 'consumed by fire.'

An additional part of Ngāti Rangiwhakaewa entered into an altercation with Ngāti Raukawa. At Waikareau pa, near the present settlement of Wanstead, a Ngāti Raukawa war-party killed two Rangitāne chiefs and carried away Ngarara to Paranui pa, Motuiti near Foxton, where he was killed. Pakapaka was adopted by the hapū after this event, denoting his passing.[13]

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[13] Mc Ewen Page 109

Glossary
Whakapapa Whakapapa connects us to everything other living thing, soil, rocks, mountains, birds, fish, trees, Relationships between past, present and future Dictates relationships are of paramount importance Requires the maintenance of appropriate relationships Whakapapa as a regulator of conduct
Raupatu Raupatu = conquest, conquer, overcome or rau = 100, patu = strike.(Carkeek)[14] Rau = blade of the weapon, Rau = many, Patu = strike or kill (Ngarongo Iwikatea Nicholson) Iwi conquests, Raupatu is often misinterpreted by the Crown and Pakeha as the total annihilation of a people and total extinguishment of all that was sacred in that place. Some iwi urban authorities have chosen to adopt this point of view as a way to politically leverage resources. Traditionally That is not the case. Therefore, the following is just but a small part of the custom of Raupatu described by Ngarongo Iwikatea Nicholson in Wai 175: "To show compassion or consideration to a person" "Te whakaora i te tangata" Take Whenua – Right or Reason to Land Some customary and descriptive examples of the way in which our people identified their rights follows: • Take tūpuna Ancestral right, by reason of ancestry • Take taunaha Bespeak, right through oral claim • Take tuku Ceded, given, right given • Take noho Occupation, occupation right or reason of • Take rahui Reservation by reason of reservation • Ahi ka Describes occupation fires • Ahi ka roa
Take Tuku Ceded, given, right given (Ngarongo Iwikatea Nicholson)
Mana Whenua Mana over all one's possessions both tangible and intangible is extinguished completely by suppression or defeat. Mountains, landmarks, sacred sites, burial grounds/caves, every possible asset would be lost to the (mana) authority of the suppressor. Maori would

[14] Otaki Cultural Impact Assessment, 27 July 2012

then through the customary practice of Waerea = 'clearing by removal' or Whakanoa = 'render common or ordinary'- take absolute authority.
Tatau Pounamu 1. (noun) enduring peace, making of peace, peacemaking - literally ' greenstone door', a metaphor for lasting peace. When peace was made a precious gift was often made to symbolise the event.
Tikanga 1. (noun) correct procedure, custom, habit, lore, method, manner, rule, way, code, meaning, plan, practice, convention, protocol - the customary system of values and practices that have developed over time and are deeply embedded in the social context
Kawa **(verb)** (-ia,-ina) to perform the *kawa* ceremony, open a new house **(noun)** a ceremony to remove *tapu* from a new house or canoe **(noun)** *karakia* (ritual chants) and customs for the opening of new houses, canoes and other events **(noun)** marae protocol - customs of the marae and *wharenui*, particularly those related to formal activities such as *pōhiri*, speeches and *mihimihi*. This seems to be a modern extension of the word.
Waerea Waerea is used to appease the spiritual influences that might pertain to property, or spiritual protective measures Maori used and applied to some of their personal property. The ritual of 'waerea' does not necessarily change the sacred (tapu) nature of anything. It simply clears away undesirable spiritual obstructions, and seeks to protect the performer or his people spiritually. Ngāti Toa oral traditions are that the ritual of Waerea was performed at, for example, the ancient burial caves on Kapiti Island and elsewhere.
Whakanoa 'render common or ordinary' Whakanoa was used for similar reasons but is used to render anything common. Whakanoa has never been performed at those burial caves and some of the other places acquired under Raupatu. The sacredness of such places from ancient times so far as we Ngāti Toa are concerned is intact to this day. Ngāti Toa knew they too were descendants of Kupe and Whatonga, and have maintained the sacred nature of such burial sites as the burial caves on Kapiti

Island by protecting them and providing guardianship over them, e.g. Te Ataotu the highly regarded captive chief. For Ngāti Toa to have desecrated particularly Wharekohu would be to offer offence to their own ancestors. Ngāti Toa on more than one occasion moved the remains of some of their own dead from other parts of the Kapiti Island to the Wharekohu Caves. They are there to this day.
Takawaenga - Mediator
Houhou te rongo - To make peace
Tatau Pounamu Our tatau pounamu had a responsibility to ensure peace as rangātira lines. With gifts of land, life and marriage such agreements were tapu, and there were responsibilities and agreements that came with such generosity

Bibliography

Published Sources

https://teara.govt.nz/en/biographies/1t86/te-whatanui for a full account