

Boffa Miskell



Tauriko West - Tupenga

Ecological Impact Assessment – Final
Prepared for NZ Transport Agency Waka Kotahi

29 July 2026





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This document may be cited as: Boffa Miskell Limited 2026. <i>Tauriko West - Tupenga: Ecological Impact Assessment – Final</i>. Report prepared by Boffa Miskell Limited for NZ Transport Agency Waka Kotahi.				
For any information regarding this report please contact: Jeremy Garrett-Walker Ecology Principal s9(2)(a)				
Revision /version:	Issue date:	Prepared by:	Description:	Reviewed by:
Final v1.3	29/07/2026	Jeremy Garrett-Walker Ecologist / Freshwater ecology Andrew Blayney Ecologist / Wetland ecology Rosa Kirkham Ecologist / Wetland ecology Karin Sievwright Ecologist /Avifauna Amanda Healy Ecologist/ Terrestrial & Herpetofauna Hazel Burridge Ecologist/Bats	Final report issued to client – minor grammatical issues resolved	Terrestrial reviewer Andrew Blayney Ecologist (Boffa Miskell Ltd) Third Party reviewer: Freshwater & wetlands Vaughan Keesing Ecologist (BlueGreen Ecology)
Approved for issue: Jeremy Garrett-Walker Ecology Principal 29/07/2026				

File name & Project number: BM250324_SH29-Tupenga_Ecology Assessment_Final_20250729-v1.3.docx | BM250324

Template revision: 20250829 0000

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1 Executive Summary

This report presents an assessment of the terrestrial, wetland and freshwater ecological effects associated with the Tauriko West – Tupenga Project. The Project involves works within the designation footprint (Proposed Designation) associated with transport infrastructure, including road construction and upgrades, stream realignments, earthworks, vegetation clearance, stormwater infrastructure and associated construction activities.

The report describes the ecological values present within the Proposed Designation and relevant receiving environments, assesses the potential effects of construction and operation of the Project on those values, and outlines the measures proposed to manage those effects.

1.1 Ecological Values

The Proposed Designation is located within a modified rural and peri-urban landscape. Land use within the Proposed Designation is dominated by pasture, horticulture, plantation forestry, amenity planting, exotic vegetation, modified watercourses and existing transport infrastructure.

Within this broader context, ecological values are associated with wetlands, streams, riparian habitats, indigenous vegetation and areas of restoration planting. These features contribute to habitat provision, ecological connectivity and a range of ecological and hydrological functions within the Proposed Designation and wider catchment (ZOI).

Terrestrial vegetation within the Proposed Designation is predominantly exotic or modified. Indigenous vegetation is largely confined to areas of planting, including amenity, infrastructure and restoration planting. These areas provide increased vegetation cover, structural complexity and habitat relative to the surrounding land use, and are often associated with wetland margins, stream corridors and landscape planting areas.

Wetlands occur throughout the Proposed Designation and vary in condition, extent and vegetation composition. Many wetlands are modified farm wetlands influenced by grazing, drainage and the presence of exotic species. Other wetlands, particularly within the Kōpūrerua Valley, form larger and more connected systems associated with streams and floodplain environments. These wetlands contribute to water storage, attenuation, sediment and nutrient processing, and provide habitat for wetland-associated species.

Freshwater environments include the Wairoa and Ōmanawa Rivers, the Kōpūrerua Stream, Nānako Stream, Belk Road watercourses, and a network of modified and artificial channels. The Wairoa and Ōmanawa Rivers function as high-value receiving environments within the wider catchment, while many of the modified channels provide comparatively lower ecological value. These waterbodies provide a range of habitat conditions and support aquatic communities, including indigenous fish.

Indigenous fauna associated with the Proposed Designation include freshwater fish, wetland and terrestrial birds, and herpetofauna. These species utilise a range of habitats across the Proposed Designation, including wetlands, streams, riparian vegetation, planted areas and modified terrestrial environments. Surveys identified copper skink within the Proposed Designation, while avifauna assemblages are typical of modified rural and peri-urban

landscapes, with use of wetland and freshwater habitats by a range of rarer, more sensitive, indigenous species. Bat surveys did not detect long-tailed bats within the Project Designation.

1.2 Ecological Effects

The Project will result in the removal and modification of terrestrial, wetland and freshwater habitats. These changes arise from vegetation clearance, earthworks, wetland loss, stream realignment, instream works, and the construction and operation of transport infrastructure.

Terrestrial effects include the removal of vegetation and habitat, fragmentation of vegetation, and changes to habitat availability for fauna. Vegetation clearance will primarily affect exotic and modified vegetation, along with smaller areas of indigenous planting and restoration planting. Effects on fauna may occur through habitat loss, disturbance, displacement and the potential for injury or mortality during construction activities.

Wetland effects include the loss of wetland extent, temporary disturbance during construction, and changes to wetland hydrology, vegetation and function. Additional effects may arise from sediment and contaminant discharges, fragmentation of wetland areas and the creation of new edge environments. These effects may influence wetland vegetation, habitat conditions and ecological processes within affected wetlands.

Freshwater effects include disturbance associated with instream works, changes to channel form through stream realignment, temporary disruption to fish passage, and potential effects from sediment and contaminant discharges. Operational effects may result from changes to stormwater inputs, hydrology and channel condition. Realignment of sections of streams will alter existing channel morphology and associated habitat conditions.

Construction activities have the potential to generate temporary effects across all ecological features, including sediment generation, disturbance of habitats, and effects on water quality. Operational effects are associated with the ongoing presence and use of the transport corridor, including changes to hydrology, stormwater discharge and habitat configuration.

1.3 Effects Management

A range of measures are proposed to manage ecological effects associated with the Project. These include design measures, construction management controls, fauna management, and restoration and enhancement works.

The Indicative Design has incorporated measures to avoid or reduce ecological effects where practicable, including the configuration of infrastructure and the design of stream realignments and crossings. Construction-related effects are addressed through erosion and sediment control, management of contaminants, and controls on vegetation clearance and instream works.

Fauna management measures include pre-clearance surveys, staged vegetation clearance, and species-specific management such as lizard salvage and relocation, fish salvage and passage management, and procedures for managing nesting birds. These measures are supported by ecological management plans (such as a Lizard Management Plan) and monitoring requirements where required or explicit conditions for implementation of management measures (such as the required nesting bird surveys).

Vegetation clearance and terrestrial habitat loss are largely addressed through measures associated with riparian planting, landscape planting and wetland habitat establishment and

age-structured replacement of affected restoration planting. These plantings are expected to reinstate vegetation cover and contribute to habitat provision and ecological function following construction. However, where there are impacts on specific native restoration plantings in the Kōpūrerua valley, specific age-structured replacement ratios are proposed to ensure the values created are proportional to those lost.

Wetland effects are addressed through a combination of remediation, restoration and compensation. Because sufficient wetland creation to fully offset losses is not practicable within the Proposed Designation, the compensation approach combines wetland creation with restoration of retained wetlands. Temporary disturbance is to be reinstated where practicable through re-establishment of wetland hydrology, landform and vegetation. Where permanent wetland loss occurs, a compensation approach is proposed that includes wetland creation and restoration of retained wetlands within the Proposed Designation. Compensation modelling has been undertaken to assess the ability of this approach to address wetland effects.

Freshwater effects will be addressed through construction controls, stream design, fish passage provisions, and riparian restoration. Stream realignments will incorporate design elements intended to provide channel form and habitat conditions, supported by planting and monitoring to confirm outcomes.

1.4 Conclusion

Overall, the assessment concludes that the ecological effects associated with the Project can be appropriately managed through the proposed design measures, construction controls, fauna management, restoration and enhancement planting, wetland remediation and compensation, stream rehabilitation, and monitoring measures. While permanent changes to terrestrial, wetland and freshwater environments will occur, implementation of the proposed effects management framework is expected to appropriately manage adverse ecological effects to low to very low levels and for some ecological features will result in positive effects.

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Appendix 1: Assessment methods

Appendix 2: Terrestrial vegetation

Appendix 3: Terrestrial fauna

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2 Qualifications, experience, and Code of Conduct

This report has been prepared by:

- Amanda Healy – terrestrial vegetation and herpetofauna
- Karin Sievwright – avifauna
- Hazel Burridge – bats
- Rosa Kirkham – wetlands
- Andrew Blayney – wetlands
- Jeremy Garrett-Walker – watercourses.

Amanda Healy

The section of this report relating to herpetofauna (lizards and frogs) and vegetation has been prepared by Amanda Healy.

My name is Amanda Healy. I am a terrestrial ecologist at Boffa Miskell Ltd, based in Tauranga. I hold a Master of Conservation Biology from Victoria University of Wellington and a Bachelor of Science in Biology from the University of Waikato. I am a Certified Environmental Practitioner (Certification # 1878) under the Certified Environmental Practitioner Scheme of the Environmental Institute of Australia and New Zealand, and I am bound by the Institute's code of ethics.

I have worked in ecological consulting for more than nine years, with a focus on terrestrial communities and fauna, particularly herpetofauna. I have also worked in the freshwater and marine spaces. I have worked across a range of development and infrastructure projects. I have also worked extensively under the Wildlife Act 1953 and have obtained numerous Wildlife Act Authorities to enable the disturbance, salvage and relocation of native fauna.

My relevant project experience includes:

- **Mansels Wastewater Pipe Renewal, Tauranga City Council (2024–2025):** Managed ecological assessment and effects management for a new wastewater pipe through a significant wetland.
- **Marine Parade Shared Pathway (2021-2023):** Provided input for the ecological impact assessment, and prepared and implemented a Lizard Management Plan for the shared pathway installed in sensitive dune environment at Mount Maunganui.
- **Oropi Watermain Renewal – Stage 1 Consenting, Tauranga City Council (2024–Present):** Provided input for an Ecological Impact Assessment for a new watermain alignment.

- **Transmission Gully Project (2016–2024):** Involved in a wide range of ecological management activities including fish and lizard relocation, bird surveys, and stream restoration assessments.
- **Various wind and solar farms (ongoing):** Provided input to ecological impact assessments and management plans (particularly lizard management) on a number of different wind and solar farms.

Although this Application is not before the Environment Court, I confirm that I have read the Code of Conduct for expert witnesses as contained in section 9 of the Environment Court Practice Note 2023. I agree to comply with that Code. My qualifications as an expert are set out above. I am satisfied that the matters which I address in this Ecological Effects Assessment are within my area of expertise, except where I state that I am relying on information provided by another person or expert. I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

s9(2)(a)

29 July 2026

Karin Sievwright

The section of this report relating to avifauna (birds) has been prepared by Karin Sievwright.

My full name is Karin Amy Sievwright. I am an ecologist at Boffa Miskell Ltd. I have been in this position since 2015. I have a Bachelor of Science degree majoring in Ecology and Zoology and a Master of Science degree in Conservation Biology (First Class Honours), both from Massey University, Palmerston North. I am a Certified Environmental Practitioner (Ecology) with the Environment Institute of Australia and New Zealand (Certification # 1805), and I am bound by the Institute's code of ethics.

My primary area of expertise is ornithology / avifauna (birds). I mainly work in ecological impact assessment and management. I have conducted bird surveys, prepared ecological impact assessments and management plans for many proposed and consented infrastructure, energy and housing developments.

My relevant project experience includes, but is not limited to:

- **Various wind and solar farms (2019-ongoing):** Conducted bird surveys, prepared the avifauna components of ecological impact assessments, management plans and monitoring reports and / or supervised post-construction bird collision monitoring.
- **Transmission Gully Project (2015-2023):** Conducted ecological construction monitoring, supervision and fauna salvage work. This included conducting native fish and lizard rescue and relocation, avifauna surveys, native vegetation clearance supervision, biannual pest planting monitoring, quarterly intertidal marine monitoring, biannual freshwater monitoring, lizard habitat construction, and post-release monitoring.
- **Summerset Village Waikanae (2019-2022):** Conducted avifauna and vegetation surveys of the site and prepared these components of the ecological impact

assessment prepared for the project. Prepared the terrestrial components of the project's environmental management plan and implemented some of the baseline ecological monitoring required for the project.

- **Pepe Bridge Replacement Project (2024-2026):** Conducted coastal bird surveys and prepared an ecological impact assessment for the project.
- **Eastern Busway Project (2018-2024):** Conducted coastal avifauna surveys for a proposed busway and prepared the coastal bird component of marine ecological impact assessments prepared for various stages of the project.

Although this matter is not before the Environment Court, I confirm that I have read the Code of Conduct for expert witnesses as contained in section 9 of the Environment Court Practice Note 2023. I agree to comply with that Code. My qualifications as an expert are set out above. I am satisfied that the matters which I address in this report are within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

s9(2)(a)

29 July 2026

Hazel Burridge

The section of this report relating to bats has been prepared by Dr Hazel Burridge.

My full name is Hazel Jane Burridge. I am a terrestrial ecologist with Boffa Miskell Ltd (Associate Principal). I have thirteen years experience working as an ecologist in the UK and Aotearoa/New Zealand. My first degree is in environmental science and my PhD is in soil microbial ecology. I have specialised in bats for the last eleven years and hold competencies from the Department of Conservation to handle and survey long-tailed bats. I am a Certified Environmental Practitioner. Experience that is relevant to the bat assessment in this project includes:

- **Renewable Energy Projects (2023 to present)** - I am currently working on a range of wind and solar projects progressing through the Fast Track process. My role within these has been to design and implement baseline surveys and ongoing monitoring for bats, and use the data to develop a mitigation strategy.
- **Transpower Tree Assessments (2023 to present)** - I have undertaken bat roost assessments for Transpower to enable management of trees around power lines and developments. This includes implementing the tree fell protocols where required.
- **Oceana Gold (2025 to 2026)** - Pre-clearance vegetation assessments and liaison with the Department of Conservation to develop a bat management plan.

Although this matter is not before the Environment Court, I confirm that I have read the Code of Conduct for expert witnesses as contained in section 9 of the Environment Court Practice Note 2023. I agree to comply with that Code. My qualifications as an expert are set out above. I am satisfied that the matters which I address in this report are within my area of expertise. I have

not omitted to consider material facts known to me that might alter or detract from the opinions I express.

s9(2)(a)

29 July 2026

Rosa Kirkham

The section of this report relating to wetlands has been co-prepared by Rosa Kirkham and Andrew Blayney (see below).

My full name is Rosa Katie Kirkham. I am a freshwater ecologist at Boffa Miskell Limited, based in Hamilton. I have held this role since June 2025 and have worked as an ecologist/freshwater scientist since 2019. I hold the qualifications of Master of Science – Physical Geography (2019) and Bachelor of Applied Science – Environmental Management and Zoology (2016), both from the University of Otago.

My relevant project experience includes, but is not limited to:

- **R2 Growth Cell Ecological Impact Assessment, Hamilton (2026- present) -** Freshwater ecologist for the fast-track consenting process for the development of the R2 Growth Cell in Hamilton.
- **Oropi Watermain Trunk Upgrade (2025) –** Provided input into the freshwater ecological assessment and effects management for an upgrade to the Tauranga City Council potable watermain upgrade between the Oropi Water Treatment Plant and Joyce/Wood Road.
- **Ferncliffe Farm (2023) -** Provided early-stage technical advice through Opportunity and Constraints assessment. This was followed by extensive field surveys of freshwater and wetland values involving watercourse classification and habitat assessments, wetland delineation, and eDNA sampling. Carried out the ecological valuation and impact Assessment including offset modelling for impacts to freshwater values.
- **Kopuku Road Cleanfill (2022) -** Freshwater ecologist responsible for the development of the Ecological Impact Assessment for consenting. This involved field surveys including SEV and wetland delineation, and the offset modelling of streams to address residual effects of stream extent loss.
- **Maleme Street Channel Enhancement (2023-2024) -** Carried out an assessment of freshwater values and effects for the project including field surveys. Lead ecologist in the implementation of the fish management plan for fish salvage during construction.

Although this matter is not before the Environment Court, I confirm that I have read the Code of Conduct for expert witnesses as contained in section 9 of the Environment Court Practice Note 2023. I agree to comply with that Code. My qualifications as an expert are set out above. I am satisfied that the matters which I address in this report are within my area of expertise. I have

not omitted to consider material facts known to me that might alter or detract from the opinions I express.

s9(2)(a)

29 July 2026

Andrew Blayney

The section of this report relating to wetlands has been co-prepared by Andrew Blayney and Rosa Kirkham (see above). Andrew also conducted Boffa Miskell's internal peer review of the terrestrial and wetland components of this report.

My name is Andrew Russell Blayney. I am a senior terrestrial ecologist (Senior Principal) at Boffa Miskell Limited, based in Hamilton. I have held this role since January 2017. I hold the qualifications of Master of Science – Zoology (1st class Honours), Massey University (2013) and Bachelor of Science - Ecology & Zoology, Massey University (2010). I am also a Certified Environmental Practitioner (Certification # 1278) under the Certified Environmental Practitioner Scheme of the Environmental Institute of Australia and New Zealand, and I am bound by the Institute's code of ethics.

I have listed a selection of projects I have worked on to highlight my experience which is relevant to my Ecological Effects Assessment:

- **Te Ara Hauāuru Northwest Rapid Transit (2026 – present)** - Lead terrestrial vegetation ecologist for the fast-track consenting process for a rapid transit busway in the Auckland area.
- **Takitimu North Link Stage 2 (2020 – present)**: Lead terrestrial ecologist for the fast-track consenting process for a four-lane highway between Te Puna and Ōmokoroa. Co-author of the Ecological Effects Assessment for the project, covering terrestrial ecology, wetlands, bats, lizards, and broader biodiversity values. Provided expert witness evidence to the Expert Panel, addressing matters including wetland offset ratios, wetland restoration management, bat management, and lizard management. Involved in expert caucusing on ecological effects and mitigation requirements and contributed to refinement of ecological conditions within the Fast-track approvals process.
- **Whangārei to Te Hana IBC / DBC, (2017-2024)**: Terrestrial ecologist (vegetation, wetlands, lizards, and bats) for initial and detailed business case. Carried out multi-criteria analyses on potential effects on ecological values arising from a range of long list and short list alignment options.
- **Rangiriri Solar Farm, Waerenga Solar Farm, Annies Way Solar Farm, and Morrinsville Solar Farm (2022-Present)**: I am the lead project ecologist for the listed grid scale solar farms. This has involved devising assessment methods, providing technical input and review of the ecological assessments and development of the effects management strategies, responding to submissions, liaison with stakeholders, and post concept advice.
- **Cambridge Wastewater Treatment Plan – Cambridge (2021 – 2025)**: Provided technical advice on ecological assessment matters regarding terrestrial and wetland

matters for the project to consent the replacement of the Cambridge Wastewater Treatment Plant. Peer review for the final Ecological Impact Assessment. Responsible for the delivery of onsite terrestrial ecology works and development of the ecological components of the landscape and ecological management plan including wetland restoration.

- **Ruakura Inland Port, Hamilton (2017 to 2025):** Lead project ecologist in the design, consenting and implementation of multiple stages of the inland port development in the Ruakura Structure Plan area and associated supporting infrastructure. This includes the survey, assessment, and management of fauna, including long-tailed bats, providing ecological input into the development and design of wetlands and lizard habitat for mitigation, management plans for long-tail bat effects management, and providing technical advice on ecological constraints and opportunities associated with the project.
- **Te Ahu Turanga: Manawatū Tararua Highway - Manawatū Gorge Replacement Project (2018-2020):** Carried out an assessment of terrestrial fauna values and effects for the project. Including surveys and habitat assessments for herpetofauna, bats, and birds.

Although this matter is not before the Environment Court, I confirm that I have read the Code of Conduct for expert witnesses as contained in section 9 of the Environment Court Practice Note 2023. I agree to comply with that Code. My qualifications as an expert are set out above. I am satisfied that the matters which I address in this report are within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

s9(2)(a)

29 July 2026

Jeremy Garrett-Walker

Qualification and experience statements for each co-author are provided below.

My full name is Jeremy Garrett-Walker. I am a Senior Freshwater Ecologist at Boffa Miskell Ltd, based in Tauranga. I hold a Master of Science (Hons) in Biological Sciences (2014) and a Bachelor of Science in Environmental Planning (2012), both from the University of Waikato. I am a Certified Environmental Practitioner (Certification # 1870) under the Certified Environmental Practitioner Scheme of the Environmental Institute of Australia and New Zealand, and I am bound by the Institute's code of ethics. I am a member of the New Zealand Freshwater Sciences Society.

I have over ten years of experience in ecological consulting, specialising in freshwater and wetland ecosystems, with additional experience in terrestrial fauna. My work spans a wide range of infrastructure and development projects across the lower and central North Island, including water and wastewater infrastructure, roading, and rail. I have led ecological inputs from early planning and consenting through to implementation and monitoring, and regularly collaborate with engineers, designers, and contractors to integrate ecological values into project delivery.

My relevant project experience includes:

- **Takitimu North Link – Stage 2 (2021–Present):** Lead freshwater ecologist contributing to the Fast-track consenting of the four-lane highway between Te Puna and Ōmokoroa. Co-author of the Ecological Effects Assessment for the project, with responsibility for freshwater ecology, including assessment of stream values, evaluation of potential aquatic habitat effects, and input into ecological mitigation design. Provided technical expert input regarding freshwater matters, including fish passage requirements, stream classification, and ecological mitigation conditions. Supported NZTA's expert evidence package through preparation of assessments and advice integral to the Panel's consideration of freshwater ecological effects.
- **Te Ara Hauāuru Northwest Busyway (2026-ongoing):** Lead freshwater ecologist brought on to the project following lodgement of the substantive application under the fast-track consenting legislation. This included initial peer review of the original ecology assessment (prepared by AECOM), and subsequent preparation of a standalone freshwater ecology assessment intended to supersede the original assessment.
- **Featherston Wastewater Treatment Plant Reconsenting (2020–Present):** Lead ecologist for the reconsenting of the plant, including ecological impact assessment, habitat and flow modelling, and development of a comprehensive ecological monitoring programme. My evidence supported the conclusion that the proposed upgrades would result in a net ecological gain for Donalds Creek.
- **Mansels Wastewater Pipe Renewal, Tauranga City Council (2024–2025):** Managed ecological assessment and effects management for a new wastewater pipe through a significant wetland.
- **Silverstream Pipe Crossing, Wellington Water (2018–2022):** Sole ecologist in MCA process and contributor to Ecological Impact Assessment for a new pipe bridge over Te Awa Kairangi / Hutt River.
- **Transmission Gully Project (2016–2022):** Involved in a wide range of ecological management activities including fish and lizard relocation, bird surveys, and stream restoration assessments.

Although this matter is not before the Environment Court, I confirm that I have read the Code of Conduct for expert witnesses as contained in section 9 of the Environment Court Practice Note 2023. I agree to comply with that Code. My qualifications as an expert are set out above. I am satisfied that the matters which I address in this report are within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

s9(2)(a)

29 July 2026

3 Introduction

3.1 Purpose and scope of this report

This report comprises three parts.

Part A: An assessment of the potential effects of the Project on terrestrial ecology:

- Characterises and assesses the terrestrial ecology values present within the ZOI;
- Assesses the potential effects of construction and operation of Project activities on those values;
- Provides measures for managing the potential effects of the Project; and
- Provides the information necessary for the Wildlife Act Authority (WAA) permits.

Part B: An assessment of the potential effects of the Project on wetland ecology:

- Characterises and assesses the terrestrial and wetland ecology values present within the ZOI;
- Assesses the potential effects of construction and operation of Project activities on those values;
- Provides measures for managing the potential effects of the Project.

Part C: An assessment of the potential effects of the Project on freshwater ecology:

- Characterises and assesses the freshwater values present within the ZOI;
- Assesses the potential effects of construction and operation of Project activities on those values;
- Provides measures for managing the potential effects of the Project; and
- Provides the information necessary for the Freshwater Fisheries Regulations approvals.

The detailed assessment methods for all parts are set out in Appendix 1.

The Project description is outlined in the Substantive Application Report.

Ecology maps are collated in a series of Ecology Mapbook Supplements, including:

- Tauriko West Tupenga Ecology Mapbook Supplement Volume 1 – Vegetation – Access,
- Tauriko West Tupenga Ecology Mapbook Supplement Volume 2 – Herpetofauna – Chiropteroфаuna,
- Tauriko West Tupenga Ecology Mapbook Supplement Volume 3 – Avifauna, and
- Tauriko West Tupenga Ecology Mapbook Supplement Volume 4 – Wetlands – Watercourses.

3.2 Acronyms, definitions and abbreviations

Glossary of terms / abbreviations	
Term	Definition
FTAA	Fast-track Approvals Act 2024
NoR	Notice of Requirement
NZTA	NZ Transport Agency Waka Kotahi
SQP	Suitably qualified person
Indicative design	The consent level design encompassing the roading works footprint including the batter slopes and permanent civil footprint of roading and paving surfaces.
Detailed design	Design limited to the Stream realignments
ZOI	Zone of Influence. Defined as all land, water bodies and receiving environments that could be potentially impacted by a project. It includes the project site where direct effects will occur (i.e. the construction footprint) and any environments beyond the project site where indirect effects such as discharges, disturbance may extend.
RoNS	Road of National Significance

Part A: Terrestrial Ecology

4 Terrestrial ecology executive summary

The terrestrial environment within the Proposed Designation is dominated by pasture, plantation forestry / shelterbelts and other exotic vegetation, with only limited indigenous vegetation largely confined to planted or restored areas. Most habitats are of negligible to low ecological value due to modification, weed presence and low structural complexity. Moderate values are associated with more established restoration planting, particularly within the Kōpūrererua Valley and along Takitimu Drive, where native species dominance and structure are more developed.

Fauna values reflect this modified environment. Copper skink was recorded at a single location, with most habitat considered low value. Avifauna are typical of peri-urban landscapes, although a range of indigenous species, including at-risk and threatened species, are likely present, with higher value habitat generally associated with wetland and restoration areas. Long-tailed bats were not detected in surveys and bat habitat is low value.

The Project will result in removal of approximately 61.7 ha of low value exotic and exotic-dominated vegetation, along with smaller areas of native amenity planting (6.5 ha) and restoration planting (1.9 ha). Effects include vegetation clearance, habitat loss and modification, potential injury, mortality and disturbance to fauna (both operational and during-construction), and increased fragmentation.

Management measures include staged vegetation clearance, pre-clearance surveys, and fauna management protocols, along with erosion and sediment controls. Restoration, riparian, wetland and landscape planting will replace and enhance vegetation and fauna habitat across the Proposed Designation. With these measures, residual terrestrial ecological effects are predominantly low, with overall outcomes achieving no net loss or a net gain in ecological values (largely as a result of the landscape planting, wetland and stream realignment planting requirements).

5 Existing environment – terrestrial

5.1 Terrestrial vegetation communities

Terrestrial vegetation surveyed in the Proposed Designation was predominantly exotic in composition with only occasional common native species present. Predominant land cover was pasture, ornamental gardens and exotic or exotic dominated scrub. Most native species were confined to either areas of planting (landscape/amenity or restoration planting) or areas of mixed / exotic-dominated regeneration. Overall, the terrestrial vegetation value across the Proposed Designation, except for limited exceptions, is primarily constrained to its ecological context and potential fauna habitat value.

Representative photos of the vegetation communities are provided in Appendix 2 and maps of the vegetation communities are provided in the Ecology Mapbook Supplement Volume 1 –

Vegetation. Due to the low values and exotic dominance of most vegetation we aggregated similar vegetation types for the purposes of descriptions and mapping. All plant names in text, outside of formal descriptions, use common names. For binomial names and threat status refer to Appendix 2.

The only *at-risk* or *threatened* species detected were those that have been planted, including kauri (*Agathis australis*; *at-risk – declining*), and shrubby tororaro (*Muehlenbeckia astonii*; *threatened – nationally endangered*) (de Lange et al., 2024). These plantings are generally for amenity purposes; kauri have been planted as roadside specimen trees or in gardens, and the shrubby tororaro has been included in landscape planting mixes. We have not weighted these planted specimen's presence as indicative of an elevated level of ecological value for the vegetation communities where they are present.

We assess that all exotic and mixed vegetation has **Negligible** or **Low value**. The exotic communities have only minimal contextual value as potential fauna habitat, and the mixed communities tend to also be exotic dominated where within the footprint, and any natives present are common and widespread.

The native landscape, amenity and infrastructure planting that has been carried out at Redwood Lane and the Tauriko West Northern access is assessed to have **Low-Moderate** value. These plantings are focused on their amenity value and their functional value in stormwater management, not on ecological value or restoration. Although the plant mixes chosen are not representative of natural communities, their value is increased slightly because of the high presence of native species and the ecosystem function provided, in particular, by the swale and stormwater pond planting.

The restoration and mitigation plantings that are found in the Kōpūrererua Valley and west of Takitimu Drive are assessed to have **Moderate** value. These plantings are typically young (all less than 20 years, and some only 1-3 years) and many are of simple composition. However, as they are typically under ongoing management, and the restoration plantings within the Kōpūrererua Valley have been seen to establish well and quickly. It is expected that they will naturalise further within the time before the proposed works start. The plantings also provide contextual benefits (e.g. wetland buffering, connectivity, habitat “stepping stones”).

5.2 Vegetation type descriptions

A summary of the areas of each vegetation type mapped is provided in Table 5-1.

Further descriptions for each vegetation community are provided in Appendix 2. Aggregate descriptions are provided for those communities that are very simple in structure, e.g. pasture, cropland, exotic plantation. Native and mixed communities, and exotic dominated communities with more complexity, are characterised separately, with specific descriptions provided for each distinct community.

Table 5-1: Vegetation communities within the Proposed Designation, and their values.

Community I.D.	Vegetation community type	Description	Value
Community Type 1	Managed exotic grassland and cropland	Agricultural areas. Little or no native diversity, very low complexity, little habitat value except for occasional foraging.	Negligible
Community Type 2	Horticulture	Kiwifruit, avocado and citrus orchards, and their associated shelterbelts. Little or no nativity diversity, complexity or habitat value	Negligible

Community I.D.	Vegetation community type	Description	Value
Community Type 3	Shelterbelts and hedgerows	Primarily exotic shelterbelts. Very low diversity, rarity, and complexity, but some value as potential bat habitat, and where fenced, potential lizard habitat.	Low
Community Type 4	Exotic plantation and tree stands	As with shelterbelts, value for exotic plantation and tree stands is primarily contextual as (low quality) habitat.	Low
Community Type 5	Garden and amenity	Generally exotic ornamental planting, with occasional planted natives. Very little diversity, complexity, or rarity, but some habitat value for fauna	Low
Community Type 6	Gorse and woolly nightshade in pasture	Areas of weedy growth in managed pasture, comprised almost entirely of gorse and/or woolly nightshade. Very low diversity and complexity and provides little contextual or habitat value.	Negligible
Community Type 7	Exotic scrub / weed land / tree land	Six communities that are either entirely or almost entirely exotic vegetation and have many weedy/invasive species present. Very little value except providing some native fauna habitat.	Low
Community Type 8	Mixed (exotic-dominated) scrublands and forest	Eight communities that are generally exotic dominated but have slightly higher proportions of native species than Community Type 7. Dominated by invasive and weedy species. The presence of some common, widespread natives does not notably elevate their value. Ecological value remains largely in the fauna habitat that they provide.	Low
Community Type 9	Native landscape, amenity and infrastructure planting	Six areas of native or mostly native planting carried out for landscape/visual value, screening, and or stormwater management. These areas have not been designed with ecological value in mind, and are generally not comprised of mixes that would be found naturally/historically within the landscape. However, they do have some added value for native diversity and complexity, and may provide some habitat.	Low-Moderate
Community Type 10	Native restoration planting	Six identified areas of restoration, within the Kōpūrerua Valley and alongside Takitimu Drive. All plantings are under 20 years old, with some areas less than 5 years old. The plantings are comprised of common and widespread species, though have increased rarity as wholly indigenous communities within the Tauranga area. They currently have low to moderate complexity. The representativeness and diversity is generally appropriate for the ecological district, and the values of these sites will continue to increase as they mature.	Moderate

5.3 Terrestrial Fauna

5.3.1 Herpetofauna

5.3.1.1 Desktop review

The DOC herpetofauna database (BioWeb) has records for copper skink (*Oligosoma aeneum*) and moko skink (*Oligosoma moco*) in the local area, as well as the exotic plague skink

(*Lampropholis delicata*). However, the database contains a distinct lack of records for geckos or skinks (several native frog surveys in the surrounding ranges are captured) across the entirety of the Western Bay of Plenty. This is likely a reflection of a lack of survey overall. Therefore, in our opinion the absence of more cryptic species in the database should not be used as a reliable indicator of their potential presence or lack thereof in the Proposed Designation.

Based on the habitat present, geographic range of lizard species, and experience in similar landscapes, the following species are potentially present in the wider area¹:

- Copper skink (*Oligosoma aeneum*), *at-risk – declining*; habitat generalist that prefers dense and complex habitats. Persists in both urban and rural environments.
- Moko skink (*Oligosoma moco*), *at-risk – relict*; Coastal and lowland open habitats such as rank grassland, forest clearings and edges, and scrubland. Persists in peri urban and rural environments normally restricted to areas close to the coast.
- Ornate skink (*Oligosoma ornatum*), *at-risk - declining*; cryptic species preferring damp thick leaf litter, rock piles and dense vegetation. Persists in the urban and rural environment. This species has not been confirmed in the wider landscape.
- Striped skink (*Oligosoma striatum*) *at-risk – declining*; Typically inhabits dense native lowland podocarp forest and assumed to be primarily arboreal. However, can be found as relict populations in farmland that was once forested where it typically inhabits moist humid sub habitats found amongst shelterbelts, dense weed field such as pampas, under logs and in rank grass.
- Forest gecko (*Mokopirirakau granulatus*), *at-risk - declining*, Pacific gecko (*Dactylocnemis pacificus*), *at-risk - relict*; and raukawa gecko (*Woodworthia maculatus*), *not threatened*; all can inhabit forest, scrublands, and herb fields, rock piles, creviced rocky bluffs. Persists in rural and peri-urban environments.
- Elegant gecko (*Naultinus elegans*), *at-risk - declining*; inhabits forest, scrublands often co-habits with forest gecko.
- Crenulate skink (*Oligosoma robinsoni* syn *Oligosoma aff. infrapunctatum “crenulate”*), *at-risk – declining*; inhabits dense scrub, shrubland, grassland and forest edges.
- Plague skink (*Lampropholis delicata*) an invasive, non-native, species occupying most farmland, peri urban, and urban habitats.
- Shore skink (*Oligosoma smithi*), *at-risk – declining*; Strictly coastal living amongst dunes, shell banks, boulder beaches and associated nearby habitats. This coastal lizard species has been noted nearby but is very unlikely to be within the alignment area.

Several species of native frog are found in the wider area. However, we have not considered these species further in this assessment as there is no suitable habitat in the Proposed Designation. Exotic frogs are also present, but are not of ecological concern.

5.3.1.2 Survey results

Three native lizards were observed during lizard surveys; two were identified as copper skinks, and one that was not definitively identified² but also was likely a copper skink. All three native lizards were observed at Survey Site 4 in the roadside vegetation alongside SH29A (east of

¹ Threat statuses are aligned with Hitchmough et al. (2026) and habitat preferences follows that described within Van Winkel, Baling, & Hitchmough (2018).

² Based on size, colouring and markings it was clearly not a plague skink and was identified as native.

Barkes Corner), under ACOs 7, 9 and 10 (refer to the Ecology Mapbook Supplement Volume 2 – Herpetofauna / Chiropterofauna).

Additionally, approximately 60 plague skinks were observed during surveys (on/under ACOs as well as within the surrounding vegetation), as well as six unidentified skinks that moved too quickly to identify.

Copper skinks only being observed at one location during surveys does not prove their absence in other areas within the Proposed Designation, though it may indicate that native lizards are not present in high numbers generally within the Proposed Designation.

5.3.1.3 Habitat values and condition

While the vegetation in the Proposed Designation is predominantly exotic, some vegetated areas may provide suitable complex habitats for native skinks. Habitats include complex vegetation debris, damp leaf litter, complex scrub cover, rank grass, and artificial debris³. A summary of the areas of each habitat mapped, the area within the Proposed Designation, and the assessed ecological value is provided in Table 6-1; the latter is also shown in the Ecology Mapbook Supplement Volume 2 – Herpetofauna / Chiropterofauna.

The potential skink habitats in the Proposed Designation have been and continue to be under pressure from factors that significantly diminish the likelihood of continued native lizard presence. Most of the habitat has undergone historical clearance and continued modification for pastoral grazing and/or orchards. This disturbance has reduced habitat quality and would have negatively impacted any resident populations present at the time. Also, pest animal signs as well as domestic cats were notably common across the entirety of the Proposed Designation which would indicate a high level of predation pressure for any lizard population present.

Overall, the vegetation within the Proposed Designation has many physical habitat attributes that would provide habitat value to native lizards. However, we consider that the disturbance history and threats such as pest animal predation would degrade this value and that the Proposed Designation is therefore unlikely to be important for native lizard populations.

Of the potential native species present in the Proposed Designation, copper skinks (the only native species observed during surveys) are expected to be present in the greatest numbers. This species tends to be the most resilient and adaptable of the native species potentially found in the area and are also the most common species found in the modified environments nearby. The other potentially present native lizards could be present at very low densities, likely below survey detection limits.

Taking into account these habitat and species factors, we consider the value of the majority of the habitats present (by area) within the Proposed Designation have a generally **Negligible** or **Low** ecological value for herpetofauna. However, Communities 5, 7, 8, 9, and 10, as well as the Kōpūrerua wetland complex, are assessed as having **Low-Moderate** value, as they have some additional habitat complexity / components that increase the likelihood of occupation by native lizards. We also consider that the at-risk – declining copper skink is known to be present in one area and will likely be present in others. This species has a **High** ecological value and impacts on populations of this species, if not managed, could cause elevated levels of effect. In the management of these habitats, consideration should be given to the potential presence of very low numbers of other *at-risk* or *threatened* species.

³ Such as old fence posts, old concrete, corrugated iron, etc. commonly found throughout farmland and ornament gardens.

5.3.2 Avifauna

The Proposed Designation provides a variety of terrestrial, wetland and freshwater habitats for avifauna as described in Sections 5.1, 11, and 16, respectively. These habitats are specifically valued in terms of avifauna habitat in

Table 5-3 below and in the Ecology Mapbook Supplement Volume 3 – Avifauna.

The birds we observed during site surveys and recorded in the desktop review (see Appendix 3) are the assemblage we would expect for a modified rural to peri-urban landscape. This assemblage is typified by exotic and common, *not threatened*⁴ bird species with occasional use by *at-risk*⁴ and *threatened*⁴ species, with greater use and abundances of indigenous species observed in high value wetland habitats.

Based on desktop and field surveys there are 31 indigenous bird species that use, or are likely to use, habitats within the Proposed Designation more than rarely for foraging, roosting and / or nesting activities. This includes 21 *not threatened* species, eight *at-risk* species and two *threatened* species (see Appendix 3).

Key habitats and survey observations of *at-risk* and *threatened* species within the Proposed Designation are summarised in Table 5-2 below. Refer to the Ecology Mapbook Supplement Volume 3 - Avifauna for the locations habitats / communities referred to in Table 5-2.

The ecological value of the indigenous species that may use the Proposed Designation ranges between **Low** (*not threatened* species) and **Very High** (*threatened* species) (Appendix 3).

*The ecological value of avifauna habitats within the Proposed Designation ranges between **Low** and **High**, as summarised and assessed in*

Table 5-3, and shown in the Ecology Mapbook Supplement Volume 3 – Avifauna. For more detailed descriptions of each habitat component refer to Section 5.1 and Appendix 2 (terrestrial vegetation), Section 11 (wetlands) and Section 16 (watercourses).

Table 5-2. Key habitats and survey observations for at-risk and threatened bird species within the Proposed Designation.

Species	Ecological Value	Habitat Within the Proposed Designation	Field Work Observations & Desktop Records within 10 km of the Proposed Designation (Appendix 3)
Australasian bittern	Very high	Wetlands (primarily those in the Kōpūrerua Valley) provide potential occasional foraging habitat for bittern as part of a wider landscape wetland foraging network; unlikely to provide nesting habitat as they lack dense vegetative cover.	No field work observations ⁵ . Occasional desktop records.
New Zealand dabchick	Very high	High value wetlands may provide foraging and roosting nesting habitat for dabchick but are unlikely to provide nesting habitat given their preference for nesting in lakes, ponds and pools.	One field work observation of a dabchick swimming in the stormwater ponds south of the roundabout by the entrance to The Lakes (this is outside of but adjacent to the Proposed Designation;

⁴ These are indigenous species.

⁵ Although this is not unexpected given that they are rare, cryptic species and targeted surveys were not conducted for bittern.

Species	Ecological Value	Habitat Within the Proposed Designation	Field Work Observations & Desktop Records within 10 km of the Proposed Designation (Appendix 3)
			Figure 5-1 left image). Occasional desktop records.
New Zealand pipit	High	Exotic grassland provides foraging and roosting habitat for pipit. Under its current land use the Proposed Designation is unlikely to provide nesting habitat for pipit as grassland is grazed or mowed and regularly disturbed by farming and maintenance activities (preferred nesting habitat is rank grassland). If farming activities cease prior to works commencing and grass is not managed (mowed) and becomes ranks, then it may provide nesting habitat for pipit.	No survey observations. Occasional desktop records.
North Island fernbird	High	High value wetland habitats provide foraging, roosting and potential nesting habitat for this species.	Six field work observations; all foraging in and / or flying between wetland vegetation at the south-western end of the Kōpūrerua Valley; two observations were of two birds together (Figure 5-1, right image). Desktop records.
Red-billed gull	High	The Proposed Designation contains no primary or nesting habitat for red-billed gulls (coastal / estuarine habitats). Exotic grassland provides occasional foraging and roosting habitat for this species.	Four field work observations of traversing birds. Desktop records.
Black shag	Moderate	Perennial watercourses and high value wetlands provide foraging and roosting habitat for shags. The Proposed Designation does not provide known or observed nesting habitat for shags.	Six field work observations; one flying overhead, five roosting in willows in the large wetland complex north-east of the Pa site in the Kōpūrerua Valley (part of wetland community 13). Desktop records.
Little black shag	Moderate		Four field work observations; two flying overhead and two foraging in the large wetland complex north-east of the Pa site in the Kōpūrerua Valley (part of wetland community 13). Desktop records.
Little shag	Moderate		Two field work observations of little shags roosting in willows in the large wetland complex north-east of the Pa site in the Kōpūrerua Valley (part of wetland community 13). Desktop records.
North Island kaka	Moderate	Kaka may occasionally traverse the Proposed Designation and forage opportunistically and seasonally. The	No field work observations. Occasional desktop records.

Species	Ecological Value	Habitat Within the Proposed Designation	Field Work Observations & Desktop Records within 10 km of the Proposed Designation (Appendix 3)
		Proposed Designation does not provide nesting habitat for kaka.	
Royal spoonbill	Moderate	The Proposed Designation contains no primary habitat (coastal / estuary) for royal spoonbills. Moderate and high value wetlands provide foraging and roosting habitat, but they do not provide known or observed nesting habitat for spoonbill.	Approximately 50 field work observations; 43 roosting and seven foraging in the large wetland complex north-east of the Pa site in the Kōpūrerua Valley (part of wetland community 13; Figure 20-4 left image). Desktop records.



Figure 5-1: The red circles show the locations where NI dabchick (left) and fernbirds (right; south-western end of Kōpūrerua Valley off Marshall Avenue) were observed during the avifauna field work conducted (two of the fernbird observations were of two birds together).

Table 5-3. Descriptions and ecological values of avifauna habitats within the Proposed Designation.

Avifauna Habitat	Description	Ecological Value
Terrestrial		
Community types 1, 2, 3, 4, 5, 6, 7	Although generally small, isolated, modified and exotic-dominated, these communities do provide habitat for <i>not threatened</i> bird species and have functional value in aggregate, with other habitats in the landscape, as ecological corridors and 'stepping-stones' through the landscape. These habitats are also likely to contribute to the seasonal food and / or structural resources indigenous birds utilise within this modified landscape. These communities are unlikely to provide permanent habitats of specific importance for any <i>at-risk</i> or <i>threatened</i> birds.	Low

Avifauna Habitat	Description	Ecological Value
Community type 8, 9, 10	These communities are generally represented in small patches (e.g. roundabouts, swales, stormwater ponds) and in thin linear bands (e.g. roadside planting), although some larger and more contiguous patches are present in and alongside wetland habitats in the Kōpūrerua Valley, as well as on the hillside on the western margin of Takitimu Drive. These communities provide habitat for <i>not threatened</i> bird species, particularly in aggregate and as 'stepping stones' of connectivity in the wider landscape. These communities do not provide core, permanent or nesting habitat for any <i>at-risk</i> or <i>threatened</i> bird species but may be used occasionally and seasonally by some species (e.g. North Island kaka) as part of a larger foraging network.	Low
Wetland		
All wetlands except wetlands 13, 14b and 15a	With the exception of wetlands 15b and 16, these features are generally in poor condition, some are disturbed (not fenced from stock), isolated, small, and / or dominated by exotic vegetation with limited vegetative complexity and diversity. Wetlands 15b and 16 are small mitigation areas for other projects that have recently been restored and planted (within the past year) with a diversity of indigenous wetland plants. These features have functional value in aggregate, with other habitats in the landscape, as ecological corridors and 'stepping-stones' through the landscape. These features provide habitat for <i>not threatened</i> wetland birds and potentially occasional but not core, foraging habitat for <i>at-risk</i> and <i>threatened</i> species. They do not provide nesting habitat for <i>at-risk</i> and <i>threatened</i> species, particularly cryptic wetland bird species, as they lack complexity required by such species.	Low
Wetland 15a	A relatively large (approximately 1.5 ha) recently planted mitigation area for Tauriko Business Estate that contains a diversity of indigenous wetland plants and hydrological features. Provides habitat for <i>not threatened</i> wetland bird species and potentially foraging habitat for <i>at-risk</i> and <i>threatened</i> species, particularly more mobile species as part of a wider wetland habitat network. In time and with continued maintenance (weed removal and infill planting) the avifauna habitat value of this wetland is likely to increase.	Moderate
Wetland 13 and 14b	Contiguous wetland features. Although modified and degraded in areas, this wetland complex is being restored by Tauranga City Council and contains large areas of open water with relatively dense and diverse wetland vegetation. This feature is utilised by a high diversity and abundance of water and wetland bird species, including <i>at-risk</i> and potentially <i>threatened</i> species. This wetland is close to Waikareao Estuary (a large intertidal estuary with extensive areas of saltmarsh vegetation) and is an important feature that wetland bird species are likely to rely on as part of a mosaic of wetland habitats in the wider landscape.	High

Avifauna Habitat	Description	Ecological Value
Watercourses		
Ephemeral watercourses	These features provide unstable, periodic foraging habitat for <i>not threatened</i> freshwater bird species. They may also provide roosting habitat if riparian margins are vegetated. They do not provide core, permanent or nesting habitat for <i>at-risk</i> and <i>threatened</i> bird species.	Low
Intermittent watercourses	These features provide intermittent foraging habitat for <i>not threatened</i> freshwater bird species. They may also provide roosting habitat if riparian margins are vegetated. They do not provide core, permanent or nesting habitat for <i>at-risk</i> and <i>threatened</i> bird species.	Low
Perennial watercourses – excluding Omanawa River and Wairoa River	Many of these watercourses are linear, artificial drains. These features provide permanent foraging habitat for <i>not threatened</i> freshwater bird species and foraging habitat for <i>at-risk</i> freshwater bird species (e.g. shag species). Those with vegetated riparian margins that include mature trees (including exotic species such as willow trees) may provide roosting habitat for avifauna species.	Low-Moderate
Perennial watercourses – Omanawa River and Wairoa River	These watercourses are large and provide permanent foraging habitat for <i>not threatened</i> and <i>at-risk</i> freshwater bird species (e.g. shag species). These watercourses are also likely to provide roosting habitat for such species if riparian margins are vegetated and if mature trees (including exotic species such as willow trees) are present within the riparian margins.	Moderate

5.3.3 Bats

5.3.3.1 Desktop records

Long-tailed bats have a conservation status of Threatened, Nationally Critical (O'Donnell et al., 2023). Long-tailed bats have been recorded on an occasional basis within 25 km of the site as shown in the Department of Conservation maps in Figure 5-2 and Figure 5-3. These maps also include multiple negative results where surveys have been undertaken and no bats recorded.

Bat surveys undertaken for the Tauriko West Urban Growth Area (Boffa Miskell Ltd, 2019) recorded two potential long-tailed bat passes at one automatic bat monitor (ABM) location, immediately adjacent to the Wairoa River.

WSP carried out further bat surveys in 2020, for the Tauriko Northern Access upgrade work and the Redwood Lane access upgrades. Forty-four ABMS were deployed in Tauriko. Four of the monitors recorded potential bat passes in low numbers (1-4 passes) (WSP, 2022b).

Long-tailed bats are also known to be present within Kaimai-Mamaku Forest Park, the margins of which are within bat commuting distance (c.10 km).

Central lesser short-tailed bats (*Mystacina tuberculata rhyacobi*) have a conservation status of *at-risk – declining* (O'Donnell et al., 2023). Short-tailed bats have not been recorded within 25 km of the site, and no habitat that is suitable for short-tailed bats will be affected. They are therefore not considered further in this assessment.

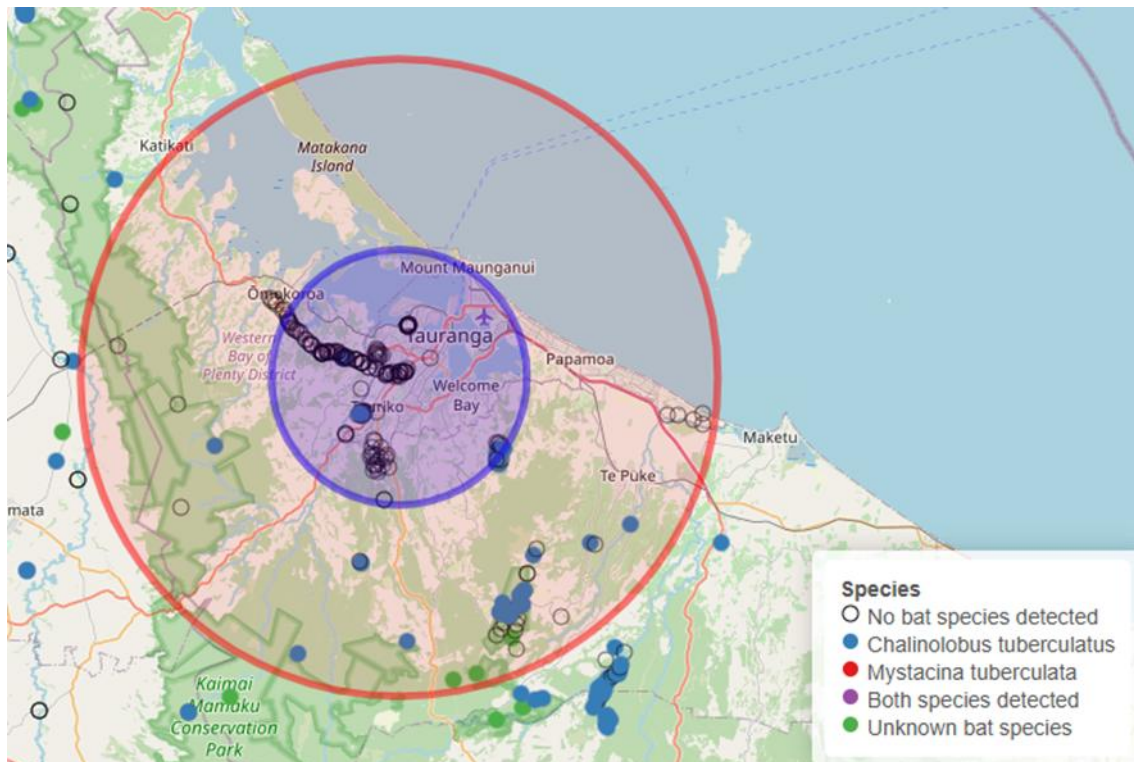


Figure 5-2: Department of Conservation bat records within 25 km (red circle) and 10 km (purple circle), accessed 27/01/26⁶.

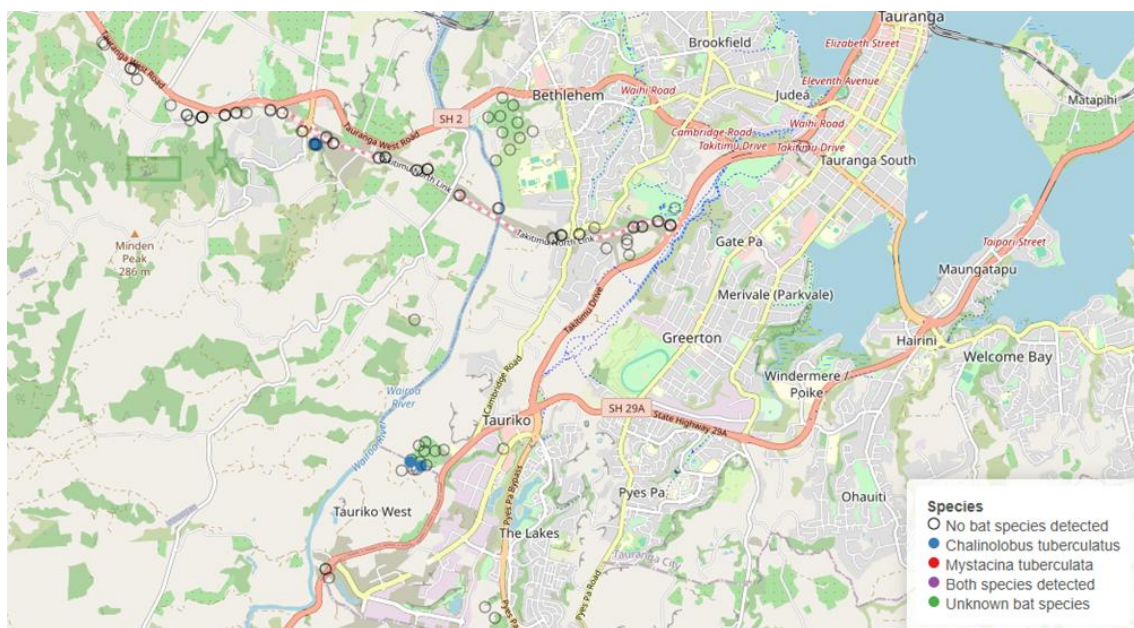


Figure 5-3: Department of Conservation records at the project location, accessed 27/01/26.

5.3.3.2 Bioacoustic survey

An acoustic survey specific to this project was undertaken during December 2025 and January 2026 using 11 full spectrum acoustic recorders (refer to the Ecology Mapbook Supplement

⁶ https://docnewzealand.shinyapps.io/bat_shiny/

Volume 2 – Herpetofauna - Chiropteroфаuna). No bats were recorded at any of the surveyed locations.

5.3.3.3 Ecological Value

Long-tailed bats (*Chalinolobus tuberculatus*) have a conservation status of *threatened – nationally critical* (O'Donnell et al., 2023). Long-tailed bats have a **Very high** ecological value based on their threat status (Roper-Lindsay et al., 2018).

There is habitat within and adjacent to the project footprint that would be suitable for bats, including trees with potential roost features, water bodies, edge features and open grassland.

However, the lack of detected bat activity indicates that the site is not a core foraging, commuting or roosting area, and despite the presence of potentially suitable habitat, it has **Low** value to bats.

6 Summary of terrestrial and habitat ecological values

A summary of the values of vegetation and habitats assessed within the proposed alignment is provided below in Table 6-1.

Table 6-1: Summary of vegetation, wetland and freshwater habitat areas for herpetofauna, avifauna and bats within the Proposed Designation.

Vegetation Community / Feature	Vegetation / Feature Name	Area mapped within Proposed Designation	Area impacted by indicative permanent works footprint	Vegetation / Feature Value	Herpetofauna Habitat Value	Avifauna Habitat Value	Bat Habitat Value
Terrestrial (ha)							
Community Type 1	Managed exotic grassland and cropland	72.7	35.1	Negligible	Negligible	Low	Low
Community Type 2	Horticulture	4.8	1.9	Negligible	Negligible	Low	Low
Community Type 3	Shelterbelts and hedgerows	1.9	0.8	Low	Low	Low	Low
Community Type 4	Exotic plantation and tree stands	1.7	0.6	Low	Low	Low	Low
Community Type 5	Garden and amenity	20.5	10.9	Low	Low-Moderate	Low	Low
Community Type 6	Gorse and woolly nightshade in pasture	2.4	0.8	Negligible	Low	Low	Low
Community Type 7	Exotic scrub / weed land / tree land	8.4	4.6	Low	Low-Moderate	Low	Low
Community Type 8	Mixed (exotic-dominated) scrublands and forest	15.2	7.0	Low	Low-Moderate	Low	Low
Community Type 9	Native landscape, amenity and infrastructure planting	11.8	6.5	Low-Moderate	Low-Moderate	Low	Low
Community Type 10	Native restoration planting	4.7	1.9	Moderate	Low-Moderate	Low	Low
Wetlands (ha)							
1, 2a-b, 3a-b, 4, 5d, 6, 9a, 10a.1-10a.5, 10b, 11, 15b, 17a	Includes grazed wetlands and pastures, waterpepper dominated	4.9	2.1	Assessed in Part B (Wetland Ecology)	Low	Low	Low
15a	Wetland offset area	2.9	0.8		Low	Moderate	Low
5a-c, 7a-d, 8, 9b, 12, 14a,16, 17b	Includes Wetland seepages, carex or willow weed dominated, and wetland complex	1.3	0.4		Low	Low	
13, 14b	Köpürerua Valley wetland complex	7.6	1.7		Low-Moderate	High	Low

Vegetation Community / Feature	Vegetation / Feature Name	Area mapped within Proposed Designation	Area impacted by indicative permanent works footprint	Vegetation / Feature Value	Herpetofauna Habitat Value	Avifauna Habitat Value	Bat Habitat Value
Watercourses (m)							
Ephemeral		339	136	Assessed in Part C (Freshwater Ecology)	N/A	Low	Low
Intermittent		1,466	677		N/A	Low	Low
Perennial (<u>excluding</u> Omanawa River and Wairoa River)		3,737	628 ⁷		N/A	Low-Moderate	Low
Perennial (Omanawa River and Wairoa River)		N/A	0		N/A	Moderate	Low

⁷ This is perennial stream length loss after stream length gain from realignments is factored in. This loss is for artificial perennial streams only (i.e. there is no loss of natural perennial watercourses).

7 Assessment of effects – terrestrial

All figures and assessments are made on the basis of the Indicative Design footprint as a preliminary effects envelope to assess the likely scale and severity of effects of constructing the project within the Proposed Designation. The levels of effect provided in this section do not incorporate any recommended effects management.

7.1 Construction and operational effects – terrestrial vegetation

We have considered the potential effects of the Project on terrestrial vegetation communities at the catchment scale⁸, as the value in much of the terrestrial vegetation present is in the ecosystem services it provides to the catchment. The potential effects on terrestrial vegetation values from the construction and operation of the Project are:

- Direct loss of vegetation dominated by exotic species and modified areas of native vegetation.
- Fragmentation of vegetation dominated by exotic species and modified areas of native vegetation.
- Loss of ecosystem services such as buffering of waterways, nutrient attenuation, soil conservation, etc.
- Increased levels of disturbance and dispersal of invasive species.
- Increased use of herbicides during operation of road.

Based on the Indicative Design, the construction of the Project is likely to result in the permanent loss of 61.7 ha of primarily non-native dominated terrestrial vegetation, and horticultural canopy, with low to negligible value. The loss of predominantly exotic dominated vegetation from a purely vegetative values perspective is not a concern from an ecological perspective and therefore we have assessed this loss as having a **Low** magnitude of effect.

The current Indicative Design would result in the loss of 6.5 ha of native landscape, amenity and infrastructure planting (Community type 9), which has a Low-Moderate value. The loss of this planting without replacement, could have a potentially **Moderate** magnitude of effect given the ecosystem services provided by these plantings, particularly the swale and stormwater pond plantings.

In total, there is 4.7 ha of restoration planting (Community type 10) within the Proposed Designation. Based on the Indicative Design, there would be the permanent loss of approximately 1.9 ha of restoration planting within the Kōpūrerua Valley and alongside Takitimu Drive. Relative to the extensive restoration planting that has been carried out within the Kōpūrerua Reserve, this would amount to a **Low** magnitude of loss. However, it is likely that there will be some additional loss of restoration planting for temporary works, which, depending

⁸ This includes the Kōpūrerua (~7,400 ha) and Wairoa (~462 ha) catchments which collectively total ~7862 ha.

on the degree of clearance (up to a maximum of 4.7 ha of restoration planting currently within the Proposed Designation) could have an up to **Moderate** magnitude of effect.

We consider the operational effects of the Project on the retained vegetation will be **Negligible** given the disturbed nature of the areas and minor changes caused by the road layout in this location.

7.2 Herpetofauna

We have considered the magnitude of effects of the Project on herpetofauna at the local landscape scale. This differs from the assessment scale used for all other elements of ecology (vegetation features, more mobile fauna, and the aquatic environment), because the biology and life history of copper skinks (the key species of potential impact from the Project) means they readily inhabit small, spatially discrete patches and are not easily mobile between these features. Therefore, impacts at small scales can have more severe effects on herpetofauna than they have on vegetation features or other more mobile fauna. The potential effects on herpetofauna from the construction and operation of the Project are:

- Mortality and injury of lizards during vegetation clearance and earthworks.
- Permanent loss of lizard habitat.
- Modification of remaining lizard habitat that may lead to a degradation of habitat value or total functional loss of habitat, such as:
 - Habitat fragmentation and isolation (including potential deaths from attempts to cross new road).
 - Increased levels of noise, lighting and disturbance during both construction and operation.

The most likely species present and therefore impacted by the Project is the copper skink (at-risk declining). It is unlikely detectable densities of other *at-risk* or *threatened* species are present. The Project will result in the permanent loss of approximately 33 ha of Low and Low-Moderate value habitat. We consider this loss of habitat is likely to result in an up to **Moderate** magnitude of effect on the species. The impact of removing this extent of habitat for a species that has small home ranges and poor dispersal ability has the potential to change the meta-population dynamics within the landscape.

Mortality and injury to copper skinks during construction could result in the loss of a moderate proportion of the copper skinks present in this area and therefore we assess this has the potential to cause a **Moderate** magnitude of effect on the copper skink populations likely present in the Proposed Designation.

We consider operational effects of the Project on both the copper skink population and habitat are likely to be limited as the proposed road occurs in a modified landscape where the habitats present already have a high degree of fragmentation and disturbance. The Project does not introduce a barrier to movement of herpetofauna, as one is already present due to the existing SH29 and SH29A alignments. Overall, we assess this potential magnitude of effect as **Negligible**.

7.3 Avifauna

We have considered the potential effects of the Project on avifauna at the catchment scale⁹. We have used this scale as avifauna of conservation concern are likely to use a matrix of habitats throughout the catchments encompassing the Project.

7.3.1 Construction effects – avifauna

7.3.1.1 Habitat loss and fragmentation

7.3.1.1.1 Low value avifauna habitats

The Indicative Design will result in permanent loss of approximately 72.5 ha of low value terrestrial (70.1 ha) and wetland (2.4 ha) avifauna habitats. Approximately 88% (61.7 ha) of the terrestrial habitat loss comprises exotic and exotic-dominated vegetation communities¹⁰. The remaining 12% (8.4 ha) that will be lost includes native landscape, amenity and infrastructure planting and native restoration planting. There will also be a permanent loss of approximately 0.81 km of low value freshwater avifauna habitat (ephemeral and intermittent watercourses). Table 6-1 provides a breakdown of the quantum of loss per community / feature relative to the quantum present in the Proposed Designation.

These habitats variously provide foraging, roosting and / or nesting habitat for *not threatened* bird species. These habitats are common within the wider area and are unlikely to have specific importance to indigenous species. Although this habitat loss will result in habitat fragmentation, potential effects will be less as a result of the abundance of these habitats in areas within the Proposed Designation that will not be developed and in the wider catchment, and because the species impacted are all highly mobile and can disperse to and utilise these alternative habitats. We consider that loss and fragmentation of low value avifauna habitat associated with the project will result in a **Low-Moderate** magnitude of effect.

7.3.1.1.2 Low-moderate avifauna habitats

The Indicative Design will result in permanent loss of approximately 0.63¹¹ km of low-moderate value avifauna habitat (perennial watercourses – excluding Omanawa River and Wairoa River; refer to Table 6-1). These watercourses provide foraging habitat for *not threatened* and *at-risk* bird species. Those with vegetated riparian margins and trees may provide roosting habitat for such species; nesting habitat was not observed within the Proposed Designation. Habitat loss will result in habitat fragmentation, however perennial watercourses are common in areas within the Proposed Designation that will not be developed and in the wider catchment. Given the relatively small amount of loss and fragmentation associated with the project and the mobile nature of the species impacted, we consider that loss and fragmentation of low-moderate value avifauna habitats will result in a **Low** magnitude of effect.

7.3.1.1.3 Moderate value avifauna habitats

The Indicative Design will result in permanent loss of approximately 0.8 ha of moderate value avifauna habitat (wetland 15a)¹². This wetland provides foraging, roosting and potential nesting

⁹ This includes the Kōpūrererua (~7,400 ha) and Wairoa (~462 ha) catchments which collectively total ~7862 ha.

¹⁰ Exotic grassland, cropland, horticulture, shelterbelts, plantation and tree stands, garden and amenity planting, gorse and woolly nightshade in pasture, exotic-dominated scrublands and forest.

¹¹ This total is derived by subtracting the perennial watercourse realignment change in stream length (+326 m) from the 954 m of artificial perennial watercourses that will be lost.

¹² There will be no loss of moderate value freshwater avifauna habitats (Omanawa River and Wairoa River)

habitat for *not threatened* bird species and potentially foraging habitat for *at-risk* and *threatened* species as part of a wider foraging network. Given the quantum of loss of this wetland relative to unaffected wetland areas remaining in the Proposed Designation and wider catchment, and the mobile nature of the species impacted, we consider that fragmentation and loss of this moderate value avifauna habitat will result in a **Low** magnitude of effect.

7.3.1.1.4 High value avifauna habitats

The Kōpūrerua stream realignments will result in permanent loss of approximately 1.7 ha of high value avifauna habitats (wetlands 13 and 14b) within the Proposed Designation. This will also result in habitat fragmentation within the Proposed Designation and wider catchment. Although modified, this wetland complex is large and diverse, both hydrologically and vegetatively. It provides foraging, roosting and / or potential nesting habitat for a high diversity and abundance of water and wetland birds, including *at-risk* and *threatened* species.

This wetland complex is an important feature that these species are likely to rely on as part of a mosaic of wetland habitats in the Proposed Designation and wider catchment. Given the quantum of loss of these high value habitats relative to that remaining unaffected in the Proposed Designation and wider catchment, and the mobile nature of the species impacted, we consider that fragmentation and loss of this high value avifauna habitat will result in a **Moderate** magnitude of effect.

7.3.1.2 Injury, mortality and disturbance of nesting birds

The mobile nature of avifauna species means that the potential for direct injuries and / or mortalities associated with construction activities are likely to be confined to birds that may be nesting in habitats within the Indicative Design. Construction activities may also indirectly disturb birds nesting outside of but adjacent to the construction footprint (i.e. birds nesting within the Indicative Design's ZOI¹³). Disturbance may indirectly cause nesting failure by reducing nest attendance by the nesting pair, potentially leading to incubation failure and increased predation risk. If vegetation clearance and construction activities occur during the breeding season, then injuries, mortalities and / or disturbance of nesting birds (including eggs and chicks) may occur. The main breeding period that encompasses all of the species that may nest within the Indicative Design is July to February (inclusive).

Exotic grassland, a low value avifauna habitat within the ZOI provides potential nesting habitat for harrier hawks and spur-winged plovers (both *not threatened* species), albeit likely marginal habitat as a result of grazing and disturbance from farming activities and stock trampling / disturbance. Under its current farmed state, exotic grassland within the Indicative Design does not provide suitable nesting habitat for NZ pipit (an *at-risk* species). However, if the grass is not managed (mowed) and left to go rank when farming activities cease prior to the commencement of works, then it may provide nesting habitat for NZ pipit.

Other low value terrestrial avifauna habitats within the ZOI (refer to

Table 5-3) provide potential nesting habitat for a number of *not threatened* shrub and forest birds.

Low and moderate value wetland habitats within the ZOI provide potential nesting habitat for some *not threatened* wetland bird species (e.g. pukeko and pied stilt).

¹³ A zone of influence is defined as all land, water bodies and receiving environments that could be potentially impacted by a project. It includes the project site where direct effects will occur (i.e. the construction footprint) and any environments beyond the project site where indirect effects such as discharges, disturbance may extend (Roper-Lindsay et al., 2018). For this project we have defined the ZOI for disturbance to nesting activities as the area extending 50 m out from the indicative design.

High value wetland habitats within the ZOI provide nesting habitat for a number of *not threatened* water and wetland bird species and potentially *at-risk* species (e.g. NI fernbird).

If birds are nesting in these areas when vegetation clearance or construction activities occurs, we consider that nesting disturbance and potential injury or mortality of nesting avifauna and nest contents (eggs, chicks) will have a **Low** magnitude of effect on *not threatened* (low value) species and a up to a **High** magnitude of effect on *at-risk* (moderate to high value) species¹⁴ due to the rarity of such species in the catchment.

7.3.1.3 Disturbance and displacement

People, activities and noise associated with construction activities within the Proposed Designation may disturb foraging, roosting and traversing birds and displace them from the area. Construction will be staged and is anticipated to take approximately ten years (six years for the SH29 portion of the project and four years for the SH29a portion); as such, disturbance and displacement effects will be long-term but temporary and in discrete areas along the alignment. The habitats in the Proposed Designation are all present, and generally common, in the wider catchment (noting that high value wetland habitats are less common). Given that the indigenous bird species associated with the Proposed Designation are all highly mobile, if disturbed during construction activities they will be able to disperse into suitable alternative habitats in undisturbed areas of the Proposed Designation and in the wider catchment.

Accordingly, we consider that construction-induced disturbance and displacement will have a **Negligible** magnitude of effect on indigenous avifauna (low to very high value species).

7.3.1.4 Operational effects – avifauna

Operational effects associated with the Project could potentially include traffic-related mortality (vehicle strike) and disturbance from noise, traffic movement and lighting. Disturbance could potentially result in functional habitat loss or displacement.

Because the Proposed Designation lies within an already modified landscape where roading (primarily state highways) already exists, operational effects are already long-established, existing features. The Proposed Designation is generally located close to the existing road corridor and, in several sections, simply involves widening the current corridor. Indigenous birds using the area as part of their wider home range are already regularly exposed to vehicle movements and road-related activity. As a result, birds are expected to be reasonably habituated to these stimuli, reducing the likelihood of increased disturbance, displacement, functional habitat loss, or elevated vehicle-strike risk beyond what currently occurs. In areas where the Proposed Designation is further away from the current roading network, if birds are disturbed and displaced during operation of the road, they will be able to disperse to and utilise alternative habitats available in the catchment.

Accordingly, we consider that operational effects associated with the Project will have a **Negligible-Low** magnitude of effect on indigenous avifauna (low to very high value species).

¹⁴ The same applies for Threatened (very high value) species, although it is highly unlikely that the habitats within the Proposed Designation provide nesting habitat for Threatened species.

7.4 Bats

7.4.1 Construction effects

Very low levels of bat activity have been detected within the vicinity of the Project, and none within the Project footprint. Potential effects on bats, including roosting and foraging habitat loss, and disturbance from noise and lighting, are likely to be **Negligible** magnitude of effect.

The level of effect for injury or mortality during tree felling has been assessed as a **Negligible** magnitude of effect. Although suitable potential roost trees are present, the acoustic survey indicates that bats are not present. Therefore, they will not be impacted by vegetation clearance.

7.4.2 Operational effects

As above, given the very low levels of bat activity in the surrounding landscape, the operational magnitude of effect resulting from additional noise and lighting is likely to be **Negligible**.

7.5 Summary of potential effects – pre-effects management

Table 7-1 provides an overview of terrestrial ecological values, the magnitude of the effects of the Project on those values and the final outcome (level) of the effects pre-effects management. We provide recommendations to manage effects within Section 8.

Table 7-1: Overview of the level of adverse effects of the Project pre-effects management on ecological values within the Proposed Designation (pre-effects management).

Feature	Ecological value	Effect	Magnitude of effect	Level of effect
Terrestrial effects				
Exotic dominated terrestrial vegetation	Low and Negligible	Construction effects	Low	Very Low
		Operational effects	Negligible	Very Low
Native landscape, amenity and infrastructure plantings	Low-Moderate	Construction effects	Moderate	Low-Moderate
		Operational effects	Negligible	Very Low
Native restoration plantings	Moderate	Construction effects	Moderate	Moderate
		Operational effects	Negligible	Very Low
Herpetofauna				
Herpetofauna habitat	Negligible or Low	Construction effects	Moderate	Low
	Low-Moderate		Moderate	Low-Moderate
	Negligible, Low and Low-Moderate	Operational effects	Negligible	Very Low
Herpetofauna – copper skink	High	Construction effects – fauna injury and mortality	Moderate	High
Avifauna				
Avifauna habitat	Low	Construction effects – habitat loss	Low-Moderate	Very Low-Low

Feature	Ecological value	Effect	Magnitude of effect	Level of effect
	Low-Moderate and Moderate ¹⁵		Low	Low
	High		Moderate	High
Avifauna species	Low	Construction effects – fauna injury and mortality	Low	Very Low
	Moderate		High	Moderate
	High and Very High			Very High
	Low, Moderate and High	Construction effects – disturbance & displacement	Negligible	Very Low
	Very High			Low
	Low	Operational effects	Negligible-Low	Very Low
	Moderate and High			Very Low-Low
	Very High			Low-Moderate
Bats				
Bat habitat	Low	Construction effects	Negligible	Low
Long-tailed bat	Very high	Construction effects – fauna mortality	Negligible	Low
		Construction and Operational lighting	Negligible	Low

8 Management of effects - terrestrial

8.1 Management of terrestrial vegetation effects

The proposed vegetation clearance for the Project is expected to result in an overall Negligible or Low level of effect, except for the loss of native landscape, amenity and infrastructure planting (Community type 9) and restoration planting (Community Type 10) which, depending on the degree of clearance needed for temporary works, could have up to a Moderate level of effect.

In any areas of temporary works that require the removal of native planting (Community Types 10; refer to the Ecology Mapbook supplement Volume 1 – Vegetation), the indigenous vegetation should be reinstated following the completion of works. For the remaining permanent vegetation clearance, we consider the habitat creation and enhancement proposed across the alignment to address wetland and stream effects, in particular the areas of riparian planting proposed alongside the Kōpūrerua and Nānako Stream realignments, and landscape mitigation planting, is likely to contribute a **positive** level of effect in indigenous terrestrial vegetation values. To achieve this positive outcome, the planting associated with these streams should be designed in consultation with a suitably qualified ecologist to ensure it is ecologically appropriate and viable¹⁶, and will provide appropriate terrestrial fauna habitat to manage effects on terrestrial fauna, as discussed in sections 8.2, 8.3, and 8.4.

¹⁵ Moderate value wetland avifauna habitats. There will be no loss of moderate value freshwater avifauna habitats.

¹⁶ This would be landscape planting that is comprised of plant mixes that are representative of the natural communities within the Tauranga Ecological District, that do not include any exotic species or cultivars, that are eco-sourced, and that

To ensure the specific effects of the loss of native landscape, amenity and infrastructure planting (Community type 9) and native restoration planting (Community Type 10) we recommend the vegetation is replaced aligned with minimum loss : replacement ratios¹⁷. For Community Type 9 we consider a minimum of a 1:1 loss to replacement ratio should be achieved. For Community Type 10 the replacement ratio depends on the age of the impacted planting at the time of clearance. This scalable replacement ratio is applied to this community as it is the only terrestrial vegetation community assessed which is expected to change in a way that meaningfully impacts its ecological value over time as it matures naturally. The scalable replacement ratio is therefore to account for the time lag between time of clearance and the replacement areas reaching an equivalent level of establishment/complexity. The following replacement ratios are proposed:

- For any restoration planting less than 10 years old at the time of clearance, the replacement ratio should be 1:1.
- For vegetation that is 10-25 years old at the time of clearance, the replacement ratio should be 2:1.
- For vegetation more than 25 years old at the time of clearance, the replacement ratio should be 3:1.

For example, if the age of all the restoration planting impacted (1.9 ha of Community type 10) was 26 years old at the time of impact, 5.7 ha of ecologically suitable replacement planting would be required to manage this effect.

This required offset planting can be incorporated into the proposed terrestrial and stream realignment riparian / wetland creation planting, provided there is enough excess ecologically appropriate and viable planting to satisfy this offset required as well as the above 1:1 replacement planting for all temporarily impacted native vegetation.

8.2 Herpetofauna

The primary method for managing impacts on herpetofauna will be through a survey and salvage process to minimise the injury and death of skinks present within the clearance zones.

A draft Lizard Management Plan (LMP) has been prepared detailing habitats present, biosecurity and disease management, survey and salvage methods, establishment times of survey equipment, timing for surveys and salvage, a release site for salvaged lizards, requirements to enhance or protect the release site from predation and disturbance, and reporting requirements. The LMP includes an incidental detection protocol for Threatened species detected during the site works.

To manage the reduction in herpetofauna habitat resulting from the proposed works, habitat elements for copper skink should be incorporated into wetland enhancement and riparian zone enhancement (outside of flood zones) within the Kōpūrerua Valley, and within any suitable areas of native landscape planting (e.g. within native screening at the road margins). These elements and features include dense planting, woody debris, dense cover and leaf litter, to be incorporated into plantings to create complex habitat with suitably humid to damp microhabitat.

provide suitable habitat for indigenous fauna. Not all landscape mitigation planting is expected to meet these requirements, and any areas that do not will not be counted towards ecological mitigation.

¹⁷ We anticipate that the proposed ecological and landscape mitigation planting requirements exceed the required amount for the replacement of Community Types 9 & 10 and these ratios are provided as a safeguard to ensure adequate offset where the design might change.

We consider that the proposed planting and enhancement completed as part of the Project is likely to have a **positive** effect on herpetofauna habitats. These matters should be integrated into landscape planting plans with the input from a suitably experienced and qualified herpetologist.

Implementation of the lizard management measures will reduce the potential magnitude of the direct effect of the Project on existing copper skink populations to **Negligible-Low**. Salvage operations are not perfect and there is likely to be mortality of some individuals. However, the genetic diversity of the sub populations is likely to be retained through the salvage process, and the implementation of habitat enhancement and predator control at the release site (as detailed in the Lizard Management Plan) should further offset that loss.

8.3 Avifauna

8.3.1 Construction effects

Habitat loss associated with the Indicative Design is expected to have very low to low levels of effect on low, low-moderate and moderate value avifauna habitats. We consider that the replacement requirements for any loss of native landscape, amenity and infrastructure planting (outlined in Section 8.1), as well as habitat creation and enhancement proposed as effects management for impacts on freshwater ecosystems (particularly riparian planting) and wetland features (outlined in Sections 18.2.1.1 and 13 respectively) are likely to result in a **Positive** level of effect on avifauna values, particularly with the inclusion of avifauna habitat features (a diversity of indigenous vegetation and hydrological components) in the habitat created and enhanced. Furthermore, there will be large areas of landscape planting (approximately 37 ha) across the Proposed Designation for visual and natural character mitigation that will be designed in consultation with a suitably qualified ecologist to be ecologically appropriate and functional and as such will provide habitat for avifauna.

Habitat loss associated with the Indicative Design is expected to have a high level of effect on high value avifauna habitats (wetlands 13 and 14b, refer to the Ecology Mapbook Supplement Volume 3 - Avifauna). To manage this effect, the following are recommended:

- If vegetation clearance / habitat loss in wetlands 13 and 14b cannot be avoided or minimised, based on the Indicative Design there will likely be a high level of effect on these features as avifauna habitat. This effect can be managed through implementation of the wetland restoration and creation compensation package outlined in Section 13.2 and detailed in Appendix 5. This package includes restoration of wetland areas within the Proposed Designation that are not directly impacted by construction or stream alignments, and via the creation of wetlands within the Proposed Designation. Where restoration of wetlands with low avifauna habitat value occurs, habitat opportunities will be created for *at-risk* and *threatened* wetland and waterbird species in areas where such habitat is currently absent or highly limited; this will improve their habitat value as currently such habitat do not provide core, seasonal or nesting habitat for such species. Wetlands will be created in appropriate locations within the Proposed Designation that expand existing areas of wetland and / or connect wetland fragments. Wetland creation and restoration will incorporate habitat features suitable for wetland and water bird species. This will include hydrological variation and wetland plant species that provide foraging, roosting and nesting habitat for indigenous avifauna potentially impacted by the loss, including, but not limited to, North Island fernbird, royal spoonbill, pied stilt and indigenous waterfowl. These requirements will be incorporated in the

Wetland Management approach outlined in Section 13 and Appendix 5. The baseline compensation outcome is no net loss but there is flexibility in how this is achieved (i.e. the amount of restoration / habitat creation may change depending on the detailed design footprint but ultimately there will be no net loss in wetland values). We consider that the improved habitat quality and complexity provided by the compensation package will result in a **positive effect** for wetland and water birds.

To manage the disturbance effects associated with construction of the Project, we recommend the following:

- Where it is practicable avoid conducting vegetation clearance in the main bird breeding period for species that may nest within the Indicative Design (July to February inclusive). If this is not practicable, then nesting bird surveys should be conducted by a suitably qualified and experienced person (SQEP) within two working days of vegetation clearance occurring. If active¹⁸ indigenous bird nests are found during these surveys (or incidentally during vegetation clearance or construction works), exclusion zones should be established and clearly marked around each nest in which vegetation clearance and construction activities cannot occur until the SQEP has confirmed that nesting activities are complete. Exclusion zones should be 50 m around the nest for nationally *threatened* and *at-risk* species and 20 m for nationally *not threatened* species (excluding spur-winged plover (*Vanellus miles*)¹⁹).
- To manage indirect construction effects to At Risk and Threatened birds potentially nesting in high value wetland habitats (wetland 13 and 14b; refer to the Ecology Mapbook Supplement Volume 3 – Avifauna) that are adjacent to enabling and construction activities, the following is recommended:
 - Where practicable avoid conducting enabling and construction activities within 50 m of high value avifauna habitats during the main bird breeding period for species that may nest within these habitats (i.e. avoid conducting these activities between July and February (inclusive)).

Where avoidance is not practicable:

- Commence enabling and construction activities within 50 m of high value avifauna habitats outside the main bird breeding season (i.e. commence between March and June inclusive) and continue these activities into the breeding season²⁰.
 - If these activities stop for seven days or more during the main breeding season, then a nesting bird survey should be conducted by a suitably qualified and experienced person (SQEP). If active²¹ nests of an *at-risk* or *threatened* species are found during this survey, a 50 m exclusion zone should be established around the nest and clearly marked. Construction activities should not occur within the exclusion zone until the SQEP has confirmed that nesting activities are complete.

¹⁸ An active nest is defined as a nest that contains, or is suspected to contain, a nesting bird, viable nest contents (egg/s and / or chick/s based on the time of year and other evidence observed at the nest by a SQEP).

¹⁹ Spur-winged plovers are not projected by the Wildlife Act (1953).

²⁰ The rationale here is that if birds have chosen to nest within 50 m of existing construction activities, then they have chosen to do so in the presence of disturbance despite there being plenty of alternative habitat that they could nest in if disturbed by construction activities.

²¹ An active nest is defined as a nest that contains, or is suspected to contain, a nesting bird, viable nest contents (egg/s and / or chick/s based on the time of year and other evidence observed at the nest by a SQEP).

Where avoidance is not practicable and works must commence within the main bird breeding season:

- Within two working days of enabling and construction activities commencing within 50 m of high value avifauna habitats during the main bird breeding season (July to February inclusive), a nesting bird survey should be conducted by a suitably qualified and experienced person (SQEP). If active nests of an *at-risk* or *threatened* species are found during this survey, a 50 m exclusion zone should be established around the nest and clearly marked. Construction activities should not occur within the exclusion zone until the SQEP has confirmed that nesting activities are complete.
 - If these activities stop for seven days or more during the main breeding season, then a nesting bird survey should be conducted by a suitably qualified and experienced person (SQEP). If active nests of an *at-risk* or *threatened* species are found during this survey, a 50 m exclusion zone should be established around the nest and clearly marked. Construction activities should not occur within the exclusion zone until the SQEP has confirmed that nesting activities are complete.
- Where practicable, lighting shall be designed to minimise light spill where the lighting has the potential to impact wetland bird species. Where practicable position laydown areas, site compounds and other temporary storage and site facilities at least 50 m away from high value avifauna habitats (refer to the Ecology Mapbook Supplement Volume 3 - Avifauna in the Proposed Designation).

8.3.2 Operational effects

To reduce potential mortality of avifauna associated with vehicle strike during operation of the road the following is recommended:

- For roadside planting (particularly directly adjacent to wetland 13 and 14b (high value avifauna habitats) and in areas where roadside planting is planted where there previously was not road) avoid or minimise planting species within 10 m of the road that are highly attractive to birds (e.g. provide an abundance of berries or nectar).

8.4 Bats

8.4.1 Management of potential construction effects

While effects are expected to be negligible on long-tailed bats, they have been periodically detected within the area. If bats were present and injured as part of vegetation clearance, the effects rating would be higher. To ensure that the magnitude of effect is still negligible prior to felling, a bat acoustic survey designed by a suitably qualified bat ecologist should be carried out within the Proposed Designation within 12 months of the start of construction.

The survey must be undertaken between October 1 and April 30 inclusive and should include at least 14 nights of suitable weather conditions as defined in the Department of Conservation Bat Roost Protocols (Bat Recovery Group - Department of Conservation, 2024).

If bat activity is recorded, tree fell protocols aligned with best current practice should be implemented to ensure that bats are not present and at risk of injury or mortality.

8.5 Summary of potential effects – post-effects management

Table 8-1 provides an overview of terrestrial ecological values, the magnitude of the effects of the Project on those values and the final outcome (level) of effects post-effects management.

8.6 Sensitivity testing of Indicative Design

The terrestrial values within the Proposed Designation are not highly sensitive to alignment changes, because regardless of values, they are typically common in the landscape, resilient, tolerant to disturbance, and/or can be readily managed. If the alignment shifts during the detailed design phase, we consider that the potential effects assessed for the Indicative Design and associated effects management recommendations are also appropriate for any such changes.

Table 8-1: Overview of the level of adverse effects of the Project on terrestrial ecological values pre- and post-effects management.

Feature	Ecological value	Effect	Pre-Effects Management		Post-Effects Management	
			Magnitude of effect	Level of effect	Magnitude of effect	Level of effect
Terrestrial effects						
Exotic dominated terrestrial vegetation	Low and Negligible	Construction effects	Low	Very Low	Positive	Positive
		Operational effects	Negligible	Very Low		
Native landscape, amenity and infrastructure plantings	Low-Moderate	Construction effects	Moderate	Low-Moderate		
		Operational effects	Negligible	Very Low		
Native restoration plantings	Moderate	Construction effects	Moderate	Moderate	Negligible	Very Low
		Operational effects	Negligible	Very Low		
Herpetofauna						
Herpetofauna habitat	Negligible or Low	Construction effects	Moderate	Low	Positive	Positive
	Low-Moderate		Moderate	Low-Moderate		
	Negligible, Low and Low-Moderate	Operational effects	Negligible	Very Low	Negligible	Very Low
Herpetofauna – copper skink	High	Construction effects – fauna injury and mortality	Moderate	High	Negligible-Low	Very Low
Avifauna						
Avifauna habitat	Low	Construction effects – habitat loss	Low-Moderate	Very Low-Low	Positive	Positive
	Low-Moderate and Moderate ²²		Low	Low		
	High		Moderate	High		
Avifauna species	Low	Construction effects – fauna injury and mortality	Low	Very Low	Negligible	Very Low
	Moderate		High	Moderate		Low
	High and Very High			Very High		
	Low, Moderate and High	Construction effects – disturbance & displacement	Negligible	Very Low	Negligible	Very Low
	Very High			Low		Low
	Low	Operational effects	Negligible-Low	Very Low	Negligible	Very Low
	Moderate and High			Very Low-Low		Very Low
Very High	Low-Moderate			Low		

²² Moderate value wetland avifauna habitats. There will be no loss of moderate value freshwater avifauna habitats.

Feature	Ecological value	Effect	Pre-Effects Management		Post-Effects Management	
			Magnitude of effect	Level of effect	Magnitude of effect	Level of effect
Bats						
Bat habitat	Low	Construction effects	Negligible	Very Low	Negligible	Very Low
Long-tailed bat	Very High	Construction effects – fauna mortality	Negligible	Low	Negligible	Low
		Construction and Operational lighting	Negligible	Low	Negligible	Low

9 Terrestrial ecology conclusion

The Proposed Designation is situated within a highly modified rural / peri-urban landscape dominated by pasture, horticulture, plantation forestry, shelterbelts and other exotic vegetation. Indigenous vegetation is generally limited to amenity, infrastructure and restoration planting, with the highest terrestrial ecological values associated with more established restoration areas within the Kōpūrerua Valley and alongside Takitimu Drive. Terrestrial fauna values are similarly influenced by the modified nature of the landscape, with copper skink recorded at one location, avifauna characteristic of peri-urban environments, and no long-tailed bats detected during project-specific surveys. The highest avifauna values are associated with wetland habitats, particularly the Kōpūrerua Valley wetland complex.

Construction of the Project will result in the removal and modification of predominantly negligible to low value exotic and exotic-dominated vegetation, together with smaller areas of native amenity planting and restoration planting. Potential ecological effects include vegetation and habitat loss, habitat fragmentation, disturbance, and the risk of injury or mortality to indigenous fauna during vegetation clearance and earthworks. The most notable terrestrial ecological effects are associated with the loss of restoration planting and native amenity/infrastructure planting, potential impacts on copper skink populations, and the loss of high-value wetland habitat utilised by indigenous wetland birds.

A comprehensive package of ecological management measures has been developed to avoid, minimise, remedy and offset these effects. These measures include ecological pre-clearance surveys, seasonal restrictions and nesting bird management procedures, lizard salvage and relocation, habitat reinstatement following temporary works, restoration and enhancement planting, wetland restoration and creation, incorporation of fauna habitat features into mitigation planting, and pre-construction bat surveys. In addition, significant areas of riparian, wetland and landscape planting associated with the Project will enhance habitat availability, connectivity and ecological function across the landscape.

With implementation of the proposed ecological management measures, residual effects on terrestrial vegetation, herpetofauna, avifauna and bats are expected to be predominantly very low to low. The proposed restoration, wetland creation and enhancement works are expected to achieve no net loss of ecological values and, for several ecological attributes, are anticipated to result in a positive effect in habitat extent, quality and ecological function within the wider landscape.

Part B: Wetland Ecology

10 Wetland executive summary

We identified and described 29 wetlands within the Proposed Designation with most being characterised by a non-native grazed farm wetland features which had with low diversity, pest plants, and were degraded from grazing pressure. These wetlands varied from low to moderate ecological value primarily depending on physical structural complexity and degree of degradation from stock pressure. Freshwater wetlands of high ecological value were present in the Kōpūrerua Valley and was characterised by their large size, greater proportion of native vegetation, and connectivity to the high value palustrine wetland areas providing ecosystem services through flood attenuation, and sediment and water quality control.

The Project's impacts on wetlands include possible erosion and sediment discharges, contaminant discharges, fragmentation of wetland extents and the creation of novel edge effects, and changes to wetland hydrology. There will also be a direct loss of wetland habitat and features along the alignment resulting in the loss of 2.056 ha low value, 1.182 ha moderate value, and 1.71 ha high value wetlands.

A range of management measures are recommended to address the Project's effects on wetlands. An Erosion and Sediment Control Plan will address the potential effects from sediment discharge to wetlands. Management of untreated discharges and avoidance of activities that increase risk of discharges to wetlands will reduce the likelihood of potential impacts of contaminant discharges to wetlands.

Fragmentation and edge effects should be addressed through restoration and buffer planting on existing wetland extents affected. Changes to wetland hydrology can be addressed through reinstatement of hydrology and vegetation adversely effected.

To address direct loss of wetland extents, an initial offset strategy was considered using wetland loss: wetland creation replacement ratios. This would require 10.44 ha of wetland creation which is a large area when considering the need to intercept groundwater to successfully create wetland extents and the availability of space within the designation. As this scale of wetland creation is not practicable within the Proposed Designation, compensation is achieved through a combination of wetland creation and restoration. To address the wetland loss, the creation of 1.4 ha of wetland extent (associated with the Kōpūrerua and Nānako Stream realignments) and 11.808 ha of wetland restoration to the remaining wetlands within the Proposed Designation is proposed. Modelling demonstrates that this approach will achieve no net loss to wetland values and is predicted to result in a 9.73% net positive outcome²³.

²³ The 9.73% positive outcome demonstrates that a contingency can be built into the compensation package that allows to uncertainty for plant survival and impacts to hydrology.

11 Existing environment – Wetlands

Wetland assessments have been undertaken for a variety of other projects in this location and many areas cross over with the Proposed Designation. Where applicable, wetlands descriptions from other projects have broadly been used, with additional site visits being undertaken to confirm descriptions and extents. Detailed methods for desktop and field assessments, and assessment of values and effect are provided in Appendix 1.

Where an assessment of the presence and extent of wetlands was required, the wetland delineation method followed the protocols within the National Policy Statement for Freshwater Management (NPS-FM). Further details of the wetland delineation protocols are provided in Appendix 1. In brief, this method relies on vegetation plant assessment and hydrophytic vegetation determination tool outlined within the Wetland Delineation Protocols (Ministry for the Environment, 2022), as well as an assessment of the presence of hydric soils and wetland hydrology. Plots were only carried out when they assisted in the evaluation and delineation of potential wetland areas, and were generally not carried out where the vegetation encountered passed a rapid test for wetland delineation (all dominant species are obligate or facultative wetland species).

Wetland values and effects have been assessed within the Proposed Designation. Wetland loss has been considered as the extent of wetlands that fall within the Indicative Design works footprint and does not include a buffer to the works footprint.

11.1 Summary of wetland values

Table 11-1 assesses and summarises the wetland values identified within, and within the vicinity of, the Proposed Designation and presented in the Ecology Mapbook Supplement Volume 4. High value wetlands were only identified in the Kōpūrerua valley. Wetlands identified in the remaining areas were typically moderate value with limited native wetland vegetation, or low value, either grazed or dominated by exotic wetland species. Table 11-2 summarises wetland value alongside the wetland extents within the Proposed Designation and Indicative Design.

Table 11-1: Ecological value and assessment criteria of the wetland features within the Proposed Designation

Wetlands	Ecological value attribute	Score	Observations
Low value wetlands			
1, 2a, 2b, 3, 3a, 4 5d, 6, 9a, 10a.1-10a.5, 10b, 11, 15b, 17a	Representativeness	Low	Lack of indigenous vegetation species and/or dominance of exotic species. Species assemblages not typical of habitat due to degraded state. Reduced wetland structure and composition with primarily grazed pasture.
	Rarity/distinctiveness	Low	Vegetation assemblage is not uncommon or scarce as the features are mainly pasture grasses and/or exotic vegetation dominated. Mainly small areas. Limited vegetation does not support threatened or at-risk flora or fauna. None of the mapped vegetation types constitute rare ecosystem types or contain

Wetlands	Ecological value attribute	Score	Observations
			unusual species assemblages. Vegetation does not support regionally uncommon communities, nor do they contain hydrological diversity.
	Diversity and pattern	Low	Vegetation shows low diversity and pattern as vegetation is typically uniform with broadly similar species composition. Limited to low growing ground cover species with no canopy. No structural variation or layering. In exotic dominated wetlands – there is structural variation but dominated by exotic and/or pest plant species.
	Ecological context	Low	Modified and degraded character due to the agricultural history of the landscape. Limited habitat provision and ecosystem function provided to the wider catchment. Primarily small, isolated sizes with no buffering from surrounding land use.
	Overall score	Low	Low species diversity and exotic dominated in some areas. General degraded state with limited habitat provision for fauna.
Moderate value wetlands			
5a, 5b, 5c, 7a-d, 8, 9b, 12, 14a, 15a, 16, 17b	Representativeness	Moderate	Indigenous plants present, however these are restricted to a handful of species. Wetlands show some structure and composition of wetland vegetation with indigenous species dominant. Assemblages represent the expected species for grassland/rushland and seepage areas.
	Rarity/distinctiveness	Low	Induced scarcity with native dominated wetlands reduced in the BOP region however these are small in size. Some distinctive wetland features with wetland hydrology in the form of seepage. Limited habitat for threatened and at-risk species with small areas. No unusual species or assemblages
	Diversity and pattern	Low	Provide habitat for several native plant species with some limited complexity of vegetation assemblages. While natives are present the wetlands are typically dominated by one or two species.
	Ecological context	Moderate	The native vegetation provides moderate ecological context, functioning as an important component of the ecological network within a highly modified agricultural landscape.
	Overall score	Moderate	Native wetland vegetation with limited diversity. However typical of the wetland type. Wetland hydrology present and functioning. Wetlands provide some habitat to fauna.
High value wetlands			
13, 14b	Representativeness	Moderate	Typical structure of low-lying wetlands. Indigenous species dominate with expected species. Assemblages typical of lowland wetland habitat and provide complex habitat for fauna.

Wetlands	Ecological value attribute	Score	Observations
	Rarity/distinctiveness	High	Uncommon due to historical land use change in the lower floodplains of the catchment. Large size is uncommon. Distinctive ecological features – large swamp and marsh areas. Habitat likely supports threatened or at-risk species avifauna, and aquatic fauna.
	Diversity and pattern	Moderate	High level of natural diversity with high level of complexity in assemblages in some locations.
	Ecological context	High	Large size, providing buffering for the internal wetland habitat and ecosystem services. Contributes considerably to the hydrology of the catchment providing flood, nutrient and sediment attenuation.
	Overall score	High	Diverse regenerating wetland habitat typical of low-lying wetlands. High level of ecosystems services provided through flood attenuation and habitat provision.

Table 11-2: Summary of wetland types and values across the alignment.

Wetland	Type	Value	Proposed Designation area (ha)	Area to be lost under Indicative Design (ha)
Wetland 1	Grazed wetland	Low	0.323	0.243
Wetland 2a			0.027	0
Wetland 2b			0.089	0
Wetland 3			0.087	0.038
Wetland 3a			0.008	.008
Wetland 4	Exotic shrub	Low	0.232	0
Wetland 5a	Wetland seepage	Moderate	0.033	0
Wetland 5b			0.009	0
Wetland 5c			0.046	0.046
Wetland 5d	Grazed wetland	Low	0.451	0
Wetland 6	Grazed wetland	Low	0.389	0.020
Wetland 7a	Carex gully heads	Moderate	0.021	0
Wetland 7b			0.01	0
Wetland 7c			0.019	0
Wetland 7d			0.044	0
Wetland 8	Willow weed dominated	Moderate	0.181	0.016
Wetland 9a	Wetland matrix	Low	0.995	0.440
Wetland 9b	Wetland matrix	Moderate	0.181	0.181
Wetland 10a.1	Grazed rushland and herbfield	Low	0.940	0.889
Wetland 10a.2			0.246	0
Wetland 10a.3			0.077	0
Wetland 10a.4			0.031	0.031
Wetland 10a.5	Wetland grasses		0.077	0

Wetland	Type	Value	Proposed Designation area (ha)	Area to be lost under Indicative Design (ha)
Wetland 10b	Grassland		0.458	0
Wetland 11	Wetland pasture	Low	0.041	0
Wetland 12	Wetland seepage	Moderate	0.059	0.004
Wetland 13	Wetland marsh and swamp complex	High	7.076	1.680
Wetland 14a		Moderate	0.460	0.119
Wetland 14b		High	0.510	0.030
Wetland 15a	Wetland offset area	Moderate	2.916	0.791
Wetland 15b	Waterpepper dominated	Low	0.387	0.387
Wetland 16	Rushland	Moderate	0.198	0.010
Wetland 17a	Wetland pasture	Low	0.070	0
Wetland 17b	Wetland seepage	Moderate	0.065	0.015

12 Assessment of effects – wetlands

All figures and assessments are made on the basis of the Indicative Design footprint as an effects envelope, with sensitivity testing for change should it occur, to assess the likely scale and severity of effects of constructing the Project within the Proposed Designation.

The assessments provided in the following sections detail the magnitude of effects on wetland features. Level of ecological effects are provided in a summary within Section 12.3.

12.1 Construction effects

12.1.1 Direct loss of vegetation and habitats

12.1.1.1 Temporary loss of wetland extents and values

Wetland extents within the Proposed Designation but not within the Indicative Design may be temporarily lost or disturbed during construction. Where this cannot be remediated (Section 13.2.1) this would become permanent loss, assessed in the following section.

12.1.1.2 Potential permanent loss of wetland extents and values

We have assessed permanent wetland loss, based on the Indicative Design, from the Project as follows:

- The potential permanent loss of approximately 2.056 ha of **Low value** wetland habitat within the Indicative Design. The loss of wetland features is assessed as a **Low** magnitude of effect as the proportion of wetland that would be lost in the catchment would be minor and the effect would primarily be related to the loss of ecosystem services.
- There is potential permanent loss of approximately 1.182 ha **Moderate value** wetlands within the Indicative Design. The permanent loss of moderate value wetlands results in a **Moderate** magnitude of effect due to the loss of key baseline elements of wetland

hydrology, ecosystem services, and potential loss of a moderate proportion of moderate value wetlands within the catchments impacted.

- There is the potential permanent loss of approximately 1.71 ha of **High value** wetlands within the Indicative Design as a result of the construction footprint of the road and realignment of the Kōpūrererua stream and the Nānako Stream. Loss of high value wetland area will result in a **Moderate** magnitude of effect primarily due to the loss and modification of the key baseline feature of wetland hydrology. However, the area expected to be lost is primarily along the edges of the wetlands and consists of a small area with regard to the wider and overall large size of the high value wetlands in this catchment. The majority of the key features providing significant ecosystems services such as the ponds and integrated watercourses will be avoided.

12.1.2 Erosion and sediment discharges

Earthworks and works within and adjacent to the wetlands need to be carefully managed to avoid uncontrolled discharges of sediment laden water during construction and operation which would adversely affect wetland values. Increased sediment deposition within wetlands can result in changes to vegetation structure by increasing substrate height, modifying nutrient loads, and smothering herbaceous wetland species. If increased sediment loads are prolonged, this can result in changes to the species composition of wetland areas, and result in eventual transition to non-wetland communities. In the absence of controls, the discharge of sediment on all value wetlands would result in a **Moderate** magnitude of effects as the composition of vegetation could be altered from baseline communities.

12.1.3 Contaminant discharge

The Project construction will require the use of machinery and materials in and around wetland habitat. There is a risk of contamination from hydrocarbons, lubricants, hydraulic fluids, oil, etc. which can reduce water and soil quality, and be toxic to vegetation.

A small scale localised and temporary spill into a **High** value wetland is assessed as having a **Moderate** magnitude of effect as it will likely result in the alteration of vegetation communities through die-off, decreasing diversity at and adjacent to the spill.

As low to moderate value wetlands have limited vegetation diversity and ecological function, a small scale localised and temporary spill into a moderate or low value wetland would result in a discernible change to baseline condition, but underlying value of wetland attributes and function will remain. Therefore, contaminant discharge to low or moderate value wetlands is assessed as a **Low** magnitude of effect.

12.2 Operational effects

12.2.1 Modification of wetland hydrology

The Project has the potential to result in changes to hydrology or flow beyond the extent of wetlands (or including partial loss of wetlands). These changes could be caused through modification to landforms, change of permeability in the catchment, lowering of local groundwater levels, and/or redirection of overland flow pathways. Such changes may reduce

the hydrology of the wetlands, and lead to the functional loss of wetlands even if they are not directly impacted by the works.

Without controls in place, modification of wetland hydrology has the potential to result in the alteration and or loss of wetland function and is considered to have a potentially **Moderate** magnitude of effect on wetlands features.

12.2.2 Fragmentation and edge effects

Fragmentation of wetland habitats increases the area to edge ratio of the wetland, making wetlands more susceptible to invasion from pest species, and degradation from nutrient runoff and poor water quality. Fragmentation of wetland habitats on the retained wetland extent results in:

- A **Low magnitude** of effect to both **Low and Moderate** value wetland extents. These wetlands are generally already fragmented with small areas and with limited and degraded vegetation communities.
- Despite anticipated loss of high value wetland extents, it is not expected that this loss will result in the fragmentation of wetland habitat as the loss will only affect the edge habitat of the wetlands. Therefore, the effect of fragmentation on **High value** wetlands is not likely to occur.

The loss of high value wetland extents will result in the creation of novel wetland/road interface creating new areas of edge effects. Edge effects could result in minor changes to wetland vegetation communities through the invasion of pest plant species resulting in a change to wetland attributes. This is considered to result in a **Low** level of effects to high value wetlands.

12.3 Summary of levels of potential Project effects – Pre-effects management

Table 12-1 provides an overview of the values and the magnitude of the effects of the Project on wetland values and the final outcome (level) of the effect analysis pre-effects management. The EIANZ guidance is that low and very low effects should not generally be of concern, but that these effects should still be minimised through appropriate design and management. A Moderate level of effect requires more careful assessment and could be managed through avoidance, design or extensive offset or compensation actions. Recommendations to manage effects are set out within Section 8.

Table 12-1: Overview of the level of adverse effects of the Project pre-effects management on wetland ecological values within the Proposed Designation (pre-effects management).

Effect	Wetland value	Magnitude of effect	Level of effect (pre management)
Construction effects – loss of extent	High	Moderate	High
	Low and Moderate	Low and Moderate	Very Low-Moderate
Construction/operational effects – Modifications of hydrology	Low- Moderate	Moderate	Low-moderate
Construction effects – erosion/sediment discharge	Low-High	Moderate	Low-High
Construction effects – Contaminant discharge	High	Moderate	High
	Low-Moderate	Low	Very low - Low

Effect	Wetland value	Magnitude of effect	Level of effect (pre management)
Construction/operational effects – Fragmentation/edge effects	High	Low	Low
	Low-moderate	Low	Very low - Low

13 Management of effects - wetlands

13.1 Management of effects approach

Ecological input was provided during early planning stages of the Project to identify the presence of wetland features within the Proposed Designation. Where possible the loss of wetlands has been avoided or mitigated through minimising the extent of adverse effects through design. In particular, the Indicative Design of the roading footprint, as much as practicable, limited the extent affecting wetland 13. The Proposed Designation has also been refined in the Kōpūrerua valley to reduce the areas of possible impacts on the wetlands.

The calculated loss of wetland extent presented in the report is considered unavoidable based on the Indicative Design for the construction of the road. Assessment and recommended effects management have included sensitivity assessments to address potential Indicative Design changes.

13.2 Wetland extent loss

13.2.1 Remediation

Where possible wetland extent lost or disturbed during construction should be reinstated (i.e. remediated) with its hydrology and function returned. Habitat features suitable for wetland bird species should be incorporated into any wetland remediation. Wetland landforms can be remedied through earthworks to restore the wetland landforms to pre-construction or better states. Wetland hydrology can be remedied with the reinstatement of overland and groundwater flow pathways and connection to groundwater. Part of remediation for wetland hydrology may involve the landform change to ensure flow pathways for wetland hydrology are restored.

The clearance of wetland vegetation can be remedied through replanting following works, where the area is not required for permanent infrastructure. The cleared areas should be replanted in suitable native species, ideally those already present within the wetland, or those that would be present if the wetland were healthier/less degraded.

With appropriate revegetation, the remediation will result in a temporary (short-term) adverse effect, resulting in a minor shift away from existing baseline condition with the underlying character and composition being similar to the pre-construction state, i.e. a low magnitude of effect outcome (although in the current low level wetlands reinstatement will result in a positive magnitude of effect, making existing low value wetland better)

- Where wetland extent loss can be reinstated the magnitude of effect is considered to be **Low** for moderate and high wetlands and **Positive** for low value wetlands.

To ensure appropriate reinstatement of wetland vegetation assemblages, a wetland management plan is proposed.

13.2.2 Offsetting

Where it is not possible to remediate wetlands (i.e. where permanent works are proposed), we initially explored an approach of offsetting (i.e. wetland creation within the Proposed Designation on a simple area for area ratio approach) to address the scope of wetland loss. However, the quantum of loss and required offset areas considerably exceed the land where wetland creation might occur within or close to the Proposed Designation.

The section below analysis sets out the process followed for considering offsetting:

- For low value wetlands a ratio of 1:1 area of loss to area of creation was applied.
 - Approximately 2.056 ha of low value wetland will be lost under the works area. This would require 2.056 ha of wetland creation.
- For moderate (but still largely exotic) value wetlands, a ratio of 1:2 area of loss to area of creation.
 - Approximately 1.182 ha of moderate value will be lost under the works area. This would require 2.36 ha of wetland creation.

These ratios were applied as the low and moderate value wetlands impacted are generally dominated by non-native plants, degraded by adjacent land use and poor water quality, and mostly lack riparian margins. They are in keeping with recent trends²⁴ in exotic wetland offset ratios. Recreating these wetlands comes with little risk and short lag times and with a high certainty that created wetlands will be able to achieve greater diversity and complexity of vegetation cover with little lag in replacing and exceeding the ecological values of the wetlands lost.

For the management of wetland loss to **High value wetlands**, we applied a ratio of 1:3; this ratio is also within accepted BOAM practises²⁵.

- 1.71 ha of **High** value wetland is expected to be lost with the roading infrastructure, construction footprint, and the Kōpūrerua and Nānako Stream realignments. Loss of wetland value and extent could be managed through the recreation of wetland extent within the Kōpūrerua valley adjacent to the existing wetland extents at a ratio of 1:3.
 - The loss of 1.71 ha of high value wetland would require the creation of approximately 5.13 ha.

Table 13-1 summarises the scope of wetland loss as a result of the Project (stream realignments). Based on the offset ratios, the table presents the area required to recreate wetland extents and to achieve the potential offset ratios. A total of 9.55 ha of wetland creation would be required to meet the offsetting ratios. This figure of required creation is impractical to achieve within the Proposed Designation or reasonable additional area within the adjacent landform. Where there is potential for intercepting suitable wetland hydrology such as in gullies and flood plains, there are already wetlands present and opportunities for creation are limited. We also considered the possibility of a universally applied 1:1 area lost to area created ratio

²⁴ Wetland loss: creation ratios have been utilised in compensation packages for projects such as the Takitimu Northern Link Stage 2.

²⁵ BOAM modelling in the industry demonstrates that a 1:3 offset ratio for high value wetlands can adequately address wetland habitat loss.

(approximately 4.94 ha) to maintain the overall wetland extent. However, even if this lower ratio was to be adopted, the area required will also not fit within the Proposed Designation and adjacent landform.

Therefore, sufficient offset of loss and extent of wetland is not feasible in order to arrive at a 'less than minor' residual effects outcome, meaning consideration needs to focus instead on a compensation package.

As offsetting through wetland creation is not achievable given spatial and landform limitations, we have addressed wetland loss through compensation modelling in the following section.

Table 13-1: Summary of wetland extent loss and recommended offset ratio and areas.

Wetland value	Indicative design area loss (ha)	Offset ratio (Loss: creation)	Required offset area (ha)	Total area of feature within the Proposed Designation (ha)
Low	2.056	1:1	2.05	4.92
Moderate	1.182	1:2	2.36	4.24
High	1.71	1:3	5.13	7.58
Total	4.94	-	9.44	

13.2.3 Wetland compensation

As offsetting impacts on wetland extents through wetland creation is not wholly achievable within spatial and landform limitation within the Proposed Designation, we recommend a compensation package to address wetland loss. There is considerable scope within the Proposed Designation for wetland restoration compared to the limited scope for wetland creation. We propose a hybrid approach that utilises wetland restoration as well as wetland creation where creation is practicable. We have modelled this approach on the basis of the Indicative Design. The proposed compensation package outlined in further detail in Appendix 5 has been assessed through a Biodiversity Compensation Model (Baber, Christensen, et al., 2021; Baber, Dickson, et al., 2021a).

13.2.3.1 Wetland restoration component of the compensation package

The modelled wetland restoration approach involves the restoration of wetland areas that will not be lost under the Indicative Design. This equates to 2.87 ha of low value, 3.06 ha of moderate value, and 5.87 ha of high value wetlands split over the available areas within the Proposed Designation: Kōpūrerua Valley Wetland, Tauriko West MDRZ wetland matrix, and the remaining wetland features spread across the alignment.

13.2.3.2 Wetland creation component of the compensation package

In terms of compensation, wetland area is able to be created as part of a riparian wetland complex alongside both the Kōpūrerua Stream realignment and the Nānako Stream realignment with a minimum of 5m width either side of each alignment. This would contribute approximately 1.4 ha of wetland. These figures have been used in the compensation calculations below as a conservative minimum of wetland creation able to be achieved within the Proposed Designation.

13.2.3.3 Biodiversity compensation principles

The proposed compensation package is 'like for like' or a 'trade up' proposal in that it provides improvements to similar or higher value wetland features to those lost. This compensation package aligns with Te Mana o Te Taiao (Department of Conservation, 2020) in achieving the

restoration and permanent protection of significant biodiversity values contributing to the ki uta ki tai approach.

The proposed habitat restoration and value enhancement measures are forms of compensation. The proposed measures meet the definition of offsetting primarily because creation of equivalent areas of wetland cannot be achieved.

The proposed measures are consistent with the biodiversity compensation principles (Ministry for the Environment, 2020) as they address adverse residual effects on biodiversity values that cannot be adequately avoided, minimised, remedied or offset. Specifically:

- **Application of the effects management hierarchy:** The effects management hierarchy has been applied with avoidance of loss where possible through modifications to the design, (see Section 13.1), and incorporation of minimisation strategies where possible as detailed in Section 13.1 Remediation of loss is incorporated within the strategy through reinstatement of disturbed areas where possible. Offsetting options have been considered and are incorporated into the proposal, however offsetting is not able to be used to wholly manage the effects of wetland loss.
- We do not consider biodiversity offsetting can be achieved (primarily due to the spatial and landform limitations of the Proposed Designation) as discussed in more detail above. Therefore, it is necessary to undertake a biodiversity compensation approach for effects management.
- **Application of the 'limits to compensation' principle:** Importantly, the values impacted are not irreplaceable or vulnerable, the effects are understood, and there are technically feasible options to secure proposed gains within acceptable timeframes.
- Modelling has been undertaken to ensure the **scale** of biodiversity compensation is adequate to compensate for the adverse effect.
- **Additionality** will be achieved because none of the proposed restoration and habitat enhancement activities would have occurred if not for the Project, nor would the areas targeted attain the values through time without the restoration intervention.
- The proposal does not involve the **displacing impact of activities** that are harmful to indigenous biodiversity to other locations.
- The landscape context has been considered through the selection of restoration sites in direct connection to areas impacted, close by in similar catchments. The restoration also seeks to enhance landscape and ecological connectivity particularly between terrestrial, freshwater and saltwater environments.
- The proposal includes management of **time lags** through predator control and calculated positive impacts are achieved within a reasonable timeframe²⁶.
- The restoration programme is **long-term, with holistic outcomes**, which will be achieved on the basis that the wetlands will be protected by legislation, and native revegetation will remain onsite. The planting will be undertaken on Crown land, forms part of permanent Crown infrastructure and is ensured by the conditions of consent which will ensure the increase in ecological values required to compensate for effects is sustained.

²⁶ Predator control supports vegetation restoration planting by reducing grazing pressure.

- **Transparency:** The proposal has been analysed and assessed from initial options assessment stage, and into the ecological effects assessment stage. The calculations and analysis are provided in Appendix 5.

13.2.3.4 Compensation package results

The Biodiversity Compensation Model confirms that there is likely to be a positive effect on the ecological values. As noted above, a detailed account of the inputs to the models and the outcomes are provided in Appendix 5. The model with current parameters predicts that a **9.73% net positive** benefit for wetland values will be achieved if 1.4 ha of wetland is created and all wetland areas within the Proposed Designation that are not directly impacted by construction of stream realignment are restored.

The model provided for this assessment demonstrates the ability to manage the effects on wetlands within this Proposed Designation based on the Indicative Design. A condition of consent is recommended that requires wetland compensation modelling to be redone for the final design and a requirement for this modelling to demonstrate there is a no net loss of natural wetland values. This approach will ensure that the loss of wetlands and a finalised restoration and creation proposal appropriately manages effects on wetlands.

Imposing a limit (in hectares) on the scale of wetland impact has been considered. A limit based on 'outcomes' is preferred over a limit based on area (hectares). There is likely to be a **positive impact** on wetland values meaning there is an overshoot of the scale of required effects management intervention compared to the scale and severity of the effect. By requiring no net loss, this condition would set a limit on scale and severity of impact to that able to be managed. The 9.73% net gain over and above the 'no net loss' principle demonstrates there is flexibility within the model to achieve no net loss should further impact or design changes arise²⁷. Accordingly, the impacts of the Project on wetland habitat loss can be adequately managed to achieve no net loss of biodiversity function.

13.3 Discharge of sediment

The potential sediment related effects on wetlands can be minimised through adherence to best practise construction methods and the development and implementation of robust Erosion and Sediment Control Plans (ESCP) during the construction phase. At a high level, the ESCP identifies measure to reduce potential sediment loads to the receiving environments including avoiding winter works, staging works and use of erosion and sediment devices.

The ESCP will be consistent with BOPRC guidelines, and the magnitude of effects on wetland habitat receiving environments is considered to be **Low**. When considering the ecological features and the values affected, the overall level of effect is **Low to Very Low**.

13.4 Discharge of contaminants

During the construction phase, contaminant discharges to wetland habitats will be managed as follows:

- Managing potentially sediment or contaminant loaded discharges through;

²⁷ Such has increase effects due to hydrology modification, design refinements, or restoration uncertainty (planting survival rates).

- Point source control
- Physical control of contaminant discharge to prevent further spreading
- Removal of contaminants
- Avoidance of refuelling of machinery near wetlands through setback zones; and
- Management of any drilling fluids or concrete wash to avoid discharge to wetlands. through
 - Designated wash down areas
 - Containment to designated discharge areas/structures utilising impermeable barriers

These management practices will result in a **Low** magnitude of effects on wetland habitat, resulting in a **Low** to **Very Low** overall level of effect.

13.5 Modification of wetland hydrology

We recommend that, where practicable, stormwater and hydrology should be managed to maintain wetland hydrology in areas of wetland not directly removed by construction. Where this is not practicable conditions require an assessment of the natural wetlands that are subject to hydrological modification, and that the effect of that modification, where present, will be managed to ensure no net loss of natural wetland values. With appropriate management of the effects of any modification, and management of hydrology to maintain wetland hydrology through design, the magnitude of effect to all wetlands is considered **low**. This will result in an overall level of effect **Very low** for **low value** wetlands, **and Low** for moderate and high value wetlands.

Should wetland hydrology be altered temporarily during the construction phase, this should be reinstated post construction. If the changes to hydrology resulted in changes to the wetland vegetation (i.e., vegetation die-off) the wetland vegetation should be reinstated with appropriate planting.

13.6 Habitat fragmentation and edge effects

To reduce fragmentation of wetland habitat vegetation, clearance should be minimised as much as practicable. It is recommended the compensation planting should occur in areas that connect fragmented areas and provide ecological corridors. Where wetlands have been bisected or otherwise impacted by the Project, but a wetland feature remains, or where wetlands are directly adjacent to the earthwork's footprint, remaining wetlands are to be restored and buffered with dense plantings on the roadside escarpments to minimise disturbance from construction and operational effects of the road. This restoration and buffering will ensure that the remaining extent of wetlands are not functionally lost, and their ecological values are retained or enhanced over time. Biosecurity measures should be put in place to minimise the risk of introducing pest plant species along the road-side corridor²⁸. Where practicable, lighting shall be designed to minimise light spill where the lighting has the potential to impact wetland

²⁸ Consent conditions require Project Works to be undertaken in general accordance with BioNet A16 "Keep it Clean" guidelines.

bird species. We considered the magnitude of effects to be **Low** and the overall level of effect to be **Very low** for **Low value** wetlands, and **Low** for moderate value wetlands.

13.7 Summary of effects post management

Table 13-2 provides an overview of the wetland values and the magnitude of the effects pre and post -construction, with the resulting overall level of effect post management.

Table 13-2: Summary of effect levels to wetland habitat pre and post management and the overall resulting level off effect.

Effect	Ecological value	Magnitude of effect without management	Magnitude of effect with management	Management measure	Level of effect with management
Loss of wetland extent - temporary	1. Low 2. Moderate 3. High	Considered permanent loss ²⁹	Low	Remediation – reinstatement of wetland extent	1. Very Low 2. Low 3. Low
Loss of wetland extent - Permanent	1. Low 2. Moderate 3. High	1. Low 2. Moderate 3. Moderate	1. Low 2. Moderate 3. Moderate	Compensation package	No net loss
Modifications of hydrology	1. Low 2. Moderate 3. High	Moderate	Low	Avoidance of disruption or remediation of adverse effects	1. Very Low 2. Low 3. Low
Erosion/sediment discharge	1. Low 2. Moderate 3. High	Moderate	Low	Mitigation – Erosion and Sediment control plan	1. Very Low 2. Low 3. Low
Contaminant discharge	1. Low 2. Moderate 3. High	1. Low 2. Low 3. Moderate	Low	Management of untreated discharges and avoidance of activities that increase risk of discharges.	1. Very Low 2. Low 3. Low
Fragmentation/edge effects	1. Low 2. Moderate 3. High	1. Low 2. Low 3. Low	Low	Mitigation - Restoration and buffer planting of remaining wetland extent	1. Very Low 2. Low 3. Low

²⁹ Without management measures the wetlands effected would not be reinstated and therefore would constitute permanent wetland loss.

13.8 Sensitivity testing of Indicative Design

The effects management measures and consent conditions have been specifically designed to ensure that if the alignment shifts, or there are other changes are made during the detailed design phase, the effects are still appropriately addressed.

Of the 29 wetlands identified, only a limited number of them are considered moderate or high value. Where high value wetlands are identified, the majority of the impact is addressed through the proposed approach to stream realignment design, reducing the degree of uncertainty regarding impacts to high level wetlands that requires flexibility.

With regard to the loss of wetland extent, the wetland compensation package has been specifically designed to be flexible to respond to such circumstances should there be movement in the alignment during detailed design. Various scenarios were tested through the BCM model exploring changes to areas of wetland available for restoration and wetland creation. A consent condition is proposed requiring an effects outcome through which they are demonstrated to achieve a no net loss of wetland values.

14 Wetland ecology conclusion

A total of 29 wetlands were identified within the Proposed Designation area, most of which are degraded, low-diversity farm wetlands dominated by non-native species and impacted by grazing. Their ecological value ranges from low to moderate, depending on structural complexity and stock pressure. In contrast, high-value wetlands in the Kōpūrerua Valley are larger, more connected, and support more native vegetation, providing important ecosystem services.

The project is expected to impact wetlands through erosion, sediment and contaminant discharges, habitat loss, fragmentation, edge effects, and altered hydrology. This includes the direct loss of 4.948 hectares of wetlands across low, moderate, and high ecological values.

To mitigate these effects, measures such as erosion and sediment control, discharge management, restoration planting, buffering, and hydrological reinstatement are proposed. While a full offset strategy based solely on wetland creation would require more wetland creation than is achievable within the Proposed Designation, the BCM compensation modelling demonstrates that no net loss of values and an ecological gain of 9.73%³⁰ can be achieved with 1.4 ha of new wetland creation and 11.808 ha of wetland restoration based on the Indicative Design.

³⁰ Note the 9.3% gain is a demonstration of there being scale and capacity for compensation activities to achieve a more than no net loss on wetland values within the proposed designation. Indicating there is flexibility for accommodating any design changes that may increase impacts or restrict potential compensation activities. This is discussed in Section 13.2.3.

Part C: Freshwater Ecology

15 Freshwater executive summary

Freshwater ecological values were assessed across the ZOI and waterways were grouped into high value rivers (Wairoa and Omanawa), moderate to high value streams (including the Kōpūrerua, Nānako, and Belk Road systems), and low value modified and artificial channels. Most waterways are highly modified with simplified habitat and degraded riparian margins, resulting in generally low to moderate ecological value. Higher value habitat is limited to the larger river systems and more intact stream reaches where connectivity and habitat diversity are greater.

During construction, the Project will result in sediment and contaminant discharges, disturbance from instream works, temporary disruption to fish passage, and localised channel modification through stream realignment. Permanent effects include changes to stormwater inputs, hydrology, and channel form. Realignment is largely confined to already degraded systems and will be designed to provide a net increase in stream length, improved habitat diversity and enhanced riparian condition.

Overall effects are low across most of the freshwater network, reflecting degraded baseline conditions and the limited scale of works in higher value systems. Effects on the Wairoa and Omanawa Rivers are negligible to low, while effects in moderate value streams are low and, in some cases, positive where realignment improves habitat and riparian condition. Effects on low value channels are very low.

Management measures during the construction period will include erosion and sediment controls, staged works, fish salvage, and maintaining fish passage at temporary crossings. Stream realignment will incorporate habitat diversity, fish passage design, and riparian planting, with monitoring and management to secure these outcomes. Stormwater treatment and hydraulic design will manage operational effects. With these measures, freshwater effects remain low to negligible overall, with some localised ecological gains.

16 Existing environment – freshwater

This section describes the freshwater ecological environment that may be affected by the Project. Because the Project traverses multiple catchments and a wide range of watercourse types, from large river systems to artificial drainage channels, the existing environment has been summarised using a grouped approach that reflects shared physical characteristics, hydrological behaviour, ecological function, and faunal patterns, as well as whether the waterways form part of the receiving environment or may be directly impacted. This approach avoids repetition, improves clarity, and ensures that the ecological values assigned later in the report are based on representative and internally consistent descriptions. The locations of the

watercourse can be found in the Ecology Mapbook Supplement Volume 4 and full watercourse-specific habitat descriptions and macroinvertebrate and fish community information are provided in Appendix 6, while the discussion below focuses on the characteristics most relevant to ecological value and sensitivity to potential Project effects.

Table 16-1 summarises the watercourse groupings used in this assessment and the ecological rationale for each grouping. The following sections provide justification for the ecological values³¹ of each individual (for Groups A and B) and type (for Group C) of watercourse.

Table 16-1: Watercourse groupings for this assessment and the rationale for each grouping.

Watercourse Group	Representative Watercourses	Reason for Grouping
A - Receiving environments	Wairoa River, Ōmanawa River	Large natural rivers with high hydraulic diversity, established riparian margins, high ecological integrity, and habitat suitable for multiple At-Risk diadromous fish species that form part of the receiving environment.
B - Realigned watercourses	Kōpūrerua Stream (main stem), Nānako Stream, Belk Road watercourses	Modified, natural lowland streams with moderate shading, mixed habitat structure, partial floodplain connectivity, and diverse native fish communities linked to maintained upstream–downstream connectivity.
C - Unnamed watercourses (incl. highly modified and artificial).	Wairoa Catchment unnamed tributaries and artificial watercourses; Kōpūrerua Valley unnamed tributaries and unnamed watercourses.	<i>Highly modified channels:</i> Historically altered channels with simplified morphology, soft-bottom substrates, limited shading, and macroinvertebrate communities dominated by tolerant taxa, offering low ecological function. <i>Artificial channels:</i> Purpose-built channels with uniform geometry, shallow and low-velocity hydrology, minimal riparian structure, and very limited or absent aquatic habitat, resulting in low–negligible ecological function.

16.1 Group A: Receiving environments (Wairoa River, Ōmanawa River)

Table 16-2: Detailed ecological valuation of the Wairoa and Ōmanawa Rivers

Criteria	Wairoa	Ōmanawa
Representativeness	Channel form includes broad wetted widths, deeper pool habitats, and mixed substrate types, consistent with regional river morphology. Despite some bank modification, it retains the general structural attributes typical of large, tidal-influenced lowland rivers within the Bay of Plenty.	Retains many physical features expected of a natural, higher-quality lowland tributary in the western Bay of Plenty. Includes sections of well-defined channel morphology, deeper pools, variable flow conditions, and riparian vegetation providing shading and bank stability. These features are typical of

³¹ Note that due to the recent updated threat classifications for freshwater fishes in New Zealand resulting in all except shortfin eel and common bully having an elevated conservation status, we have not prioritised fish threat classification to inform rarity values as it does not assist with teasing out differences between watercourses, additionally, these classifications are at a national scale, whereby many of the species are prevalent in these watercourses so are not considered 'ecologically' rare.

Criteria	Wairoa	Omanawa
		lowland forest-influenced streams in the region.
Rarity and distinctiveness	Supports several Threatened or At-Risk species, Their occurrence here relates primarily to river size, flow regime, and access rather than unusual habitat features.	
Diversity and pattern	Diverse habitat including deep pools, runs, and marginal areas influenced by tidal exchange. Hydraulic heterogeneity supports a range of aquatic communities.	Diverse habitat including pools, runs, shaded margins, coarse substrate. Hydraulic heterogeneity creates a range of habitats supporting diverse aquatic communities.
Ecological context	Primary receiving environment for multiple tributaries in the Tauriko West areas functioning as the main migratory pathway. The river contributes hydrologically and biologically to the wider Tauranga Harbour system, influencing downstream estuarine processes and supporting upstream recruitment for multiple tributaries.	Forms part of the wider Wairoa River system, providing habitat and passage for diadromous species. Its connectivity to lower catchment waterways enables recruitment processes for migrating species. Contributes to local hydrological processes, conveying freshwater inputs and linking terrestrial and aquatic ecosystems.
Ecological integrity	Supports a diverse aquatic fauna and generally good habitat overall. Some bank and riparian vegetation modification is present. Core physical and biological functions remain consistent with a large lowland system. Habitat structure, hydrological connectivity, and substrate patterns support allow both sensitive and tolerant species, reflecting mixed but functional ecological integrity across the system.	Good water quality and high aquatic fauna richness. Stable channel morphology, consistent baseflows, shading, and intact instream structure, indicate a stream that maintains functional hydrological and physical processes. While some historical or localised modifications may be present, the stream supports a mixture of species with differing habitat requirements, suggesting ecological conditions that remain structurally and functionally coherent.
OVERALL ECOLOGICAL VALUE:	VERY HIGH	HIGH

16.2 Group B: Realigned streams (Kōpūrererua Stream main stem, Nānako Stream, Belk Road watercourses)

Table 16-3: Detailed ecological valuation of the Kōpūrererua Stream within the Proposed Designation.

Criteria	Kōpūrererua	Nanako	Belk Road Watercourses
Representative ness	Modified lowland watercourse with recent naturalisation works. Widened channel sections, re-introduced meanders, variable depths, and developing riparian plantings. Sections of marginal wetland habitat and a mixture of run and pool environments. Representative of a partially restored lowland watercourse within an urbanising catchment.	Retains characteristics typical of a natural lowland tributary including shaded margins, more defined channel morphology, and sections of stable substrate. Its morphology and riparian structure provide conditions commonly associated with highly modified tributary streams in the region.	The Belk Road watercourses consist of straightened, incised channels typical of lowland pastoral drainage systems. Their physical form reflects long-term modification combined with more recent earthworks associated with offset channel construction. The channels exhibit soft-bottom substrates, shallow low-velocity runs, and limited riparian shade, which are characteristic of highly modified, low-gradient agricultural drains rather than natural stream types.
Rarity and distinctiveness	Supports several Threatened or At-Risk native fish species in the lower Kōpūrererua catchment. Their presence reflects the catchment's connectivity to the Tauranga Harbour and indicates that the stream contains habitat used by multiple diadromous species.	Supports several Threatened or At-Risk native fish species. While these species are not unique to Nānako Stream, their expected presence indicates that the watercourse provides habitat conditions suitable for taxa that rely on cover, variable depth, or more stable substrates.	These watercourses do not support habitat features that are unusual or distinctive relative to similar modified lowland channels. Threat-classified species such as longfin eel and inanga have been recorded in the catchment, but their presence would reflect regional diadromous distributions rather than distinctive habitat attributes within the reach. No rare geomorphic, hydrological, or vegetation features have been recorded.
Diversity and pattern	Range of hydraulic units, including runs, pools, shallower marginal shelves, and vegetated edge habitats. Localised meanders, and shade variation create modest habitat diversity relative to other lowland systems. Macroinvertebrate data show a mixture of tolerant and moderately sensitive taxa, consistent with moderate pollution or nutrient enrichment.	Contains features such as shaded reaches and well-defined bank structure, contributing to a range of physical habitats. Marginal vegetation and internal structural elements support a variety of hydraulic conditions, including pool-run sequences and vegetated margins. This physical arrangement allows for a wider range of aquatic biota.	Habitat diversity is limited, with channels dominated by soft sediment, shallow run habitat, and recently disturbed margins. Hydraulic patterns are relatively uniform, offering few microhabitats or changes in depth or velocity. Biological communities are expected to be shaped by these conditions, with fish and macroinvertebrate assemblages typical of slow-flowing, depositional waterways.

Criteria	Kōpūrererua	Nanako	Belk Road Watercourses
Ecological context	Major tributary within Tauranga Harbour catchment and acts as a significant migratory pathway. Broad floodplain, associated wetland complexes contribute to hydrological processes, including flood attenuation and sediment conveyance. The stream's position within a regionally important aquatic network means its condition and connectivity influence biotic movement patterns across multiple sub-catchments.	Contributes to the wider Kōpūrererua catchment providing upstream habitat and a migratory pathway. Forms part of the broader network of waterways and wetland remnants in the valley. This positional role enables exchanges of biota and hydrological inputs with the main stem, contributing to catchment processes such as flow conveyance and local habitat linkage.	The watercourses form part of a constructed/modified drainage network within the Tauriko West area and remain hydrologically connected to the downstream Wairoa River system. This enables potential movement of diadromous fish species into the area. Their position within an offset area also means they sit within a broader network of newly created and modified channels, though their functional interactions are primarily localised to surface-water conveyance.
Ecological integrity	Elevated nutrients, suspended fine sediment, and E. coli levels Retains functional hydrological connectivity and supports a diverse diadromous fish assemblage. Macroinvertebrate indices correspond to moderate ecological condition, reflecting catchment-scale influences such as land use, stormwater inputs, and sedimentation. The presence of both sensitive and tolerant fauna suggests a system with mixed levels of habitat quality, influenced by ongoing naturalisation alongside residual modification and water-quality stressors.	Supports relatively intact channel structure in several reaches, with riparian vegetation providing shading and stabilising banks. These characteristics, alongside deeper pools and flowing sections, suggest a stream with moderate physical habitat integrity relative to other modified tributaries in the area. A complex and diverse aquatic community aligns with the expectation that parts of the stream maintain functional instream habitat and generally favourable waterway conditions, although localised modification may still influence sections of the channel.	Physical habitat is recently disturbed in places, reflecting earthworks and early-stage channel establishment. Substrates are fine and easily mobilised, riparian vegetation is limited to young plantings or pasture grasses/weeds, and hydraulic conditions remain simple. Macroinvertebrate indices from the retained 'natural' channel show communities dominated by tolerant taxa and low MCI and SQMCI scores, indicative of soft-bottom, low-complexity habitat conditions. These patterns align with the current early-establishment and modified state of the channels.
OVERALL ECOLOGICAL VALUE:	HIGH	MODERATE	MODERATE

16.3 Group C: Unnamed modified and artificial watercourses

Table 16-4 and Table 16-5 summarise the values of the unnamed perennial, intermittent, and ephemeral reaches within the Project designation. (Wairoa Catchment tributaries, Kōpūrererua

Valley tributaries). The modified watercourses follow remnant natural gullies or depressions but have been significantly altered through historical agricultural drainage, channel straightening, incision, and more recent earthworks. Under current conditions, these watercourses (both artificial and modified) provide only low-functioning habitat and limited ecological context relative to larger systems.

Table 16-4: Detailed ecological valuation of the unnamed watercourse of the Wairoa catchment within the Proposed Designation

Criteria	Wairoa River catchment		
	Perennial	Intermittent	Ephemeral
Representative ness	Representative of heavily altered lowland drainage features in pastoral and peri-urban landscapes. Morphology is typically straightened and incised with shallow soft-bottom runs, and minimal riparian shading.	Characteristic of modified or constructed drainage lines within lowland hill-country landscapes. Morphology of shallow depressions, simplified banks, and periodic drying, aligning with the expected form of intermittent drains in heavily modified settings.	Typical characteristics of ephemeral flow paths formed through land modification for drainage. Lack persistent surface water and present as shallow, lightly incised or constructed depressions.
Rarity and distinctiveness	No distinctive hydrological or geomorphic features. Threatened or At-Risk species such as longfin eel and inanga may be present due to catchment connectivity and not reflective of habitat quality.	No rare or distinctive features are present. The intermittent hydrology and simplistic channel form do not support uncommon habitat types and provide only short-term aquatic conditions. Occasional eel movement may occur intermittently, but this is not indicative of distinctiveness.	No rare or distinctive ecological features are associated with these ephemeral channels. Hydrology is storm-driven flow only and lack of defined channel features make them unsuitable for aquatic species that require sustained habitat.
Diversity and pattern	Habitat diversity is low, with slow velocities, uniform depths, extensive fine sediment, and sporadic macrophyte colonisation. Hydraulic variation is minimal and mesohabitat structure is limited, producing biotic communities dominated by tolerant taxa.	Habitat structure is minimal, typically comprising shallow, low-velocity flows or isolated pools when water is present. Shifts between wet and dry periods limit the development of complex instream communities, with biological patterns reflecting opportunistic or highly tolerant taxa.	Habitat diversity is minimal, with no development of aquatic mesohabitats. Biological patterns are limited to terrestrial or opportunistic species during brief wet periods. Such features do not support aquatic community structure.
Ecological context	Provide local drainage connectivity and link to downstream. Their ecological role is primarily hydrological, with limited sustained habitat or	Facilitate stormwater conveyance and localised surface-water connectivity. Limited consistent linkage for aquatic organisms.	Their function is hydrological, acting as short-duration runoff pathways connecting slopes and paddocks to downstream channels. They do not provide

Criteria	Wairoa River catchment		
	Perennial	Intermittent	Ephemeral
	movement function for aquatic fauna		pathways for aquatic fauna and have negligible ecological connectivity.
Ecological integrity	Soft-bottom substrates, limited shade, and uniform channel form constrain ecological processes. Biological assemblages typical of low oxygen, fine sediment environments occur, reflecting the low structural integrity of the system.	Uniformity of form, fine sediments, and periodic drying restrict ecological integrity. Vegetation is typically ruderal or pasture-derived, and instream structural elements are minimal.	Physical and ecological integrity is shaped by the absence of sustained flow, high sediment mobility, and minimal riparian structure. These characteristics are uniform across both modified and artificial ephemeral features.
OVERALL ECOLOGICAL VALUE:	LOW	LOW	NEGLIGIBLE

Table 16-5: Detailed ecological valuation of the unnamed watercourse of the Kōpūrererua catchment within the Proposed Designation

Criteria	Kōpūrererua River catchment		
	Perennial	Intermittent	Ephemeral
Representative ness	These channels represent modified lowland perennial drains embedded within a wetland–floodplain system. Their form reflects historical drainage, with soft substrates and limited structural diversity, typical of simple perennial watercourses adjacent to wetlands.	Reflect typical intermittent drainage channels along wetland margins, shaped by shallow gradients and historical land drainage.	Ephemeral drainage depressions characteristic of wetland-edge landscapes shaped by anthropogenic drainage.
Rarity and distinctiveness	No unusual or distinctive features are present. Diadromous species may occasionally use lower reaches during higher flows, but such use reflects downstream connectivity, not unique habitat attributes.	No rare hydrological or structural features are present; conditions are common in modified wetland-edge landscapes.	No rare or distinctive habitat values; no sustained aquatic habitat present.
Diversity and pattern	Slow, uniform flow conditions, soft sediment, and dense marginal vegetation limit mesohabitat diversity. Biological communities typical of depositional, low-velocity environments are expected.	Low habitat diversity due to intermittent flow, soft substrate, and limited channel structure.	Low habitat diversity due to intermittent flow, soft substrate, and limited channel structure.

Criteria	Kōpūrerua River catchment		
	Perennial	Intermittent	Ephemeral
Ecological context	These perennial drains contribute to floodplain hydrology and interface with wetland areas but have limited sustained ecological connectivity with the broader aquatic network.	Provide hydrological conveyance with short-duration aquatic linkage only during high flows.	Primarily function as stormwater runoff pathways; no ecological connectivity
Ecological integrity	Integrity is constrained by historic modification and wetland-edge sedimentation, with soft, anoxic substrates and limited riparian shading.	Low due to intermittent dry phases, fine sediment accumulation, and limited habitat structure.	Limited by absence of flow permanence, unstable substrates, and lack of instream structure.
OVERALL ECOLOGICAL VALUE:	LOW	LOW	NEGLIGIBLE

16.4 Summary of aquatic physical habitat ecological value

Table 16-6: Summary of watercourse value and area within the Proposed Designation and Indicative Design.

Group	Watercourse name/type	Habitat value	Length intersected by Indicative Design (m)	Length in Proposed Designation (m)
A	Wairoa River	Very High	N/A	N/A
	Ōmanawa River	High	N/A	N/A
B	Kōpūrerua Stream	High	728	795
	Nānako Stream	Moderate	583	657
	Belk Road watercourses	Moderate	680	680
C	Natural, modified - intermittent	Low	40	304
	Artificial – ephemeral	Negligible	136	339
	Artificial – intermittent	Low	637	1,162
	Artificial - perennial	Low	954	1,605

16.5 Wetland-watercourse complex

A large wetland-watercourse complex is located in the Kōpūrerua Valley north-east of the Pa site. It is likely that a number of drains were created to drain the wetland during the period of agricultural use of this area. Subsequently, the valley has been retired from agricultural use, and

the Kōpūrerua Stream has undergone naturalisation at various points resulting in improved connectivity with the surrounding wetland/floodplain. Therefore, this feature contains the old historic drainage channels which have now become integrated with the surrounding wetland. During dry seasons the surface water may constrict to the drainage channels that may act as refuge to freshwater species, but overall, this area should be considered a wetland and is assessed as such in this assessment.

16.6 Aquatic fauna

16.6.1 Macroinvertebrate communities

Macroinvertebrates are used as a primary indicator of stream health because their community composition responds predictably to changes in water quality, sedimentation, flow variability, riparian shading and habitat structure (e.g., Collier & Winterbourn, 2000). They have limited mobility, occupy a wide range of microhabitats, and adapt to environmental conditions over time, meaning their presence or absence provides a sensitive measure of ecological integrity that is often more diagnostic than snapshot physicochemical data (e.g., Stark & Maxted, 2007). In the context of this assessment, macroinvertebrate patterns are useful for understanding baseline ecological condition, identifying stressors associated with land use and channel modification, and determining the ecological resilience or sensitivity of each watercourse to potential construction and operational effects (e.g., Clapcott et al., 2017).

The following macroinvertebrate community understanding is based on a review of available monitoring data and ecological assessments from the wider study area, including the Tauranga City Council State of the Receiving Environment (SoRE) monitoring programme, Tauriko West Plan Change ecological assessments, the Tauriko Business Estate Environmental Management Plan, and associated NZTA/WSP ecological assessments undertaken within the Tauriko and Ōmanawa areas. These datasets provide a representative indication of macroinvertebrate community composition and stream health across the principal watercourse types present within the study area. The references and information used are provided in Table 20-11 in Appendix 6.

Macroinvertebrate communities varied considerably across the ZOI and generally reflected differences in flow permanence, catchment condition and the degree of channel modification. The highest ecological condition was recorded within larger perennial receiving environments, including Kōpūrerua Stream and the Ōmanawa Stream offset site, where MCI values ranged from approximately 101 to 111 and QMCI values from 3.2 to 4.5 (Table 16-7), indicating the presence of more diverse communities and a greater proportion of pollution-sensitive taxa. In particular, the Keenan Road site on Kōpūrerua Stream supported the highest quality assemblage within the Kōpūrerua catchment, with an MCI of 100.8 and QMCI of 4.5. Conversely, lower catchment sites at Hastings Road (Nānako Stream), Faulkner Street and Birch Avenue supported poorer quality communities dominated by tolerant taxa, indicating a decline in ecological condition through the more modified and tidally influenced reaches of the stream.

Within the Wairoa catchment, macroinvertebrate communities recorded from Tauriko West and the Tauriko Business Estate were generally characteristic of highly modified lowland streams and drains. MCI values ranged from approximately 60 to 81 in modified perennial and intermittent channels, while onsite mitigation watercourses within the Tauriko Business Estate recorded MCI values between 65 and 72 (Table 16-7) and were dominated by pollution-tolerant taxa. These results indicate generally poor ecological condition, likely reflecting historical

channel modification, fine sediment deposition, limited habitat diversity and degraded riparian margins.

No macroinvertebrate data are available for the unnamed watercourses within the Kōpūrerua Valley portion of the ZOI. However, these watercourses are predominantly modified, low-gradient drainage channels with limited habitat complexity and are broadly analogous to the artificial and modified watercourses assessed within the Tauriko West area. Based on their physical characteristics and field observations undertaken during the present assessment, these watercourses are expected to support low-diversity macroinvertebrate communities dominated by tolerant taxa such as oligochaete worms, snails and chironomids, with few or no pollution-sensitive EPT taxa likely to be present. This is consistent with the ecological values assigned to these watercourses elsewhere in the study area.

Overall, the available data indicate a clear gradient in macroinvertebrate community health across the study area, with the highest ecological condition occurring in larger perennial receiving waters and the poorest condition occurring within highly modified intermittent, artificial and drainage-dominated watercourses.

Table 16-7: Summary of macroinvertebrate community MCI and QMCI data from recent publications.

Group	Watercourse name/type	Community indices scores (quality classes as per Stark & Maxted (2007))	Comments
A	Wairoa River ³²	MCI _{sb} : 3.41 (2017) – Poor quality QMCI: 69.33 (2017)	TCC monitoring site F8-1. Macroinvertebrates not sampled in 2023 due to accessibility constraints.
	Ōmanawa River ³³	MCI: 104 QMCI: No data	No QMCI data presented in WSP (2025).
B	Kōpūrerua Stream at SH29A bridge ³²	MCI _{sb} : 82.87 (2023); 75.67 (2017) QMCI _{sb} : 2.37 (2023); 2.7 (2017)	TCC monitoring site F7.1. Data also exists for upstream (near Keenan Road) and downstream (near Faulkner Ave and again near Birch Ave), with data showing slightly improved MCI and QMCI scores upstream and similar or worse downstream.
	Nānako Stream ³²	MCI _{sb} : 56 (2023) QMCI _{sb} : 2.7 (2023)	TCC monitoring site F7.4.
	Belk Road watercourses ³⁴	MCI _{sb} : 65 QMCI _{sb} : 2.4	These data reflect the macroinvertebrate community prior to implementation of the TBE offset.
C	Perennial ³⁵	MCI _{sb} : 74-81 QMCI _{sb} : 2.31-4.3	Type of watercourse modification is not relevant to macroinvertebrate community data.
	Intermittent ³⁵	MCI: 60-79 QMCI: 2.35-4.45	Type of watercourse modification is not relevant to macroinvertebrate community data.

³² (Boffa Miskell Limited, 2023)

³³ (WSP, 2025)

³⁴ (Boffa Miskell Ltd, 2021)

³⁵ (Boffa Miskell Ltd, 2023a)

16.6.2 Fish communities

The following fish community understanding is informed by the existing data and information available from previous studies, assessment, and reports, and associated datasets. Fish communities across the ZOI are shaped primarily by connectivity, catchment position and local habitat availability. Overall, fish communities across the ZOI align closely with physical habitat condition: functional, diverse assemblages occur only where natural channel features and connectivity persist, while highly modified and artificial channels support little more than sporadic or transient fish use.

Table 16-8 summarises the likely freshwater fish communities within the Project. The Wairoa River and Ōmanawa River provide high-quality habitat for a broad suite of diadromous native species. The available habitat supports both migration and key life-cycle functions, making them the most significant aquatic environments in the context of the Project.

The Kōpūrerua Stream and Nānako Stream also support diverse native fish assemblages. Although water quality is influenced by surrounding land use, these streams remain important migratory pathways and provide comparatively higher ecological function than the more modified tributaries.

Within modified natural tributaries of Tauriko West and Belk Road, fish communities are restricted to tolerant or mobile species due to lack of preferable habitat and likely restricted fish passage. In artificial drains, fish use is minimal and largely opportunistic.

Table 16-8: Summary of freshwater fauna likely present in watercourses

Group	Watercourse name/type	Potential Freshwater fauna	Comments
A	Wairoa River	Longfin eel* Shortfin eel Giant kokopu* Inanga* Redfin bully* Giant bully* Common smelt* Common bully	Good longitudinal connection. Natural channel form, depth, shading and substrate complexity
	Ōmanawa River		
B	Kōpūrerua Stream	Longfin eel* Shortfin eel Giant kokopu* Inanga* Redfin bully* Giant bully* Common smelt* Common bully	Good longitudinal connection. Natural channel form, depth, shading and substrate complexity. Water quality degraded.
	Nānako Stream		
	Belk Road watercourses	Limited to tolerant species such as: Longfin eel* Shortfin eel Common bully	Reduced habitat complexity with limited shading, absence of coarse substrate, increased soft sediments. Possible fish barriers limited connection
C	Modified	Limited to tolerant species such as: Longfin eel* Shortfin eel Common bully	Limited shading, shallow flow, fine sediments and the absence of coarse substrate reducing habitat complexity. Culverts and channel incision further restrict the upstream extent of fish movement.

	Artificial perennial	Limited to tolerant species such as: Longfin eel* Shortfin eel Common bully	May temporarily support tolerant and mobile species during periods of elevated flow.
	Artificial intermittent and ephemeral	N/A	Do not provide suitable/stable habitat due to inconsistent hydrology and shallow, uniform morphology.

*denotes species with an elevated conservation status.

16.7 Aquatic ecological values summary (habitat + fauna)

Table 16-9 provides a consolidated summary of the key characteristics of each watercourse grouping, including their physical condition, macroinvertebrate and fish community patterns, and the resulting ecological values assigned. This table brings together the information presented in the preceding subsections and offers an overview of how watercourse condition and ecological function vary across the ZOI.

Table 16-9: Summary of the existing freshwater environment across watercourse groups.

Watercourse Group	Watercourses within the group	Physical Environment Summary	Macroinvertebrate Community	Fish Community	Overall Ecological Value
A - High-value receiving environments	Wairoa River	Large natural lowland rivers with deep pools, runs, coarse substrates, and structurally complex channel morphology. Strong longitudinal connectivity and well-developed riparian vegetation provide shading, bank stability, and habitat heterogeneity.	Moderate to good condition with multiple sensitive taxa (including EPT). Community composition reflects hydraulic diversity, stable substrates, and relatively good water quality compared with other systems in the ZOI.	Diverse diadromous assemblages including longfin eel, inanga, giant kōkopu, banded kōkopu, redfin bully and smelt. High connectivity allows full migration and life-cycle completion.	Very High
	Ōmanawa River				High
B - Moderate to high-value natural impact	Kōpūrerua Stream (main stem)	Natural or naturalised streams with soft-bottom substrates,	Low-moderate condition typical of soft-bottom urban lowland streams but with occasional	Well-connected native fish communities including eels, bullies,	High

Watercourse Group	Watercourses within the group	Physical Environment Summary	Macroinvertebrate Community	Fish Community	Overall Ecological Value
streams	Nānako Stream; Belk Road watercourses	moderate shading, mixed riparian condition and some floodplain interaction. Habitat includes a mix of shallow runs, deeper pockets, macrophytes, and vegetated margins. Some areas show active restoration, but ecological function is still developing.	sensitive taxa and more functional diversity than modified channels. Reflects partial habitat complexity and moderate shading.	galaxiids, and smelt. Suitable pool–run habitats exist, though water quality and sediment loads impose constraints.	Moderate
C - Negligible to low value unnamed watercourses (incl. highly modified and artificial)	Wairoa Catchment modified perennial and intermittent tributaries	Historically straightened or incised natural channels with simplified morphology, shallow depths, fine sediments, low hydraulic energy, and variable riparian margins (often early-stage or limited).	Poor condition dominated by tolerant taxa such as oligochaete worms, midges, and snails. Sensitive taxa absent or extremely rare. Habitat limitation and stormwater influence drive community structure.	Tolerant or mobile native species (e.g., common bully, eels) present mainly due to connectivity opportunities rather than habitat suitability. Spawning habitat sparse due to soft substrates and shallow hydrology.	Low
	Perennial, intermittent, and ephemeral constructed drains throughout the Proposed Designation	Constructed drains with uniform geometry, soft substrates, minimal riparian vegetation, and shallow, low-velocity hydrology. Intermittent and ephemeral drains often	Very poor or absent communities. Perennial drains support only ultra-tolerant taxa; intermittent and ephemeral channels do not sustain macroinvertebrate populations.	Limited, opportunistic fish use in perennial drains (generally eels and bullies). Intermittent and ephemeral channels provide no usable fish habitat due to lack of	Low–Negligible

Watercourse Group	Watercourses within the group	Physical Environment Summary	Macroinvertebrate Community	Fish Community	Overall Ecological Value
		lack surface water for extended periods.		permanent flow.	

16.8 Applicability of results to unassessed or inaccessible watercourses

In several locations across the Proposed Designation, small or highly constrained watercourses could not be directly surveyed due to access limitations, safety constraints, or the physical condition of the features themselves. Where these streams, drains, or ephemeral flow paths were not able to be assessed in the field, their likely characteristics, ecological condition, and aquatic ecological values can reasonably be inferred from the patterns documented across the full suite of unnamed watercourses that were surveyed in Tauriko West and the Kōpūrerua Valley. The assessed watercourses collectively represent a broad range of physical forms, hydrological regimes, and degrees of modification. Given this representativeness, the unnamed watercourse groups provide an appropriate reference framework for extrapolating the likely attributes of unsurvey features.

This same approach has been applied in the effects assessment (Section 17), where the responses of unassessed watercourses are inferred from the behaviour of representative watercourse groups.

17 Assessment of effects – freshwater

The construction and operation of the Project can influence freshwater ecosystems through a variety of mechanisms typical of large-scale roading projects. This assessment considers all reasonably foreseeable effects on watercourses, aquatic habitats, and freshwater biota within the ZOI. The effects evaluated include:

- Physical modification of watercourses, including permanent stream realignment, reclamation, and temporary diversions and culverts.
- Changes to fish passage and connectivity, arising from the replacement or installation of structures.
- Temporary instream disturbance, including the potential for fish injury or mortality during dewatering and construction activities.
- Sediment discharges and turbidity, resulting from earthworks and vegetation removal.
- Temporary hydrological changes, such as altered flow paths or pumped diversions.
- Concrete and alkaline discharges, arising from construction activities near waterways.
- Operational stormwater quality effects, including contaminants generated by road use.

- Operational hydrological effects, including changes to peak flows and flow variability.

These effects have been assessed using the EIANZ ecological impact framework that considers (1) the ecological value of each affected watercourse, (2) the magnitude of change introduced by the Project, and (3) the overall level of ecological effect. While the degree of construction-related disturbance varies between watercourses, the scale and significance of effects depend primarily on the existing ecological condition and the extent of physical change proposed.

Additionally, the assessment of effects presented in this section reflects a best practice construction scenario, including standard industry measures such as erosion and sediment control, fish salvage, and flow diversion. These measures represent typical practice for infrastructure of this nature. Additional project-specific management measures are outlined in Section 18.

17.1 Construction effects – freshwater

17.1.1 Stream realignments

Stream realignment is required where the highway footprint intersects existing watercourses such that the affected watercourse requires a 'new' path. Stream realignment is required for Kōpūrerua, Nānako, and Belk Road streams. Design work has been undertaken for the stream realignments as shown in [Ecology Mapbook Supplement Volume 4 – Wetlands - Watercourses]. The outcomes for the stream alignments will be addressed in the conditions of consent, providing certainty as to the general ecological outcomes of these realignments.

The realignment process will replace the existing channels (the highly modified Kōpūrerua and Nānako watercourses plus recently established 'offset' channels in the Belk Road area constructed as part of the Tauriko Business Estate (TBE) development) with a newly constructed reach where they intersect the Proposed Designation. The new stream reaches will initially lack the geomorphic maturity, hydraulic diversity, riparian shading, and hyporheic connectivity of the original streams. Habitat features such as pool–riffle organisation, marginal shelves, root mats, and undercut banks can be lost during construction, and fine sediment may be mobilised during channel excavation and transition/livening works.

The proposed realignments have been conceptually designed to reinstate key aspects of natural stream form and function, including appropriate channel geometry, sinuosity, and floodplain interaction. The resulting channels will operate at low, non-eroding velocities and incorporate a range of geomorphic features such as runs, pools and vegetated margins, providing increased habitat diversity and improved conditions for native freshwater species. In particular, the approach is expected to increase the extent and availability of spawning habitat for banded and giant kokopu and refuge habitat for all indigenous fish, while maintaining or enhancing fish passage through appropriate depth and velocity conditions. Compared to the existing highly modified and simplified channels, the realigned streams are expected to support healthier, more resilient, and more diverse aquatic ecosystems over time.

Where these conditions are achieved through detailed design and implementation, the magnitude of effect is expected to be:

- **Positive** in the medium to long term; and
- **Low** in the construction phase to short term (accounting for a minor shift from the existing baseline and having a minor effect on aquatic populations and range of habitats within the wider catchments).

However, a more uniform or over-simplified/hard engineered reach than described above may result in a **Moderate** magnitude of ecological effect due to the loss of natural hydraulic and structural diversity that may be permanent.

The overall length of realigned stream with improved ecological condition, values, etc across the Project is 2,317 m, which is an overall increase in stream length of 326 m (Table 17-1). This includes a 276 m increase in length of the High value Kōpūrerua Stream. There will be an approximate 115 m reduction in stream length in the Belk Road watercourse, where the pre-existing artificially straightened channel cannot be entirely replaced.

Table 17-1: Stream realignment lengths, including length of stream they are replacing.

Watercourse to be realigned	Impacted length (m)	Realignment length (m)	Change in stream length (m)
Kōpūrerua Stream	728	1,004	+276
Nānako Stream	583	748	+165
Belk Road watercourses	680	565	-115
Totals	1,991	2,317	+326

Overall, a positive magnitude of effect on aquatic ecological values results in a **Positive overall level of effect**, regardless of the pre-existing ecological value of the impacted watercourse. While these outcomes are anticipated, they are dependent on detailed design and implementation and therefore conditions of consent are proposed to ensure that the outcomes anticipated are realised.

At the Belk Road catchment scale, a reduction in stream length by 115 m will be discernible; however, the proposed realignment designs will result in an improvement to the underlying character and baseline conditions, including the improvements anticipated by the TBE offset package as it establishes. As a result, the reduction in 115 m of watercourse length in the Belk Road watercourse equates to a **Low** magnitude of effect and a **low overall level of effect**.

17.1.1.1 Culvert daylighting (Belk Road watercourse)

Daylighting will occur on the Belk Road watercourse where the culvert under the existing SH29 is to be removed as part of the Project. This work will allow for the stream realignment to contain no instream structures and is considered a positive ecological outcome as it allows for the re-establishment of natural channel processes, including light penetration, riparian interaction, and substrate development, as well as unobstructed fish passage and improved habitat availability within the catchment. This is a **Positive** magnitude of effect and an overall **Positive level of effect**.

17.1.2 Temporary culverts and stream crossings

Temporary stream crossings, including culverts and other in-channel structures, may be required during construction to maintain access. While these structures are temporary and do not result in permanent habitat loss, they have the potential to affect freshwater ecology through disruption of longitudinal connectivity, particularly for fish passage.

The key potential ecological effect is the temporary restriction of access to upstream habitat at a catchment scale, rather than localised in-stream habitat effects, which are readily remedied following removal of the structure. The magnitude of effect is therefore primarily governed by:

- i. the duration of installation, and
- ii. whether fish passage is maintained.

These are described in more detail below.

17.1.2.1 Crossings in place for short durations (<2 weeks)

Where temporary crossings are in place for short periods (generally less than two weeks), any restriction to fish movement is brief and unlikely to result in measurable ecological consequences.

Mobile species present within the Proposed Designation are tolerant of short-term variability, and upstream habitats remain accessible once the structure is removed. Accordingly, the magnitude of effect on fish passage is **Negligible to Low**, resulting in a **Very Low** overall level of effect across all watercourse groups.

17.1.2.2 Crossings in place for extended durations (>2 weeks)

For crossings that remain in place for longer durations, the ecological outcome is controlled by installation quality and ongoing management.

Well designed, installed, and maintained crossings that achieve appropriate flow depth, velocity, and channel alignment, and that maintain fish passage and accessibility of upstream habitats throughout the construction period are needed. Given that these outcomes are readily achievable using standard design approaches and construction practices, this represents the expected scenario for the Project, resulting in a **Negligible magnitude of effect** and an overall **Very Low level of effect**.

All effects are fully reversible following removal of temporary structures. Accordingly, provided that fish passage is maintained for crossings installed for extended periods, temporary stream crossings represent a low ecological risk within the context of the Project.

17.1.3 Instream Works and Fish Mortality

Dewatering, temporary diversions, and channel excavation can harm fish through stranding, direct injury, or exposure to thermal and oxygen stress. These effects are most consequential in streams containing sensitive or high-density fish populations or where deep pools complicate salvage; however, most watercourses within the Proposed Designation differ from this pattern. Fish communities are dominated by tolerant species such as eels and bullies, with low densities in many modified drains. Channels are shallow and accessible, allowing for effective and comprehensive fish salvage prior to instream works. In the tributaries in the Kōpūrerua catchment, deeper pools require more careful management, but these reaches remain amenable to standard salvage protocols.

As per baseline fauna summaries, Group C have low fish densities, low habitat quality, and low species sensitivity. Group B reaches require more careful salvage but remain manageable due to shallow widths and predictable hydrology.

Where standard salvage protocols are implemented, the magnitude of effect is **Low**. Regardless of the value of the fish species likely to be present (Low-High), the resulting level of effect is **Low**.

17.1.4 Erosion, Sediment Discharges, and Turbidity

Sediment discharges can degrade aquatic ecosystems by reducing clarity, smothering habitat, and altering oxygen dynamics, with effects most pronounced in coarse-gravel streams that depend on clean substrate for spawning and for sensitive macroinvertebrate communities. The receiving environment is dominated by soft-bottom, depositional channels where natural sedimentation rates are already high and tolerant macroinvertebrate taxa are well established. Short-duration sediment pulses associated with construction do not represent a significant departure from baseline conditions.

Receiving environment streams already contain persistent fine sediment, embedded substrates, low hydraulic energy, and macroinvertebrate communities dominated by highly tolerant taxa. These factors strongly limit ecological sensitivity to short term sediment pulses.

The Project will be constructed in accordance with the ESCPs under which the scale and frequency of sediment releases will be appropriately managed. Any discharges that do occur are expected to be localised and short-lived under normal construction practice. Accordingly, the magnitude of sediment-related effects is **Low** in all watercourses except the large Wairoa River, and when combined with the **Low to Moderate** ecological value of affected reaches, the overall level of effect is **Low**. The size and flow regime of the Wairoa River means any sediment-related effects under normal construction practices is likely to equate to a **Negligible** magnitude of effect (change barely distinguishable), resulting in a **Low** overall level of effect on the Wairoa River.

17.1.5 Concrete / Alkaline Contamination

Concrete washout and slurry can rapidly elevate pH to levels fatal to fish and invertebrates. However, concrete works will be managed using standard isolation and containment methods, typically undertaken in dry or diverted conditions to avoid contact with flowing water. Because this risk is well understood and effectively managed through standard construction protocols, the magnitude of effect is **Negligible**, and the overall level of effect is **Negligible**.

17.1.6 Temporary Flow Alteration and Dewatering

Flow diversions can temporarily alter habitat conditions, expose substrate, or compress fish into limited pools. In the Tauriko setting, such diversions will be brief and spatially constrained, occurring in channels already characterised by variable hydrology and modest ecological value. Under standard construction practice, including fish salvage and appropriate sequencing, the magnitude of effect is expected to be **Low**.

Across Group C, hydrological variability, low habitat complexity, and the dominance of tolerant fish species further reduce ecological sensitivity to temporary flow manipulation.

17.2 Operational Effects

17.2.1 Stormwater Quality

Road stormwater typically contains copper, zinc, hydrocarbons, and suspended solids, which can impair aquatic ecosystems over time. Many waterways within and downstream of the Proposed Designation currently receive unmanaged runoff from the existing SH29/SH29A corridor and surrounding land uses. The Project includes treatment wetlands, swales, and attenuation devices that will treat and moderate runoff before discharge into receiving waterbodies. The ecological sensitivity to operational stormwater effects varies with the baseline condition of each stream. Receiving environments in the waterways in Groups A and B (see section 16 above) exhibit higher ecological value and stronger biological function. Watercourses in Groups C already experience high contaminant loads, low hydraulic diversity, and degraded ecological integrity.

Because the receiving environments are already degraded, and the Project introduces significant treatment where none exists today, the magnitude of operational water-quality effects is **Negligible to Positive**. When combined with the **Low to Moderate** ecological value of most receiving waterways, the overall level of effect is **Negligible**, trending to **Positive** where treatment improves current water quality.

For high-value Group A receiving environments (Wairoa River and Ōmanawa River), stormwater discharges will be treated, attenuated, and delivered in a manner consistent with regional stormwater standards. Given the scale of these rivers relative to proposed discharges, and the effectiveness of treatment devices, operational effects remain negligible. For Group B tributaries, treated stormwater discharges are not expected to adversely affect the naturalised system. For Group C watercourses, the proposed stormwater treatment is likely to improve water quality compared with existing conditions, as runoff currently receives little, if any, treatment before entering these catchments.

17.2.2 Hydrological Regime Changes

Impervious surfaces increase peak flows and reduce lag time during rainfall events, potentially increasing erosion potential. However, the Tauriko streams are naturally flashy due to their modified form, and attenuation devices will reduce peak flows to within current variability. Realigned streams with vegetated banks may be more resistant to erosion than current degraded channels.

Across Group C, which exhibits simple channel form, uniform substrate, and limited riparian shading, hydrological variability is already a defining feature of stream behaviour. Any incremental changes associated with operation occur well within natural variability.

For Group B tributaries, attenuation moderates peak discharge sufficiently to avoid meaningful hydrological stress on pool–run structure.

Group A rivers, given their scale and hydraulic capacity, are not sensitive to the modest stormwater contributions generated by the Project.

As a result, the magnitude of hydrological effects is **Low**, and given the **Low to Moderate** ecological value of affected streams, the level of effect is **Low**.

In summary, typical attenuation and treatment measures will ensure that operational stormwater hydrology interacts with all watercourse groups in a way that does not change ecological functioning or instream processes beyond existing variability.

17.2.3 Long-Term Fish Passage

Because existing potential barriers will be removed (Belk Road watercourse culvert under existing SH29) or upgraded (through stream realignments), the Project is likely to improve, and at the very least will not make worse, longitudinal connectivity across multiple sub-catchments. The magnitude of effect is therefore like to be **Positive**. This improvement will be most consequential for Group B natural tributaries, where restoring or improving connectivity enhances access to spawning and rearing habitat. In Group C modified natural channels, upgraded fish passage removes existing constraints without creating new ones. In artificial watercourses (across Group C), the ecological benefit will be modest but still positive. Although habitat quality remains poor, improved passage allows mobile species such as tuna (eels) to make opportunistic use of habitat during favourable hydrological conditions. Bridges in Group A and B streams prevent any barrier effects in the highest-value watercourses.

Overall, fish passage outcomes represent an ecological gain/improvement across all watercourse groups.

17.3 Summary of unmitigated freshwater effects

Table 17-2 summarises the construction and operational effects before the application of the effects-management measures set out in Section 18. The measures outlined in Section 18 provide a framework to ensure that these good practice assumptions are consistently achieved during detailed design and construction. This ensures a clear distinction between assessed effects (pre-mitigation) and the residual effects that remain once mitigation and management are applied

Table 17-2: Summary of the magnitude and overall level of ecological effects before application of additional effects-management measures (described in Section 18)

Watercourse Group	Ecological Value	Construction Effects (Pre-Mitigation)	Operational Effects (Pre-Mitigation)	Magnitude of Effect (Pre-Mitigation)	Overall Level of Effect (Pre-Mitigation)
Group A – Receiving environments (Wairoa River, Ōmanawa River)	High – Very High	Instream effects avoided entirely through bridging; only minor, localised riparian removal at abutments. Risk of construction earthworks related sediment discharge.	Treated stormwater discharges negligible relative to river scale; no measurable hydrological or behavioural effects.	Negligible to Low	Very Low to Low

Watercourse Group	Ecological Value	Construction Effects (Pre-Mitigation)	Operational Effects (Pre-Mitigation)	Magnitude of Effect (Pre-Mitigation)	Overall Level of Effect (Pre-Mitigation)
Group B – Realigned streams (Köpürerua Stream, Nānako Stream, Belk Road watercourses)	Moderate – High	Localised channel modification or realignment. Magnitude Low–Moderate depending on realignment quality. Temporary sediment and diversion effects Low.	Stormwater treatment and attenuation ensure negligible contaminant and hydrological effects.	Low to Positive	Low to Positive
Group C – Modified natural and artificial unnamed watercourses	Low - Negligible	Small-scale physical modification (culvert extensions, diversions) in already degraded habitat; Low magnitude. Sediment effects Low; fauna tolerant.	Stormwater inputs largely improved relative to baseline; ecological sensitivity low. Hydrological effects negligible.	Negligible to Low	Very Low

18 Management of effects – freshwater

18.1 Management of effects approach

The assessment presented above identifies that potential ecological effects on aquatic environments are generally Low to Very Low across the Project, with potential positive effects relating to the proposed stream realignments. These higher magnitude effects will be addressed through the detailed engineered design of the realigned channels, to achieve stable hydraulic conditions and to enhance ecological function relative to the existing highly modified environments. As such, the effects of the stream realignments will be appropriately managed so as to secure the proposed outcomes.

For the remaining Project components, potential ecological effects are assessed as Low to Very Low in the absence of mitigation. In accordance with EIANZ guidelines, such effects are typically not considered to be ecologically meaningful at a population or ecosystem scale and would not ordinarily require mitigation.

Notwithstanding this, a set of precautionary effects management recommendations is provided below to ensure that ecological outcomes remain consistent with those assessed, particularly

where design refinements or construction-related changes may occur. These recommendations are intentionally scalable and adaptable, enabling them to respond proportionately to any change in the nature or extent of works while maintaining effects within the assessed Low to Very Low range.

The recommended measures are designed to be practical, transparent, and readily implemented, avoiding unnecessary complexity while providing confidence that potential effects will be appropriately managed under a range of reasonable design scenarios. In this context, the focus is on achieving reliable and proportionate ecological outcomes, rather than applying prescriptive or overly complex mitigation frameworks that may not be warranted given the generally low level of effect anticipated.

18.2 Management of construction effects – freshwater

18.2.1.1 Stream realignment design recommendations

The Project will result in approximately 2,310 m of open realigned stream channel that will provide perennial aquatic habitat. This is an overall increase of approximately 377 linear meters of perennial stream habitat over and above the current environment.

As stated in section 17.1.1 above, there will be an approximate 115 m reduction in stream length in the Belk Road watercourse, where the existing (including the artificially straightened channel within the TBE offset area) cannot be entirely replaced (the other channels in the TBE offset area are accounted for in the stream realignment). This channel is part of the TBE offset package, with riparian planting of the channel designed to improve instream function and values. The proposed Belk Road stream realignment will result in improved aquatic ecological values and conditions than is likely to be realised under the conditions of consent applying to TBE offset package. There will be a localised **positive ecological effect**, with the 115 m shortfall in stream **length** offset by the estimated 304 m increase in stream length in the Kōpūrererua Stream. The considerable improvement in aquatic values, complexity, and available aquatic habitat area in the Kōpūrererua Stream compared to what is likely to ever eventuate in the Belk Road watercourse as part of the TBE offset justifies a 1:1 stream length ratio.

With considered stream design, the Project has the opportunity to not only provide an overall increase in stream length but also return improved aquatic conditions and habitats. This includes potential spawning and habitat opportunities for aquatic fauna that are currently not found within and near to the affected reaches.

The indicative stream realignment designs and the conditions of consent will ‘lock in’ outcomes for the morphology and indication of instream, floodplain, and riparian vegetation. An appropriately qualified freshwater ecologist should be included as part of the Project design/construction team for the stream diversions. The diversions should also include, to the extent practicable and/or appropriate:

- Diverse instream habitat, including (where possible/suitable), sequences of riffles (if gradient allows), runs, pools, woody debris and overhanging riparian vegetation.
- Maintenance or enhancement of a varied depth profile with sufficient depths for the expected faunal assemblages (minimum summer low-flow surface water depth of 200 mm).
- Dense riparian vegetation that is, where practicable, a minimum of 10 m wide. If the riparian corridor encroaches on pre-existing wetland habitat, this wetland should be

retained and only enhanced/vegetated if deemed appropriate by a suitable qualified wetland ecologist and/or of the wetland effects management package recommends it.

- Minimising erosion protection elements that comprise hard engineered solutions (i.e., rock armouring) on the banks and beds (with the preference to avoid any armouring of the beds).
- If rock armouring is required, do not line it with geotextile material other than where/if culverts are proposed.
- Keep any shared paths and/or maintenance tracks at least 15 m from the bankfull edge of the realignments, ensuring vegetation is present between any path/track and the realignment.

We recommend the final stream creation designs be detailed in a Stream Realignment Plan, with each stream realignment being addressed individually to avoid 'generic' designs being adopted. The Stream Realignment Plan should also include a detailed installation process and methodology to ensure the improvements to aquatic habitat expected from the design have achieved through construction and implementation.

The potential benefits to aquatic habitat as part of the stream realignments rely on suitable design and appropriate installation. Therefore, to ensure the potential improvements to aquatic habitat as a result of the Project are realised, a detailed installation process and methodology is recommended to be captured in the Stream Realignment Plan. We recommend the stream creation installation process include input and direction from a suitably qualified and experienced aquatic ecologist, including in the design, pre-installation, installation, and post-installation phases, and include requirements for ecological sign-off following completion. Success monitoring for a minimum of 5 years following installation is also recommended to ensure long-term successful operation, with further monitoring to be informed by the results of the 5 years of monitoring.

With appropriate aquatic ecological habitat remediation, this will result in a **positive magnitude of effect across the Project**.

18.2.1.2 Stream Realignment Plan

A Stream Realignment Plan should be prepared and implemented to provide a realignment design process and achieve the intended ecological outcomes. In addition the Stream Realignment Plan should include aims and outcomes for each of the proposed realignment sites.

The Stream Realignment Plan should include (but not be limited to):

- Success measurement(s) that utilises freshwater fish and macroinvertebrate community data to assess whether the stream realignments replace or, ideally, improve aquatic ecological values.
- A process in the event stream restoration, diversion, and/or enhancement has not been successful.
- Methods for assessing fish passage provision through the stream realignments.
- Qualitative assessment of the riparian margin planting to measure success in relation to functional benefit to the stream environment.

The Stream Realignment Plan should include success monitoring requirements and criteria, including providing a pathway or framework for ecological offsetting should the required

ecological outcomes not be realised and residual effects are identified that require management. This should include assessment of potential residual effects at the pre-installation and post-installation phases as well as allowing a path for ecological offsetting to occur if success monitoring shows achieving the outcomes is unlikely (i.e., allow for assessment of potential residual effects at the 5-year success monitoring mark with the option of ecological offsetting to address any identified residual effects that are determined to need management).

18.2.2 Fish passage provision through temporary culverts

Temporary culvert installation is likely to facilitate construction progress and vehicle movement. Poorly installed temporary stream crossings, particularly culverts, can result in partial or total fish passage impediment either by way of increased velocities (e.g., 'pinched' flows) or perched outflows. If temporary crossings are in place for 2 weeks or less, then no fish passage provision is required as the impact to the wider fish population/community is like to be immeasurable. However, temporary crossings that are in place for more than 2 weeks will require fish passage provision on all natural watercourses. If fish passage cannot be provided and/or monitoring suggests a fish impediment has established following installation, then trap and transfer measures during key migration stages may be required.

Managing potential impacts on fish passage relies on suitable design and appropriate installation. Therefore, to ensure fish passage is provided through stream crossings in place for greater than 2 weeks, a detailed installation process and methodology is recommended to be captured in a Stream Realignment Plan that targets construction phase stream management. We recommend the culvert/crossing installation process include input and direction from a suitably qualified and experienced ecologist, including at the design, pre-installation, installation, and post-installation phases, and include requirement for ecological sign-off following completion of the installation phase. For any temporary culvert in place for greater than one year, visual inspection of each structure is required prior to the spring (galaxiid) and summer (eels) peak migration periods. If impediments are observed, remediation action should occur so unimpeded passage is reestablished prior to the peak migration periods.

Provided that appropriate temporary culvert design and installation is implemented, there will not be any construction phase effects on fish passage. In the absence of a 'no effect' outcome in the EIANZ guidelines, this best equates to a **Very Low** overall level of effect.

18.2.3 Fish and kākahi rescue and relocation to avoid/minimise injury / mortality

Instream works (including dewatering, structure installation, etc) during construction have the potential to cause injury and / or mortality to native aquatic fauna, including fish and kākahi (if present), unless they are relocated prior to impact. A fish and kākahi (if present) salvage and relocation protocol is recommended to be included in an Aquatic Fauna Management Plan, which includes the process to be followed to ensure salvage occurs prior to impact. These protocols should allow flexibility so that salvage methods can best adapt to the flows, conditions, and species present rather than a prescribed process/methods that may not achieve best outcomes if followed explicitly.

Overall, assuming aquatic fauna rescue occurs, the Project is likely to have a **Negligible** magnitude of effect on existing aquatic fauna populations with respect to mortality, resulting in an overall Very Low level of effect for all Negligible to High value species and a Low level of effect for Very High value species (inanga/lamprey).

18.2.4 Monitoring of receiving environments during construction

Earthworks across the Project have the potential to temporarily reduce the water and habitat quality of the receiving environments (i.e., the downstream reaches of the impacted watercourses) through erosion and sediment runoff. Best practice erosion and sediment controls are proposed in the draft conditions which would reduce sediment discharge into the freshwater receiving environments. However, there remains a risk of erosion and sediment control failure. Therefore, receiving environment monitoring is recommended during construction. Given the scale of earthworks in each catchment, distance to receiving environment, and the existing condition of the receiving environment, monitoring is only recommended in Kōpūrerua Stream.

No active monitoring is recommended in Ōmanawa River due to the minimum earthworks in this catchment or in Wairoa River itself due to the size of the water and complexity of monitoring and difficulty in attributing potential changes to the Project given the size of its catchment.

The following should be monitored in the Kōpūrerua main stem, downstream of any potential Project inputs, beyond the zone of reasonable mixing, and upstream of any potential Project inputs:

- Quarterly baseline monitoring for a minimum of one year.
- Biannual monitoring for the duration of works occurring in the catchment.

Given the pre-existing soft-bottom substrate in Kōpūrerua Stream, the quarterly and biannual monitoring should focus on macroinvertebrate community analyses.

We recommend the specific details of the monitoring regime be detailed in the consent conditions, which includes, but is not limited to:

- Trigger values developed following baseline monitoring.
- Rainfall event-based monitoring to confirm efficacy of sediment control devices during and following heavy rainfall.

Overall, with the design and implementation of a robust erosion and sediment control plan, the likely magnitude of effect of erosion and sediment control discharges from the Project during construction on water quality and habitat will be **Negligible**.

18.2.5 Contaminant release – concrete

Pre-cast concrete should be used within and near watercourses where practicable. However, if this cannot be achieved and *in situ* concrete pouring is required, measures need to be put in place (similar to erosion and sediment control measures) to completely isolate downstream/downslope aquatic systems from any area where concrete is being used. This can include the diversion of flows to ensure concrete pouring is occurring in a 'dry' reach.

Avoiding pouring concrete in flowing water and from ensuring wet concrete cannot ensure nearby watercourses will result in a **Negligible** magnitude of ecological effect.

18.3 Management of operational effects – freshwater

18.3.1 Fish passage provision

The Project includes the establishment of new stream realignments. The Indicative Design for these realignments aims to maintain and, where practicable, enhance fish passage through the incorporation of appropriate channel gradients, minimum water levels, instream habitat complexity, and provision for riparian margins that may support spawning for relevant species. As such, the realigned channels are not anticipated to pose barriers to upstream or downstream fish movement under normal flow conditions.

For the stream realignments, while the overall gradient and alignment will be designed to facilitate fish passage, there is a potential risk that, in very low gradient sections, fish passage may be indirectly compromised over time. Specifically, low-flow velocities may promote the accumulation of fine sediment and/or proliferation of nuisance macrophytes, which could reduce flow conveyance and / or water depths which result in localised passage impediments for some species, particularly during key migration periods.

To address these potential risks and uncertainties, a monitoring approach is recommended for 2 years following completion of each stream realignment to monitor as the reaches 'naturalise'. This approach should be incorporated into the Stream Realignment Plan and include the following components:

- Routine visual inspections of all realigned channels (and any installed culverts), undertaken at least annually for a minimum of 5 years or until the realignment is considered stable and 'naturalised' by a SQP, with a preferred timing in late winter prior to key fish migration periods. These inspections should assess:
 - Evidence of sediment accumulation or aggradation
 - Presence and extent of macrophyte growth
 - Channel form stability and maintenance of designed gradients
 - Any physical barriers or conditions that may impede fish movement.
- Triggered ecological monitoring, whereby if visual inspections identify conditions that may restrict fish passage, targeted fish surveys are undertaken during peak migration periods (generally spring to summer). These surveys should be designed and implemented by a suitably qualified and experienced freshwater ecologist and may include methods such as electrofishing or spotlighting, as appropriate to site conditions.
- Management responses, which may include selective sediment removal, macrophyte management, or minor channel regrading where monitoring identifies that fish passage is likely being compromised.
- Design and construction oversight, particularly if culverts are required at later design stages, including input from a suitably qualified ecologist during detailed design and installation, and ecological sign-off following completion.

Adoption of this approach will provide a mechanism to identify and address any unforeseen operational issues affecting fish passage and will reduce the likelihood of long-term adverse effects. If implemented, and the stream realignments are in general accordance with the proposed designs and the recommendations in section 18.2.1.1, the Project will have an overall Very Low level of effect on fish passage.

These considerations are also relevant to the Project's obligations under the Freshwater Fisheries Regulations, which require the provision of fish passage unless otherwise authorised.

18.3.2 Stormwater discharge

Stormwater entering the waterways from the Project once operational has the potential to reduce the water quality of the watercourses due to the presence of roading contaminants within the stormwater. The conditions of consent will ensure that best practice stormwater treatment is implemented to reduce the discharge of contaminants into the freshwater receiving environments.

The magnitude of effect on ecological values from operational stormwater discharges is assessed as being **Negligible** if such water sensitive design measures are adopted.

18.4 Sensitivity testing of indicative alignment

The freshwater values within the Proposed Designation are generally not highly sensitive to small-scale alignment or design changes to the Indicative Design. This is because the majority of affected watercourses across the Proposed Designation exhibit very consistent physical and ecological conditions, characterised by straightened channels, soft-bottom substrates, low hydraulic complexity, and aquatic communities dominated by tolerant species. Where alignment shifts occur within these areas, the type and scale of ecological effects would typically remain the same, with effects essentially relocating rather than increasing.

These watercourses correspond to Group C (modified natural and artificial unnamed watercourses). Their uniform physical condition, limited hydraulic function, and dominance of tolerant macroinvertebrate and fish communities mean that small positional changes in culverts, diversions, or short realignments do not meaningfully alter ecological sensitivity or the magnitude of effect. In these systems, ecological effects are governed far more by construction methodology than by precise location.

Only a limited number of watercourses contain sections of moderate ecological value. In these locations, shifting a culvert or realignment upstream or downstream may alter the localised magnitude of habitat modification. Even so, changes remain within the same general effect category, because the stream morphology and habitat condition are still relatively consistent over short distances. Ecological realignment design (e.g., appropriate bedform, roughness, shading, and width–depth ratios) is the factor that most strongly controls ecological outcomes, and this design can be applied regardless of precise location.

Watercourses corresponding to Group B (Moderate-High value natural streams), have higher ecological sensitivity than Groups C. However, substrate conditions, hydrology, and riparian structure remain sufficiently consistent within short reaches that reasonable shifts in alignment do not create new effect types or increase ecological significance. Instead, the quality of the engineered realignment governs the success of ecological outcomes.

For fish passage, sensitivity is driven by culvert geometry rather than location. Even if a culvert shifts into slightly steeper terrain, NES-F and NIWA guidelines constrain design such that no complete barrier can be created. As a result, the magnitude of effect may vary slightly (e.g., from Low to Moderate), but the level of effect stays within the effects envelope.

This applies to both Group B and Group C waterways where culverts may be present. In Group A and Group B waterways spanned by bridges, no sensitivity arises because instream works are avoided entirely.

Sediment, hydrology, and stormwater quality effects are even less sensitive to alignment changes, because they are governed by controls, treatment design, and catchment-scale processes rather than by small differences in structure placement. With attenuation devices, sediment controls, and water treatment in place, these effects remain at or below the levels assessed, regardless of alignment refinements.

Overall, no plausible alignment movement or refinement of the design within the Proposed Designation would increase the freshwater ecological effects beyond what has been assessed, nor change the effects management requirements, provided stream realignments are provided for any Moderate Value system.

19 Freshwater ecology conclusion

The freshwater environments within the Proposed Designation comprise a network of highly modified artificial channels, modified lowland streams, and larger river systems including the Wairoa and Ōmanawa Rivers. Ecological values generally increase with watercourse size, habitat complexity, and connectivity to the wider catchment. The highest freshwater ecological values are associated with the Wairoa and Ōmanawa Rivers, which provide important aquatic habitat and migration pathways for indigenous fish species. Moderate ecological values are associated with the Kōpūrerua Stream, Nānako Stream, and the Belk Road watercourses. In contrast, many of the smaller artificial and highly modified channels provide limited habitat diversity and support comparatively low ecological values.

The Project will result in temporary and permanent effects on freshwater environments associated with stream realignment, instream works, temporary disturbance of stream beds and banks, sediment generation, contaminant risks, temporary fish passage disruption, and changes to channel form and hydrology. However, the majority of direct works are focused on modified lowland streams and artificial channels, while the highest value receiving environments, including the Wairoa and Ōmanawa Rivers, will generally be avoided through the use of bridge structures and other design measures. The proposed stream realignments include measures to improve channel morphology, habitat diversity, riparian condition, and fish passage relative to existing conditions.

A comprehensive package of freshwater management measures has been developed to avoid, minimise, remedy, and where necessary offset potential adverse effects. These measures include erosion and sediment controls, fish salvage and relocation, management of temporary stream crossings, protection and maintenance of fish passage, stormwater treatment, riparian restoration planting, ecological monitoring, and adaptive management. Stream realignment designs incorporate habitat-forming features and are supported by riparian planting and monitoring requirements intended to promote the establishment of ecologically functional watercourses over time. The proposed management framework also provides flexibility to respond to detailed design refinements while maintaining the ecological outcomes identified in this assessment.

With implementation of the proposed freshwater management measures, residual effects on freshwater ecological values are expected to be predominantly very low to low. In several locations, particularly where stream realignments replace highly modified channels, the Project is expected to result in improvements to aquatic habitat quality, fish passage, riparian condition, and overall stream function. Overall, the assessment concludes that adverse effects on freshwater ecology can be appropriately managed and that the Project is capable of achieving

no net loss of freshwater ecological values and function, with opportunities for localised ecological enhancement and positive effects in freshwater habitat values within parts of the wider catchment.

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Appendix 1: Assessment methods

The absence of a proposed Condition 1 (i.e., no in general-accordance requirement) means an effects envelope must be established. To do this, the Indicative Design was used to estimate the likely extent and nature of the Project effects within the Proposed Designation. Where potential effects are of a level where mitigation is required, scalable effects-management measures have been recommended that can scale commensurate with the actual extent of effects of construction. Where a fully scalable effects-management response would not be appropriate, recommendations have been made for conditions that set explicit limits on allowable effects.

1. Terrestrial ecology

1.1. Terrestrial vegetation survey

The Proposed Designation was initially surveyed 15-17 December 2025. It was then revisited on 18 December 2026 and 15-16 March 2026 in response to changes in the earthwork footprint. We walked the sites using geo-referenced aerial maps on a tablet to navigate to areas that appeared to have vegetation other than pasture (based on aerial maps). We surveyed the entire Proposed Designation for plant species and composition. No quantitative vegetation studies were undertaken (i.e., transects or quadrats) as the vegetation potentially impacted is largely limited to modified and disturbed early seral plant communities primarily consisting of non-native vegetation. Therefore, for the purposes of determining potential ecological impact, the assessment did not require detailed quantitative vegetation composition information. Given the site's evident disturbance history and modified condition, we judged that the risk of not discovering habitat specialist (species specialised to live in rare or unique habitats) or rare species in the absence of a more detailed site investigation was minimal.

The detail of the vegetation mapping responded to the land use present. In many areas where there were large tracts of horticultural land such as kiwifruit and avocados, the area was broadly mapped, while areas with more complexity were mapped in more detail.

1.2. Terrestrial fauna

1.2.1. Herpetofauna

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 elusive behaviour/activity patterns. As such, even an intensive lizard survey cannot reliably detect a representative population within a given sample area and may fail to detect any of the lizards present. Surveys may be able to confirm the presence of high-density populations but cannot confirm absence of low-density cryptic species (Anderson et al., 2012).

Native lizards often occupy habitats of otherwise low ecological value (i.e. weedy vegetation and vegetation margins) (Anderson et al., 2012). Therefore, to attribute ecological value to habitat for this assessment, we considered the threat status (following Hitchmough et al. (2026)) of the likely and potential herpetofauna species present in the Western Bay of Plenty, based on habitat preference, pest animal presence and site disturbance history.

We deployed artificial cover objects (ACOs) over the Proposed Designation to survey, primarily for ground dwelling skinks,³⁶. The ACOs we used for this assessment were composed of Onduline® material and typically measured 400mm by 400mm. Image 1 (on subsequent page) shows an example of an ACO that was deployed on site.

We deployed the ACOs following methods outlined in Lettink & Monks (2016) and modified to suit assessment objectives and site habitat coverage. The Ecology Mapbook Supplement Volume 2 – Herpetofauna – ChiropteroFauna shows the locations where ACOs were deployed. We deployed all ACOs as double layers. ACOs were deployed in areas that we identified as having habitat features preferred by native lizards (specifically ground dwelling skinks) including complex vegetation cover, woody debris, deep leaf litter, and long grass (Image 1). ACOs were left on site for three months following deployment.

We deployed a total of 45 ACOs (five at each site) within areas of potential habitat on 24 October 2025, and then checked for lizards, scat and slough three times on 20 January, 02 February, and 11 March 2026, when weather was suitable³⁷.

We made no attempt to capture or pursue lizards seen taking refuge under the covers, and surveys relied on visual identification of lizards.

A specific arboreal/nocturnal lizard survey was not undertaken as no good quality arboreal habitats were identified, and because reliable detection of these species is not practically feasible given the densities typically found in this landscape.



Image 1: Example of a double-layered ACO that was deployed alongside SH29A

³⁶ Initial visual site assessments and previous experience in similar habitats determined this was the most likely type of native lizard present in the landscape.

³⁷ While surveys should be carried out during the warmer months when lizards are their most mobile, ACOs should not be checked during hot/sunny weather as they become too hot and are unlikely to be occupied. As such, surveys were carried out on mild, overcast days to increase the likelihood of occupancy.

1.2.2. Avifauna

1.2.2.1. Desktop review

A desktop investigation was conducted and included a review of scientific literature, relevant statutory documents, relevant published and unpublished reports, ecological assessments for other developments within or near the Proposed Designation and reputable websites (including eBird) to find information on avifauna within the Proposed Designation and immediate surround. Data were also collated from the NZ Bird Atlas online effort map³⁸ 10x10 km grid squares that encompass the Proposed Designation and immediate surrounds (AL79 and AM79).

1.2.2.2. Site investigations

Five-minute bird counts were conducted at 12 locations within the Proposed Designation (refer to the Ecology Mapbook Supplement Volume 3 – Avifauna). Sites were selected that provided good coverage of the Site, encompassed different vegetation types and habitat features present on Site (e.g., pasture, shelterbelts, wetlands, ponds, other vegetation), could be safely accessed and were not too noisy (e.g. roadsides were avoided). Between 15 December 2025 and 27 February 2026 each survey location was surveyed twice, once in the morning and once in the afternoon to account for temporal variation in bird activity. The surveys were preceded by a five-minute stand down period and followed the standard 5MBC count methodology (Dawson & Bull, 1975).

Records were kept of any bird species incidentally observed outside of the formal bird survey periods. A roaming inventory was also compiled of all bird species seen and heard during the botanical surveys.

The ecological value of the vegetation within the Proposed Designation was assessed for its potential to provide habitat for indigenous birds. Factors considered included:

- The size, complexity, condition, and diversity of the habitats present;
- The age / maturity of vegetation assemblages; and
- Connectivity of habitats to other habitats (particularly high quality habitats) outside of the Proposed Designation.

1.2.3. Bats

1.2.3.1. Desktop survey

Local bat records were identified from the Department of Conservation Bat Observations Map³⁹. Additional ecological reports from nearby projects were reviewed.

1.2.3.2. Acoustic survey

An acoustic survey specific to this project was undertaken during December 2025 and January 2026 using 11 full spectrum Song Meter Mini Bat 2 acoustic recorders at the locations shown in the Ecology Mapbook Supplement Volume 2 – Herpetofauna – Chiropterofauna.

The habitat within and adjacent to the project footprint is a mosaic of residential and commercial use, native bush, exotic species, roadside grass verges, and agricultural land.

³⁸ Atlas Effort Map – New Zealand Bird Atlas (ebird.org). Accessed October 2025.

³⁹ https://docnewzealand.shinyapps.io/bat_shiny/

Not all areas of potential habitat that could be impacted were accessible, and the survey was confined to locations that could be accessed from the roadside. Mature trees and waterways were targeted as these are often used preferentially by bats to forage.

Data was analysed using Kaleidoscope Pro.

2. Wetland ecology

Preliminary wetland surveys were conducted on 23 January and 2 February 2026. Of note, the preceding spring and early summer periods had high rainfall potentially affecting wetland extents due to fluctuations between wet and dry seasons.

Wetland assessments have been undertaken for other projects, with many areas crossing over with the current SH29 Proposed Designation. Where this has been the case, those wetlands descriptions have broadly been used, with additional site visits being undertaken to confirm descriptions and extents.

Where we determined an assessment of the presence and extent of wetlands was required, the wetland delineation method followed the protocols outlined by the Ministry for the Environment (Ministry for the Environment, 2025), which is incorporated within the National Policy Statement for Freshwater Management (NPS-FM). This method relies on vegetation plan sampling and hydrophytic vegetation determination tool outlined within the Wetland delineation protocols (Ministry for the Environment, 2022), as well as an assessment of the presence of hydric soils and wetland hydrology.

We only carried out plots when they assisted in the evaluation and delineation of potential wetland areas and generally did not carry them out where the vegetation encountered passed a rapid test for wetland delineation (all dominant species are obligate or facultative wetland species).

Where the extent of wetlands were not well defined by topography and reasonably abrupt vegetation changes, delineation plots were conducted to confirm the boundary of wetland features.

The wetland indicator rating status for each plant species follows Clarkson et al. (2021). The meanings of these classifications are as followed (taken from Clarkson (2013)):

- OBL: Obligate. Almost always is a hydrophyte, rarely in uplands (estimated probability >99% occurrence in wetlands)
- FACW: Facultative Wetland. Usually is a hydrophyte but occasionally found in uplands (estimated probability 67–99% occurrence in wetlands)
- FAC: Facultative. Commonly occurs as either a hydrophyte or non-hydrophyte (estimated probability 34–66% occurrence in wetlands)
- FACU: Facultative Upland. Occasionally is a hydrophyte but usually occurs in uplands (estimated probability 1–33% occurrence in wetlands)
- UPL: Obligate Upland. Rarely is a hydrophyte, almost always in uplands (estimated probability <1% occurrence in wetlands)

There are areas within the Proposed Designation that have a long history of disturbance and productive agricultural land use. These should be considered significantly disturbed and be problematic for wetland delineation following the NPS-FM protocols. Therefore, we note that our interpretation of “significantly disturbed” was where there were clear and recent indicators of disturbance to the soil or hydrology, rather than an alternative broader interpretation of historic land use change and disturbance.

Our final mapping of the wetlands used plot information, contours, vegetation types, and previously mapped wetland areas to delineate the wetland features.

No wetlands identified were excluded on the basis of being artificially constructed nor under the pasture exclusion within the NPS-FM – therefore, having not been needed, the methods for confirmation these exclusions have been omitted from this section.

3. Freshwater ecology

3.1. Overview

This assessment has been undertaken to describe the freshwater ecological environment within the ZOI, to assign ecological values to identified watercourses, and to assess the potential effects of the Project on those values. The methodology has been developed to be fit-for-purpose, recognising both the scale of the Project and the characteristics of the receiving environment.

In contrast with some ecological assessments that rely heavily on new field data collection, this assessment is primarily based on a comprehensive review of existing information, supported by targeted field verification. This approach reflects the fact that a substantial amount of relevant ecological information already exists for the ZOI, and that the freshwater environment is generally well understood, particularly in terms of its physical condition and ecological function.

The overall approach follows a standard ecological impact assessment framework, consistent with the Environmental Institute of Australia and New Zealand (EIANZ) guidelines and applied in a manner similar to recent large-scale infrastructure projects. In practical terms, the assessment involves three key steps:

1. characterising the existing environment using available information and field observations;
2. assigning ecological values to watercourses based on recognised criteria; and
3. assessing the magnitude and overall level of effects arising from the Project.

3.2. Information Sources

The assessment draws on a wide range of existing information sources to establish the baseline freshwater environment. These include regional datasets such as watercourse mapping, previous ecological assessments undertaken within the wider Tauriko West area and Kōpūrerua Valley, and TCC State of the Receiving Environment monitoring data. Additional information has been obtained from aerial imagery, GIS datasets, and nationally available databases such as freshwater fish records.

Where available, existing monitoring data (for example, water quality or biological information) has been used to inform understanding of stream condition and ecological function. In many cases, this information provides a more reliable indication of long-term conditions than a single snapshot field survey.

Key information sources are listed as follows:

- Previous ecological assessments and technical reports:
 - Ōmanawa Bridge Replacement Ecological Impact Assessment.
 - Redwood Lane Ecological Assessment.
 - Tauriko West (Southern Gully) Ecological Assessment.
 - Tauriko West Urban Growth Area ecological assessments.
 - Project-specific freshwater ecology memorandum.
- Regional monitoring data and datasets:
 - Bay of Plenty Regional Council (BOPRC) State of the Receiving Environment (SoRE) monitoring data.
 - Relevant water quality and habitat condition datasets associated with these monitoring sites.
- National databases:
 - New Zealand Freshwater Fish Database (NZFFD).
- Spatial data and imagery:
 - Aerial imagery.
 - GIS mapping (including watercourse mapping and catchment context).
- Field observations (see below):
 - Targeted site walkovers undertaken as part of this assessment to verify and update existing information.

3.3. Field Verification

Targeted site walkovers were undertaken to verify and supplement the information described above. The purpose of this fieldwork was to confirm that existing data remains representative of current conditions and to ensure that watercourses have been correctly identified, classified, and described.

Field observations focused on key physical attributes, including channel morphology, substrate composition, flow characteristics, riparian condition, and the degree of modification. These observations were used to support watercourse classification (e.g. perennial, intermittent, ephemeral) and inform the grouping of watercourses used in the main assessment.

No targeted aquatic fauna surveys were undertaken. Instead, aquatic communities were characterised based on a combination of existing information and interpretation of habitat condition and connectivity.

3.4. Justification for approach

The methodology adopted for this assessment reflects both the availability of existing information and the characteristics of the receiving environment.

A substantial amount of relevant ecological information is already available for the ZOI, including previous assessments and regional datasets. Field verification confirmed that this information remains representative of current conditions and provides a reliable basis for the assessment. In this context, targeted additional sampling is not expected to materially change the understanding of ecological values.

Many of the watercourses within the ZOI are highly modified and exhibit similar physical characteristics, including fine sediment substrates, simplified channel form, and limited habitat complexity. These conditions strongly influence ecological communities, meaning that aquatic fauna assemblages are relatively predictable and largely constrained by habitat quality rather than localised variation.

Given this consistency, ecological value is primarily determined by physical habitat condition, connectivity, and position within the catchment. These attributes can be robustly assessed using a combination of existing data and field observations, without the need for additional survey effort.

The approach is therefore considered proportionate to the scale of the Project and the likely level of ecological effect, and consistent with accepted practice for ecological impact assessment where existing information is sufficient to characterise the environment and support effects evaluation.

Given the large number of watercourses within the ZOI and their generally similar characteristics, watercourses have been assessed using groupings based on shared physical and ecological features. This avoids unnecessary repetition while still providing a clear and robust assessment of ecological values.

4. Assessment of Effects

4.1. Framework

Our method for assessing the significance of the ecological effects associated with the Project was based on the Environment Institute of Australia and New Zealand's (EIANZ) Ecological Impact Assessment Guidelines (EIANZ, 2018).

In summary, this method requires an assessment of:

- Ecosystem/habitat and species values as described in Section 4.1.1;
- The magnitude of effect using the criteria listed in Section 4.1.3; and
- The level of ecological effect using the decision matrix presented in Section 4.1.4, which determines the level of effect based on the ecological value of the ecosystems or species assessed and the magnitude of effect.

4.1.1. Scale of assessment

Overall effects have primarily been assessed at the catchment scale. A catchment is the area of land that drains into a particular watercourse, and it represents the natural scale at which freshwater and wetland ecosystems function which is an appropriate focus given these habitats are the primary remnants of ecological value in the Proposed Designation.

Assessing effects at this scale avoids overstating the significance of small, localised changes, and ensures that conclusions reflect the broader ecological context.

We have considered the magnitude of effects of the Project on herpetofauna at the local landscape scale. This differs from the assessment scale used for all other elements of ecology (vegetation features, more mobile fauna, and the aquatic environment), because the biology and life history of copper skinks (the key species of potential impact from the Project) means they readily inhabit small, spatially discrete patches and are not easily mobile between these features. Therefore, impacts at small scales can have more severe effects on herpetofauna than they have on vegetation features or other more mobile fauna.

4.1.2. Ecological values assessment method

Ecological value has aspects of both quantity (rarity or extent) and quality (integrity, functionality or condition) and incorporates an array of attributes across multiple levels of ecological organisation (species, communities, habitats and ecosystems). The EIANZ impact assessment guidelines (Roper-Lindsay et al., 2018) (EIANZ Guidelines) provide a summary scale whereby a site's value is assessed as the extent to which an area or site exemplifies qualities of representativeness, rarity/distinctiveness, diversity and pattern, and ecological context characteristic of its ecosystem type. The EIANZ Guidelines also use the concept of freshwater system "integrity" using aspects of 'native-ness', pristineness, diversity, and resilience (adaptability) (EIANZ Guidelines, Section 5.3).

The EIANZ Guidelines do not provide a framework for how to incorporate Ecological Integrity into the overall assessment of ecological value for freshwater habitats. As such, we have adopted the same criteria as used for terrestrial systems, tailored to accommodate the five matters detailed in Table 20-1. Freshwater species' valuation follows the same approach as terrestrial species (Table 20-2).

We have assessed terrestrial, wetland, and freshwater ecosystems / communities / habitats and species in the proposed designation against the EIANZ Guidelines criteria to determine the overall value of the features. In terms of both wetlands and freshwater these criteria align with and provide an assessment against the values identified within the NPSFM; ecosystem health, indigenous biodiversity, and hydrological functioning. Ecological value (terrestrial and freshwater) is assessed following the EIANZ Guidelines provided in Table 20-1 and Table 20-2.

Table 20-1: Criteria to consider for ecological value of terrestrial habitats and species (modified from EIANZ Guidelines)

Matter	Assessment considerations terrestrial	Assessment considerations freshwater
Representativeness	Criteria for representative vegetation and aquatic habitats: • Typical structure and composition • Indigenous species dominate • Expected species and tiers are present • Thresholds may need to be lowered where all examples of a type are strongly modified Criteria for representative species and species assemblages: • Species assemblages that are typical of the habitat • Indigenous species that occur in most of the guilds expected for the habitat type	• Extent to which site/catchment is typical or characteristic • Stream order • Permanent, intermittent, or ephemeral waterway • Catchment size • Standing water characteristics
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 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	• Supporting nationally or locally Threatened, At Risk or uncommon species • National distribution limits • Endemism • Distinctive ecological features • Type of lake/pond/wetland/spring
Diversity and pattern	• Level of natural diversity, abundance and distribution • Biodiversity reflecting underlying diversity	• Level of natural diversity • Diversity metrics • Complexity of community • Biogeographical considerations - pattern, complexity, size, shape

Matter	Assessment considerations terrestrial	Assessment considerations freshwater
	• Biogeographical considerations – pattern, complexity • Temporal considerations, considerations of lifecycles, daily or seasonal cycles of habitat availability and utilization.	
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	• Stream order • Instream habitat • Riparian habitat • Local environmental conditions and influences, site history and development • Intactness, health and resilience of populations and communities • Contribution to ecological networks, linkages, pathways • Role in ecosystem functioning – high level, proxies • Fish spawning and rearing habitat
Ecological Integrity	N/A	• <u>Nativeness</u> – the degree to which an ecosystem's structural composition is dominated by the indigenous biota characteristics of the particular region • <u>Pristineness</u> – relates to a wide array of structural, functional, and physico-chemical elements (including connectivity), but is not necessarily dependent on indigenous biota constituting structural and functional elements • <u>Diversity</u> – richness (the number of taxa) and evenness (the distribution of individuals amongst taxa); link to a possible

Matter	Assessment considerations terrestrial	Assessment considerations freshwater
		reference condition; the use abundance weighting; and geographical scale • <u>Resilience (or adaptability)</u> – quantifying the probability of maintaining an ecosystem's structural and functional characteristics under varying degrees of human pressure or stressors such as climate change.

Table 20-2: Criteria for assigning ecological value to habitats and species (modified from EIANZ Guidelines)

ECOLOGICAL VALUE	SPECIES	HABITATS, VEGETATION, WETLANDS, FRESHWATER
Very High	<i>Threatened - (Nationally Critical, Nationally Endangered, Nationally Vulnerable)</i>	Area rates High for 3 or all of the four or five assessment matters listed in Table 20-1. Likely to be nationally important and recognised as such.
High	<i>At-risk - (Declining)</i>	Area rates High for 2 of the assessment matters, 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	<i>At-risk - (Recovering, Relict, Naturally Uncommon)</i> Locally (Ecological District) uncommon or distinctive species	Area rates High for one matter, Moderate and Low for the remainder, or Area rates Moderate for 2 or more assessment matters Low or Very Low for the remainder. Likely to be important at the level of the Ecological District.
Low	Native - <i>Not Threatened</i> . Nationally and locally common indigenous species.	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	Exotic species, including pests, species having recreational value.	Area rates Very Low for 3 matters and Moderate, Low or Very Low for remainder.

4.1.3. Assessing magnitude of effect

Once the value of the ecosystem components had been determined, we then assessed the magnitude of the effect of the Project on that ecosystem. Magnitude of effect is a measure of the extent or scale of the impact, its duration, and the degree of change that it will cause to the relevant ecosystem. A typical scale of magnitude ranges from very high to negligible as outlined in (Table 20-3).

Table 20-3. Criteria for describing magnitude of effect (Roper-Lindsay et al., 2018).

Magnitude of Effect:	Description:
Very High	Total loss of, or very major alteration to, key elements/ features of the 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 baseline conditions such that 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 baseline conditions such that post development character, composition and/or attributes of the existing baseline 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 baseline conditions. Change arising from the loss/alteration will be discernible but underlying character, composition and/or attributes of existing baseline condition will be similar to predevelopment circumstances/patterns; AND/OR having a minor effect on the known population or range of the element/feature.
Negligible	Very slight change from 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.

4.1.4. Assessing level of ecological impact

We determined the overall level of the effect by applying the following matrix (Table 20-4), which combines the ecological value of an area and magnitude of effect of the Project on this area to determine the overall level of ecological effect.

Table 20-4: Matrix of level of adverse effect (modified from EIANZ Guidelines).

		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)	0 (Very Low)
	Moderate	--- (High)	--- (High)	-- (Moderate)	- (Low)	0 (Very Low)
	Low	-- (Moderate)	- (Low)	- (Low)	0 (Very Low)	0 (Very Low)
	Negligible	- (Low)	0 (Very Low)	0 (Very Low)	0 (Very Low)	0 (Very Low)
	Positive	+ (Positive)	+ (Positive)	+ (Positive)	+ (Positive)	+ (Positive)

4.2. Effects envelope and design flexibility

The assessment has been undertaken based on an Indicative Design, recognising that aspects of the Project may change during detailed design. To account for this, an “effects envelope” approach has been used.

An effects envelope defines the reasonable range of potential effects that could occur, rather than relying on a single fixed design scenario. This approach ensures that the assessment remains valid even if the Project design changes within the defined limits.

Sensitivity testing has also been undertaken to confirm that reasonable alignment or design changes would not materially alter the conclusions of the assessment. This reflects standard practice for large infrastructure projects where design certainty increases over time.

4.3. Limitations and Assumptions

As with any ecological assessment, there are some limitations to the methodology. These include reliance on existing datasets, the absence of targeted biological surveys, and the fact that not all watercourses could be directly assessed in the field.

In addition, ecological conditions can vary seasonally, and site inspections represent a snapshot in time. However, given the generally consistent and modified nature of watercourses within the ZOI, these factors are not considered to materially affect the conclusions of the assessment. Importantly, field verification confirmed that existing information remains representative of current conditions. As a result, the assessment is considered to provide a reliable and appropriate basis for evaluating freshwater ecological values and effects for the purposes of the Project.

Appendix 2: Terrestrial vegetation

5. Terrestrial vegetation communities

Community Type 1: Managed exotic grassland and cropland

Agricultural areas of grazed pasture and cropland, and areas of mown grass such as lawns, berms, golf courses. In some areas occasional scattered exotic scrub species (e.g. gorse), or individual trees, but is generally homogenous.

Some smaller areas of managed grassland are captured under Community Type 5 (garden and amenity).

Community Type 2: Horticulture.

Typical kiwifruit, avocado and citrus orchards with a dominant cover of the cultivated species, interspersed with Japanese cedar or cypress shelterbelts.

Community Type 3: Shelterbelts and hedgerows

Shelterbelts are common components of the vegetation along the proposed alignment. These shelter belts have only been mapped specifically when occurring outside of orchards. The most common exotic trees encountered within the shelter belts are Japanese cedar, tree privet, and radiata pine. The understorey is typically sparse, with some shelterbelts containing small patches of weedy vegetation (kahili ginger, blackberry, woolly nightshade, *Prunus* spp., *Ligustrum* spp.) and pastoral grasses.

Community Type 4: Exotic plantation and tree stands

Areas of planted trees, primarily pine but occasionally other large exotic species (e.g. cypress, eucalyptus).

Community Type 5: Garden and amenity

The Proposed Designation contains many garden areas, and exotic mixed tree stands. Occasional planted natives are present in these areas, but they are generally exotic communities, with common garden and ornamental plant species present throughout. This community type also includes some areas of exotic streetscaping.

Community Type 6: Gorse and woolly nightshade in pasture

More scattered or sparse gorse and woolly nightshade have been captured under Community Type 1, but where it is denser it has been mapped as its own community.

Community type 7: Exotic scrub / weed land / tree land

Areas densely vegetated in exotic scrub, weeds, and trees species. These areas have no or very low proportions of native vegetation, and any ecological value is primarily functional/contextual, as potential habitat for indigenous fauna.

Community 7.1 - Belk Road exotic vegetation

Comprised primarily of overgrown, weedy garden vegetation. Large trees include honey locust, *Cryptomeria*, *Ginkgo*, poplar, *Paulownia*, *Casuarina*, tulip poplar, coastal redwood, avocado and walnut. Scrub and ground layer are comprised of woolly nightshade, gorse, pampas, Japanese honeysuckle, grey willow, blackberry, cherry, tuber ladder fern and tree privet.

Community 7.2 – Omanawa exotic scrub and tree land

Primarily exotic vegetation community including oak, tree privet, eucalyptus, wonder tree, feijoa, cherry, and woolly nightshade over pasture and herbaceous weeds. Also includes a single large rimu.

Community 7.3 – Roadside exotic weed land/scrub

A band of exotic vegetation at the SH29 road margin, across from Belk Road. Includes cherry, woolly nightshade, gorse, and large areas of Japanese honeysuckle. Also includes an area of planted *Agapanthus*.

7.4: Tauriko west exotic scrubland

Dense scrubland/forest of bamboo, black wattle, woolly nightshade, Chinese privet, pine, gorse, tradescantia and Japanese honeysuckle

7.5: Exotic scrubland and tree land alongside Takitimu Drive

These areas are dominated by cherry, privet, woolly nightshade, Japanese honeysuckle, as well as some more open areas with pampas and gorse. Larger trees present include *Eucalyptus*, pine, blackwoods and some exotic streetscaping trees

7.6: Willow dominated exotic tree land, adjacent to Redwood Lane landscape planting.

A small area of scattered willows and several *Eucalyptus* trees. There are also a small number of young tree ferns, and the adjacent landscape planting extends under the exotic trees in some areas (those areas have largely been captured under the Community 9.5 landscape planting).

Community Type 8: Mixed scrublands and forests.

The mixed vegetation within the Proposed Designation is typically dominated by exotic vegetation, but with a notable native component.

Community 8.1 – Silkwood Lane mixed vegetation

The canopy here is comprised of largely of exotics, primarily willow with some oak, wonder tree, Persian silkwood, and coastal redwoods. In the understory several young natives are present, including mamaku, māhoe, whau, lacebark and tī kōuka, as well as several weedy exotics such as Italian arum, cherry seedlings, *Clivia* and *Agapanthus*. There is also a band of more established planted natives at the garden margin of 37 Silkwood Lane.

Community 8.2 – exotic tree land with mixed regeneration.

This area is immediately northeast of Community 8.1, and is dominated by exotics including cherry, woolly nightshade, pine and poplar, with native tree ferns regenerating throughout.

Community 8.3 – vegetated escarpment west of Takitimu Drive.

This community is a combination of natural mixed regeneration, and some areas of recent planting on the upper slopes. The broader community outside of the Proposed Designation has significant native component, with regenerating tree ferns, mānuka/kānuka, māhoe and flax. However, the lower portion which falls within the Proposed Designation is largely dominated by exotic/weedy species including cherry, gorse, woolly nightshade, pampas, and Japanese honeysuckle.

Community 8.4 – Nature Place quarry mixed vegetation

This community appears to be⁴⁰ largely exotic, comprised of pampas, black wattle, pines, bamboo, gorse, grey willow and phoenix and windmill palms. There are some native species present, in particular native tree ferns regenerating on the back slope of the property, and several (likely planted) rimu.

Community 8.5 – 999 State Highway 29 mixed regeneration and garden planting

The vegetation around 999 State Highway 29 is a mix of primarily exotic garden/amenity planting, and exotic and native gully vegetation. Garden species include Chinese lantern, rose, *Wisteria*, phoenix palm and *Camellia*. There are also several planted natives present in the garden, such as red mapou, mangeao, tī kōuka, and several large kahikatea.

The small gully on the property is comprised of cherry, *Casuarina*, birch, pampas, Italian arum and other herbaceous weeds, with some native regeneration occurring; largely mahoe, silver fern, mamaku and kawakawa.

Community 8.6 – Tauriko west mixed vegetation

A primarily exotic community comprised of woolly nightshade, cherry, *Tradescantia*, privet, poplar and pines, but has a notable proportion of māhoe and mamaku regenerating throughout.

Community 8.7: Wairoa River edge mixed vegetation

A riparian vegetation community comprised of a mix of exotic and native scrub species. Exotics are dominant, including cherry, brush wattle, gorse, woolly nightshade, *Eucalyptus* and sycamore maple. Natives present include māhoe, tree ferns and mānuka. Near the confluence with the Omanawa stream is a low fernland/vineland with bracken and *Calystegia*, surrounded by woolly nightshade.

Community 8.8: Omanawa Road mixed vegetation

The community here is comprised of a mixed understory regenerating under pine forest. Native species here include māhoe, silver fern, tall mingimingi, hangehange and taupata, and exotics include cherry, gorse, Japanese honeysuckle, blackberry, pampas, and woolly nightshade.

Community Type 9: Native landscape, amenity and infrastructural planting.

These are planted communities that are primarily native, or were primarily native at the time of planting and may be more mixed or exotic dominated now as the result of weedy incursions.

⁴⁰ This land parcel could not be accessed and so was assessed from the road and from aerial imagery. Not all vegetation within the site was able to be assessed, however the general features of the community could be recorded.

They are separate to restoration planting, as they have generally not been planted with ecological value, ecological mitigation, or ecosystem function in mind, but rather to provide landscape/visual value, screening, and/or stormwater management.

Community 9.1: Tauriko roundabout

A small patch of native amenity planting on the Tauriko roundabout, comprised of flaxes, *Carex* and karo.

Community 9.2 SH29A roadside plantings

On either side of SH29A are thin linear bands of native planting, providing screening between the road and surrounding industrial and residential areas. The planting is comprised of common species that are typical in amenity plant mixes such as lemonwood, black matipo, tī kōuka, karo and kānuka. There are considerable areas of exotic and weedy species, including some areas where exotics dominate. These include Taiwan cherry, woolly nightshade, Chinese privet, willows and occasional pines in the canopy, and Himalayan honeysuckle, *Tradescantia*, kahili ginger in the understory/ground layer.

Community 9.3: SH29 roadside screening (west of road)

The planting here is mānuka/kānuka, flaxes, tī kōuka, karamu, puka, ngaio, *Pittosporum* spp., and occasional kahikatea. This community has a considerable presence of weedy species, with cherry, Chinese privet and Japanese honeysuckle throughout.

Community 9.4: Roadside planting – Kōpūrererua reserve

A linear band of planting that was carried out to provide screening between the Kōpūrererua Valley and Takitimu Drive. Consists of a similar plant mix to Community 9.3 on the other side of the road, and also has considerable exotic incursions with grey willow, woolly nightshade, occasional wilding pines, pampas, Chinese privet and gorse.

Community 9.5: Redwood Lane landscape, amenity and infrastructure plantings

Planting has recently been carried out as part of the Redwood Lane roundabout development, along the road and cycleway margins, in the swales, and surrounding the stormwater pond. The plantings here are primarily comprised of functional communities to aid in stormwater management (in the swales and pond) and landscape amenity planting comprised primarily of natives but with a number of cultivars present.

The Redwood Roundabout Landscape Concept Plan (WSP, 2022c) provides further details on plant species and locations.

Community 9.6: Tauriko West northern access landscape, amenity and infrastructure planting.

As with Community 9.5, recent landscape and infrastructure planting has been carried out at the Tauriko West Northern Access enabling works. Plant mixes are similar to Community 9.5, and can be found in the project's Landscape Concept Plan (WSP, 2022a).

Community Type 10: Native restoration planting

Areas of planting carried out for restoration or ecological mitigation. These areas are found in only in the Kōpūrererua Valley and alongside Takitimu Drive

Community 10.1 - Mānuka dominated restoration planting in Kōpūrererua Valley

Primarily comprised of mānuka tī kōuka and harakeke occasional akeake scattered throughout, and patches of gorse in more open areas and margins. This community is on the slopes below and west of 570 SH29 within the Kōpūrererua Reserve

Community 10.2: Planted rimu stand

A small stand of rimu on the Kōpūrererua Stream margin, at the southernmost end of the Kōpūrererua Reserve.

Community 10.3 – Kōpūrererua mixed restoration planting

A patch of very recent plantings, including kānuka, tī kōuka, flaxes, giant umbrella sedge, tarata, tōtara, ribbonwood, sedges and rushes.

Community 10.4 – Kōpūrererua Stream riparian planting

Vey recent planting of the riparian margin next to the Kōpūrererua stream. The plant mix includes mānuka, karo, *Carex*, giant umbrella sedge, flax, makomako, koromiko, black matipo and taupata. There are also occasional tōtara and kahikatea seedlings throughout. This community is currently still under 1 m in height.

Community 10.5 – Kōpūrererua native treeland

A small area of planted native trees in the Kōpūrererua Valley, including lacebark, tōtara, ngaio, and mamaku

Community 10.6 – Takitimu Drive restoration planting

Areas of native plantings on the western margin of Takitimu Drive, which appear to have been planted in relation to the construction of the road. Primarily comprised of mānuka/kānuka, with flaxes, tī kōuka, and occasional kahikatea and tree ferns. Some exotics have established throughout, with scattered cherry and Chinese privet, and in more open areas are patches of pampas, willow and Japanese honeysuckle.

6. Terrestrial vegetation photos



Image 2: Community type 1 – Managed exotic grassland and cropland



Image 3: Community type 2 – Horticulture



Image 4: Community type 3: Shelterbelts and hedgerows



Image 5: Community type 4: Exotic plantation and tree stands



Image 6: Community type 5 – Garden and amenity



Image 7: Community type 6 – Gorse and woolly nightshade in pasture



Image 8: Community 7.1 – Belk Rd exotic vegetation



Image 9: Community 7.2 – Omanawa exotic scrub and tree land



Image 10: Community 7.3 - Roadside exotic weedland/scrub



Image 11: Community 7.4 – Tauriko West exotic scrubland

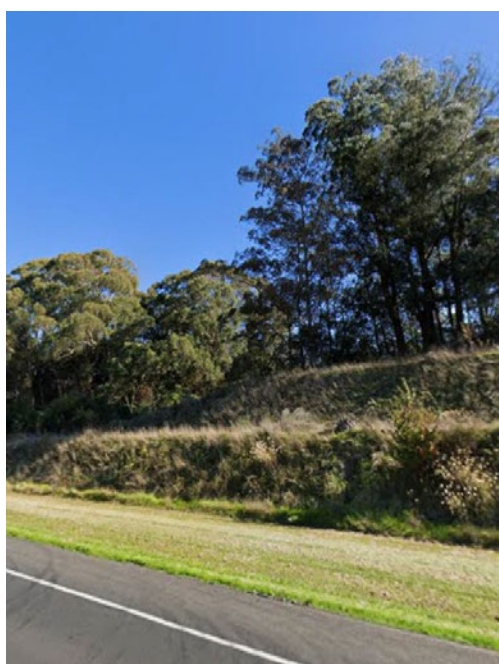


Image 12: Community 7.5 – Exotic scrubland and tree land alongside Takitimu Drive



Image 13: Community 7.6 – Willow dominated exotic tree land, adjacent to Redwood Lane planting

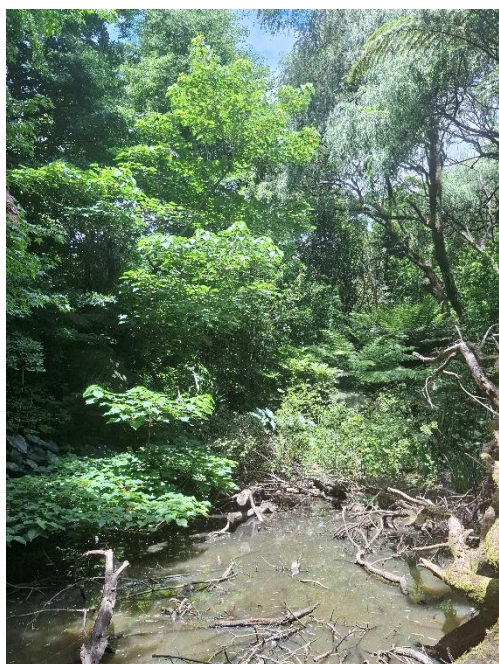


Image 14: Community 8.1 – Silkwood Lane mixed vegetation

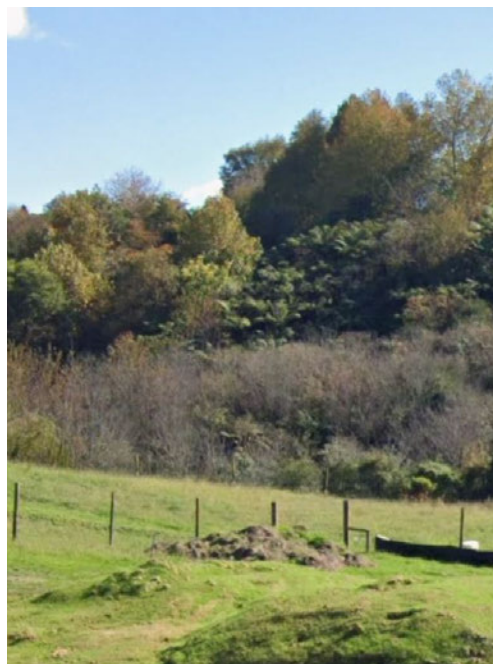


Image 15: Community 8.2 – exotic tree land with mixed regeneration



Image 16: Community 8.3 – vegetated escarpment west of Takitimu Drive



Image 17: Community 8.4 – Nature Place quarry mixed vegetation

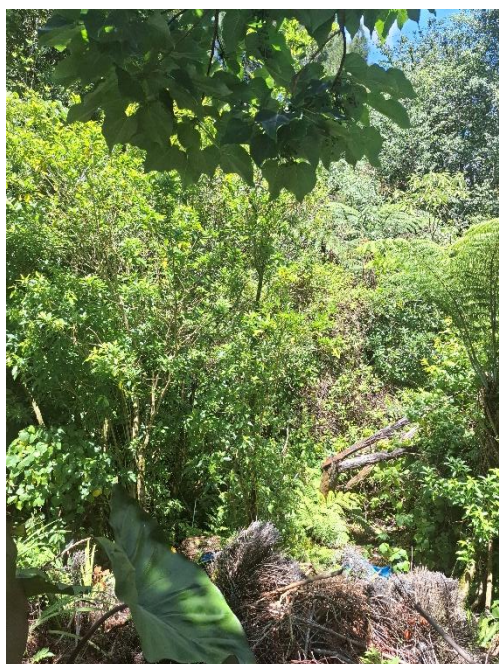


Image 18: Community 8.5 – 999 State Highway 29 mixed regeneration and garden planting



Image 19: Community 8.6 – Tauriko West mixed vegetation



Image 20: Community 8.7 – Wairoa River edge mixed vegetation



Image 21: Community 8.8 – Omanawa Road mixed vegetation

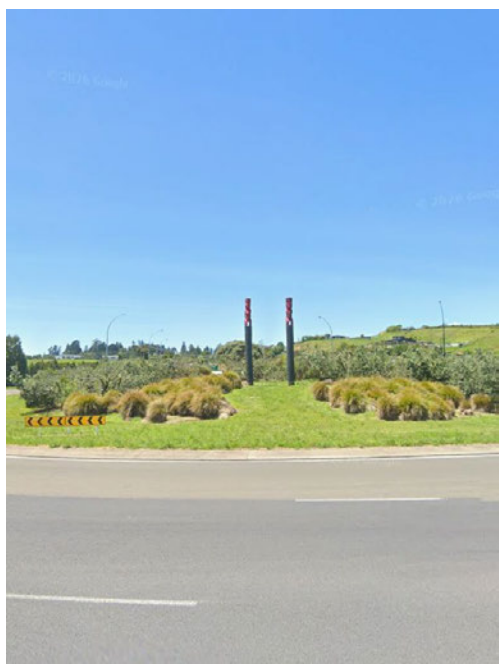


Image 22: Community 9.1 – Tauriko roundabout



Image 23: Community 9.2 – SH29A roadside plantings



Image 24: Community 9.3 – SH29 roadside screening (west of road)



Image 25: Community 9.4 – Roadside planting – Kōpūrererua Reserve



Image 26: Community 9.5: Redwood Lane landscape, amenity and infrastructure plantings.



Image 27: Community 10.1 – Mānuka dominated restoration planting in Kōpūrerua Valley



Image 28: Community 10.2 – Planted rimu stand



Image 29: Community 10.3 – Kōpūrerua mixed restoration planting



Image 30: Community 10.4 – Kōpūrerua Stream riparian planting



Image 31: Community 10.5 – Kōpūrerua native tree land.

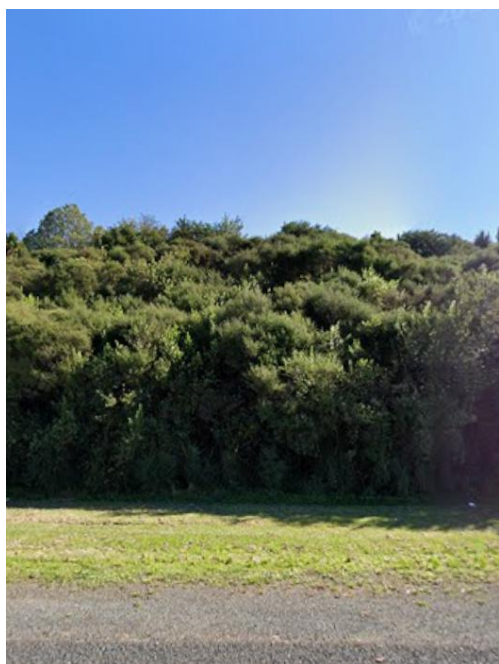


Image 32: Community 10.6 – Takitimu Drive restoration planting.

7. Terrestrial vegetation binomial names and threat status

Species name	Common name	Threat status
<i>Agathis australis</i>	Kauri	At Risk - Declining
<i>Alectryon excelsus</i> subsp. <i>excelsus</i>	Titoki	Not Threatened
<i>Alsophila dealbata</i>	Silver fern	Not Threatened
<i>Aristotelia serrata</i>	Makomako	Not Threatened
<i>Asplenium oblongifolium</i>	Shining spleenwort	Not Threatened
<i>Calystegia sepium</i> subsp. <i>roseata</i>	Pink bindweed	Not Threatened
<i>Carpodetus serratus</i>	Marbleleaf	Not Threatened
<i>Coprosma repens</i>	Cop repens	Not Threatened
<i>Coprosma robusta</i>	Karamū	Not Threatened
<i>Cordyline australis</i>	Ti kouka	Not Threatened
<i>Corokia cotoneaster</i>	Corokia	Not Threatened
<i>Corynocarpus laevigatus</i>	Karaka	Not Threatened
<i>Dacrycarpus dacrydioides</i>	Kahikatea	Not Threatened
<i>Dacrydium cupressinum</i>	Rimu	Not Threatened
<i>Dicksonia squarrosa</i>	Wheki	Not Threatened
<i>Dodonaea viscosa</i>	Akeake	Not Threatened
<i>Entelea arborescens</i>	Whau	Not Threatened
<i>Ficinia nodosa</i>	Wiwi	Not Threatened
<i>Geniostoma ligustrifolium</i>	Hangehange	Not Threatened
<i>Hoheria populnea</i>	Lacebark	Not Threatened
<i>Knightia excelsa</i>	Rewarewa	Not Threatened
<i>Kunzea robusta</i>	Kānuka	Not Threatened
<i>Leptospermum scoparium</i>	Mānuka	Not Threatened
<i>Leucopogon fasciculatus</i>	Tall mingimingi	Not Threatened
<i>Litsea calicaris</i>	Mangeao	Not Threatened
<i>Meliccytus ramiflorus</i>	Māhoe	Not Threatened
<i>Griselinia lucida</i>	Puka	Not Threatened
<i>Myoporum laetum</i>	Ngaio	Not Threatened
<i>Myrsine australis</i>	Red mapou	Not Threatened
<i>Austroblechnum lanceolatum</i>	Lance fern	Not Threatened
<i>Parablechnum novae-zelandiae</i>	Kiokio	Not Threatened
<i>Phormium tenax</i>	Harakeke	Not Threatened
<i>Phyllocladus trichomanoides</i>	Tanekaha	Not Threatened
<i>Piper excelsum</i> subsp. <i>excelsum</i>	Kawakawa	Not Threatened
<i>Pittosporum crassifolium</i>	Karo	Not Threatened

Species name	Common name	Threat status
<i>Pittosporum eugenioides</i>	Lemonwood	Not Threatened
<i>Pittosporum tenuifolium</i>	Black matipo	Not Threatened
<i>Podocarpus totara</i>	Totara	Not Threatened
<i>Pseudopanax arboreus</i>	Five finger	Not Threatened
<i>Pseudopanax lessonii</i>	Houpara	Not Threatened
<i>Pteridium esculentum</i>	Bracken	Not Threatened
<i>Pteris tremula</i>	Shaking brake	Not Threatened
<i>Rhopalostylis sapida</i>	Nikau	Not Threatened
<i>Sphaeropteris medullaris</i>	Mamaku	Not Threatened
<i>Veronica parviflora</i>	Hebe	Not Threatened
<i>Veronica stricta</i>	Koromiko	Not Threatened
<i>Carex spp.</i>	Carex	
<i>Abutilon megapotamicum</i>	Red vein lantern	Exotic
<i>Paraserianthes lophantha</i>	Brush wattle	Exotic
<i>Acacia mearnsii</i>	Black wattle	Exotic
<i>Acanthus mollis</i>	Bear breeches	Exotic
<i>Acca sellowiana</i>	Feijoa	Exotic
<i>Acer pseudoplatanus</i>	Sycamore maple	Exotic
<i>Actinidia deliciosa</i>	Kiwifruit	Exotic
<i>Agapanthus praecox</i>	Agapanthus	Exotic
<i>Albizia julibrissin</i>	Persian silkwood	Exotic
<i>Alnus glutinosa</i>	Black alder	Exotic
<i>Alocasia macrorrhizos</i> / <i>Colocasia esculenta</i>	Elephant ear	Exotic
<i>Alstroemeria sp.</i>	Alstroemeria	Exotic
<i>Araucaria heterophylla</i>	Norfolk pine	Exotic
<i>Araujia hortorum</i>	Moth plant	Exotic
<i>Arum italicum</i>	Italian arum	Exotic
<i>Asparagus scandens</i> / <i>A. africanus</i>	Climbing asparagus	Exotic
<i>Athyrium filix-femina</i>	Lady fern	Exotic
<i>Banksia integrifolia</i> / <i>B. serrata</i>	Banksia	Exotic
<i>Berberis glaucocarpa</i> / <i>B. darwinii</i>	Barberry	Exotic
<i>Betula sp.</i>	Birch	Exotic
<i>Callistemon sp.</i>	Orange bottlebrush	Exotic
<i>Camellia sp.</i>	Camellia	Exotic
<i>Castanea sativa</i>	Sweet chestnut	Exotic
<i>Casuarina cunninghamiana</i>	River oak	Exotic
<i>Chamaecyparis lawsoniana</i>	Lawsons cypress	Exotic
<i>Clivia miniata</i>	Clivia	Exotic
<i>Colocasia esculenta</i>	Taro	Exotic

Species name	Common name	Threat status
<i>Cortaderia selloana</i> / <i>C. jubata</i>	Pampas	Exotic
<i>Cotoneaster glaucophyllus</i>	Cotoneaster	Exotic
<i>Crocosmia</i> × <i>crocosmiiflora</i>	Montbretia	Exotic
<i>Cryptomeria japonica</i>	Cryptomeria	Exotic
<i>Cupressus</i> spp.	Cypress	Exotic
<i>Cyperus eragrostis</i>	Ex. umbrella sedge	Exotic
<i>Diospyros kaki</i>	Persimmon	Exotic
<i>Eucalyptus</i> sp.	Eucalyptus	Exotic
<i>Fagus sylvatica</i>	European beech	Exotic
<i>Fatsia japonica</i>	Fatsia	Exotic
<i>Fraxinus excelsior</i>	European ash	Exotic
<i>Fraxinus</i> sp.	Ash	Exotic
<i>Ginkgo biloba</i>	Ginkgo	Exotic
<i>Gleditsia triacanthos</i>	Honey locust	Exotic
<i>Hedera helix</i>	English ivy	Exotic
<i>Hedychium gardnerianum</i>	Wild ginger	Exotic
<i>Hydrangea macrophylla</i> (sensu lato)	Hydrangea	Exotic
<i>Idesia polycarpa</i>	Wonder tree	Exotic
<i>Jacaranda mimosifolia</i>	Jacaranda	Exotic
<i>Jasminum officinale</i> / <i>J. polyanthum</i>	Jasmine	Exotic
<i>Jasminum polyanthum</i>	Pink jasmine	Exotic
<i>Ligustrum lucidum</i>	Tree privet	Exotic
<i>Ligustrum sinense</i>	Chinese privet	Exotic
<i>Liquidambar styraciflua</i>	Liquidambar	Exotic
<i>Liriodendron tulipifera</i>	Tulip poplar	Exotic
<i>Lonicera japonica</i>	Japanese honeysuckle	Exotic
<i>Macadamia integrifolia</i>	Macadamia	Exotic
<i>Magnolia</i> spp.	Magnolia	Exotic
<i>Miscanthus nepalensis</i>	Himalayan fairy grass	Exotic
<i>Nandina domestica</i>	Nandina	Exotic
<i>Nephrolepis cordifolia</i>	Tuber ladder	Exotic
<i>Paulownia tomentosa</i>	Empress tree	Exotic
<i>Persea americana</i>	Avocado	Exotic
<i>Persicaria maculosa</i>	Willow weed	Exotic
<i>Phoenix canariensis</i>	Phoenix palm	Exotic
<i>Phyllostachys</i> spp. / <i>Bambusa</i> spp.	Bamboo	Exotic
<i>Physalis peruviana</i>	Cape gooseberry	Exotic
<i>Phytolacca americana</i>	American pokeweed	Exotic
<i>Phytolacca octandra</i>	Inkweed	Exotic

Species name	Common name	Threat status
<i>Pinus spp.</i>	Pine	Exotic
<i>Platanus orientalis</i>	Oriental plane	Exotic
<i>Platanus x hispanica</i> / <i>P. orientalis</i>	Plane tree?	Exotic
<i>Populus spp.</i>	Poplar	Exotic
<i>Prunus campanulata</i>	Taiwan cherry	Exotic
<i>Quercus sp.</i>	Oak	Exotic
<i>Rosa spp.</i>	Rose	Exotic
<i>Rubus x loganobaccus</i>	Loganberry	Exotic
<i>Rubus fruticosus</i> agg.	Blackberry	Exotic
<i>Rumex sagittatus</i>	Climbing dock	Exotic
<i>Salix cinerea</i>	Grey willow	Exotic
<i>Salix fragilis</i>	Crack willow	Exotic
<i>Salix sp.</i>	Willow	Exotic
<i>sequoia sempervrens</i>	California redwood	Exotic
<i>Solanum mauritianum</i>	Woolly nightshade	Exotic
<i>Trachycarpus fortunei</i>	Chinese windmill palm	Exotic
<i>Tradescantia fluminensis</i>	Tradescantia	Exotic
<i>Tropaeolum majus</i>	Nasturtium	Exotic
<i>Ulex europaeus</i>	Gorse	Exotic
<i>Ulmus procera</i>	Scotts elm	Exotic
<i>Vitis vinifera</i>	Grape	Exotic
<i>Wisteria sinensis</i> / <i>W. floribunda</i>	Wisteria	Exotic
<i>Yucca filamentosa</i> / <i>Y. aloifolia</i>	Yucca	Exotic
<i>Zantedeschia aethiopica</i>	Calla lily	Exotic
<i>Zea mays</i>	Corn	Exotic

Appendix 3: Terrestrial fauna

8. Avifauna desktop review base list

The below table provides the full, unfiltered list of birds recorded in the desktop review and includes all species recorded in the 10x10 km Bird Atlas squares that encompass the Proposed Designation. To produce the list of key species that may use the Proposed Designation (see table below), this list was filtered to exclude exotic species, species that do not have primary habitat within the site or immediate surrounds, vagrant species, and species that are likely to visit the Proposed Designation only rarely.

Common Name	Scientific Name	Conservation Status
African collared-dove	<i>Streptopelia risoria</i>	Exotic
Australasian gannet	<i>Morus serrator</i>	Indigenous
Australasian shoveler	<i>Spatula rhynchotis</i>	Indigenous
Banded rail	<i>Hypotaenidia philippensis</i>	Indigenous
Bar-tailed godwit	<i>Limosa lapponica</i>	Indigenous
Bellbird	<i>Anthornis melanura</i>	Indigenous
Black shag	<i>Phalacrocorax carbo</i>	Indigenous
Black swan	<i>Cygnus atratus</i>	Indigenous
Black-backed gull	<i>Larus dominicanus</i>	Indigenous
Black-billed gull	<i>Chroicocephalus bulleri</i>	Indigenous
Blackbird	<i>Turdus merula</i>	Exotic
Bush falcon	<i>Falco novaeseelandiae 'bush'</i>	Indigenous
California quail	<i>Callipepla californica</i>	Exotic
Canada goose	<i>Branta canadensis</i>	Exotic
Caspian tern	<i>Hydroprogne caspia</i>	Indigenous
Chaffinch	<i>Fringilla coelebs</i>	Exotic
Feral goose	<i>Anser anser</i>	Exotic
Fernbird	<i>Poodytes punctatus</i>	Indigenous
Goldfinch	<i>Carduelis carduelis</i>	Exotic
Greenfinch	<i>Chloris chloris</i>	Exotic
Grey duck	<i>Anas superciliosa</i>	Indigenous
Grey teal	<i>Anas gracilis</i>	Indigenous
Grey warbler	<i>Gerygone igata</i>	Indigenous
Harrier hawk	<i>Circus approximans</i>	Indigenous
Hedge sparrow	<i>Prunella modularis</i>	Exotic
House sparrow	<i>Passer domesticus</i>	Exotic
Kereru	<i>Hemiphaga novaeseelandiae</i>	Indigenous

Common Name	Scientific Name	Conservation Status
Kingfisher	<i>Todiramphus sanctus</i>	Indigenous
Little black shag	<i>Phalacrocorax sulcirostris</i>	Indigenous
Little penguin	<i>Eudyptula minor</i>	Indigenous
Little shag	<i>Microcarbo melanoleucos</i>	Indigenous
Magpie	<i>Gymnorhina tibicen</i>	Exotic
Mallard duck	<i>Anas platyrhynchos</i>	Exotic
Marsh crane	<i>Zapornia pusilla</i>	Indigenous
Morepork	<i>Ninox novaeseelandiae</i>	Indigenous
Muscovy duck	<i>Cairina moschata</i>	Exotic
Myna	<i>Acridotheres tristis</i>	Exotic
New Zealand dabchick	<i>Poliiocephalus rufopectus</i>	Indigenous
New Zealand dotterel	<i>Anarhynchus obscurus</i>	Indigenous
New Zealand kaka	<i>Nestor meridionalis</i>	Indigenous
New Zealand pipit	<i>Anthus novaeseelandiae</i>	Indigenous
New Zealand scaup	<i>Aythya novaeseelandiae</i>	Indigenous
North Island fantail	<i>Rhipidura fuliginosa</i>	Indigenous
Paradise shelduck	<i>Tadorna variegata</i>	Indigenous
Pied shag	<i>Phalacrocorax varius</i>	Indigenous
Pied stilt	<i>Himantopus himantopus</i>	Indigenous
Pukeko	<i>Porphyrio melanotus</i>	Indigenous
Red-billed gull	<i>Chroicocephalus novaehollandiae</i>	Indigenous
Redpoll	<i>Acanthis flammea</i>	Exotic
Reef heron	<i>Egretta sacra</i>	Indigenous
Ring-necked pheasant	<i>Phasianus colchicus</i>	Exotic
Rock pigeon	<i>Columba livia</i>	Exotic
Rosella	<i>Platycercus eximius</i>	Exotic
Royal spoonbill	<i>Platalea regia</i>	Indigenous
Shining cuckoo	<i>Chrysococcyx lucidus</i>	Indigenous
Silvereye	<i>Zosterops lateralis</i>	Indigenous
Skylark	<i>Alauda arvensis</i>	Exotic
Song thrush	<i>Turdus philomelos</i>	Exotic
South Island pied oystercatcher	<i>Haematopus finschi</i>	Indigenous
Spotless crane	<i>Zapornia tabuensis</i>	Indigenous
Spotted dove	<i>Streptopelia chinensis</i>	Exotic
Spur-winged plover	<i>Vanellus miles</i>	Indigenous
Starling	<i>Sturnus vulgaris</i>	Exotic
Tui	<i>Prosthemadera novaeseelandiae</i>	Indigenous
Variable oystercatcher	<i>Haematopus unicolor</i>	Indigenous
Welcome swallow	<i>Hirundo neonexa</i>	Indigenous
White-faced heron	<i>Egretta novaehollandiae</i>	Indigenous

Common Name	Scientific Name	Conservation Status
White-fronted tern	<i>Sterna striata</i>	Indigenous
Whitehead	<i>Mohoua albicilla</i>	Indigenous
Wild turkey	<i>Meleagris gallopavo</i>	Exotic
Yellow-crowned kakariki	<i>Cyanoramphus auriceps</i>	Indigenous
Yellowhammer	<i>Emberiza citrinella</i>	Exotic

9. Key indigenous avifauna species

The table below lists key indigenous bird species that use, or are likely to use, the Proposed Designation based on field work observations and desktop records. The conservation status of each species is included and their associated ecological value. Cells shaded dark green represent primary habitats used by these species. Cells shaded light green represent secondary habitats used by these species. At-risk and threatened species are highlighted grey.

SPECIES (Robertson et al., 2021)		CONSERVATION STATUS (Robertson et al., 2021)	ECOLOGICAL VALUE (Roper- Lindsay et al., 2018)	HABITAT USE								RECORD		
				Native forest	Exotic forest	Scrub / shrubland	Farmland / open country	Freshwater / wetlands	Coastal / estuary	Oceanic	Urban / residential	eBird & NZ Bird Atlas	Other desktop sources ⁴¹	Field work observation
Bellbird / Korimako	<i>Anthornis m. melanura</i>	<i>Not threatened</i>	Low									✓	✓	
Kereru	<i>Hemiphaga novaeseelandiae</i>	<i>Not threatened</i>	Low									✓	✓	
Kingfisher / Kōtare	<i>Todiramphus sanctus vagans</i>	<i>Not threatened</i>	Low									✓	✓	✓
Morepork / Ruru	<i>Ninox n. novaeseelandiae</i>	<i>Not threatened</i>	Low									✓	✓	
North Island fantail / Pīwakawaka	<i>Rhipidura fuliginosa placabilis</i>	<i>Not threatened</i>	Low									✓	✓	✓
North Island kaka / Kākā	<i>Nestor meridionalis</i>	<i>At-risk - recovering</i>	Moderate									✓	✓	
Shining cuckoo /	<i>Chrysococcyx l. lucidus</i>	<i>Not threatened</i>	Low									✓	✓	✓

⁴¹ (Boffa Miskell Ltd, 2018, 2023; Kessels & Associates Ltd, 2017; WSP, 2022b, 2022d, 2025)

SPECIES (Robertson et al., 2021)		CONSERVATION STATUS (Robertson et al., 2021)	ECOLOGICAL VALUE (Roper- Lindsay et al., 2018)	HABITAT USE								RECORD		
				Native forest	Exotic forest	Scrub / shrubland	Farmland / open country	Freshwater / wetlands	Coastal / estuary	Oceanic	Urban / residential	eBird & NZ Bird Atlas	Other desktop sources ⁴¹	Field work observation
Tui / Tūī	<i>Prosthemadera n.</i>	Not threatened	Low									✓	✓	✓
Grey warbler / Riroriro	<i>Gerygone igata</i>	Not threatened	Low									✓	✓	✓
Silvereye / Tauhou	<i>Zosterops lateralis lateralis</i>	Not threatened	Low									✓	✓	✓
Harrier hawk / Kāhu	<i>Circus approximans</i>	Not threatened	Low									✓	✓	✓
New Zealand pipit / Pīhoihoi	<i>Anthus n. novaeseelandiae</i>	At-risk - declining	High									✓	✓	
Spur-winged plover	<i>Vanellus miles</i>	Not threatened	Low									✓	✓	✓
Welcome swallow / Warou	<i>Hirundo n. neoxena</i>	Not threatened	Low									✓	✓	✓
Australasian bittern / Matuku-hūrepo	<i>Botaurus poiciloptilus</i>	Threatened - nationally critical	Very High									✓		
Australasian shoveler / Kuruwhengi	<i>Anas rhynchotis</i>	Not threatened	Low									✓	✓	
Black shag / Māpunga	<i>Phalacrocorax carbo novaehollandiae</i>	At-risk - relict	Moderate									✓	✓	✓
Black swan / Kakiānau	<i>Cygnus atratus</i>	Not threatened	Low									✓		✓
Grey teal / Tētē-moroiti	<i>Anas gracilis</i>	Not threatened	Low									✓	✓	✓
Little black shag / Kawau tūī	<i>Phalacrocorax sulcirostris</i>	At-risk - naturally	Moderate									✓	✓	✓
Little shag / Kawaupaka	<i>Phalacrocorax melanoleucos brevirostris</i>	At-risk - Relict	Moderate									✓	✓	✓

SPECIES (Robertson et al., 2021)		CONSERVATION STATUS (Robertson et al., 2021)	ECOLOGICAL VALUE (Roper- Lindsay et al., 2018)	HABITAT USE								RECORD		
				Native forest	Exotic forest	Scrub / shrubland	Farmland / open country	Freshwater / wetlands	Coastal / estuary	Oceanic	Urban / residential	eBird & NZ Bird Atlas	Other desktop sources ⁴¹	Field work observation
New Zealand dabchick / Weweia	<i>Poliocephalus rufopectus</i>	Threatened - nationally increasing	Very High									✓	✓	✓
New Zealand scaup /	<i>Aythya novaeseelandiae</i>	Not threatened	Low									✓	✓	✓
North Island fernbird /	<i>Bowdleria punctata vealeae</i>	At-risk - declining	High									✓	✓	✓
Paradise shelduck / Pūtangitangi	<i>Tadorna variegata</i>	Not threatened	Low									✓	✓	✓
Pied stilt / Poaka	<i>Himantopus h. leucocephalus</i>	Not threatened	Low									✓	✓	✓
Pukeko / Pūkeko	<i>Porphyrio m. melanotus</i>	Not threatened	Low									✓	✓	✓
Black-backed gull / Karoro	<i>Larus d. dominicanus</i>	Not threatened	Low									✓	✓	✓
Red-billed gull / Tarāpunga	<i>Larus novaehollandiae</i>	At-risk - declining	High									✓		✓
Royal spoonbill / Kōtuku ngutupapa	<i>Platalea regia</i>	At-risk - naturally uncommon	Moderate									✓		✓
White-faced heron / Matuku moana	<i>Egretta novaehollandiae</i>	Not threatened	Low									✓	✓	✓

10. Combined five-minute bird count data

Species	Seen	Heard	Total
Black shag	1	0	1
Black swan	2	0	2
Blackbird	11	1	12
California quail	1	1	2
Canada goose	55	0	55
Chaffinch	12	1	13
Fantail	5	0	5
Fernbird	1	0	1
Goldfinch	26	6	32
Greenfinch	1	0	1
Grey teal	5	0	5
Grey warbler	6	1	7
Harrier hawk	5	0	5
House sparrow	168	64	232
Kingfisher	5	1	6
Little black shag	3	0	3
Mallard duck	55	0	55
Mixed waterfowl	200	0	200
Myna	33	7	40
Paradise shelduck	92	0	92
Pied stilt	5	0	5
Pukeko	51	10	61
Red-billed gull	3	1	4
Rock pigeon	4	0	4
Rosella	1	0	1
Royal spoonbill	2	0	2
Silvereye	14	7	21
Skylark	5	0	5
Song thrush	2	0	2
Spotted dove	1	0	1
Spur-winged plover	23	3	26
Starling	67	0	67

Tui	8	1	9
Unidentified finch	1	0	1
Unidentified gull	3	0	3
Unidentified passerine	1	0	1
Welcome swallow	39	0	39
White-faced heron	2	0	2
Yellowhammer	6	0	6
Total	925	104	1029

11. Incidental observations of at-risk and threatened bird species

Species	Number	Notes
Black shag	5	Roosting in willows in the large wetland complex north-east of the Pa site in the Kōpūrerua Valley (part of wetland 13).
Little black shag	1	Flying overhead.
Little shag	2	Roosting in willows in the large wetland complex north-east of the Pa site in the Kōpūrerua Valley (part of wetland 13).
New Zealand dabchick	1	Swimming (presumably foraging) in the stormwater ponds south of the roundabout by the entrance to The Lakes (outside of but adjacent to the Proposed Designation).
North Island fernbird	5	Foraging in and / or flying between wetland vegetation at the south-western end of the Kōpūrerua Valley. Two observations were of two birds together.
Royal spoonbill	48	43 were roosting and 5 were foraging in the large wetland complex north-east of the Pa site in the Kōpūrerua Valley (part of wetland 13).

Appendix 4: Wetland Descriptions

12. Tauriko West MDRZ

Generally, wetlands in these areas are in degraded states, low diversity, small size, and with a high incidence of pest species (Figure). However, some seepage features have a more diverse vegetation community increasing their value (Figure). Grazed wetlands typically were dominated by mercer grass (*Paspalum distichum*), creeping bent (*Agrostis stolonifera*), with willow weed (*Persicaria maculosa*) and soft rushes (*Juncus effusus*) present. Hydrology consisted of saturated soils, standing water, and drainage patterns. The grazed areas in degraded states and exotic dominate were assessed as low value. Some wetland seepages were also identified and had indigenous vegetation, good hydrology and therefore were assessed as moderate value. Most of these wetlands passed the rapid vegetation test and further delineations were not required.

Table 20-5: Summary of wetland features and ecological value in the Tauriko west MDRZ area.

Wetland	Vegetation type	NPS Test	Soil ⁴²	Hydrology	Value
Wetland 1	Mercer grass and creeping bent willow weed, soft rush, and lotus (<i>Lotus pedunculatus</i>)	Rapid	NA	Saturated soils/standing water, drainage patterns	Low
Wetland 2a					
Wetland 2b					
Wetland 3					
Wetland 3a					
Wetland 4	Exotic shrub - elephants ear (<i>Alocasia brisbanensis</i>), and green goddess (<i>Zantedeschia aethiopica</i> 'Green Goddess'), and willow weed.	Rapid	NA	Saturated soils, Drainage patterns	Low
Wetland 5a	Wetland seepage - swamp millet (<i>Isachne globosa</i>), <i>Isolepis prolifera</i> , twig rush (<i>Machaerina rubiginosa</i>), and mercer grass.	Rapid	NA	Saturated soils and pugging	Moderate
Wetland 5b					
Wetland 5c					
Wetland 5d	Mercer grass, creeping bent and	Rapid	NA	Drainage patterns	Low

⁴² Where wetlands passed the rapid vegetation assessment no soil sampling was undertaken. Similarly where there was standing water no soil sample was undertaken.

Wetland	Vegetation type	NPS Test	Soil ⁴²	Hydrology	Value
	creeping buttercup (<i>Ranunculus repens</i>) with the occasional willow weed and soft rush.				
Wetland 6	Wetland pasture - mercer grass and creeping bent with the occasional willow weed and soft rush.	Passes dominance test (100%) Prevalence: 2.6	Gley and mottled	Saturated soils, drainage patterns	Low
Wetland 7a, b, c, d,	Carex gully heads rautahi (<i>Carex lessoniana</i>).	Rapid	NA	Saturated soils, Drainage patterns/geomorphic position	Moderate
Wetland 8	Willow weed and mercer grass dominated with rautahi present.	Rapid	NA	Saturated soils, surface water	Moderate
Wetland 9a	Wetland matrix - mercer grass and willow weed (<i>Persicaria maculosa</i>) interspersed with non-wetland areas (kikuyu (<i>Cenchrus clandestinus</i>))	Rapid ⁴³	NA	Saturated soils	Low
Wetland 9b	Wetland matrix mercer grass, <i>Carex virgata</i> , <i>Isolepis polifera</i> , and umbrella sedge (<i>Cyperus ustulatus</i>).	Rapid	NA	Saturated soils, drainage patterns.	Moderate

⁴³ Where wetland vegetation was dominant this area passed the rapid vegetation test, however the non wetland and wetland areas are so interspersed in is not practicable to delineate between them and the area as a whole should be treated as a wetland.



Figure 20-1: Left – an example of grazed pasture wetland with juncus and willow weed, pugging, and surface water. Right – Wetland 4 consisting of shrub vegetation and pest species.



Figure 20-2: Left – Wetland 5c consisting of swamp millet and Isolepis vegetation. Right- Overview of the Ferncliffe farm wetland system (Wetland 9a and 9b). The valley floor forms a wetland matrix with Carex wetlands in the side gullies (Wetlands 7).

13. Kōpūrererua Valley

The previous land use of this valley was agriculture and farming; however, there is now a reserve adjacent to the Kōpūrererua Stream. In recent years restoration projects have been commenced to naturalise the area and the valley floor is reverting to a wetland marsh system (Figure). There are several large wetland systems present, with mapping and surveys having been undertaken across multiple assessments by a number of consultancies. Wetlands 10a and 10b within the valley are also historic wetlands, that are heavily grazed now and have a high degree of disturbance.

Table 20-6: Summary of wetland features and ecological value in the Kōpūrererua Valley.

Wetland	Vegetation type	NPS Test	Soil ⁴⁴	Hydrology	Value
Wetland 10a.1	Soft rush, jointed rush (<i>Juncus articulatus</i>), creeping buttercup and paspalum dilatatum	Dominance: 67% Prevalence: 2.91	Gley and mottled	Saturated soils	Low
Wetland 10a.2	Creeping buttercup, bedmarsh straw (<i>Gallium palustre</i>), paspalum dilatatum, and soft rush	Prevalence: 2.63	Gley soils mottles	Saturated soils	Low
10a.3	Jointed rush, water purslane (<i>Ludwigia palustris</i>), willow weed	Rapid test	NA	Standing water	Low
10a.4	Jointed rush, water purslane, creeping bent	Dominance 100% Prevalence: 2.6	NA	Standing water	Low
10a.5	<i>Glyceria maxima</i> , mercer grass and soft rush	Rapid	NA	Saturated and standing water	Low
Wetland 10b	<i>Glyceria maxima</i> willow weed, soft rush, creeping buttercup	Rapid	NA	Saturated soils	Low
Wetland 11 (Figure)	Mercer grass, <i>Glyceria maxima</i>	Rapid	NA	Saturated soils	Low
Wetland 12	Swamp millet, twig rush (<i>Machaerina rubiginosa</i>), mercer grass, <i>Carex lurida</i> , knobby rush (<i>Ficinia nodosa</i>), and fox sedge (<i>Carex vulpinoidea</i>).	Rapid	NA	Saturated and standing/running water. Drainage patterns	Moderate
Wetland 13	Jointed rush, wiwi (<i>Juncus edgariae</i>), marsh bedstraw, fox	Rapid	NA	Saturated soils, and standing water	High

⁴⁴ Where wetlands passed the rapid vegetation assessment no soil sampling was undertaken. Similarly, where there was standing water no soil sample was undertaken.

Wetland	Vegetation type	NPS Test	Soil ⁴⁴	Hydrology	Value
	sedge, <i>Glyceria maxima</i>), <i>Carex virgata</i> , and soft rush				
Wetland 14a	Jointed rush, marsh bedstraw, fox sedge, <i>Glyceria maxima</i> , and soft rush, creeping buttercup	Rapid		Saturated soils	Moderate
Wetland 14b	Jointed rush, wiwi (<i>Juncus edgariae</i>), marsh bedstraw, fox sedge, <i>Glyceria maxima</i>), <i>Carex virgata</i> , and soft rush	Rapid		Saturated soils, and standing water	High



Figure 20-3: Left – Mercer grass dominated wetland feature (wetland 11). Right – Seepage feature identified in Kōpūrererua Valley (wetland 12).



Figure 20-4: Left – The large wetland system in the Kōpūrererua Valley with significant surface water and diverse wetland vegetation (wetland 13). Right – wetland extents added to the current BOPRC map of the Kōpūrererua Valley (wetland 14).

14. Belk Road Wetland

The Belk Road area has previously been assessed for wetlands with delineation undertaken for the development of the Tauriko Business Estate which concluded the value of Wetland 15a area is moderate (WSP, 2022b) (Boffa Miskell Ltd, 2021). Although the wetland has undergone significant change due to earthworks, the mitigation planting in the wetland is valued as moderate, with the value of the wetland likely to increase as mitigation plantings mature and establish (Figure). Wetland 15b is not part of the wetland mitigation area. However, the areas surrounding the stream channel are dominated by water pepper, with saturated soils (Figure 20-5). Wetland 16 is a rushland with standing water and aquatic plant species such as water purslane.

Table 20-7: Summary of wetland features and ecological value in the Belk Road area.

Wetland	Vegetation type	NPS Test	Soil ⁴⁵	Hydrology	Value
Wetland 15a	Wetland offset area - wineberry (<i>Aristotelia serrata</i>), cabbage tree (<i>Cordyline australis</i>), kahikatea (<i>Dacrycarpus dacrydioides</i>),	Rapid	NA	Saturated soils	Moderate

⁴⁵ Where wetlands passed the rapid vegetation assessment no soil sampling was undertaken. Similarly, where there was standing water no soil sample was undertaken.

Wetland	Vegetation type	NPS Test	Soil ⁴⁵	Hydrology	Value
	rewarewa (<i>Knightia excelsa</i>), karamū (<i>Coprosma robusta</i>), mānuka (<i>Leptospermum scoparium</i>), māhoe (<i>Melicytus ramiflorus</i>), māpou (<i>Myrsine australis</i>), <i>Carex geminata</i> , <i>Juncus australis</i> .				
Wetland 15b	Waterpepper dominated	Rapid	NA	Saturated soils	Low
Wetland 16	<i>Glyceria maxima</i> , soft rush, bed marsh straw, water purslane, Harakeke	Rapid	NA	Surface water, Hydrogen sulphide odour	Moderate



Figure 20-5: Left – Wetland 15a showing the mitigation planting. Right – Wetland 15b with water pepper dominated areas adjacent to the stream.

Two other wetlands have been previously identified in the Belk Road area through regional council mapping. However, these wetlands are no longer present due to a series of earthworks and the construction of ponds as seen in Figure 20-6 below.



Figure 20-6: Previously mapped wetland from the regional council maps. Left – imagery from 2024, Right - imagery from 2023.

15. Wetland 17

Wetlands 17a and 17b are located on agricultural land. Wetland 17a has a high level of disturbance with grazing and vegetation limited to grass species and soft rush. Wetland 17b was less degraded through disturbance and had a mixture of rush and sedge species (Figure 20-7) with saturated soils.

Table 20-8: Summary of wetland features and ecological value of Wetlands 17a and 17b.

Wetland	Vegetation type	NPS Test	Soil ⁴⁶	Hydrology	Value
Wetland 17a	Wetland pasture, soft rush	Rapid	NA	Drainage patterns, saturated soils	Low
Wetland 17b	Wetland seepage <i>Carex</i> species, soft rush, swamp millet.	Rapid	NA	Saturated soils, Drainage patterns,	Moderate

⁴⁶ Where wetlands passed the rapid vegetation assessment no soil sampling was undertaken. Similarly where there was standing water no soil sample was undertaken.



Figure 20-7: Left – Wetland 17a showing pasture dominated vegetation with saturated soils. Right – Wetland 17b, a seepage feature with rush and Carex species.

Appendix 5: Wetland Compensation Modelling

16. Introduction

This section outlines the proposed approach to managing wetland ecological effects of the State Highway 29 project on wetland systems of all values (i.e., low, moderate, and high). The features impacted are present along the length of the Indicative Design, with high value wetlands limited to the Kōpūrerua Valley wetland system.

This section also explains the compensation modelling which forms part of the approach to scoping an appropriate scale and ecological outcome (no ecological loss/ecological gain in biodiversity values) for effects management.

A total of 4.94 ha of wetland extent will be permanently lost from the Indicative Design. It is anticipated that the proposed indicative restoration area and wetland creation area will be able to accommodate the establishment of an equivalent areal extent for wetland to the wetland extent that is lost.

17. Approach

A mixture of low, moderate, and high value wetland extent will be lost as a result of the Project. While we have assessed these impacts to be of a low to moderate level of effect with management through offsetting using wetland creation, there is insufficient spatial extents within the Proposed Designation to achieve the offsetting goals. As such, the compensation approach has been identified to manage that effects of wetland extent lost.

The compensation package will involve primarily the restoration and enhancement of existing wetland extents. However, where wetland creation can be achieved within the Proposed Designation this approach will also be utilised to manage effects. Restoration versus recreation is defined as:

- Wetland restoration is the active intervention and management, appropriate to the type and location of the wetland, aimed at restoring its ecosystem health, indigenous biodiversity, or hydrological functioning.
- Wetland creation is the modification of an area that is not currently a wetland⁴⁷ sufficient to intercept or otherwise interact with groundwater or surface water creating hydrological conditions suitable for the maintenance of a wetland ecosystem. The area of new wetlands will then be planted with indigenous wetland species to form a novel wetland or extension to an existing wetland.

The proposed restoration and enhancement is a holistic, system-based approach which seeks to increase the ecological value and resilience of the wetland features present. This will include

⁴⁷ But may be directly adjacent to an existing wetland thereby expanding the area of an existing wetland.

the establishment of riparian vegetation and progressive pest plant control, pest animal control, native revegetation of wetland areas, removal of in wetland structures and connectivity barriers, and recreation of wetland extents.

The preliminary details of the restoration and enhancement approach that will form part of the effects management package for each of the wetland value groups is provided below. This approach will need to be outlined in further detail in the consent conditions and a Wetland Management Plan which is intended to be a sub-part of a wider Ecological Management Plan. This should include the details of the methods, locations, and timing of the compensation actions as well as a monitoring programme to ensure and demonstrate success in attaining the modelled ecological values within this report.

The outcome of this restoration will be resilient, structurally complex native dominated wetland with riparian forest ecosystem on its boundaries. Stock permanently excluded from both wetland and riparian areas. Wetland hydrology and hydrological regimes are sustainable and resilient.

18. Kōpūrererua Valley wetland complex

18.1. Baseline

The Kōpūrererua valley wetland complex is a historically heavily modified wetland with more recent restoration and enhancement improving the vegetation communities and habitat. It has semi-permanent standing water with a diverse vegetation including jointed rush (*Juncus articulatus*), wiwi (*Juncus edgariae*), marsh bedstraw (*Galium palustre*), fox sedge (*Carex vulpinoidea*), reed sweetgrass (*Glyceria maxima*), *Carex virgata*, and *Juncus effusus*. There is limited pressure from pest plant species.

The Kōpūrererua Valley wetland system is assessed as high value due to the diversity of vegetation and ecological function it serves as part of the Kōpūrererua Stream flood plain, and the potential habitat it provides to aquatic fauna and avifauna.

18.2. Constraints/opportunities

While there is limited pest plant presence within the wetland, opportunities for pest plant management is primarily along the edges where pressure is highest exist. There is a considerable opportunity to create and improve habitat for cryptic wetland bird species and native freshwater fish spawning in this catchment/area.

18.3. Baseline

The top portion of wider wetland matrix is within the Proposed Designation, with a handful of small *Carex* dominated gully heads. The wetland matrix is dominated by rushes and pasture grasses including *Paspalum distichum* and willow weed. Several mature willow trees are present on the valley floor. Stock grazing, and general agricultural use has led to significant degradation of this wetland matrix. The valley floor area of the wetland matrix is predominantly low value.

The *Carex* gully head are spring fed seepages dominated by *Carex lesssoniana*. Due to the dominance of *Carex* species these wetlands are of moderate value.

18.4. Constraints/opportunities

There is a significant opportunity to create habitat for cryptic wetland bird species and there may be some limited opportunities for creation of native freshwater fish spawning along the existing waterways.

As the wetland matrix is currently grazed, restoration would include the exclusion of stock. Following stock exclusion, there is significant scope for improving hydrology and planting of indigenous wetland vegetation.

19. Other wetland areas

Low and moderate value wetland extents in the remaining Proposed Designation that are not lost are potentially available for restoration. These include:

- Wetland 2b and 2a
- Approximately half of Wetland 3a
- Wetland 4
- Wetlands 5a, 5b, and 5d
- Wetland 6
- Wetland 10b
- Wetland 17a and 17b

19.1. Baseline

The wetlands listed above consist of low and moderate value wetlands of primarily grazed pastureland with low vegetation diversity, and/or dominated by exotic species. Wetlands 5a and 5b, are dominated by plant species such as swamp millet (*Isachne globosa*), *Isolepis prolifera*, twig rush (*Machaerina rubiginosa*), and mercer grass (*Paspalum distichum*).

19.2. Constraints/opportunities

Many of the low and moderate value wetland have significant scope for pest plant and exotic species control including elephants' ear (*Alocasia brisbanensis*), and green goddess (*Zantedeschia aethiopica* 'Green Goddess'), and woolly nightshade (*Solanum mauritianum*). Many of the wetlands are also within grazed pasture areas and would benefit from the exclusion of stock.

There is a significant opportunity to create habitat for cryptic wetland bird species, however the creation of freshwater fish spawning habitat is likely inappropriate as much of these wetlands are seepage feature disconnected from waterways.

There is significant opportunity to improve wetland vegetation communities by the restoration and enhancement planting of native wetland vegetation.

19.3. Wetland creation approach

There are several methods through which wetlands may be created in association with the Kōpūrerua Stream and Nanako Stream realignments within the Proposed Designation:

- Stepped wetland features along the length of the diverted water course.
- Excavation and widening of terrestrial areas adjacent to stream extents to recreate wetland hydrology and extent.

Once the wetland hydrology has been established the general steps for restoration are as follows:

- Plant native wetland plants within areas of constructed wetland.
- Plant riparian vegetation on riparian area around constructed wetlands.
- Maintenance and replacement where needed of native plantings, and monitoring of constructed wetland during establishment phase.
- Pest plant control as and where required to prevent the establishment of wetland pest plants.
- Pest animal control during the restoration phase to increase avifauna populations resilience during the periods of disturbance and restoration and lag between impact and establishment of resilient and structurally complex habitats.

19.4. Wetland creation outcome

Resilient, constructed, structurally complex wetland with riparian forest ecosystem on its boundaries. Stock permanently excluded from both wetland and riparian areas. Native dominated wetland with functional wetland hydrology and processes.

Compensation modelling

Modelling was undertaken using the qualitative Biodiversity Compensation Model (BCM V1; Baber, Christensen, et al., 2021; Baber, Dickson, et al., 2021a). This model was used as a precautionary assessment tool to ensure effects could be feasibly managed as designs changed and evolved. The results of the modelling are provided Table 20-9, with the details of this model and its inputs are provided in Table 20-10.

20. Biodiversity Compensation Model (BCM)

The BCM V1 was used initially to model the impacts and to calculate the adequacy of the effects management package in achieving an ecological gain in biodiversity. Calculations were done using the Biodiversity Compensation Model for New Zealand– Excel Calculator Tool (Version 1) (Baber, Dickson, et al., 2021b). The inputs to the model and explanation of the inputs are provided in Table 20-10. The scoring for pre and post impact values was derived from ecological value assessments following EIANZ (2018) guidance.

The approach for quantifying management actions has been to consider both the management and outcome on the freshwater wetlands present at a catchment scale to enable 'like with like' comparisons. This provides a holistic picture of management actions and cumulative increase in ecological value through the various management interventions.

Table 20-9 provides the output of the BCM and demonstrates the predicted outcome of a 9.73% positive impact on wetland values within five years.

Table 20-9: BCM model outputs.

	Total impact score	Low value wetlands	Moderate value wetlands	High value wetlands	
Impact score	-2.74648	-0.64721	-0.65132	-1.44796	
	Total compensation score	Low value wetland restoration	Moderate value wetland restoration	High value wetland restoration	Wetland creation
Compensation score	3.01366	0.91664	0.73248	0.83633	0.52820
Net gain outcome	9.73%				

Table 20-10: Biodiversity Compensation Model for New Zealand inputs and explanations for SH29.

Model inputs	Model inputs and explanation.
Project/reference name	Tauriko West Tupenga –wetland impact effects management
Biodiversity type	Mixture of low diversity grazed and exotic wetlands, moderate value wetland seepages and matrix, and high value wetland marsh and swamp complex.
Technical expert input(s)	Andrew Blayney & Rosa Kirkham
Benchmark	A benchmark of 5 equates to a large contiguous lowland freshwater wetland ecosystem type. This includes an intact and resilient riparian margin buffer consisting of native vegetation. The wetland system includes heterogenous landform which results in a diverse pattern of wetland hydrology. A full suite of indigenous flora and fauna present at or near carrying capacity. The wetland, as well as its riparian margins are protected from the impacts of stock and surrounding land uses.
How many habitat types OR sites are impacted	3
Number of proposed effects management measures	4
	Explanation: The effects management measures have been partitioned

Model inputs	Model inputs and explanation.
	to four distinct categories based on areas of wetland value and wetland creation. At each site there are several management measures/actions.
Ecological Gain target	10% (i.e., the ecological gain score needs to be at least 10% higher than the impact score)
Impact model inputs and descriptions	
Habitat/site impacted	Low value wetland
Impact risk contingency	Data input: 1 – Negligible or low risk (calculated biodiversity impact score is multiplied by 1.0 (+0%)) Explanation: The impact risk was assessed as 'Negligible/low' because the wetland areas were assessed as being of 'low' value based on the ecological assessment. These wetlands have low native vegetation diversity.
Impact uncertainty contingency	Data input: 1 - Low uncertainty (calculated biodiversity impact score is multiplied by 1.5 (+5%)) Explanation: Low value wetlands are typically small, discrete areas with uniform vegetation communities typical of grazed pasture. They are not connected to broader ecological features being situated in agricultural land use.
Areal extent of impact (ha)	Data input: 2.056 ha Explanation: Area of impact/works footprint resulting in loss of ecosystem.
Value score <u>prior to impact</u>	Data input: 1.5 Explanation: A value of 1 relative to the benchmark of 5 for the wetland extent equating to an ecological value of 'Low' value.
Value score after impact	Data input: 0.001 Explanation: A value of 0.001 as there will be a permanent loss of habitat (noting that the formula cannot work with 0).
Habitat/site impacted	Moderate value wetlands
Impact risk contingency	Data input: 2 - Moderate risk (calculated biodiversity impact score is multiplied by 1.05 (+5%)) Explanation: The impact risk was assessed as 'Moderate' because the wetland features were assessed as being of 'Moderate' value with some natural vegetation diversity and hydrology.
Impact uncertainty contingency	Data input: 1 - Low uncertainty (calculated biodiversity impact score is multiplied by 1.05 (+5%)) Explanation: Moderate value wetlands are typically small, discrete areas with moderate diversity vegetation communities typical of wetland seepages. They are typically not connected to broader ecological features.
Areal extent of impact (ha)	Data input: 1.182 ha Explanation: Area of impact/works footprint resulting in loss of ecosystem.
Value score <u>prior to impact</u>	Data input: 2.5 Explanation: A value of 2 relative to the benchmark of 5 for the wetland extent equating to an ecological value of 'Moderate' value.

Model inputs	Model inputs and explanation.
Value score after impact	Data input: 0.001 Explanation: A value of 0.001 as there will be a permanent loss of habitat (noting that the formula cannot work with 0).
Habitat/site impacted	High value wetlands
Impact risk contingency	Data input: 3 – High risk (calculated biodiversity impact score is multiplied by 1.1 (+10%)) Explanation: The impact risk was assessed as 'High' because the wetland complex was assessed as being of 'High' value. These wetlands have high diversity of native vegetation, with intact wetland hydrology provide significant ecological services.
Impact uncertainty contingency	Data input: 2 - Moderate uncertainty (calculated biodiversity impact score is multiplied by 1.1 (+10%)) Explanation: The impact location on high value wetlands is limited in scope and primarily associated with stream realignment. The high value wetland are more complex with high vegetation diversity and hydrological connections between areas.
Areal extent of impact (ha)	Data input: 1.71 Explanation: Area of impact/works footprint resulting in loss of ecosystem.
Value score <u>prior to</u> impact	Data input: 3.5 Explanation: A value of 3 relative to the benchmark of 5 for the wetland extent equating to an ecological value of 'High' value.
Value score after impact	Data input: 0.001 Explanation: A value of 0.001 as there will be a permanent loss of habitat within footprint of works (noting that the formula cannot work with 0).
Effects management model inputs	
	Low value wetlands
Effects management action	Data input: Effects management actions as described above under approach and outcome for this wetland.
Discount rate	Data input: 3% Explanation: Default
Finite endpoint	Data input: 5 years Explanation: At 5 years the wetland and riparian vegetation and buffer vegetation should be well established, resilient, and self-sustaining. Pest plant control in and around the wetland should have reduced pest plant presence in the wetlands.
Confidence contingency	Data input: 1 – Very High confidence (Likelihood of success is >90%) Explanation: Wetland and riparian buffer planting and wetland restoration is a commonly applied effects management tool used to create or restore indigenous habitat. For low value wetlands planting of natives will quickly establish a more diverse vegetation community.
Areal extent (ha) of effects management	Data input: 2.872 ha Explanation: Area of wetland present in the across the Proposed Designation with low value.

Model inputs	Model inputs and explanation.
Value score <u>prior to effects management measure</u>	Data input: 1.5 Explanation: A value of 1.5 relative to the benchmark of 5 for the wetland extent equating to an ecological value of 'Low-Moderate' value.
Value score after effects management measure	Data input: 3.5 Explanation: A value of 3.5 relative to the benchmark of 5 for the wetland extent equating to an ecological value of 'High' value – increased wetland vegetation density and diversity. Improving ecological services providing increase habitat complexity.
	Moderate Value wetlands
Effects management action	Data input: Effects management actions as described above under approach and outcome for this wetland.
Discount rate	Data input: 3% Explanation: Default
Finite endpoint	Data input: 5 years Explanation: At 5 years the wetland and riparian vegetation and buffer vegetation should be well established, resilient, and self-sustaining. Pest plant control in and around the wetland should have reduced pest plant presence in the wetlands.
Confidence contingency	Data input: 1 – Very High confidence (Likelihood of success is < 90%. Explanation: Wetland and riparian buffer planting and wetland restoration is a commonly applied effects management tool used to create or restore indigenous habitat. For moderate value wetlands planting of natives will quickly establish a more diverse vegetation community, with regeneration progressing with stock exclusion.
Areal extent (ha) of effects management	Data input: 3.06 ha Explanation: Area of wetland present in the across the Proposed Designation with moderate value.
Value score <u>prior to effects management measure</u>	Data input: 2.5 Explanation: A value of 2.5 relative to the benchmark of 5 for the wetland extent equating to an ecological value of 'moderate' value.
Value score after effects management measure	Data input: 4 Explanation: A value of 4 relative to the benchmark of 5 for the wetland extent equating to an ecological value of 'Very High' value with improved vegetation diversity and ecosystem services.
	High value wetland
Effects management action	Data input: Effects management actions as described above under approach and outcome for this wetland.
Discount rate	Data input: 3% Explanation: Default
Finite endpoint	Data input: 5 years Explanation: At 5 years the wetland and riparian vegetation and buffer vegetation should be well established, resilient, and self-sustaining. Pest plant control in and around the wetland should have reduced pest plant

Model inputs	Model inputs and explanation.
	presence in the wetlands.
Confidence contingency	Data input: 2 - High confidence (Likelihood of success is 75%-90%). Explanation: Wetland and riparian buffer planting and wetland restoration is a commonly applied effects management tool used to create or restore indigenous habitat. For high value wetlands planting of natives will support natural regeneration and provide vegetation community complexity and structure providing improved habitat for fauna.
Areal extent (ha) of effects management	Data input: 5.876 Explanation: Area of wetland present in the Kōpūrerua valley wetland complex within the Proposed Designation.
Value score <u>prior</u> to effects management measure	Data input: 3.5 Explanation: A value of 3.5 relative to the benchmark of 5 for the wetland extent equating to an ecological value of 'High' value.
Value score after effects management measure	Data input: 4.5 Explanation: A value of 4.5 relative to the benchmark of 5 for the wetland extent equating to an ecological value of 'Very High' value.
Wetland creation	
Effects management action	Data input: Wetland creation in available locations across the Proposed Designation including Kōpūrerua valley and the Tauriko West MDRZ area.
Discount rate	Data input: 3% Explanation: Default
Finite end-point	Data input: 5 Explanation: At 5 years wetland hydrology will have stabilised and wetland vegetation should be well established, resilient, and self-sustaining.
Confidence contingency	Data input: 3 - Moderate confidence (Likelihood of success is > 50%) Explanation: Riparian buffer planting and wetland restoration is a commonly applied effects management tool. The creation of wetlands is less certain in its outcome. Recreating the hydrology and processes to ensure a resilient and functional wetland is more uncertain than restoring an area of existing wetland. As such we have given this action a moderate confidence.
Areal extent (ha) of effects management type	Data input: 1.4 ha Explanation: Preliminary figure of wetland recreation associated with Proposed Designation the Kōpūrerua Stream and Nānako Stream Realignment.
Value score prior to effects management measure (relative to benchmark)	Data input: 0.001 Explanation: A value of 0.001 as this will be carried out in a location that did not previously have a wetland (noting that the formula cannot work with 0).
Value score after effects management measure (relative to benchmark)	Data input: 3.5 Explanation: A value of 3.5 relative to the benchmark of 5 for the

Model inputs	Model inputs and explanation.
	wetland extent equating to an ecological value of 'High to very high' value.

Appendix 6: Freshwater environment

21. Affected waterways descriptions

21.1. Wairoa catchment

This catchment includes a network of natural and artificial watercourses that drain into the Wairoa River. There are three notable watercourses that contain unique characteristics (Omanawa River, Belk Road Stream, and Wairoa River) as well as a series of other gullies that contain simplified and homogenous networks of watercourses.

The remaining watercourses have been described and classified as part of the Tauriko West urban growth area plan change process. These descriptions and classifications have been adopted for this assessment as they have not materially changed since those descriptions were made.

21.1.1. Wairoa River (receiving environment)

The Wairoa River banks have been modified through riparian vegetation removal and management. However, the river still runs its natural course and is habitat for a diverse aquatic community, supporting 'At Risk' freshwater species. These include, for example, longfin eel, shortfin eel, common smelt, red fin bully, inanga, giant bully, giant kokopu. The Wairoa River is also a key connecting artery for tributaries and upper catchment areas. Overall, the freshwater ecological value should be considered as, at least, high for both habitat and fauna.

21.1.2. Omanawa River (receiving environment)

The ecological condition of the Ōmanawa River as part of this assessment has been informed primarily by the Ōmanawa Bridge Replacement Ecological Impact Assessment prepared for NZTA, with ground-truthing site checks undertaken as part of the current project to confirm that the reported habitat and water quality characteristics remain representative of existing conditions. The river forms part of the receiving environment for the current proposal rather than being directly affected, noting that bridge replacement works have already been progressed separately and no in-channel works form part of this application.

Within the vicinity of the Indicative Design, the Ōmanawa River exhibits moderate to low physical habitat quality, largely shaped by its location at the lower end of the catchment where surrounding land use transitions to agricultural pasture. The river margins in the assessed reach contain limited riparian vegetation, resulting in minimal shading and a relative lack of bank undercutting or complex edge habitat. Sedimentation and bank erosion were evident during the field inspection and are consistent with the findings of the existing assessment, which recorded a Rapid Habitat Assessment score of 35, driven by low hydraulic heterogeneity and noticeable fine sediment deposition. Channel morphology is relatively simple, dominated by soft-bottom substrates, and the riparian zone is narrow and frequently open, reducing the buffering capacity against runoff and sunlight.

Physico-chemical monitoring undertaken for the bridge assessment showed good overall water quality, with nutrient concentrations (TN 1.4 mg/L; DRP 0.019 mg/L) well within ANZG guideline thresholds and toxicant concentrations in both water and sediment markedly below guideline values, indicating minimal contaminant loading. Turbidity readings (7.5 NTU) align with a moderately impacted lowland system, but dissolved oxygen, pH, and temperature measurements fall within typical ranges for a healthy flowing watercourse. These results were verified during recent site walkovers, which confirmed clear water, stable physicochemical conditions, and no evidence of contaminant stress. Overall, the Ōmanawa River in this location represents a hydrologically intact, largely unmodified channel with good water quality but simplified physical structure, reflecting its position as a rural receiving environment for upstream forested reaches and downstream agricultural influence.

21.1.3. Belk Road Stream (impact watercourse)

The Belk Road watercourses⁴⁸ are perennial in nature but highly modified as this area is utilised as a stream (and wetland) offset area for the Tauriko Business Estate (TBE) Stage 3 and 4 development. Due to the recent works, the riparian vegetation is limited to new plantings of predominantly wetland species (Photo 2). The original (though highly modified and straightened) channel is still present, however a secondary channel, diverging – running adjacent to – and then rejoining the original channel now exists, along with a new meandering channel, that also forms part of the TBE offset, discharging from the permanent stormwater TBE stormwater ponds. The streams appear to be soft bottom with generally homogenous flow. Streams at Belk Road are likely considered to be of low value currently; however, have elevated ecological importance, relevance, and sensitivity given they are part of an ecological offset requirement for TBE.

21.1.4. Downstream of SH29

The physical and physico-chemical condition of the downstream reach has been informed primarily by the Redwood Lane Ecological Assessment (WSP, 2022b), supported by catchment-scale descriptions from the Tauriko West (Southern Gully) assessment (Boffa Miskell Ltd, 2023a), with recent walkovers verifying that the described conditions remain representative. This downstream section forms part of the receiving environment for the current project and is not subject to any direct works.

Downstream of SH29, the stream is a permanent, modified watercourse that has been historically straightened and is now characterised by predominantly slow-flowing run habitat, with some riffle–run–pool sequences occurring closer to the Wairoa River. The channel exhibits an average wetted width of ~4.6 m, bankfull width of ~8.8 m, and average depth of ~0.9 m, reflecting a comparatively wide, depositional lowland reach. Substrates are dominated by fine silts, with intermittent patches of woody debris, gravels, cobbles, and compacted clay in areas where macrophyte growth is less dense. These substrate patterns indicate long-term infilling and reduced hydraulic diversity. Riparian vegetation is present along the true left bank but is patchy and dominated by exotic species, while the true right bank offers minimal shading and limited structural cover. Overall habitat condition was assessed as moderate (51%), with scores reduced by high levels of deposited sediment, narrow riparian margins, and simplified channel form.

⁴⁸ This area has been subject to ecological offsets as a result of the Tauriko Business Estate Stage 3 and 4 developments so now contains multiple watercourses.

Physico-chemical measurements indicate a system with generally clear water at baseflow, although sediment is highly mobile and easily resuspended, reflecting the fine substrate profile. Spot measurements recorded a neutral pH (~6.7) and low electrical conductivity (~99 $\mu\text{S}/\text{cm}$), both typical of minimally mineralised freshwater. However, dissolved oxygen was low (42%, 4.2 mg/L), consistent with the slow-flowing hydrology and macrophyte-dominated channel. Water clarity was moderate (0.66 m) but quickly decreased with disturbance, signalling high suspended sediment potential. Broader water quality sampling downstream identified low concentrations of heavy metals, low total suspended solids, and generally neutral pH, although nutrient concentrations were elevated and *E. coli* levels were high, reflecting diffuse agricultural influences on the catchment. Collectively, these conditions describe a hydrologically functional but physically degraded channel with limited shading, constrained riparian structure, elevated sedimentation, and moderate water quality stressors typical of pastoral lowland receiving systems.

21.1.5. Upstream of SH29

The upstream section of the watercourse, located north of the Stage 3A development area and immediately upstream of SH29, forms part of the Belk Road greenbelt stream and wetland offset area established for the Tauriko Business Estate (TBE) Stage 3A and 4 consents. Historically functioning as a straightened pastoral drain, this reach now sits within a zone specifically designated for offset delivery, where a combination of channel enhancement, stream creation, and riparian planting is required to compensate for losses occurring elsewhere within the development footprint. As a result, this area currently represents a transitional and actively managed restoration landscape, where early-stage ecological uplift is beginning to materialise but has not yet matured into its intended state.

In its present form, the upstream reach exhibits the legacy straightened and incised agricultural channel, which persists as one of several active flow paths. This original channel remains physically simple, characterised by fine, soft-bottom sediments, low hydraulic diversity, and largely homogeneous run habitat. Works undertaken as part of the offset programme have introduced additional channel features, including a secondary diversion channel that locally diverges from and reconnects with the original alignment, as well as a newly constructed meandering channel extending across the wider greenbelt floor. These constructed channels display wider berms, shallow benches, and gently sloping banks, but flow conditions remain uniform and slow-moving due to the early stage of geomorphic development.

Earthworks associated with channel construction, sediment control, and bank shaping are clearly evident. Much of the recent ground disturbance remains visible, including exposed soils, erosion-control matting, and emergent low vegetation establishing on freshly contoured surfaces. Localised armouring has been installed at key structural interfaces such as the SH29 culvert outlet, where rock protection has been placed to stabilise gradients and manage erosive forces. Across the reach, substrate conditions are still dominated by unconsolidated fines, which resuspend easily when disturbed and contribute to the generally turbid appearance typical of newly constructed or recently disturbed lowland channels.

Riparian margins within the upstream reach are also at an early establishment stage, consisting mainly of recently planted sedges, rushes, and other wetland-appropriate species. These plantings provide minimal shading or structural influence at present but have begun to stabilise portions of the banks and promote the early development of shallow wetland benches. Opportunistic herbaceous species are widespread across disturbed soils, while planted areas show the expected spatial variability associated with initial survival and establishment. Collectively, the limited vegetation cover means that stream temperatures, bank stability, and

nutrient attenuation functions remain only partially developed, and instream habitat complexity remains low as a result.

Looking forward, this upstream section is expected to undergo substantial functional improvement as the offset features mature. The created meandering channel is designed to develop increased hydraulic and geomorphic diversity over time, with planting growth gradually narrowing the channel, increasing roughness, promoting sediment sorting, and fostering more distinct pool–run sequences. Expansion of riparian vegetation will deliver shading, organic matter inputs, and bank reinforcement, while the maturing wetland benches will contribute to improved water quality through filtration and retention processes. Although current condition remains reflective of its recent construction and establishment phase, the reach holds high future ecological importance, as its successful development is required to deliver the stream function, habitat complexity, and long-term ecological gains central to the TBE offset package.



21.1.6. Tauriko West urban growth area

Across the Tauriko West growth area, unnamed watercourses are dominated by highly modified or fully artificial drainage channels, reflecting the long agricultural history of the landscape. Most features are straightened, incised, and physically simplified, with soft-bottom substrates, limited riparian structure, and homogenous flow profiles. Mapping and previous assessments show that over 60% of the network comprises artificial drains, with the remainder being modified natural channels of similarly low physical complexity. Because these watercourses share consistent hydrological behaviour and physical habitat characteristics, they can be appropriately grouped by flow regime (perennial, intermittent, ephemeral) and by origin (modified vs artificial) for the purposes of description and effects assessment.

21.1.7. Natural highly modified watercourses – perennial

Perennial modified streams in Tauriko West are typically straightened, incised lowland channels, often with bankfull heights of around 1 m and widths ranging from approximately 1–1.5 m. They contain slow-flowing run habitat, with soft-bottom substrates dominated by silt and fine organic material, reflecting long-term agricultural sediment inputs. Hydraulics are generally simple, with limited riffle formation and minimal velocity variation under normal flows.

Riparian vegetation is generally a mixture of exotic shrubs, scattered trees, and rank pasture, with some shading where larger vegetation persists, though tall riparian cover is inconsistent across the network. Modification often includes bank erosion, armouring, or piped stormwater inflows, which further simplifies habitat structure. Overall, these watercourses provide variable

physical habitat but remain strongly influenced by historic straightening and agricultural drainage practices.



21.1.8. Natural highly modified watercourses – intermittent

Modified intermittent streams in the growth area resemble the perennial-modified type but exhibit reduced or absent flows during drier periods. Channels are incised but narrower and shallower, frequently around 0.5 m bankfull height. Substrates remain dominated by soft silts, with patchy macrophytes and periphyton forming in pooled or slow-moving water. Habitat diversity is limited, with homogeneous run/pool sequences and no structural features such as woody debris or developed undercuts.

Riparian margins consist mostly of pasture grasses, with limited shading and periodic mowing/grazing influencing bank stability. These channels are sensitive to disturbance due to their fine substrates and shallow depth profiles.



21.1.9. Natural highly modified watercourses – ephemeral

Modified ephemeral channels occur near headwater slopes or shallow gullies that have been historically reshaped or deepened for drainage but still follow an existing landform. They typically contain saturated soils rather than defined flow, with no persistent channel form or surface water during normal conditions. Their function is primarily hydrological (conveying storm runoff), with negligible aquatic habitat. Substrates consist of fine silts and mud with pasture grass dominating the banks.



21.1.10. Artificial watercourses – perennial

These are fully constructed drainage channels, often straight, uniform, and deeply incised (1–1.5 m), designed to convey water year-round. Substrates are soft-bottomed with sand/silt deposits, and flows are slow or stagnant under baseflow conditions. Periphyton and opportunistic macrophytes (e.g., starwort, *Persicaria*, mercer grass) commonly colonise the channel margins, forming dense mats that reflect nutrient-rich conditions.

Riparian zones are dominated by rank pasture, weeds, and occasional tree clusters, but shading is generally minimal. The lack of sinuosity and physical structure results in homogenous flow and limited habitat diversity. These channels function primarily as engineered drainage and show strong evidence of agricultural modification.

21.1.11. Artificial watercourses – intermittent

Artificial intermittent channels represent the majority of agricultural drains in Tauriko West. They are incised, simplified drains with bank heights typically 0.5–1 m, containing stagnant water or very slow runs at the time of survey. Substrates consist entirely of fine silts, with frequent bank slumping and visible erosion.

Aquatic vegetation (mercer grass, *Persicaria*) is common, reflecting low velocities and infrequent flushing. Flow conditions and channel form are uniform and homogenous, providing minimal hydraulic variation.



21.1.12. Artificial watercourses - ephemeral

These features are identifiable mainly by saturated soils or muddy depressions, with no continuous channel form and no observable flow. Banks are vegetated by pasture grasses, and no aquatic habitat is present. They function solely as surface runoff pathways, especially under heavy rainfall.



21.2. Kōpūrererua catchment

This catchment includes a network of natural and artificial watercourses that drain into the main stem of the Kōpūrererua Stream. Except for the Kōpūrererua Stream and Nānako Stream, there is little variation between the watercourses, allowing for them to be described and valued in accordance with their classification.

21.2.1. Kōpūrererua Stream – main stem (impact and receiving environment)

The ecological condition of Kōpūrererua Stream has been informed using data from the BOPRC State of the Receiving Environment (SoRE) monitoring network, with results from sites F7-1 and F7-2 used to characterise the main stem in proximity to the Project. These data have been ground-truthed through site walkovers completed for this assessment, confirming that the existing monitoring information remains representative of current stream condition and suitable for use in this EclA.

Upstream of the impact site, conditions at F7-1 illustrate the prevailing physical and water quality environment and provide a reliable proxy for baseline condition. This reach is characterised by a soft-bottomed channel dominated by fine sediments, consistent with historic channel modification and ongoing sediment inputs. Channel shading has declined slightly over time (10% to 5%), and aquatic macrophyte cover has reduced, with submergent vegetation shifting from common to rare, indicating reduced structural complexity and increased channel homogeneity. These changes correspond with a substantial reduction in overall habitat quality, with the RPHA habitat score declining from 88 (2017) to 24 (2023), reflecting broad reductions in aquatic habitat abundance, habitat diversity, hydraulic variation, and bank stability. The reach remains fully perennial and hydrologically intact but exhibits limited channel complexity.

Despite degraded habitat structure, water quality at F7-1 remains within expected limits, with no exceedances of stormwater contaminant thresholds recorded in either year of assessment. This suggests that physical habitat degradation is more strongly attributed to long-term geomorphic modification and riparian condition than to acute water quality stressors. Riparian margins are narrow and dominated by exotic species, providing intermittent shade but limited buffering or root reinforcement. Overall, the reach reflects a lowland stream with restricted hydraulic heterogeneity, soft-bottom substrates, and simplified physical form.

Downstream, F7-2 provides insight into conditions within the receiving environment. While also modified, F7-2 shows improved water clarity relative to earlier assessments (turbid to clear) and increases in both emergent and submergent macrophytes. However, habitat quality has still declined, with RPHA scores reducing from 80 to 40.5, driven primarily by reduced aquatic habitat diversity, hydrological variation, and natural channel form. Periphyton, previously absent, was present in 2023, likely reflecting shifts in light, flow, or nutrient dynamics. As with F7-1, no contaminant threshold exceedances were detected, indicating that despite variable habitat condition, water quality remains stable.

Overall, the Kōpūrerua Stream within the assessment area can be described as a physically degraded but hydrologically functional lowland watercourse. Substrates are predominantly fine, channel morphology is simplified, macrophyte cover is patchy, and riparian areas are dominated by exotic vegetation. While water quality remains within acceptable limits, long-term channel modification, limited shading, sedimentation, and riparian degradation collectively result in low to marginal physical habitat condition, forming a representative baseline for impact assessment.



21.2.2. Nānako Stream – main stem (impact watercourse)

The ecological condition of Nānako Stream has been characterised using results from the SoRE monitoring site F7-4, which provides the closest long-term dataset relevant to the Proposed Designation. These data have been validated through field confirmation undertaken as part of

this assessment, verifying that the SoRE dataset accurately reflects existing physical and hydrological conditions upstream of the impact site.

Nānako Stream at F7-4 is a modified lowland tributary with a soft-bottomed channel and moderate light availability supporting abundant emergent macrophytes and common periphyton. Water clarity is generally slightly turbid, consistent with fine sediment mobilisation from upstream pastoral or urbanising catchments. Physical habitat quality is assessed as marginal (RPHA score 60), reflecting simplified channel form, limited hydraulic variation, and poor hydrological heterogeneity. The channel shows evidence of historical straightening and low substrate diversity. Riparian vegetation comprises a mixed exotic-dominated assemblage with scattered native species providing some local shading and organic input.

Notably, bank stability is rated optimal, indicating that although overall geomorphic diversity is low, ongoing erosion pressure is limited within this reach. Conversely, most other habitat parameters score marginally or poorly, highlighting the dominance of fine substrates and the limited availability of complex instream cover. Water quality monitoring recorded no exceedances of stormwater trigger values, suggesting that despite physical modification, contaminant pressures remain low.

In summary, Nānako Stream upstream of the impact area represents a moderately modified lowland tributary with a simplified physical environment dominated by fine sediments, marginal riparian condition, and constrained hydrological diversity. While chemical water quality appears suitable, physical habitat structure presents the primary limitation to ecological condition. These characteristics align with expectations for small tributaries in the Kōpūrererua catchment and provide a sound basis for evaluating potential project effects.



21.2.3. Unnamed watercourses in the Kōpūrererua Valley

Unnamed watercourses within the Kōpūrererua Valley occur in a very different ecological and hydrological setting, where historic drainage channels now sit within a broader wetland, floodplain complex rather than an actively farmed pastoral landscape. Many artificial drains remain visible, but their physical expression and behaviour are strongly influenced by wetland hydrology, including groundwater connectivity, persistent soil saturation, and periodic contraction of surface water into deeper channels during dry periods. As a result, even watercourses with similar constructed origins present differently here than in Tauriko West. For this reason, the same classification system (modified vs artificial × perennial/intermittent/ephemeral) is applied, but descriptions are developed separately,

reflecting the valley's wetter substrate, vegetated margins, and integration with naturalised stream and wetland processes.

21.2.4. Perennial-Modified

Perennial modified channels in the Kōpūrerua Valley differ from Tauriko West equivalents due to their connection with the broader wetland–river system. These channels are often historic drainage paths that now function as semi-natural lowland streams within the wetland matrix. They remain physically modified (straightened or incised), but water levels are more strongly influenced by wetland hydrology, resulting in more stable perennial flow and wider shallow benches.

Substrates remain soft and depositional, reflecting the valley's floodplain processes, and hydraulic diversity is low where straightened, but slightly higher near naturalised or widened reaches. Margins support a mix of wetland sedges, grasses, and regenerating vegetation, providing more consistent shading and edge structure compared to Tauriko West drains.

21.2.5. Intermittent- modified:

Intermittent modified channels occur in valley margins where historic drains or shallow gullies have been cut through wetland soils. These channels possess soft, anoxic substrates with frequent pooling and slowly moving or stagnant water during normal conditions.

Riparian vegetation is strongly wetland-influenced, with sedges, rushes, and herbaceous wetland plants colonising channel edges. Flows contract during dry periods, but due to the surrounding wetland, soil saturation often persists even when surface water retreats into the deeper parts of the channel.



21.2.6. Ephemeral-modified

Ephemeral modified channels are common within the wider wetland mosaic, particularly where old drains cross higher ground or shallow depressions. These channels contain water only during or immediately after rainfall, with the substrate comprising saturated mud or silt. They lack defined channel form and function more as micro-flowpaths within the wetland–floodplain gradient. Their habitat value is negligible, but they contribute to surface water redistribution.

21.2.7. Perennial – artificial

Artificial perennial drains in the Kōpūrerua Valley are sometimes deeply cut but are now embedded within wetland vegetation, making them visually distinct from Tauriko West's open pasture drains. They convey perennial flow due to consistent groundwater/soil saturation from the valley floor.

Substrates remain soft and organic, often highly anoxic, with thick mats of emergent and submerged vegetation. Flow paths may become partially obscured by dense wetland plant growth, but water movement persists year-round. Hydraulics are slow, with low gradient and low velocity throughout.



21.2.8. Intermittent – artificial:

These channels occur in elevated parts of the wetland margins and exhibit intermittent or seasonally variable flow. They are straight, uniform, and shallow, with fine silt substrates and abundant emergent vegetation. Flow stagnation is common, and habitat structure is minimal. Compared to Tauriko West, these drains are more vegetation-dominated and less defined as discrete channels.



21.2.9. Ephemeral – artificial

Ephemeral artificial drains are widespread across the wetland complex, often presenting as isolated depressions or faint channels with saturated mud but no persistent water. No aquatic habitat is present, and the features are essentially part of the broader wetland hydrological mosaic, providing minor drainage of near-surface water.



22. Aquatic fauna communities - supplementary information

22.1. Macroinvertebrate community information sources

Table 20-11: Reference material and information used to inform macroinvertebrate community results and interpretation.

Reference	Relevant Information Used
Tauranga City Council – State of the Receiving Environment Monitoring Report 2022	Macroinvertebrate data for F7-1 (The Lakes/SH29), F7-2 (Faulkner Street), F7-3 (Keenan Road), F7-4 (Hastings Road) and F6-1 (Birch Avenue) on Kōpūrererua Stream, and F8-1 (Wairoa River), including MCI, QMCI and EPT richness data used to assess stream health and longitudinal trends.
Boffa Miskell – Tauriko West Plan Change Ecological Assessment	Macroinvertebrate data from sites M1–M7, representing modified perennial, intermittent and artificial watercourses within the Tauriko West growth area.
Boffa Miskell – Tauriko Business Estate Environmental Management Plan (EMP)	Baseline macroinvertebrate data for the Greenbelt Main Stem (Upstream and Downstream), Catchment 4 Main Stem, Control Site, and Offsite Mitigation (Ōmanawa Stream) monitoring locations.
WSP – Ecological Assessment: Redwood Enabling Works (2022)	Habitat condition, water quality and macroinvertebrate community context for a modified permanent tributary discharging to the Wairoa River.

Reference	Relevant Information Used
WSP – Ecological Assessment: Northern Access Enabling Works (2022)	Ecological context for modified headwater channels, drains and wetland-associated watercourses within the Tauriko growth area.
WSP – SH29 Ōmanawa Bridge Replacement Ecological Impact Assessment (2025)	Ecological context regarding the condition and value of the Ōmanawa River and lower Wairoa catchment perennial river systems.

22.2. Fish communities

Fish communities within the ZOI are primarily structured by habitat condition, flow permanence, and longitudinal connectivity, particularly to downstream receiving environments within the Wairoa River system and Tauranga Harbour.

Fish assemblages are not uniformly distributed, instead varying predictably across the range of watercourse types present. In general:

- Highly connected, less modified systems support diverse diadromous assemblages, including several At Risk or Threatened taxa
- Moderately modified systems support reduced but still functionally important communities
- Highly modified channels and artificial drains support only tolerant or opportunistic species, typically at low diversity

A summary of fish community composition, ecological characteristics, and conservation status across key watercourse types is provided in Table 20-12.

The following fish conservation classifications have been used in this assessment and are based on the latest NZTCS report (Dunn et al., 2025):

- Longfin eel (*Anguilla dieffenbachii*) – At Risk – Declining
- Shortfin eel (*Anguilla australis*) – Not Threatened
- Inanga (*Galaxias maculatus*) – Threatened – Nationally Vulnerable
- Banded kōkopu (*Galaxias fasciatus*) – At Risk – Naturally Uncommon
- Giant kōkopu (*Galaxias argenteus*) – At Risk – Declining
- Koaro (*Galaxias brevipinnis*) – At Risk – Declining
- Common smelt (*Retropinna retropinna*) – At Risk – Declining
- Redfin bully (*Gobiomorphus huttoni*) – At Risk – Naturally Uncommon
- Common bully (*Gobiomorphus cotidianus*) – Not Threatened

These classifications indicate that while many species present remain widespread, a significant proportion are experiencing ongoing population declines or are dependent on the maintenance of habitat connectivity and quality.

Table 20-12: Summary of fish community patterns and conservation status.

Watercourse / Group	Connectivity	Key Species	NZTCS Status (2023)	Community Characteristics	Ecological Interpretation
Wairoa River (Receiving Environment)	High (fully connected)	Longfin eel, shortfin eel, inanga, giant kōkopu, banded kōkopu, redfin bully, common smelt, common bully	Mix of Threatened, At Risk, and Not Threatened taxa	Species-rich diadromous assemblage including At Risk species	High ecological function; key migration corridor
Ōmanawa River	High	Longfin eel, shortfin eel, inanga, kōkopu spp., redfin bully, koaro	Predominantly At Risk with some Threatened taxa	Diverse assemblage supported by habitat complexity	High ecological function with good structural habitat
Kōpūrurerua Stream (main stem)	High	Longfin eel, shortfin eel, inanga, kōkopu spp., bullies, smelt	Mix of At Risk and Threatened taxa	Moderately diverse, influenced by sediment and nutrients	Moderate–high ecological function; important corridor
Nānako Stream	Moderate–High	Longfin eel, shortfin eel, kōkopu spp., inanga, bullies	Mix of At Risk and Threatened taxa	Moderately diverse with local habitat features	Moderate ecological function
Modified natural and artificial watercourses (Group C)	Variable	Longfin eel, shortfin eel, common bully, occasional inanga	Mostly Not Threatened and At Risk taxa	Low diversity; dominated by tolerant species, transient use only in intermittent and ephemeral watercourses.	Limited habitat function; opportunistic use

23. Applicability of results to unassessed or inaccessible watercourses

In several locations across the Proposed Designation, small or highly constrained watercourses could not be directly surveyed due to access limitations, safety constraints, or the physical condition of the features themselves. Any extrapolation of ecological features, biotic assemblages and connectivity should be considered a cautious, provisional interpretation rather than a definitive assignment of ecological value. Although the unsurveyed watercourses fall within the same landscape setting and broad modification categories described for surveyed and assessed features, localised variation in flow permanence, riparian condition, substrate stability, or hydrological connectivity may occur at a finer scale. These factors can influence ecological attributes such as macroinvertebrate composition or potential fish use, particularly during periods of elevated flow or seasonal hydrological changes. As such, the extrapolated values presented here should be regarded as the most likely outcome based on available information, rather than a substitute for reach-level field assessment.

The patterns observed in assessed unnamed watercourses, such as the strong influence of modification level on representativeness, the lack of rare or distinctive features in modified or artificial channels, and the consistent links between physical structure, hydrology, and ecological integrity, provide a robust basis for anticipating similar outcomes in unassessed watercourses. These consistencies reflect the broader drainage and wetland-edge environments documented across the Tauriko West and Kōpūrerua Valley areas. However, because subtle variations in channel morphology or hydrological behaviour can influence ecological condition, there remains a possibility that certain unassessed reaches could display attributes that differ from those extrapolated here. Should such differences exist, they would most appropriately be identified through targeted reassessment at a later phase.

For these reasons, while the extrapolated aquatic ecological values presented in this assessment are considered fit for purpose at the current planning stage, they should be subject to confirmation during the detailed design or pre-construction phase, should access conditions allow. Any future fieldwork should focus on verifying representativeness, ecological integrity, and hydrological context, ensuring that localised conditions are accurately reflected in final value assignments. This approach provides a pragmatic balance between the use of representative survey data and the recognition that some watercourse-scale variation may only become evident through direct assessment.