Waikanae North Development

Fast Track Application:

Assessment of Ecological Effects

Report prepared for

Waikanae North Developments Limited

Prepared by

RMA Ecology Ltd

Report number and date

Job 2144

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BETTER ECOLOGICAL OUTCOMES

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Executive Summary

Waikanae North Developments Limited is applying for consents and approvals under the Fast-Track Approvals Act for a subdivision of approximately 1,200 lots. The development proposal includes a commercial centre, recreational open space, and a network of supporting infrastructure, including roading, shared walkways and cycleways, stormwater and flood management, and enhancement and connection of existing ecological features.

The site lies on the coastal plains of the Kāpiti District, within the Foxton Ecological District (ED). The landform is characteristic of the ED, with a high stable dune ridge, extensive flats to the west and east, with a scattering of low rolling stable dunes. The site is an active farm and has been farmed for over a century, with the eastern flats extensively drained. Vegetation onsite is dominated by exotic pasture, with exotic shrubland and rank grass covering most of the high dunes. Detailed assessment of ecological communities, habitats and species was undertaken using desktop assessment and best practice field survey methods during 2024 and 2025.

Ecological features at the site with a high or very high level of ecological value include:

- Te Harakeke Swamp (Wetland Cluster 1) and Peka Peka Road Swamp (Wetland Cluster 6) which are relatively intact, peat-forming fens and swamps. These wetlands and some margins are listed by Kāpiti Coast District Council as Ecological Sites (Significant Natural Areas) and are recognised by Greater Wellington Regional Council in the Natural Resources Plan. They are primarily dominated by native *Isolepis* and *Juncus* rushland, *Typha orientalis* reedland, *Carex secta* tussockland, and *Coprosma* and mānuka shrubland communities, with small areas of shallow open water present in Te Harakeke Swamp. These wetlands both extend across the site boundaries.
- These wetlands provide moderate to high quality habitat for a range of Threatened and At Risk wetland bird and fish species. Species detected include North Island fernbird, marsh or spotless crake, and black shag. Species detected in the recent past or within the Te Harakeke Swamp on adjacent properties include the Threatened Australasian bittern, New Zealand dabchick, and brown teal, as well as the At-Risk little shag, little black shag, longfin eel, īnanga, and brown mudfish.
- Several stands of sand dune kānuka (*Kunzea amathicola,* At Risk-Declining) are located on the eastern margins of Te Harakeke Swamp (outside the development footprint), as well as two small trees on the eastern flats;
- Isolated patches of indigenous vegetation on the stable high dunes meet GWRC significance criteria and class as naturally uncommon and endangered ecosystems, including dune shrubland, rushland, and treeland and scattered trees. Dense patches of *Muehlenbeckia complexa* provide high quality habitat for a population of northern grass skink (Not Threatened), which are protected under the Wildlife Act.

Additional ecological features of low or moderate ecological value include:

- A network of degraded wetlands with moderate ecological value is scattered across the flats and low dunes east of the high dune ridge. These wetlands are grouped into four clusters that share similar features, histories, and likely future trajectories. Wetlands located along the Ngarara Stream floodplain are characterised by peat soils and have been extensively drained historically, whereas those situated in stable dune areas predominantly contain mineral soils. In all wetlands, seasonal water-table fluctuations are pronounced. A history of

farming, stock access, pugging, and nutrient enrichment has led to exotic species dominance, although two native rush species remain common throughout; and

- A network of artificial farm drains on the eastern flats is of poor to poor-moderate condition and low value, and the network drains into the highly modified and low-moderate condition and value Ngarara Stream. Ngarara Stream supports five species of native fish, including two At Risk species (longfin eel and īnanga), as well as kōura. Extensive trapping and eDNA sampling in the eastern watercourses provide a high degree of confidence that brown mudfish are unlikely to be present.

The proposed development will avoid most of the high and moderate value ecological features at the site. However, there are some unavoidable effects, because there are engineering constraints to provide access roads, building platforms, and stormwater management and to achieve a well functioning environment (as advised by the engineering and urban design expert on the project). The wetlands that will be reclaimed are of low or moderate ecological values are have been severely damaged by years of farming, stock access, and exotic weeds and grasses.

Adverse effects include the permanent reclamation of 1.69 ha of wetland, the removal of 993 m of stream (2,965 m^2 un-culverted stream bed area), the culverting of 76.9 m of stream, the clearance of 1,187 m^2 of indigenous ngaio treeland and scattered trees comprising 55 native trees, the clearance of 1,773 m^2 of a mosaic of indigenous scrub and rushland on stable dunes, and the clearance of 261 m^2 of exotic-dominated SNA vegetation bordering Peka Peka Road Swamp (wetland W11).

Ecological and hydrological mitigation actions will minimise, remedy, or offset the severity of losses and reduce or eliminate the risk of adverse effects on most ecological values, as well as providing additional positive outcomes (beyond requirements to manage effects) by enhancing the hydrology and ecology of the large degraded Ngarara floodplain wetlands by:

- Raising the water level in Ngarara Stream, through the site by approximately 0.4 m to increase the localised groundwater level and assist in achieving greater soil moisture in the adjacent low-lying wetland areas (Wetland Clusters 2 and 3);

- Controlling flood flow levels in the Ngarara Stream, by the construction of the downstream flow control system (twin culvert and weir structure) at the southern edge of the development to increase frequency and extent of ponding from flood events, which will increase soil moisture, restore core function, and prevent dryland plant invasion in wetlands W2.1, W2.2, W2.3, W2.4, W2.5, W6, W16 & W18 and the newly created wetlands; Incorporating small log weirs and other flow restriction structures into existing drains adjacent to wetlands to enhance wetland health;

- Managing stormwater runoff from the development areas to enhance discharges to the wetland areas by minimisation of direct instantaneous loss of flow to downstream water courses;

- the use of erosion and sediment controls to prevent sediment from discharging into watercourses;

- the salvage and relocation of native freshwater fauna and native lizards;

- appropriate timing of earthworks near high value wetland habitats;

- Onsite remediation of stream extent and values through the realignment of 979 m of highly modified stream (Ngarara Stream) (plus 14 m of culverts) into 974 m of meandered and naturally contoured channel (plus 76 m of culverts). The un-culverted stream bed area within the realigned reach will be increased to the extent necessary to achieve a net gain of stream extent and ecological values overall.

- the recontouring and restoration of more natural bank profiles, and riparian margins along 385 m of retained drain reaches;
- the removal of 14.5 m of existing stream culverts;
- offsetting of 1.69 ha of wetland losses;
- options to create an additional 0.85 ha of wetland extent, over and above loss extent offsets;
- restoration planting along the margins of all wetlands, averaging 20.5 m wide for Te Harakeke Swamp wetland; 10.7 m wide for Pekapeka Road wetland, and 9.7 m wide for all other wetlands, constituting a total planted wetland buffer area of 7.25 ha.
- restoration planting along all stream margins, averaging 10.3 m wide.
- high density restoration planting within constructed offset wetlands, and low density enrichment planting within degraded wetlands (Wetland Clusters 2, 3 and 4);
- onsite mitigation and enrichment of terrestrial indigenous vegetation through the planting of at least 3,546 m^2 of dune shrubland and rushland, and 0.7 ha of dune treeland and scattered trees (550 trees) including sand dune kānuka and other At Risk or Threatened species, to expand and enhance areas of retained indigenous dune vegetation as well as creating new areas; and
- replacement and enhancement of lizard habitat in the dunes through establishment of a 17 ha open space reserve, shrubland restoration (as above), addition of woody debris habitat features; and
- A pest plant and animal control programme in all wetland and dune restoration areas, including control of invasive weeds and mammalian predators threatening SNA wetlands and At Risk birdlife, coupled with management of domestic cats and dogs.

This will result in no net loss of terrestrial indigenous vegetation extent and wetland and stream extent and values.

Wetland removal (extent) will be offset to achieve no-net-loss of values. The offset package to address residual effects on wetlands was calculated using an offset accounting tool. The package of offsets estimated to provide a no-net-loss outcome includes the creation of 1.74 ha of high-value wetland area at site. An option to create and additional 8,345 m^2 in wetland extent will result in a net positive outcome. These offsets will be complemented by other wetland enhancement programmes (comprising improvement work to an additional 6.52 ha of degraded wetland on the site) that sit outside of the effects management package.

The management actions required to establish and maintain these offset wetland areas include stock exclusion, restoration margin planting averaging 20 m wide around Te Harakeke Swamp wetland, 10 m wide around other wetlands, and 10 m along both stream sides, control of ecological weeds, control of animal pests, and active planting of ecologically appropriate native trees, shrubs, and ground cover species to protect and restore margins and edges, and to extend habitat and management of groundwater and stream or drain water levels to optimise soil moisture in the wetland areas where proposed.

With the proposed avoidance, mitigation, and offset measures in place, the project will result in no significant residual ecological effects[1]. The development will increase the extent and considerably enhance the value of wetlands; it will provide a net gain in indigenous vegetation extent and diversity; and it will enhance habitat for wetland birds, fish and lizards.

The proposed wetland, stream and dune revegetation aligns with broader district-scale restoration objectives for the wider Te Harakeke Swamp and Peka Peka coastal dunes. It will enhance ecological connectivity along the dune and wetland corridor to the north and south, and will contribute to re-establishing indigenous habitat linkages from the coast to the mountains.

In order to effectively execute the mitigation and offsetting that is required, several management plans accompany this application including a Lizard Management Plan (LMP), Native Freshwater Fauna Salvage and Relocation Plan (NFFSRP), and an Ecological Restoration Management Plan (ERMP). The construction activity associated with wetlands and their surrounds will also require adherence to the approved Construction Management Plan.

[1] The project ecologists and the developer are currently working through options to ensure that the adverse effects of predation do not give rise to significant adverse effects, in particular on wetland birds within Te Harakeke Swamp wetland for crake and fernbird. Further details about the proposed approach will be provided as soon as this is available

Contents

1.0 Introduction

Waikanae North Developments Ltd (WNDL) has prepared a Fast Track Approvals Act (FTAA) application (resource consents and wildlife authority) for a residential and commercial development in an area described as Kukutauaki, at Peka Peka Road, Peka Peka, Kapiti (hereafter 'the site' or 'Waikanae North Development'; see Figure 1).

This site is located between the Kapiti Expressway and the Kapiti Coast, and covers approximately 141 ha, excluding a leased block for stormwater management. The area supports mainly pastoral grazing within a lowland dune landscape. It is characterised by a central ridge of tall dunes, separating the large Te Harakeke Swamp in the west from extensive historic wetlands and poorly drained land in the east. The site is drained by a network of drains feeding into Ngarara Stream.

Figure 1. The site investigations area (white polygon).

1.1 Purpose and scope

WNDL has engaged RMA Ecology to prepare this Ecological Effects Assessment for the FTAA application being considered for land at the site. This report contains the following:

- An overview of the methods used to assess the ecological values of areas potentially affected by the development;
- A description of ecological values within the development footprint and immediate surrounds;
- An assessment of the type and magnitude of potential effects associated with the subdivision proposal;

- Mitigations to address actual and potential adverse effects; and
- Offsets to address residual adverse effects.

1.2 Legislative background

The application is made under the Fast-track Approvals Act 2024. The purpose of the FTAA is to provide a permanent fast-track consenting and approvals pathway for projects that deliver nationally and regionally significant benefits, including housing and infrastructure. The FTAA seeks to enable faster delivery of such projects by establishing an alternative consenting pathway to that under the Resource Management Act 1991 (RMA), while still ensuring that environmental, cultural, and community effects are appropriately considered. Applications are assessed by an Expert Panel appointed under the FTAA. The Panel exercises decision-making powers similar to those of a consent authority under the RMA, but within a streamlined framework that specifies shorter timeframes and a simplified procedural structure.

The expert Panel must consider potential adverse environmental, social, and cultural effects, as well as the extent to which these can be avoided, remedied, mitigated, or offset. The application must have regard to the relevant provisions of the Resource Management Act, national policy statements, national environmental standards, regional policy statements and plans, and district plans, but is not bound by them.

Accordingly, this report assesses the proposal against the over-arching principles and objectives of the National Policy Statement for Freshwater Management (NPS-FM) and National Environmental Standard for Freshwater Management (NES-F), the National Policy Statement for Indigenous Biodiversity (NPS-IB), the Greater Wellington Regional Policy Statement, Natural Resources Plan and proposed Plan Change 1, and the Kāpiti Coast District Plan, but does not detail compliance with specific policies within these policy instruments.

This assessment does identify recommended measures to avoid, remedy, mitigate, offset, or compensate for adverse ecological effects, resulting in adequate and appropriate mitigation overall. For a range of ecological values, the enhancements proposed provide additional benefits.

1.3 Credentials and Code of Conduct

Dr Ussher, Dr Nicol, and Mr Lurling (variously, the authors, co-authors or technical reviewers to the ecology reports and plans) are qualified and experienced ecologists.

Dr Ussher holds the qualifications of BSc, MSc (1st class honours) and PhD in conservation ecology. He has 34 years experience as an ecologist in New Zealand, with speciality expertise in herpetology, and effects assessment and management, including offset accounting and modelling.

Dr Nicol holds the qualifications of BSc, MSc, and PhD in ecology and botany. He has 9 years experience as an ecologist in New Zealand, with speciality expertise in conservation, restoration, and taxonomy with strengths in botany, biostatistical analysis, and GIS bio-analysis.

Mr Lurling holds the qualifications of BSc, Postgraduate Diploma in Wildlife Management (Distinction), and GradDip (Geography), specialising in Aquatic Ecology & Water Quality (Distinction).

He has 28 years experience as an ecologist and specialises in the fields of bat ecology, wetland ecology (botany, plant communities, wetland classification and functions), avifauna, and botany.

Dr Ussher, Dr Nicole, and Mr Lurling have extensive experience in ecological site assessments, significance assessments, impact assessment, and impact management, including extensive experience on the ground designing, constructing, implementing, monitoring and reporting on interventions to restore, enhance, salvage, and protect ecology values at sites across New Zealand. They are considered to be sufficiently qualified to undertake an assessment of this kind.

Although this document has not been written as a statement of expert evidence, we confirm that at all times we have complied with the Environment Court's Code of Conduct for Expert Witnesses contained in its Practice Note 2023 as well as the UDIA Code of Ethics. No part of this report has been authored by an AI or other software.

We declare that in relation to our role in providing expert ecological assessment and advice for this project we are not, to the best of our knowledge, subject to any real or perceived conflicts of interest.

2.0 Methods

Desktop and field assessments were used to identify and classify ecological features and determine their ecological value and significance.

2.1 Desktop assessment

A desktop assessment of the site and surrounding area was undertaken to provide insight into the history of the site and to identify potential or mapped ecological features by reviewing:

- Historic and present-day aerial images;
- Kāpiti Coast District Council and Greater Wellington Regional Council GIS;
- Threatened Environment Classification (TEC), LENZ;
- New Zealand Freshwater Fish Database;
- Wilderlab eDNA database;
- National Amphibian and Reptile Database System (Herpetofauna);
- eBird Atlas of New Zealand;
- DOC bat database; and
- iNaturalist records.

Individual plant species were recorded and their conservation status checked against the national threatened species classification list for vascular plants[2]. For wildlife species assessed as present or potentially being present, their conservation status was checked against the national threatened species classification lists for fish[3], birds[4], bats[5], and reptiles[6].

2.2 Field assessment

Extensive field assessments of ecological values were undertaken at these six times:

- 20 October 2023 to scope potential matters for investigation;

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[2] de Lange, P.J., J. Gosden, S.P. Courtney, A.J. Fergus, J.W. Barkla, S.M. Beadel, P.D. Champion, R. Hindmarsh-Walls, T. Makan and P. Michel (2024). Conservation status of vascular plants in Aotearoa New Zealand, 2023. New Zealand Threat Classification Series 43. Department of Conservation, Wellington. 105 p.

[3] Dunn, N.R., Allibone, R.M., Closs, G.P., Crow, S.K., David, B.O., Goodman, J.M., Griffiths, M., Jack, D.C., Ling, N., Waters, J.M., Rolfe, J.R. (2018). Conservation status of New Zealand freshwater fishes, 2017. New Zealand Threat Classification Series 24. Department of Conservation, Wellington. 11 p

[4] Robertson, Hugh A., Karen A. Baird, Graeme P. Elliott, Rodney A. Hitchmough, Nikki J. McArthur, Troy Makan, Colin M. Miskelly, Colin. J. O'Donnell, Paul M. Sagar, R. Paul Scofield, Graeme A. Taylor and Pascale Michel (2021). Conservation status of birds in Aotearoa New Zealand. New Zealand Threat Classification Series 36. Department of Conservation, Wellington. 43p.

[5] O'Donnell, C.F.J., K.M. Borkin, J. Christie, I. Davidson-Watts, G. Dennis, M. Pryde and P. Michel (2023). Conservation status of bats in Aotearoa New Zealand, 2022. New Zealand Threat Classification Series 41. Department of Conservation, Wellington. 18 p.

[6] Hitchmough, R.A., B. Barr, C. Knox, M. Lettink, J.M. Monks, G.B. Patterson, J.T. Reardon, D. van Winkel, J. Rolfe and P. Michel (2021). Conservation status of New Zealand reptiles (2021). *(updated Feb 2024 to include a draft revised assessment for Oligosoma lineoocellatum).* New Zealand Threat Classification Series 35. Department of Conservation, Wellington. 15 p.

- 13-18 November 2023 for high level site investigations, with detailed fish and wetland surveys;
- 18 January 2024 for further site investigations;
- 19 May 2025 to investigate the stormwater easement area, which effectively extends the site's southern boundary;
- July 2025 for further lizard monitoring investigations; and
- 6-10 October 2025 for further detailed site investigations on bats, lizards, rare plants, vegetation communities, wetland birds, and wetland offset opportunities.

The weather was mostly fine or cloudy during site visits. Several notable events include a cold front with rain on 18 November 2023; there was a prolonged period of severely dry conditions during and after surveys in May 2024; there was heavy rainfall in the days prior to the visit on 19 May 2025 (c.a. 44 mm), but it had been dry for approximately 24 hours before the visit; and there was light rain on 9 October 2025.

2.2.1 Wetlands

The site was assessed for wetlands based on the definition in the Resource Management Act 1991 (RMA). The site was also assessed for 'natural inland wetlands' based on the definition within the National Policy Statement for Freshwater Management 2020 (NPS-FM) (last amended October 2024) and associated technical guidance documents.

The updated NPS-FM technical support documents regarding wetland classification and delineation require that a step-wise assessment is undertaken. That assessment includes application of the exclusion criteria based on pasture grassland, assessment of threatened species habitat use, and then application of three separate vegetation tests (Rapid Test, Dominance Test, and Prevalence Index). Wetland soils and hydrology information can be applied if the results of vegetation community and exotic pasture grass exclusion are inconclusive.

We understand that the National Environmental Standards for Freshwater 2020 (NES-F) and NPS-FM require Councils to ensure that the loss of values and extent of 'natural inland wetlands' is avoided in most instances (excluding some activities, including urban development).

The NPS-FM and NES-F also restrict activities within a 10 m buffer around 'natural inland wetlands', and place controls on the level of potential adverse effects (from, for example, discharge of water or diversion of water) within 100 m from a 'natural inland wetland'.

The methodology applied for the identification of wetlands at this site was as follows:

- Visual assessment as to whether the potential wetland area could support a threatened species;
- Visual assessment as to whether the potential wetland and surrounding area is clearly dominated by pasture grass species (the Rapid Pasture Test);
- Visual assessment of areas where the vegetation composition includes species that are scored as wetland obligate, facultative wetland, or facultative (e.g., rushes, wet pasture or 'wetland-type' vegetation) as assessed by Clarkson *et al.*[7] (following the Pasture Exclusion

[7] Clarkson B. R., Fitzgerald N. B., Champion P. D., Forester L., Rance B. D. (2021). New Zealand wetland plant indicator status ratings 2021: Data associated with Manaaki Whenua - Landcare Research contract report LC3975 for Hawke's Bay Regional Council.

Test, and Wetland Delineation Protocols as laid out in the Pasture Exclusion Assessment Methodology[8]);

- Where these compositions exist, an assessment of vegetation, soils, and hydrology is required according to the Pasture Exclusion Assessment Methodology:
  - Vegetation is assessed through plant identification and percentage cover estimates (as per the method described by Clarkson[9]) of 2 m x 2 m plot areas within each potential wetland area;
  - Soils are assessed by applying the criteria outlined in Fraser (2018)[10] for identifying hydric (wetland) soils – which involves excavation and examination for gleyed, mottled, peaty, or wet soils; and
  - Hydrology is assessed by applying the criteria outlined in the Ministry for the Environment tool[11];

An area can be classified as a wetland based on the definition within the Regional Plan and the RMA, but not be classified as a 'natural inland wetland' under the NPS-FM because the definition of the latter includes some exclusions:

"*Natural inland wetland means a wetland (as defined in the [Resource Management] Act) that is not:*

(a) in the coastal marine area; or

(b) a deliberately constructed wetland, other than a wetland constructed to offset impacts on, or to restore, an existing or former natural inland wetland; or

(c) a wetland that has developed in or around a deliberately constructed water body, since the construction of the water body; or

(d) a geothermal wetland; or

(e) a wetland that:

(i) is within an area of pasture used for grazing; and

(ii) has vegetation cover comprising more than 50% exotic pasture species (as identified in the National List of Exotic Pasture Species using the Pasture Exclusion Assessment Methodology (see clause 1.8)); unless

(iii) *the wetland is a location of a habitat of a threatened species identified under clause 3.8 of this National Policy Statement, in which case the exclusion in (e) does not apply*"

The boundaries of potential wetland areas were delineated by carrying out assessments of the various vegetation communities and through professional judgement.

The Paetawa Road addition was assessed through desktop review of aerial imagery over various years and seasons, as well as assessment of photos taken onsite.

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[8] Ministry for the Environment. 2022. Pasture exclusion assessment methodology. Wellington: Ministry for the Environment.

[9] Clarkson, B. (2013). A vegetation tool for wetland delineation in New Zealand. Report prepared for Meridian Energy Limited by Landcare Research.

[10] Fraser S., Singleton P., Clarkson B. (2018). Hydric soils – field identification guide. Envirolink Tools Contract C09X1702. Manaaki Whenua – Landcare Research Contract Report LC3233 for Tasman District Council.

[11] Ministry for the Environment. (2021). Wetland delineation hydrology tool for Aotearoa New Zealand. Wellington: Ministry for the Environment.

2.2.2 Watercourses

Watercourses were mapped and classified onsite according to the definitions within the Wellington Regional Policy Statement. The GWRC guidance document on watercourse types[12] was used for guidance. Watercourse types and definitions within this document include:

- River or stream

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

- Highly modified river or stream

  "For the purposes of Rules R121, R121A and R121B only, means a river or stream that has been modified and channelled for the purpose of land drainage of surface or sub-surface water and has the following characteristics:
  a. It has been channelled into a single flow, and
  b. The channel has been straightened, and
  c. The channel is mechanically formed with straight or steeply angled banks, and
  d. It exhibits these characteristics for at least its entire length through the property in which the activity is being carried out."

- Ephemeral watercourse that is not a river

  "A watercourse that:
  a. Has a bed that is predominantly vegetated, and
  b. Only conveys or temporarily retains water during or immediately following rainfall events, and
  c. Does not convey or retain water at other times, and
  d. Is not a wetland."

- Artificial watercourses and drains (not a river)

  "*Drain … means any artificial watercourse, designed, constructed, or used for the drainage of surface or subsurface water, but excludes artificial watercourses used for the conveyance of water for electricity generation, irrigation, or water supply purposes."*

  "*Based on the definitions… the following… factors must be assessed when determining whether a watercourse can be categorised as a river… or an artificial watercourse: …*

  a. *Whether the watercourse has a 'natural' or 'constructed/modified' form … [and]*
  b. *Whether the watercourse has a natural or artificial source of flow."*
  c. *"If a watercourse has a constructed/modified form, determine if it was modified from a pre-existing water body. If so the source of flow can be considered natural, otherwise it is artificial."*

Watercourses which drain historic wetlands, but have no historic stream channel at the site or upstream, are classed by the guidance document as highly modified rivers or streams.

[12] Watercourse Types: How to determine whether a watercourse is a river, ephemeral watercourse, highly modified river or stream, or artificial watercourse. Greater Wellington Regional Council, May 2021 (updated 2022).

Legal advice obtained by Waikanae North developments Ltd[13] challenges this classification under these circumstances, stating that watercourses draining historic wetlands are considered to be artificial watercourses (drains), *not* highly modified streams. This definition was applied onsite.

Greater Wellington Regional Council's online broad-scale maps of highly modified streams were consulted. Site investigations were used to either verify or correct these modelled stream classifications at a finer scale.

To provide a comprehensive description of the site, the condition and ecological value of each watercourse was assessed, including artificial watercourses (drains), using a customised scale (see Table 8).

In addition, Stream Ecological Valuation (SEV) assessments[14] were carried out for representative 100 m reaches of W1 (Ngarara Stream), W1.1 (northern drain) and W1.1.1 (southern drain). Conservative estimates of SEV measurements were made using onsite measurements and desktop assessments of photographs and aerial imagery.

The SEV method was developed in Auckland to quantify stream ecosystem function, and groups ecological functions into the following categories:

- Hydraulic functions (processes associated with water storage, conveyance, flood flow retention and sediment transport);
- Biogeochemical functions (processes associated with processing of minerals, particulates and water chemistry);
- Habitat provision functions (the type, amount and quality of habitat for flora and fauna); and
- Native biodiversity functions (the occurrence of diverse populations of indigenous native plants and animals). These components were excluded from the SEV calculation. The SEV score presented represents the mean of the remaining assessed habitat and ecosystem function components.

2.2.3 Indigenous vegetation and Significant Natural Areas

Vegetation was mapped and described in terms of its composition and values. Areas listed as SNAs under in the Kāpiti Coast District Plan were identified using Council's online GIS. Any areas of indigenous vegetation which were not already listed as SNAs, were assessed to determine if they were considered to be 'SNA-qualifying' under the Wellington Regional Policy Statement Criteria (Appendix A) and the NPS-IB.

Vegetation was also assessed to determine if it was otherwise protected by the Kāpiti Coast District Plan for specifically listed species, such as 'trees of note'. Individual species were recorded and their threat status checked against the national threatened species classification list for vascular plants[15].

[13] Senior, P. (2025) Waikanae North Developments Limited: Response to questions on stream classification, wetlands and scope, Unpublished Memorandum dated 23 September 2025. Shortland Chambers Barristers. 7pp.

[14] Storey, R.G.; Neale, M.W.; Rowe, D.K.; Collier, K.J.; Hatton, C.; Joy, M.K.; Maxted, J.R.; Moore, S.; Parkyn, S.M.; Phillips, N. & Quinn, J.M. (2011). Stream Ecological Valuation (SEV): a method for assessing the ecological function of Auckland streams. Auckland Council Technical Report 2011/009.

[15] de Lange, Peter J., Jeremy R. Rolfe, John W. Barkla, Shannel P. Courtney, Paul D. Champion, Leon R. Perrie, Sarah M. Beadel, Kerry A. Ford, Ilse Breitwieser, Ines Schönberger, Rowan Hindmarsh-Walls, Peter B. Heenan and Kate Ladley (2017). Conservation status of New Zealand indigenous vascular plants. New Zealand Threat Classification Series 22. 82p.

2.2.4 Fish

A targeted fish survey was undertaken, focusing on the Ngarara Stream catchment in the east of the site where development is focused. The survey employed multiple techniques, including netting, trapping, and eDNA sampling.

In May 2024, four fyke nets and 29 Gee's minnow traps were set for up to four nights in Ngarara Stream and tributary drains (Figure 2 and Plate 1). A range of habitat at the site was sampled, with a strong focus on potential habitat of brown mudfish (*Neochanna apoda*).

Brown mudfish have a conservation status of At Risk - Declining, and are known to inhabit farm drains and wetlands in parts of the Kapiti Coast. Fine mesh (3 mm) Gee's minnow traps were deployed in areas with the best potential mudfish habitat. Areas of shallow water with the potential to dry up over summer were targeted, particularly where a muddy bed and tree roots were present.

Two eDNA samples were taken in the network of drains and waterways in the east of the site in May 2024. One sample was taken at the downstream end of Ngarara Stream, and one at the downstream end of the major drain network feeding into the stream (Figure 3). Wilderlab's standard six-replicate eDNA kits were used. The 'comprehensive' analysis option was chosen, as it employs 20 screenings to maximise detection, and provides a 'wheel of life' graphic and TIKI stream health score.

A limitation of the May 2024 survey was the lack of surface water in Te Harakeke Swamp and other smaller wetlands which lacked deeper drains or watercourses with residual water. These wetland areas were unable to be surveyed by netting, trapping or eDNA, despite having areas of moderate quality mudfish habitat under normal hydrological conditions.

In October 2025, water levels were considerably higher, at 100–400 mm depth across much of Te Harakeke Swamp (W1). A six-replicate eDNA sample was taken there, using a Wilderlab 'turbid' water kit, which has greater filter porosity to account for fine sediment and algae in wetlands. The six subsamples were spread across the central part of the wetland to maximise the probability of detecting mudfish, bittern and other species where there is limited mixing (Figure 2). A repeat six-replicate eDNA sample was also taken in the Ngarara Stream catchment in October 2025, with subsamples spread across the main stem of the stream, and several tributary drains within the main project site and the added southern stormwater leased area. This sample was taken during the first flush of a light rainfall event, when levels of suspended eDNA are expected to peak.

2.2.5 Avifauna

Avifauna monitoring included five-minute bird counts (5MBCs), as well as targeted wetland bird playback surveys, a bittern survey, and eDNA sampling of streams and wetlands.

2.2.5.1 Five-minute bird counts

The 5-minute bird count (5MBC) is a standardised survey where all birds seen or heard from a fixed point are recorded during a five-minute period [16] [17]. Repeated across sites, it provides comparable data on bird species presence and can provide information on relative abundance. Although developed for forest birds, the method is especially effective in open and scrubby habitats, where visibility and sound travel make birds very detectable. Nine 5MBC stations were located at strategic

[16] Dawson, D.G. & Bull, P.C. (1975). *Counting birds in New Zealand forests.* Notornis, 22: 101–109.

[17] DOC (2021). *5-minute bird counts: New Zealand standard method.* Department of Conservation, Wellington.

viewpoints spaced 350-500 m apart, providing effective coverage of all vegetation types (Figure 3). Three 5MBC replicates were completed in May 2025 at each of these nine stations.

Any additional species seen or heard on site outside of the 5MBCs were recorded as incidental counts, as were any incidental records of Threatened or At-Risk birds.

2.2.5.2 Call playback surveys

As nearby historic records and habitat for rare, cryptic, crepuscular, and nocturnal bird species are present, more targeted survey techniques were used to increase detection probability.

Call playback was used to survey for the more cryptic wetland birds, including marsh crake, spotless crake, fernbird and brown teal. Calls of each species in turn were played for 30 seconds, followed by 2 minutes of listening for a response. Call playback surveys were undertaken at fixed points along the eastern and western margins of Te Harakeke swamp (Figure 4). They were repeated within 1.5 hours of sunset over two evenings, and once at dawn, to provide three replicates in May 2024.

Peka Peka Road swamp has less optimal habitat and was surveyed once through call playback at dusk. This timing of the survey was outside the main period of courtship, breeding and thus high call frequency for these species. Therefore, an additional three call playback survey replicates were completed during 6 - 10 October 2025, which falls within the peak breeding and calling season for these species, and thus the optimal survey time. Again, two evening survey replicates and one morning survey were completed.

Figure 2. Locations of wetland habitats (cyan polygons), drains (purple lines), Gee's minnow traps (green diamonds), fyke nets (blue circles), aquatic eDNA samples (red circles), and Ngarara Stream (blue line).

Figure 3. Locations of 5-minute bird count locations labelled B1 to B9 (green circles).

Plate 1. A Gee's minnow trap (lower centre) set in a shallow muddy drain under a macrocarpa canopy at the east of the site. This is moderate quality mudfish habitat, but may be constrained by limited seasonal water fluctuation.

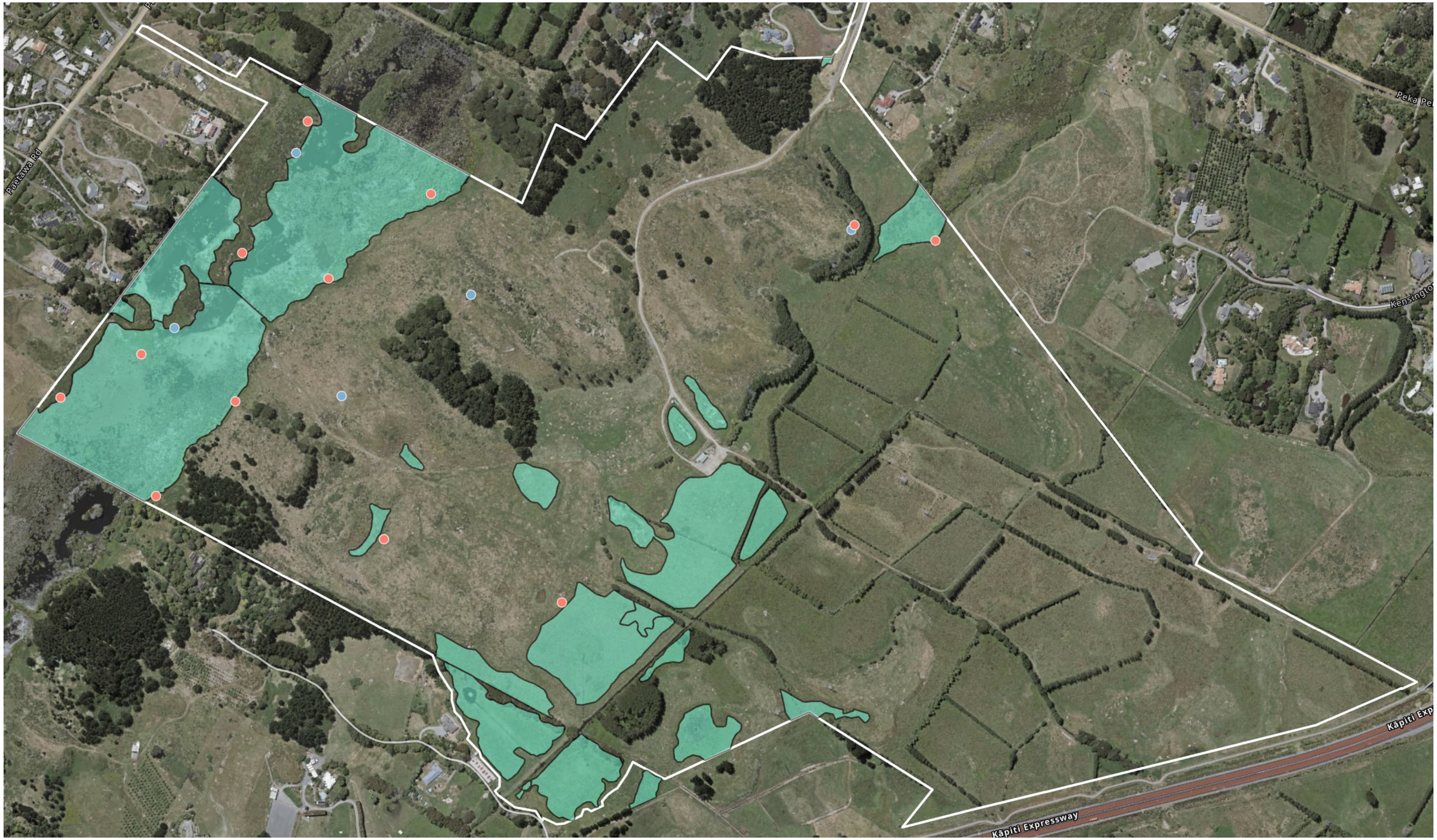

Figure 4. Locations of wetlands (cyan polygons), bird call playback points (red circles) and bittern call count survey points (blue circles).

2.2.5.3 Bittern survey

Triangulation surveys were employed to survey for Australasian bittern, in accordance with the national Department of Conservation (DOC) protocol. Bittern triangulation surveys were carried out by 2-3 surveyors listening from different points simultaneously during the peak call activity period from 0.5 hours before sunset to 1 hour after sunset. These surveys were completed during 6 to 10 October 2025, which lies within the peak 'booming' call season and thus the ideal survey time. One to three nights are sufficient to determine if booming male bittern are present. Three nights of surveying were carried out, providing support to determine whether bittern were present or absent. Surveyors were stationed at the top of the central dune ridge during calm nights, providing excellent hearing coverage over all potential habitat onsite (bittern calls will easily carry 500 m). On evenings with slight to moderate wind, more sheltered survey triangulation points alongside Te Harakeke Swamp margins were used to maximise call detection within prime habitat (Figure 4).

2.2.5.4 Visual waterfowl surveys

Visual surveys for waterfowl were undertaken in all areas of shallow open water (determined through aerial imagery and site walkover). In 2024, water levels were low and no standing water was observed in wetlands onsite, and no waterfowl were detected (other than a group of resident domestic geese). In October 2025, water levels were considerably higher, with four main areas of open water within Te Harakeke Swamp, all on the western margin of the wetland. Three surveys were completed over three separate days to account for the high mobility of waterfowl and potential for high variability in numbers. eDNA samples were also taken from several of these open water areas (see Section 2.2.4).

Extensive time spent onsite by staff undertaking ecological assessments provided additional opportunities for incidental bird observations. A total of 28 person-days were spent onsite by bird experienced RMA Ecology staff. Much of this time was spent in and around wetlands, and on the high dunes, during which staff intentionally listened and scanned for wetland birds and New Zealand pipit (At Risk – Declining). Two walk-through surveys of dune habitat for pipit were also completed, as well as two 5MBCs located in this habitat type.

2.2.6 Lizards

A lizard survey was undertaken to assess the presence and distribution of lizard species at the site. The methods used were selected based on the species which could be present based on a desktop survey. The approach for this lizard survey was guided by walkover surveys, the history of the site, and the lizard habitat assessments. Survey effort and location was developed accordingly.

The combined survey method included a desktop survey, habitat assessment, debris inspections, artificial cover object (ACO) layouts, and pitfall trapping.

Historic land-use and reoccupation are key factors in understanding presence and distribution potential. For example, there may be high quality habitat absent of lizards, because it had been previously cleared for agriculture; or there may be low quality habitat with lizards, because it was used as refuge from displaced adjacent habitat. The historic phases of vegetation change at a location, the types of vegetation, maintenance or removal of corridors, and the fragmentation of vegetative habitat all contribute to potential presence. For example, scrub, scattered trees, and ngaio treeland along the Te Harakeke Swamp eastern margin provided potential low quality habitat for barking gecko, but the habitat is small and isolated and not impacted by the development, therefore it was not systematically surveyed.

In addition to vegetation history and type, another factor for lizard presence and distribution is the history and intensity of predator pressure. The site is likely to have a range of pest animals which could predate on lizards. For example, while surveying, cats were seen wandering about the site.

Lizards were surveyed using a combination of two systematic methods and active manual searching beneath natural cover objects. More detail is described for each below.

> Artificial cover objects (ACOs) – are an effective means of surveying skinks (and sometimes geckos) when there is a local abundance of habitat. Three 400 x 500 mm sheets of corrugated Onduline™ (a bitumen saturated material) are laid on top of each other in a "triple-stack". Small wooden rectangles were pre-installed on the bottom of each sheet to create a 10 mm gap between sheets for protective habitat.
>
> ACO triple-stacks were installed in areas of potential habitat where lizard encounters were considered likely. In these areas, rank grass and weeds were mown with a line-trimmer so the triple-stack could be laid flush with the ground in selected best-suitable locations. ACO triple-stacks were installed in clusters of 4 at 23 locations (Figure 5).
>
> After installation, the ACOs were left for a minimum of five (5) weeks to allow familiarity and occupation by lizards. ACOs were then checked by carefully and quickly moving the triple-stack over a large bin, searching the ground underneath, and searching through each sheet. ACO clusters were removed if lizards were found, because presence in that habitat was confirmed. Otherwise, clusters were checked daily for four (4) to five (5) days. If lizards were not found after this period, the clusters were removed and the area was classified as having a low likelihood of lizard presence.
>
> Pitfall traps – are an effective means of surveying for lizards by luring with sugary bait. Pitfall traps were installed on day two (2) of the five (5) day survey. There were five (5) localities which had moderate–good habitat, but lizards were not found in the ACOs. A pitfall trap was installed at each of five (5) ACO cluster locations.
>
> Installation included digging holes, placing 4 L buckets with pre-drilled drainage holes on the bottom, baiting the buckets with wet sponges with fruit paste drizzled on top, and covering the bucket with a 400 x 500 mm Onduline sheet.
>
> Pitfall traps were checked for the remaining three (3) days alongside ACO checks. Pitfall traps were to be removed if mice were found inside, however, this did not happen.
>
> Manual searches – during autumn and winter surveys, and in spring while walking from cluster to cluster of ACOs and pitfalls, natural cover objects (e.g., logs) were lifted to check for lizards. Similarly, suitable locations were visually searched to check for basking lizards.

Searches and handling of native lizards at this site were undertaken under the Wildlife Act Authority 117825-FAU, issued to RMA Ecology Ltd for the Wellington Region. Data were recorded for each captured lizard before release, including ACO cluster, species, date, age class, sex, original tail length, re-grown tail length, and weight.

2.2.7 Bats

A desktop assessment of bat records within 25 km of the site was carried out using the Department of Conservation's bat database.

An onsite bat presence-absence survey was undertaken over 24 nights, from 6–30 October 2025. This falls within the monitoring season for bats in New Zealand, when they are most active. Ten (10) Songmeter Min Bat 2 full-spectrum automatic bat monitors (ABMs) were deployed at key locations providing either feeding areas (focusing on wetlands and watercourses), flyways (especially treelines and corridors), or likely roost trees, primarily large macrocarpas (Figure 6). They were set to record for 3 seconds when triggered, from 1.5 hours before sunset to 1.5 hours after sunrise.

Long-tailed bat activity can be influenced by overnight weather conditions such as temperature, rainfall and wind speed. Weather data from the survey period was examined to ensure conditions were suitable for bats to be active and hence detectable via acoustic monitoring. Suitable conditions for the purpose of this survey report were defined as follows:

- Air temperature does not drop below 8°C from sunset until four hours after sunset[18];
- Rainfall of no more than 2.5 mm occurs in the first two hours after sunset;
- Mean overnight wind speed does not exceed 20 km/h; and
- Overnight wind gusts do not exceed 60 km/h.

The number of suitable monitoring nights within a survey were used as a measure of survey effort.

All data were analysed, including recordings during unsuitable survey nights. All recordings were downloaded and analysed using Anabat Insight.

Most trees onsite are relatively young poplar or willow trees. However, a number of large mature macrocarpa trees are scattered throughout the dunes and eastern flats. Prior to completion of the presence-absence survey, tree habitat assessments for bats were undertaken for the larger macrocarpa trees, to evaluate their risk of containing bat roosts (Figure 6). The survey was conducted by a bat ecologist having completed the required training for DOC Competency training level 3.3. The trees were classed as either 'high-risk' or 'low-risk' in accordance with the Department of Conservation Bat Roost Protocol[19].

[18] Kerry M Borkin, Justyna Giejsztowt, Joanna McQueen-Watton, Des HV Smith. (2023) Influence of weather on long-tailed bat detection in a North Island exotic forest. *New Zealand Journal of Ecology* 47(1): *3546*

[19] Department of Conservation (New Zealand), *"Protocols for minimising the risk of felling occupied bat roosts – Version 4: October 2024*

Figure 5. Locations of triple-stack ACOs (yellow circles) and pitfall trap cluster locations (orange hexagons).

Figure 6. ABM locations during the bat presence-absence survey (green stars) and large macrocarpa trees assessed for bat habitat (red circles). Habitat features including streams (blue lines), drains (purple lines), and wetlands (cyan polygons) are also shown.

2.3 Assessment of ecological effects methodology

This ecological assessment of effects follows the Ecological Impact Assessment Guidelines (Roper-Lindsay et al., 2018; EIANZ Guidelines), best practice methodology, and the four (4) stage EcIA approach (Figure 7).

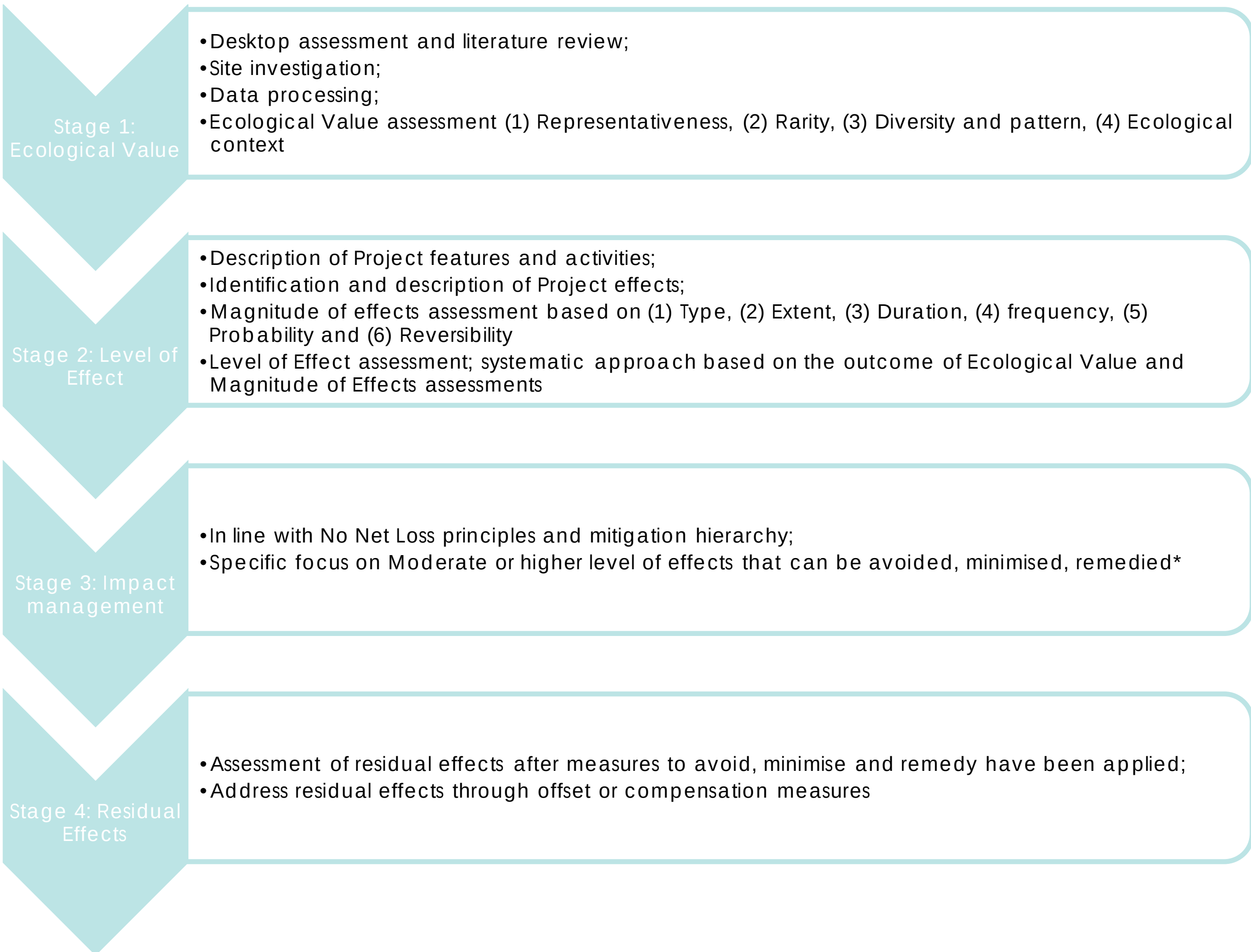

Figure 7. Process followed for this EcIA (Roper-Lindsay et al., 2018).

2.3.1 Step one: assigning ecological value

The first stage of the EcIA process involves evaluating the ecological value of key features—such as terrestrial, aquatic, and wetland habitats, along with their associated fauna—within the Project site and wider zone of influence.

2.3.2 Step two: assessing the level of effects

The second stage systematically examines the magnitude of ecological effects associated with specific Project components and activities. The magnitude of ecological effect is assessed at the spatial scale at which each ecological feature is significant — local, district, regional, or national. This magnitude is then integrated with the findings from the ecological value assessment (stage one) to determine the inherent level of effect before impact management measures are applied (including embedded controls, but prior to formal mitigation considerations).

2.3.3 Step three: managing effects

The third stage focuses on identifying practical and effective mitigation measures, particularly when the level of effect is Moderate or higher. These mitigation efforts should align with the mitigation hierarchy, address uncertainties, and take cumulative effects into account.

2.3.4 Step four: residual effects management

The fourth and final stage addresses the management of residual effects when direct mitigation is insufficient to maintain ecological values. In such cases, offset strategies (aiming for No Net Loss or, preferably, Net Gain) or compensation measures may be required.

3.0 Results

3.1 Ecological context

3.1.1 Foxton Ecological District

The site is located within the Foxton Ecological District of the Manawatu Ecological Region. This Ecological District stretches from Kapiti to south Taranaki, and is characterised by New Zealand's most extensive dune system. These dunes are now primarily stabilised and dominated by agriculture and pine forestry, as well as extensive lifestyle block development.

A narrow, intermittent strip of fore-dunes persists along the coastline, where aeolian processes continue to mobilise the sand, maintaining habitat for a series of rare pioneering dune and wetland plant species dependent upon bare ground to persist. Extensive wetland systems, including naturally uncommon dune slack wetlands, have been heavily impacted by agricultural, lifestyle and urban development, with drainage, stock disturbance, fertilizer application and pest plant invasion impacting wetland extent and values.

3.1.2 Site description

The site is approximately 141 ha (excluding the stormwater easement area), and it is typical of the Ecological District and the Kapiti Coast: the original vegetation has been cleared, and agriculture is the dominant land use (Plate 2), with forestry recently cleared over much of the prominent dune ridge.

The site has operated as a working farm for many decades, and the landform has been modified to some extent through the construction of farm tracks, farm drains, and a large catchment drain with associated culvert crossings. The national Threatened Environment Classification (TEC) lists the site as being located within a highly modified environment, with less than 10 % indigenous vegetation remaining.

The landform is also characteristic of the Kapiti Coast and Foxton Ecological District, being dominated by a tall stabilised back-dune ridge, surrounded by a mosaic of low dunes, wetlands, and farmed historic wetlands. Although a natural landform, the dunes are stabilised and dominated by exotic vegetation. East of this dune ridge, a primarily flat low-lying area at approximately RL 5.5–6.0 m, is drained by the Ngarara Stream (also known as Waimeha Stream) and a network of artificial drains, which have been constructed over time. The site lies within the floodplain of the Ngarara Stream and parts experience floodwater inundation during moderate to heavy rainfall events. West of the dune ridge, Te Harakeke Swamp lies in a broad depression draining to the south. The site lies entirely within the Coastal Environment as mapped in the District Plan.

Peat deposits have been identified within the eastern and southern portions of the site, associated with low-lying wetland terrain and historic wetland features (Geotechnical Report, CGW Ltd). Peat thickness at site varies from 0.2 m to 2.6 m, with an average thickness of 1.2 m where it is present. Not all low-lying areas contain peat (Figure 8).

Plate 2. Land use onsite is primarily agricultural grazing (beef).

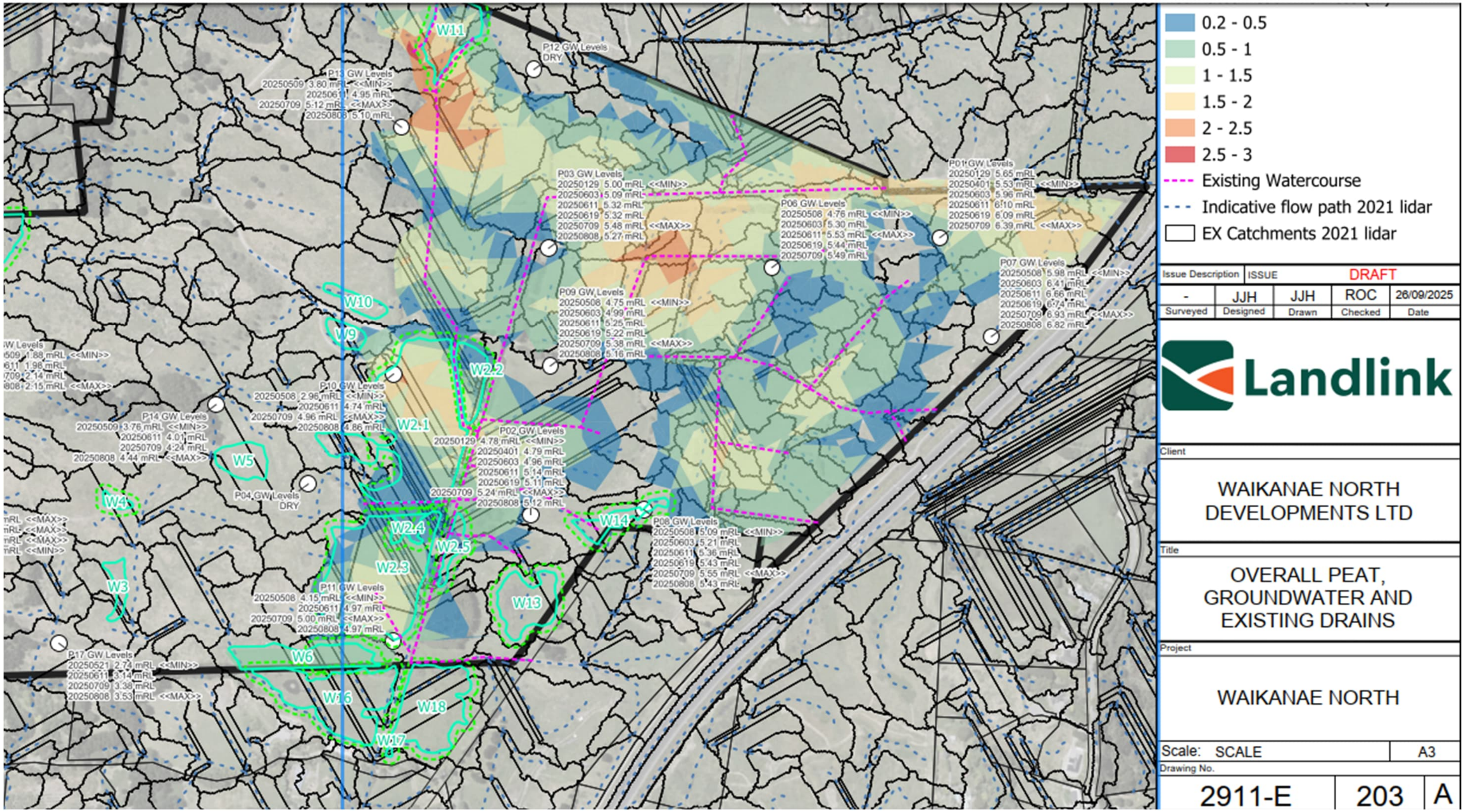

Figure 8. Peat soil and groundwater assessment (Geotechnical Report, CGW Ltd). Colours relate to depth of peat soils east of the high dunes. Note, peat depth was not assessed across the western part of the site.

Groundwater levels across the site were monitored (by the project hydrologist) and deemed to fall into three zones (Table 1), with the low lying eastern and southern flats having shallow groundwater levels, which fluctuate seasonally by around 0.5 m and are close to the surface in the winter months. The CGW investigations found saturated conditions in areas with at least 0.5 m depth of peat, which also influenced surrounding areas and retained higher water tables due to low permeability adjacent to peat. In these areas, groundwater was found near the ground surface following rainfall, with a persistent high groundwater table in the peat areas (Hydrology Report, O'Callaghan Design Ltd). Rainfall infiltration and frequent shallow flooding soak into the underlying soils. There is also a direct interconnection between groundwater and the level of Ngarara Stream.

Table 1. Groundwater levels and zones (Geotechnical Report, CGW Ltd).

Area	Representative Locations	Typical GW Depth (m bgl)	Comments
Low-lying Flats	P01–P07, HA/DCP in flats	0.4 – 1.2	Saturated low areas, peat zones, strong surface influence
Central Undulating Dunes	P08–P10, central dunes	1.4 – 1.9	Undulating sandy terrain with variable groundwater depths
Elevated Dune Ridges	P11–P12, elevated dunes	>2.5	No groundwater in several hand augers to 5.0 m; deeply drained

A low level of mammalian predator control has been carried out by the previous landowner along the margins of Te Harakeke Swamp for at least the last 4 years. Six trap boxes have caught mustelids, cats and hedgehogs at a rate of approximately one per month. Greater Wellington Regional Council (GWRC) also carries out some trapping along the wetland to reduce predation pressure. Extensive rabbit control involving pindone poison has been undertaken by the applicant across the site, assisted by GWRC within 100 m of Te Harakeke Swamp. GWRC has also undertaken some limited buffer planting along the margins of the swamp recently, to increase native dominance.

GWRC, in conjunction with the applicant, is undertaking planting in parts of Te Harakeke Swamp SNA. GWRC and the applicant have also been undertaking occasional pest plant management through 2023 to 2025, and has been assisting the applicant in the management of pest plants (for example, blackberry) along the edge of the wetland.

3.1.3 Identified areas of significance

The primary areas of indigenous vegetation onsite are Te Harakeke Swamp and Peka Peka Road Swamp. Both these wetlands are listed as Ecological Sites (SNAs) in the Operative Kāpiti Coast District as SNA KO66 (Te Harakeke Swamp) and SNA KO60 (Peka Peka Road Swamp) (Figure 9). These SNAs are described further in the wetlands section of this report.

The main dune ridge and Te Harakeke Swamp are listed as a Special Amenity Landscape (SAL 19, Ngarara Dunes) in the Operative Kāpiti Coast District Plan (Figure 10). They are part of a wider sequence of dune ridges and intervening wetlands and dune lakelets, with a moderate to high degree of naturalness.

Te Harakeke Swamp and Peka Peka Road Swamp are protected under QEII covenants on the properties to the north and south, but not on the site itself (Figure 11).

Figure 9. Significant Natural Areas (green outlines) at the site. The site boundary is indicated by the white polygon.

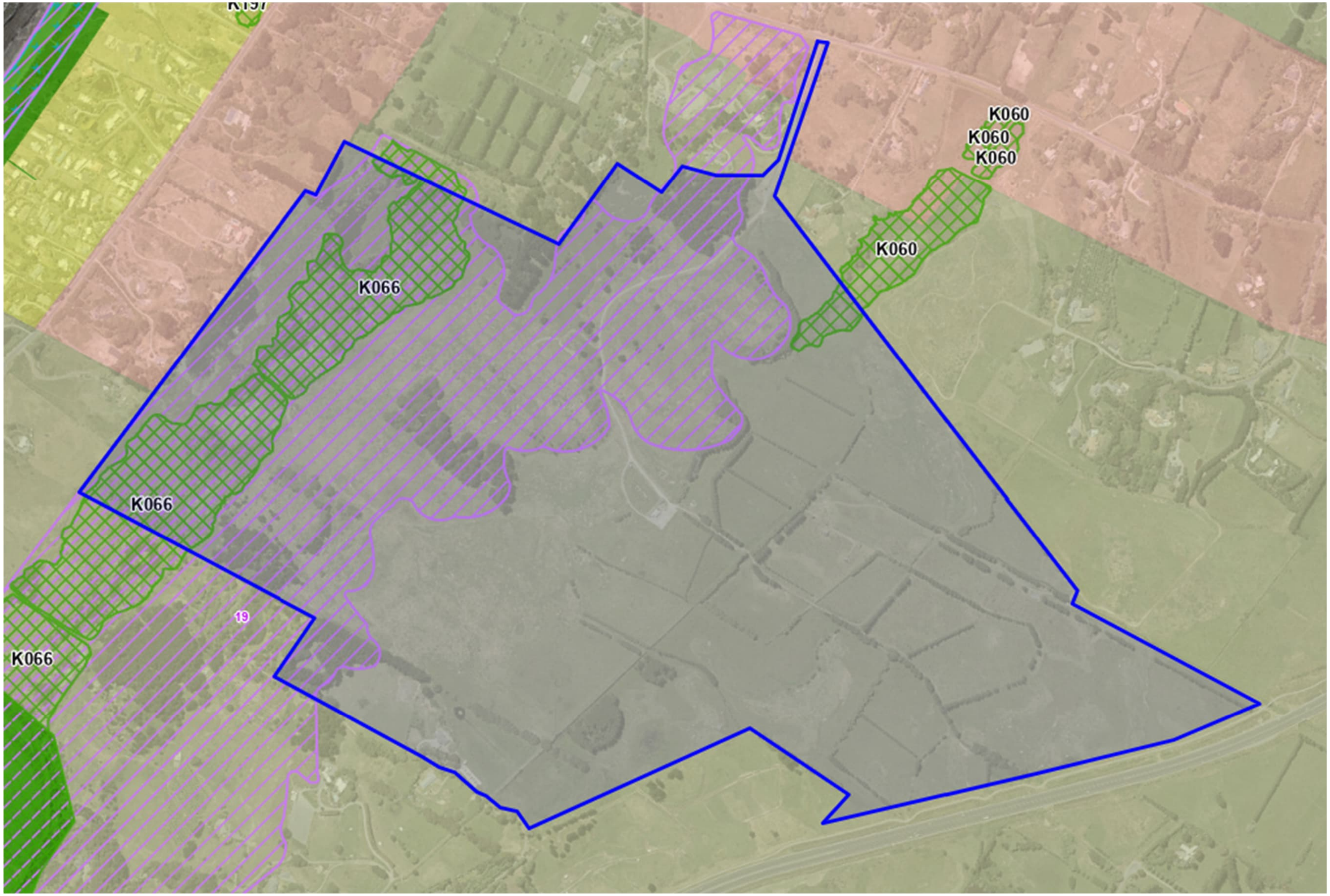

Figure 10. Special Amenity Landscape at the site (purple hatch) and site boundary (blue polygon).

Figure 11. The Protected Areas Network near the site – primarily consisting of QEII covenants (orange polygons).

3.2 Terrestrial ecology

3.2.1 Vegetation

The existing vegetation on the site consists largely of cultivated exotic grassland on the flats and gentle slopes, in line with historical clearance and ongoing maintenance for agriculture (Figure 12). The taller dunes have been cleared of exotic forestry and the current vegetation consists of mixed exotic shrubland, rank grassland, and scattered exotic trees. Remaining indigenous vegetation includes very small pockets of indigenous scrub and trees in the dunes, as well as extensive indigenous vegetation communities within wetlands.

Vegetation on site can be categorised into five main communities:

1. Managed exotic pasture: Exotic grassland, as managed for pastoral agriculture, is the most common vegetation community at the site. Pasture management had occurred across most of the eastern flats and low rolling hills prior to survey (Figure 12). Most of this managed pasture was bare soil at the time of initial surveys, but where seed has sprouted, it was largely ryegrass (*Lolium* sp.), and had low plant species diversity (Plate 3).
2. Wetland: The relatively intact Te Harakeke Swamp (WC1) and Peka Peka Road Swamp (W11) are dominated by a mosaic of indigenous mixed rushland, reedland, and flaxland (Plate 4), with shrubland around some margins. Several dune hollow wetlands and the eastern and southern floodplain wetlands are more degraded, being dominated by exotic grasses, herbs, and native rushes. Wetland vegetation types are described further in section 3.3.
3. Exotic dominated shrubland and rank pasture: The main dune ridge is vegetated by exotic shrubland, scrub, rank pasture, weeds, and vines, with occasional exotic trees, including *Macrocarpa*. In places this vegetation covers forestry slash where *Pinus radiata* forestry has been harvested. Dominant plant species include tree lupin (*Lupinus arboreus*), blackberry, boxthorn, tall fescue grass and pampas grass (Plate 5).
4. Exotic trees: A network of willow, poplar, and macrocarpa shelterbelts fringes paddocks in the eastern half of the site (Plate 6). There also are several poplar woodlots along Ngarara Stream (Figure 12).
5. Indigenous dryland vegetation: Relatively small patches of indigenous scrub and trees are scattered within the dunes (Figure 12; see next Section 3.2.2).

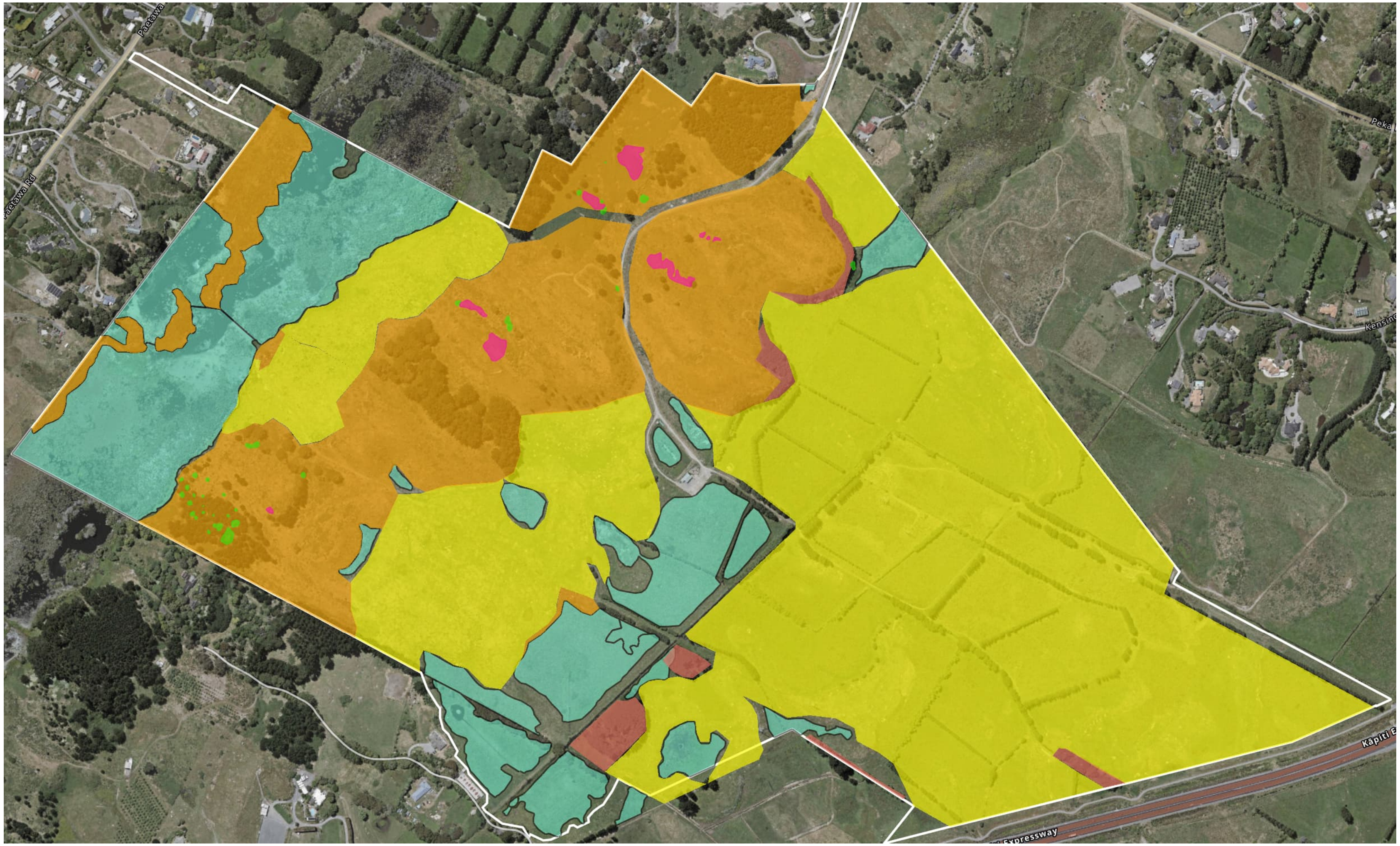

Figure 12. Vegetation types on the site include managed exotic pasture and shelterbelts (yellow polygons), mixed exotic scrub and rank grassland (orange polygons), wetland (cyan polygons), exotic trees (red polygons), indigenous scrub (pink polygons) and indigenous trees (green polygons). Unmapped gaps include roads, road verges, farm sheds and pasture areas which are not intensively managed. Note, shelterbelts and waterways remain unmanaged and intact but are included within managed exotic pasture for simplicity of mapping. Scattered exotic trees within the dunes are included within exotic scrub mapping.

Plate 3. Recent pasture management typical of the site, with bare soil and newly germinated grass, including ryegrass (*Lolium* sp.). (Left) Low dunes. (Right) Eastern flats.

Plate 4. A view from the main dune ridge, over managed pasture and Te Harakeke swamp.

Plate 5. Exotic shrubland on the main dune ridge, with rank grass, tree lupin, boxthorn and harvested pine forestry.

Plate 6. Poplar shelterbelts in the east of the site.

3.2.2 Indigenous Vegetation and SNAs

Small patches of dryland indigenous vegetation are scattered throughout the central dune ridge (Figure 13). These consist of two vegetation communities. The most common community is native shrubland, dominated by pōhuehue (*Muehlenbeckia complexa)* with occasional bracken (*Pteridium esculentum*), oioi (*Apodasmia similis*) and knobby club-rush (*Ficinia nodosa*) (Plate 7). This community provides high value habitat for native lizards.

The second dryland indigenous vegetation community is restricted to individual trees or small copses of native trees, primarily ngaio (*Myoporum laetum)* trees up to 6 m high (Plate 8), with occasional *Coprosma repens,* māhoe (*Melicytus ramiflorus*) and cabbage trees (*Cordyline australis*). Eight indigenous trees of note, above the height of interest under the Kāpiti Coast District Plan, were identified (Figure 13). These include six māhoe (*Melicytus ramiflorus*), and two cabbage trees (*Cordyline australis*) within 20 m of wetland 11 (Plate 29d).

Stable sand dunes with indigenous vegetation class as a naturally uncommon and endangered ecosystem[20]. The areas mapped in Figure 13 meet this definition and were also judged to meet the rarity and representative criteria in the RPS significance criteria (Appendix A). Note, these areas have not been listed as SNAs in the District Plan.

The primary areas of indigenous vegetation onsite were within Te Harakeke Swamp (wetland 1) and Peka Peka Road Swamp (wetland 11), both of which are listed SNAs. A number of more degraded wetlands onsite have areas of the indigenous rushes *Juncus sarophorus* and *J. edgariae* (wīwī) as dominant species, but with exotic grass and herb dominated understories. Vegetation communities within wetlands are described in detail in section 3.3.2.

3.2.3 Threatened plants

A desktop assessment indicates the presence of four At Risk plant species in the local area: sand dune kānuka (*Kunzea amathicola*), dwarf mistletoe (*Korthalsella salicornioides),* sand coprosma (*Coprosma acerosa*), and kōkihi (*Tetragonia tetragonoides*). The sand dune kānuka, dwarf mistletoe (which grows on kānuka and mānuka), and sand coprosma have a conservation status of At Risk – declining. Kōkihi (*Tetragonia tetragonoide*s) has a status of At Risk – Naturally Uncommon. Sand coprosma and kōkihi grow on active sandy beaches, and no suitable habitat for these species exists onsite. No Threatened plant species were detected during the desktop assessment, nor were they detected onsite despite extensive surveying, reflecting the long history of disturbance across most of the site.

One At Risk – Declining species was detected. The eastern margins of Te Harakeke swamp are bordered by several mature sand dune kānuka (*Kunzea amathicola*) trees, with seedlings emerging elsewhere along the wetland margins (Figure 14, Plate 9). Two (2) sand dune kānuka trees are located under a shelterbelt to the east of the main dune ridge. Despite binocular scanning of kānuka and mānuka canopies onsite for mistletoe, none was detected onsite. Particular focus was given to a detailed survey for rare plants in the dune swale and ephemeral wetlands (W3, W4, W5). These wetlands have become significantly more overgrown with exotic grasses, herbs and native rushes since they were visited in May 2024. Few native species, and no At Risk or Threatened species were detected in dune swale wetlands, nor in other wetlands.

[20] EIANZ EciA guidelines. Roper-Lindsay, J., Fuller S.A., Hooson, S., Sanders, M.D., Ussher, G.T. 2018. Ecological impact assessment. EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems. 2nd edition

Figure 13. Indigenous dryland vegetation onsite, including indigenous trees (green polygons), and shrubland or tussock (pink polygons), but excluding wetlands. Indigenous trees of note are indicated by yellow diamonds.

Figure 14. Sand dune kānuka (*Kunzea amathicola*) detections onsite (crimson stars), with wetland extent (cyan polygons) for reference.

Plate 7. Patches of indigenous scrub and rushland on the main dune ridge, dominated by knobby clubrush (*Ficinia nodosa*; upper image) and pōhuehue (*Muehlenbeckia complexa;* lower image).

Plate 8. Lone indigenous trees, as well as small copses, are scattered across the high dunes, primarily ngaio, with occasional māhoe and *Coprosma repens*.

Plate 9. A small copse of sand dune kānuka (*Kunzea amathicola*) and māhoe along the northeastern margin of Te Harakeke Swamp.

3.2.4 Birds

Records from Wilderlab eDNA, eBird and iNaturalist sightings from off-site parts of Te Harakeke swamp confirmed the presence of a number of waterfowl and wetland bird species in 2021-2023 (Table 2). Records include four At Risk species, and three Threatened species, including the Nationally Critical Australasian bittern, and Nationally Increasing brown teal and New Zealand dabchick.

eDNA samples from 2021 detected Gruiformes, a bird order which includes crakes and pūkeko, but did not identify to species level. Pūkeko are common onsite, but Te Harakeke swamp does contain excellent habitat for spotless crakes and marsh crakes when water tables are higher.

There are 18 bittern observations within 6 km of the site over the past 20 years, mostly at Waikanae estuary to the south, and Te Hapua wetlands to the north, with several in Te Harakeke Swamp in the 2010s, and one within 1 km of the site in Pharazyn Reserve in 2022 (eBird observations).

GWRC surveys in 2022 and 2023 detected spotless crakes throughout Te Harakeke swamp, including onsite, with at least three individuals present. New Zealand dabchicks are commonly observed in large numbers (up to 60) on the Pharazyn Reserve oxidation ponds 400 m south of the site. At these oxidation ponds there is a record of two marsh crakes in 2018, records of up to three brown teal, regular records of up to 35 little black shags, and records of little and black shags. There are no online records of fernbird within 5 km of the site.

During the field surveys, 18 native and 15 exotic bird species were detected at the site, including four species listed as At Risk (Table 3).

At Risk - Declining species detections included North Island fernbird (likely two pairs heard over six detections during both call playbacks and incidental observations) and an unidentified crake (a single marsh crake or spotless crake call during call playback surveys) both in Te Harakeke Swamp (Figure 15). One black shag (At Risk – Relict) was observed flying over the site. One downed seabird, a Snares Cape petrel (At Risk – Naturally Uncommon), was found sitting on the driveway after high winds. It had a bill injury and was taken to a local vet with seabird experience. This species is not normally associated with land, except when breeding on the subantarctic islands.

No bitterns were detected during call triangulation surveys (conducted between 0.5 hour before sunset and 1 hour after sunset over three suitable survey nights in October 2025), supporting the absence of male bittern. However, bittern have been recorded throughout the Kapiti and Manawatu coast (eBird and iNaturalist records). Abundant high quality habitat is present within Te Harakeke Swamp, in the form of shallow open water and swamp with 100–300 mm water depth, dominated by raupō, flax, pūrei and *Isolepis prolifera.* Bitterns may use this wetland periodically for foraging, as part of the broader network of dune wetlands in the vicinity.

Table 2. List of bird species recorded in the vicinity of the site in literature review, and likelihood of presence onsite. Several less common Not Threatened waterfowl species are also included. Excludes exotic species and common natives other than waterfowl.

Species	Common name	National threat status	Regional threat status	Likelihood of presence onsite *	Notes**
Anas chlorotis	brown teal	Threatened – Nationally Increasing	Threatened - Regionally Critical	Possible periodically	Nearby eDNA and observations. Breeding recorded on Mana and Kapiti, not on mainland.
Anas gracilis	grey teal	Not Threatened			
Anas rhynchotis	Australasian shoveler	Not Threatened			
Aythya novaeseelandiae	New Zealand scaup	Not Threatened		Possible periodically	Common on Pharazyn Reserve Pond
Botaurus poiciloptilus	Australasian bittern	Threatened – Nationally Critical	Threatened – Regionally Critical	Likely periodically	1 bittern recorded in 2022 at Pharazyn Reserve approx. 200 m to the south and Te Hapu wetland 1 km to the north
Phalacrocorax carbo	black shag	At Risk – Relict		Present flying over. Possible periodically	eDNA and observations
Phalacrocorax sulcirostris	little black shag	At Risk – Naturally uncommon		Possible periodically	
Platalea regia	royal spoonbill	At Risk – Naturally uncommon		Unlikely	
Poliocephalus rufopectus	New Zealand dabchick	Threatened – Nationally Increasing	Threatened – Regionally Vulnerable	Possible periodically	Nearby eDNA, Common on Pharazyn Reserve Pond
Porzana tabuensis tabuensis	spotless crake	At Risk – Declining		Present or likely	Nearby observations online. Unknown crake sp. heard onsite.
Zapornia pusilla	marsh crake	At Risk – Declining		Present or likely	Nearby observation online. Unknown crake sp. heard onsite.

*based on nearby records and presence of suitable habitat for feeding, breeding, roosting or moulting.

**desktop sources include eDNA samples in Te Harakeke swamp (off site) in 2021 (Wilderlab online database), as well as eBird and iNaturalist databases.

New Zealand dabchick (Threatened – Vulnerable) and brown teal (Threatened – Nationally Increasing) were undetected on the site, despite the presence of suitable brown teal habitat and marginal dabchick habitat in Te Harakeke Swamp in 2025 when water tables rose. These species require open water and fringing wetland vegetation for nesting, with dabchick preferring larger shallow waterbodies. Given the nearby records at Pharazyn Reserve ponds (including 10 dabchick observed during the survey period), these species may use the site intermittently when water tables rise and habitat area increases. eDNA samples in Ngarara Stream and Te Harakeke Swamp did detect 'brown or grey teal', but were unable to distinguish to species level. Grey teal were observed at Te Harakeke Swamp wetland.

Large numbers of pūkeko (up to 87 per 5MBC, and well over 100 overall) and paradise shelduck (groups of up to 29), as well as moderate numbers of spur winged plover (up to 15 per 5MBC) were present on the flats east of the dunes in May 2024, primarily in pasture but also in wetlands. All three of these species are native and Not Threatened. The former two are listed as game birds under the Wildlife Act 1953, while the spur winged plover is not protected by the Act. Also of interest is a morepork, heard in the trees at the western boundary.

Habitat quality for wetland birds, including spotless crake, marsh crake, Australasian bittern, fernbird, and brown teal is high for Te Harakeke Swamp (excluding W1.3). A dense mosaic of emergent vegetation including *Carex secta* tussockland, raupō reedland, and harakeke flaxland, provides cover. Shallow water inundation (100–300 mm deep) within this vegetation, and a series of shallow open water ponds on the western margin, provide food resources in the form of invertebrates, fish and frogs. The wetland is large and connected, extending onto properties to the north and south. For NZ dabchick, feeding and nesting habitat is of good quality, but constrained in area, with potential for very low numbers to be resident or use the site intermittently. Peka Peka Road Swamp (W11) also provides high habitat quality, with a shallow surface water and *Carex secta* tussockland present, but no raupō reedland or open water areas present on the site.

A prolonged dry spell in 2024, during which surface water was largely absent, significantly impacted habitat quality within Te Harakeke Swamp and W11. Conditions became unsuitable for waterfowl, and of low to very low quality for bitterns and crakes. The variability in water levels affects the abundance of food resources, limiting the long-term quality of this (otherwise ideal) habitat.

The southeastern wetlands provide low habitat quality for all native wetland birds except pūkeko (very common and Not Threatened) during normal hydrological conditions. Periods of high water tables create intermittent low quality feeding habitat (but not breeding habitat) for At Risk and Threatened birds such as Australasian bittern, but the lack of hydrological stability will constrain food availability. Bittern travel widely and require a network of wetlands to provide sufficient food. They prefer at least 70 % emergent vegetative cover, which is present in several eastern wetlands in the form of *Juncus* spp., but absent from much of the Ngarara floodplain wetlands, particularly on the lower floodplain wetlands in the stormwater easement (Figure 16).

Table 3. List of bird species detected on site during the field survey.

Species	Common name	National Conservation status	Regional conservation status	Regional population	Notes
Anas gracilis	grey teal	Not Threatened			
Anas platyrhynchos	mallard	Introduced and naturalised			
Anas superciliosa x *Anas platyrhynchos*	grey duck, mallard hybrid	Not Threatened			
Anser anser	greylag goose	Introduced and naturalised			
Carduelis carduelis	European goldfinch	Introduced and naturalised			
Chloris chloris	European greenfinch	Introduced and naturalised			
Circus approximans	Australasian harrier	Not Threatened			
Columba livia	rock pigeon	Introduced and naturalised			
Cygnus atratus	black swan	Introduced and naturalised			
Daption capense australe	Snares cape petrel, Cape pigeon	At Risk – Naturally uncommon	Regionally non-resident native	-	Downed seabird, not associated with the habitat
Egretta novaehollandiae	white-faced heron	Not Threatened			
Embreza citrinella	yellowhammer	Introduced and naturalised			
Fringilla coelebs	chaffinch	Introduced and naturalised			
Gerygone igata	grey warbler	Not Threatened			
Gymnorhina tibicen	Australian magpie	Introduced and naturalised			
Hirundo neoxena	welcome swallow	Not Threatened			
Ninox novaeseelandiae	morepork	Not Threatened			At western boundary
Passer domesticus	house sparrow	Introduced and naturalised			
Phalacrocorax carbo	black shag	At Risk – Relict	Threatened - Regionally Critical	<250	1 flying over site

Species	Common name	National Conservation status	Regional conservation status	Regional population	Notes
Phasianus colchicus	pheasant	Introduced and naturalised			
Platycercus eximius	eastern rosella	Introduced and naturalised			
Poodytes punctatus vealeae	fernbird	At Risk - Declining	Threatened - Regionally Vulnerable	250-1000	
Porphyrio melanotus	pūkeko	Not Threatened			100+ on site
Porzana pusilla affinis or *Zapornia tabuensis*	marsh crake or spotless crake	At Risk Declining At Risk declining	Threatened - Regionally Critical Threatened - Regionally Endangered	<250 <250	1 unidentified crake heard at Te Harakeke Swamp
Prosthemadera novaeseelandiae	tui	Not Threatened			
Rhipidura fuliginosa placabilis	North Island fantail	Not Threatened			
Sturnus vulgaris	European starling	Introduced and naturalised			
Todiramphus sanctus	kingfisher	Not Threatened			
Tadorna variegata	paradise shelduck	Not Threatened			
Turdus merula	blackbird	Introduced and naturalised			
Turdus philomelos	song thrush	Introduced and naturalised			
Vanellus miles novaehollandiae	spur-winged plover	Not Threatened			
Zosterops lateralis	silvereye	Not Threatened			

Figure 15. Detections of At Risk bird species onsite and in adjacent areas during field surveys.

Figure 16. Wetland habitat quality for Threatened and At Risk birds. Note, wetlands W2 and W5 have low value intermittently when water tables are high.

The high dunes provide patches of moderate quality habitat for New Zealand pipit, although none was observed onsite. The majority of the dunes are covered in dense lupin and blackberry scrub which is too dense to provide good pipit habitat.

Within intensively managed pasture areas, habitat is unsuitable or of very low quality for Threatened and At Risk bird species.

3.2.5 Lizards

Desktop assessment indicated seven native lizard species are known to be present in the wider area (Table 4). Most have a low or moderate likelihood of being present at the site due to the lack of suitable habitat and isolation from other areas of habitat. The native northern grass skink (*Oligosoma polychroma*) is the most likely to be present.

Table 4. Lizard species which are known in the wider area surrounding the site, with their conservation status, preferred habitat, and likelihood of presence at the site.

Species	Common name	Conservation status	Preferred habitat	Presence likelihood
Naultinus punctatus	Barking gecko	At Risk - Declining	Being an arboreal species, barking geckos are closely associated with forested habitats, and thus inhabit a wide variety of forest types in the south-eastern North Island, including swamps, scrubland, sub-alpine scrub, and mature forest. They appear to favour scrubby and regenerating habitats.	Very low
Mokopirirakau "southern North Island"	Ngahere gecko	At Risk - Declining	Being an arboreal species ngahere geckos are closely associated with a range of forested habitats, including swamps, scrubland, and mature forests (beech, podocarp, and broadleaf).	Very low
Woodworthia maculata	Raukawa gecko	Not Threatened	Often associated with rocky habitats throughout the country, however, they can actually be found in a vast array of habitats, from sandy or rocky coastlines right through to inland beech and broadleaf forests.	Low
Oligosoma polychroma	Northern grass skink	Not Threatened	Occupies a wide range of habitat types preferring open areas including coastal vegetation, rock piles, grassland, flaxland, shrubland, screes, forest margins tussock and modified urban and suburban habitats. Often takes refuge in dense vegetation or under rocks and logs when not active.	High
Oligosoma aeneum	Copper skink	At Risk - Declining	Inhabit areas with good ground cover in open and shaded areas of forests. In coastal areas, copper skinks can be found close to the high tide line. Copper skinks are also found in urban areas, most commonly found in thick-rank grass, compost heaps, or under rocks, logs and other debris	Low

Oligosoma zelandicum	Glossy brown skink	At Risk - Declining	Occur in a wide range of habitats including coastal areas near the high tide mark, in coastal pebble banks, grassland, wetland, dense scrubland, mature forest with dappled sunlight, and will also live in suburban gardens with sufficient ground cover. Glossy brown skinks show a preference for somewhat damper microhabitats	Moderate
Oligosoma ornatum	Ornate skink	At Risk - Declining	Inhabit forested areas, shrubland and heavily vegetated coastlines; they are often found amongst leaf litter, in dense low foliage, thick rank grass and under rocks or logs, and are known to occupy small burrows	Low

Pasture areas onsite have been recently ploughed and resowed, and are unsuitable habitat for lizards. Much of the dunes were previously in pine forestry, which was felled and the slash later cleared. This habitat is heavily disturbed and forms poor habitat for native lizards. Large areas of rank grass and exotic shrubland in the dunes provide poor to moderate quality habitat (Plate 5). Several small areas of indigenous pōhuehue (*Muehlenbeckia complexa*) vines in the dunes provide good quality habitat for northern grass skink and potentially copper skink (Plate 7). Te Harakeke Swamp provides a corridor of wetland shrubland habitat potentially suitable for barking gecko, ngahere gecko and glossy brown skink, although the scrub is in relatively poor condition. Historical records of these species exist in the vicinity, particularly barking gecko, including at the margins of this wetland, to the south of the site.

For the field survey, clusters of ACO (Artificial Cover Object) triple-stacks were checked for lizards each day for five days. If lizards were detected, the following day the ACO was checked and removed.

The field survey detected one species of lizard, the northern grass skink (*Oligosoma polychroma*), which has a threat status of Not Threatened, but it is protected under the Wildlife Act (Plate 10). A total of 31 northern grass skinks were detected onsite (Appendix B, Table 5).

Most were located within an area of indigenous dune scrub pōhuehue, which forms a dense tangle, providing protection from predators. ACO clusters 18–20 in the pōhuehue dune scrub had the highest number of lizard detections, ranging from average counts of 1 to 4 lizards per check (Figure 17, Table 5). Two gravid females were also detected here (Clusters 19 and 22).

ACO clusters 11–13 were the next most abundant group, located in the western part of the site, ranging from 0.33–0.75 lizards per check. Lizards were found at two other clusters at site: cluster 9 in the southeast and cluster 4 in the northeast.

Across the site, several northern grass skinks were seen basking on top of the ACO triple-stacks and escaped as the ecologists approached. All of these were northern grass skinks.

The remaining clusters were left out for 4–5 days to meet standard ACO layout methodology checks for determining likelihood of presence or absence in the area. Clusters 7, 8, and 10 were removed on day 4 because of the wet shaded location. The remaining clusters were removed on day 5. No lizards were detected at these locations.

Pitfall traps were set up and baited on the second day of surveying. Pitfall traps were checked and baited on day three and four, and removed after checking on day 5. No lizards were caught in the pitfall traps.

Figure 17. Average count of northern grass skink per ACO cluster per check. Clusters with white circles had no detections.

Plate 10. Example of a northern grass skink caught onsite, measured, and photographed at cluster 20.

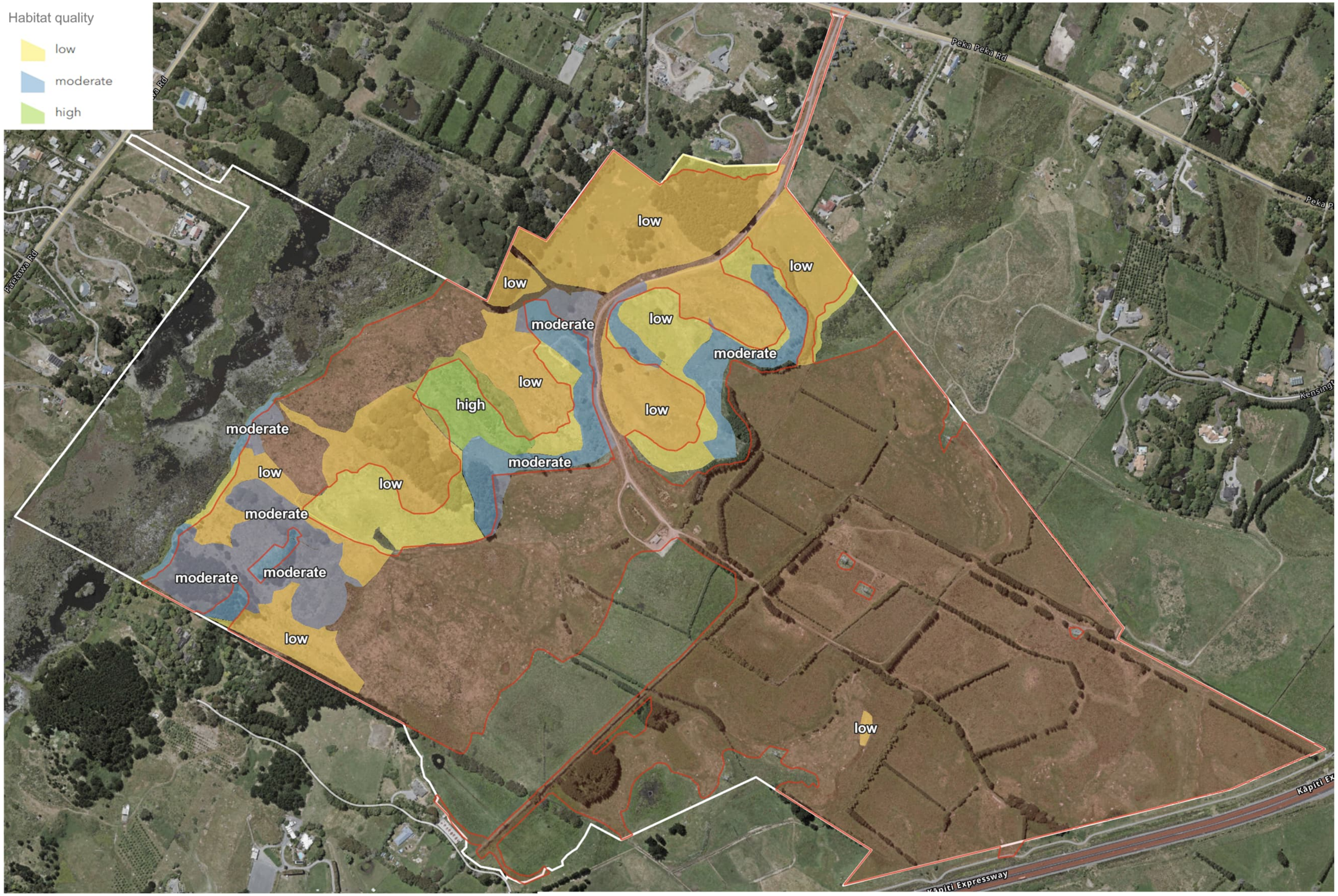

Figure 18. Suitable lizard habitat across site, classified as low (yellow), moderate (blue) and high (green) quality. Earthworks extent at site (red shade and outline).

Table 5. ACO cluster number (each of which includes four ACO triple-stacks) and the days each cluster were checked, along with the number of lizards detected and the average lizard count per check.

ACO cluster number	Total survey days	Total lizard count	Average lizard count
Cluster 17	2	8	4.00
Cluster 19	2	7	3.50
Cluster 20	2	4	2.00
Cluster 18	2	2	1.00
Cluster 12	4	3	0.75
Cluster 11	4	2	0.50
Cluster 13	4	2	0.50
Cluster 9	3	1	0.33
Cluster 4	5	1	0.20
Cluster 01	5	0	0.00
Cluster 02	5	0	0.00
Cluster 03	5	0	0.00
Cluster 05	5	0	0.00
Cluster 06	5	0	0.00
Cluster 07	4	0	0.00
Cluster 08	4	0	0.00
Cluster 10	4	0	0.00
Cluster 14	5	0	0.00
Cluster 15	5	0	0.00
Cluster 16	5	0	0.00
Cluster 21	5	0	0.00
Cluster 22	5	0	0.00
Cluster 23	5	0	0.00

Suitable lizard habitat was mapped across the site and then classified as low, moderate, or high quality (Figure 18). The grading was based on present structural availability, lizard surveys, and historical management. Most of the site has been heavily modified for agriculture or forestry, or both. Recent forestry clearance has left some areas with slash. Other areas have been neglected for several years, and mixed exotic shrubland, rank grassland, and scattered exotic trees have taken hold. Common exotic species include blackberry (*Rubus fruticosus* agg.), broom (*Cytisus scoparius*), pampas (*Cortaderia selloana*), lupin (*Lupinus arboreus*), and inkweed (*Phytolacca octandra*). Relevant native vegetation includes one established population of pōhuehue (*Muehlenbeckia complexa*), several scattered pōhuehue individuals amongst mixed exotic shrubland, and several scattered divaricate shrubs (*Coprosma propinqua*) spread around site.

Low quality habitat – generally contains grazed pasture grasses and rank grassland. Lizard surveys detected one lizard in the middle of a paddock at a pile of cut exotic trees. If northern grass skink is also present elsewhere, it is likely that populations will be patchy and at low density because of the low quality habitat.

Moderate quality habitat – generally contains a mix of exotic and native vegetation left undisturbed for several years or exotic shrubland growing through forest slash. There is moderate structural complexity for lizards to find safety, including amongst scattered individual pōhuehue or divaricate shrubs. There also has been several years for lizards to repopulate the sites. Lizard surveys detected several northern grass skinks in these moderate quality habitats.

High quality habitat – is restricted to the established population of pōhuehue. It has remained undisturbed for several years and there is sufficient structural complexity for lizards to hide and shelter inside the shrub. This high quality habitat occupies a small area in the centre of the high dunes (Figure 18).

3.2.6 Bats

Despite the locality's name, no bats (pekapeka) have been recorded at or near the site in recent times, as per the Department of Conservation bat database and the iNaturalist website. The nearest known bat populations are located on Kapiti Island (approximately 6 km from site), based on a confirmed long-tailed bat (*Chalinolobus tuberculatus*; Threatened – Nationally Critical) record in 2017, as well as several unidentified bat observations. On the mainland, the nearest confirmed records indicated a population of long-tailed bats and southern lesser short-tailed bats (*Mystacina tuberculata tuberculata*; At Risk – Declining) 30 km to the east in the Tararua Forest Park. There is also a recent record of an unknown bat 35 km to the south at Titahi Bay. Historical records include a lesser short-tailed bat in 1958 in Levin, 30 km to the north, and another in 1921, in the Tararua Ranges 10 km east of the site.

Over 100 bat survey points completed within 25 km of the site in the last 10 years have detected no bats, apart from the Kapiti Island record. Under the bat roost protocol[21], this record triggers the need for a presence-absence survey prior to felling of any 'high risk' bat habitat trees.

A preliminary bat roost tree habitat assessment was undertaken prior to completion of the presence-absence survey, identifying 13 large macrocarpa trees with high bat roost risk (Figure 19). High risk trees have a diameter breast height (DBH) >150 mm and potential bat roost features. The macrocarpa trees met the DBH trigger, and the potential roost features identified included hollows and bark crevices. Several trees were rated high bat roost risk as they were unable to be fully assessed due to their size and dense foliage. These trees are isolated from forest areas, but are large (up to 25 m high and wide) and occasionally grouped, reducing exposure and providing potential low-moderate quality habitat (Plate 11). Other trees onsite are primarily poplars and willows of young to moderate age (many recently dead). A representative sample of these trees was assessed for bat roost habitat, and no features were identified.

The bat presence-absence field survey in October 2025 detected no bats after 24 survey nights. No recording sequences met diagnostic criteria for New Zealand long-tailed or short-tailed bats. Given the logger's deployment duration onsite and the lack of bat detections across the dataset, we conclude that New Zealand bats were absent from the Waikanae North Development site for the surveyed period.

A best practice survey would involve further presence-absence surveys during summer and late summer–autumn when bats can disperse more widely after the end of the breeding season. Further surveys were not completed due to the application timeframe.

New Zealand long-tailed and short-tailed bats tend to avoid long crossings of exposed open water bodies, such as the 5.2 km strait between Kapiti Island and the mainland at Paraparaumu Beach. Short-tailed bats are forest dwellers and are extremely reluctant to cross open gaps of more than 100 m. Long-tailed bats are documented to cross wide rivers and lakes, but there is no verified evidence of them crossing sea channels several kilometres wide. Population genetics show strong isolation between mainland and offshore islands, which implies they rarely, if ever, cross

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[21] Department of Conservation. (2024). *Protocols for minimising the risk of felling occupied bat roosts* (Version 4). Wellington, New Zealand: Author. Retrieved from https://www.doc.govt.nz/globalassets/documents/conservation/native-animals/bats/bat-recovery/protocols-minimising-risk-felling-occupied-bat-roosts.pdf

kilometres of open sea. Such a crossing is ecologically implausible given their behaviour, orientation cues, and risk aversion.

It is considered extremely unlikely that bats use this site, because the only recent records within 25 km are located on Kapiti Island. The 5 km sea gap effectively forms a barrier to movement, and it is here deemed very unlikely that bats cross the strait to use the site. We are comfortable that no additional surveys are required, and this has been confirmed after consultation with Mike Jones, independent DOC certified bat personnel trainer.

Under the DOC tree felling protocol for bats, bat roost habitat assessment does not apply if no bats are present (ie. trees can be felled without applying the bat roost pre-felling protocols).

Plate 11. An example of the large macrocarpa trees onsite, providing potential bat roosts. The finger indicates a hollow spar providing a potential roost feature. However, no bats were detected at site, so all risk assessment does not apply.

3.3 Aquatic ecology

3.3.1 Freshwater fauna

Five native fish species and kōura were detected onsite within the Ngarara Stream and its tributaries (Table 6). The detections included two At Risk – Declining species: īnanga and long-fin eel. A desktop assessment indicated that two other At Risk fish species have been detected in downstream reaches and tributaries of the Ngarara Stream catchment, as well as two At Risk species within Te Harakeke Swamp (Table 6), all of which could access watercourses on the site.

The Wilderlab eDNA database indicates multiple records of brown mudfish in Te Harakeke swamp, both immediately north and south of the site, dating between 2021 and 2023. The NZFFD also records brown mudfish detection in Te Harakeke Swamp 200 m south, and 50 m north of the site. Therefore, it is reasonable to expect mudfish are likely to be present on the site within Te Harakeke swamp, despite the lack of detection in eDNA samples in 2025. Limited water flow (as occurred during 2025) tends to restrict DNA dispersal and detectability within wetlands.

Mudfish are adapted to seasonally dry habitats, and could persist in Te Harakeke swamp despite the drying event in 2024 because they have the ability to burrow into the mud and survive without water during drought.

No mudfish detections exist in the eDNA database or NZ freshwater fish database elsewhere on the site or in the drain network east of the main dune ridge. This survey also detected no mudfish in the Ngarara Stream and associated drain network east of the main dune ridge despite extensive eDNA sampling over two sampling periods, comprehensive Gee’s minnow trapping, and fyke netting in mudfish habitat. Therefore, we have a high degree of confidence that mudfish were not present in the stream and drain network east of the main dunes. Habitat in these drains is suboptimal, due to the presence of eels that prey on mudfish, due to a relative lack of riparian vegetation, and due to the permanent hydrology of most of these drains.

Gee’s minnow trapping and fyke netting in Ngarara Stream and the network of drains in the east of the site detected three native fish species and no exotic species (Table 7). Longfin eel (*Anguilla dieffenbachii*), At Risk – Declining, is common in Ngarara Stream and watercourse W1.1, in which 13 individuals up to 1,300 mm in length were captured (Plate 12). Īnanga is also common in Ngarara Stream and W1.1, but none was caught in the surrounding modified streams. Common bully (*Gobiomorphus cotidianus*) and kōura are occasional in Ngarara Stream. In drain 1.2, one longfin eel and an unidentifiable elver were detected.

Figure 19. Bat roost habitat assessment for macrocarpa trees onsite. High risk trees have >150 mm DBH and have potential roost features or were unable to be fully assessed (blue), low risk trees do not contain potential roost features (orange).

Table 6: Summary of fish records for the site split into the onsite field survey and the office-based desktop survey. Likelihood of presence was assessed at both Ngarara Stream and Te Harakeke Swamp.

Source	Location	Species	Common name	Threat status	Likelihood onsite
Field survey (onsite)	Ngarara Stream	*Galaxias maculatus*	īnanga	At Risk – Declining	Present
		Anguilla dieffenbachia	longfin eel	At Risk – Declining	Present
		Anguilla australis	shortfin eel	Not Threatened	Present
		Galaxias fasciatus	banded kokopu	Not Threatened	Present
		Gobiomorphus cotidianus	common bully	Not Threatened	Present
		Paranephrops	kōura	Not Threatened	Present
	Te Harakeke Swamp	*Anguilla australis*	shortfin eel	Not Threatened	Present
		Anguilla sp.	an eel*	-	Present
Desktop assessment (offsite)	Ngarara Stream (offsite)	*Galaxias argenteus*	giant kokopu**	At Risk – Declining	Unlikely – poor habitat
		Gobiomorphus huttoni	redfin bully	At Risk – Declining	Unlikely – no suitable habitat
		Gobiomorphus gobioides	giant bully	At Risk – Naturally Uncommon	Possible
		Gobiomorphus breviceps	upland bully	Not Threatened	Unlikely – no suitable habitat
	Te Harakeke Swamp (offsite)	*Galaxias maculatus*	īnanga	At Risk – Declining	Likely
		Neochanna apoda	brown mudfish***	At Risk – Declining	Likely
		Anguilla australis	shortfin eel	Not Threatened	Likely
		Gobiomorphus cotidianus	common bully	Not Threatened	Likely

*eDNA results could not distinguish species.
**1992 NZFFD record in Ngarara Stream 800 m downstream of the site.
***2021 NZFFD gee minnow trap record 50 m upstream of site, and Wilderlab eDNA records upstream and downstream of site in 2021-2023.

Table 7. Fish survey results in watercourses onsite from Gee's minnow trapping and fyke netting. Watercourses with no trap nights were not surveyed due to insufficient water being present.

Stream	Type	Trap nights	Fish detected	eDNA
S1 – Ngarara Stream	Highly modified river	24	28 īnanga 11 longfin eel 1 common bully 1 kōura	shortfin eel longfin eel banded kokopu *Galaxias* sp.
W1.1	Drain	17	55 īnanga 1 longfin eel	Īnanga longfin eel shortfin eel *Galaxias* sp.
W1.1.1	Drain	4	-	
W1.1.1.1	Drain	-	-	
W1.1.2	Drain	12	-	
W1.1.3	Ephemeral watercourse that is not a river	-	-	
W1.1.4	Drain	-	-	
W1.1.5	Drain	4	-	
W1.1.6	Drain	2	-	
W1.1.7	Drain	3	-	
W1.2	Drain	12	1 longfin eel 1 elver (*Anguilla* sp.)	
W1.3	Drain	3	-	
W1.4	Drain	4	-	
W1.7	Drain	-	-	
W1.8	Drain	-	-	
W1.9	Ephemeral watercourse that is not a river	-	-	
W1.10	Drain	-	-	
W1.11	Drain	-	-	
W1.12	Ephemeral watercourse that is not a river	-	-	
W1.13	Drain	-	-	
W1.14	Drain	-	-	Shortfin eel *Galaxias* sp.
W1.15	Drain	-	-	
W1.16	Drain	-	-	
W1.17	Drain	-	-	shortfin eel longfin eel
Wetland Cluster 1 (Te Harakeke)	Wetland	-	-	shortfin eel *Anguilla* sp.

Plate 12. Longfin eel caught in a fyke net in Ngarara Stream near the southern property boundary.

eDNA results from this survey confirmed the results from Gee's minnow trapping and fyke netting. In addition, eDNA sampling detected shortfin eel (*Anguilla australis*; Not Threatened) and banded kokopu (*Galaxias fasciatus*; Not Threatened) in Ngarara Stream (Appendix C). In the Ngarara stream tributary drain W1.1, eDNA also detected shortfin eel and an unidentified bully species (*Gobiomorphus* sp.).

3.3.2 Streams

One watercourse onsite meets the criteria as a highly modified stream; Ngarara Stream (labelled W1) (Figure 20, Plate 13, Table 8). It is mapped as a 'highly modified river or stream' in GWRC maps online, and it is classified as such because it is a modified form of a historic stream (as per GWRC guidance note on watercourse types - May 2021). Our assessment concurs with this classification, because this stream has natural stream channels upstream of the reach on site, as evidenced by present and past aerial imagery. Onsite, Ngarara Stream has been modified into an almost completely straight eastern section of stream approximately 850 m long, entering the site from an NZTA marginal strip extending from the Kapiti Expressway. It then turns to the southwest and has a straight section approximately 750 m long to the southern boundary of the application site.

This straightening occurred prior to the earliest (1940s) aerial photographs. It has been straightened and channelised, with steep banks along the entire length of its route through the property, and it is of moderate ecological condition (Table 8) and low-moderate representativeness. Ngarara Stream recorded a SEV score of 0.422, placing it at the lower end of the moderate ecological value range (Appendix D). Substrate in Ngarara Stream consists of fine mud and silt, with minimal woody debris, and minimal flow heterogeneity or habitat diversity, scoring low for diversity and pattern. Riparian shelterbelts of poplar and willow provide moderate shading in summer, and abundant leaf fall seasonally. In-stream macrophytes are common where the stream is not well shaded. Fish abundance and diversity is low-moderate, but includes two At Risk – Declining species, īnanga and longfin eel, scoring high for rarity.

A network of 20 artificial watercourses (farm drains) feeds into Ngarara Stream. These straight watercourses appear to have been excavated to drain historic wetlands onsite and upstream. Despite examination of aerial imagery and field assessment, no evidence of an existing or historic natural stream channel or surface water body could be found for these watercourses, either on the site or upstream. However, it should be noted that these drains were already in place in the earliest aerial imagery from the 1940s, so the assessment is restricted to contours and landforms indicative of former features (Figure 21).

The ecological condition of these drains ranged from poor to poor-moderate, using a custom index of condition (Table 8) and SEV scores for the ‘northern drain’ (W1.1) and ‘southern drain’ (W1.1.1) recorded scores of 0.398 and 0.394 respectively, both within the upper range of poor ecological value (Appendix D).

Overall, the results indicate that Ngarara Stream retains slightly greater ecological function than the adjacent drainage channels, although all assessed watercourses show evidence of modification typical of rural drainage environments. Common characteristics include a high loading of fine sediment, no natural sinuosity, steep banks, no flow heterogeneity (standing water only, mostly stagnant), little to no habitat diversity or pattern (apart from seasonal drying), and poor to moderate shading and riparian vegetation (Plate 12a). Many of these drains are intermittent, with all but the larger drains drying in summer or during dry spells (as in 2024).

Despite the seasonal drying, no mudfish were detected using trapping or eDNA sampling. Fish were detected in two drains: W1.1 had īnanga and long-fin eel present, and W1.2 had one long-fin eel and one elver (Table 7). Rarity value of the drains is insufficient to meet high value criteria. Although drains onsite support or have potential habitat for At Risk species (īnanga and longfin eel), these species are common in the Ecological Region, and drains onsite provide only low-moderate quality habitat, resulting in a rarity value of moderate. The overall ecological value of artificial drains onsite is low.

Three ephemeral farm drains were identified (Table 8). These ephemeral drains exist at the head of artificial watercourses. They had a vegetated bed and no surface water at the time of survey, thus being classified as ‘ephemeral watercourse that is not a river’ (Plate 14).

No watercourses exist on the dunes or in the west of the site. Onsite and desktop assessment indicates a fairly laminar water flow through Te Harakeke Swamp with no distinct channels.

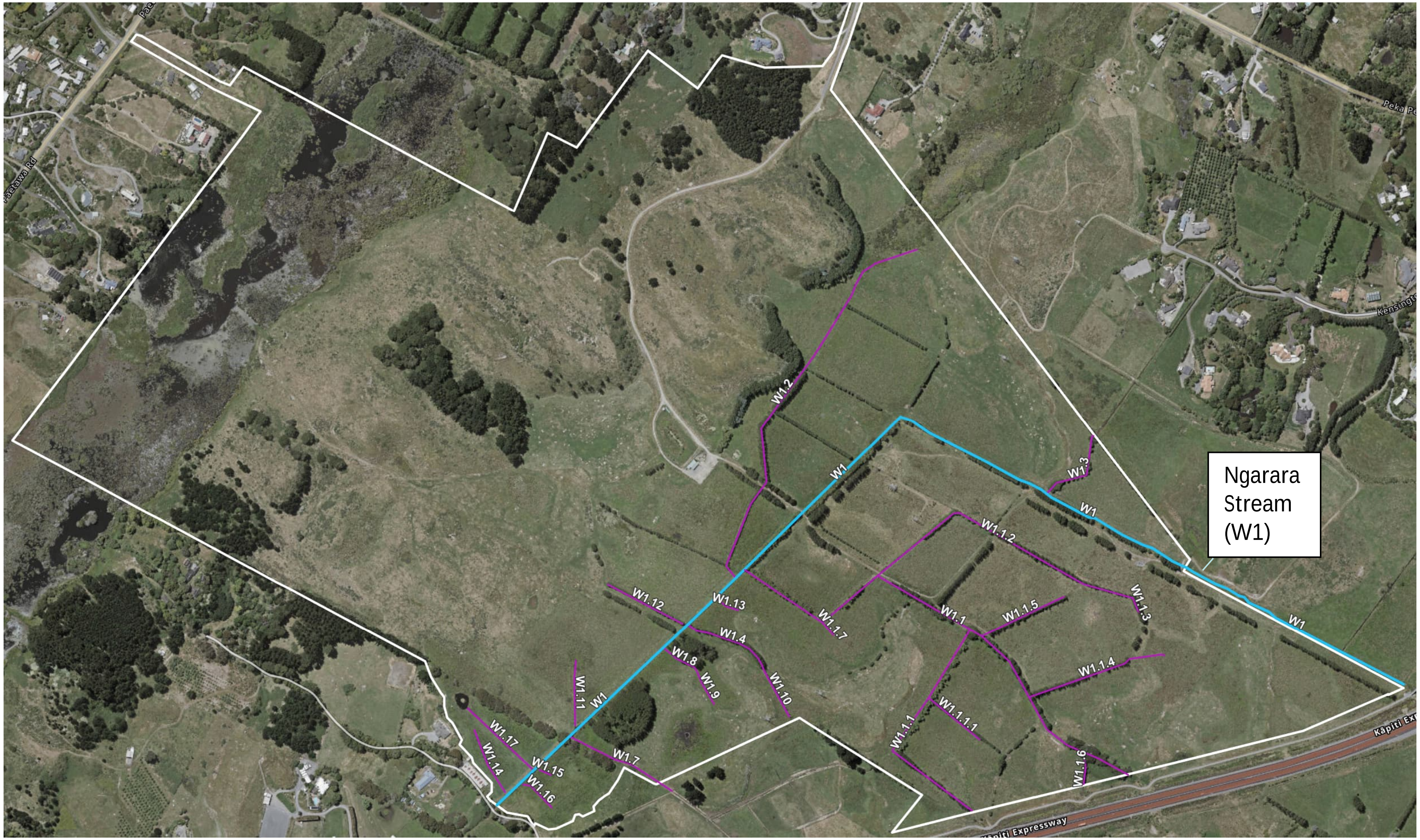


Figure 20. Watercourses onsite. Ngarara Stream (W1, blue line) and the network of drains feeding into it (purple lines, pink where ephemeral).

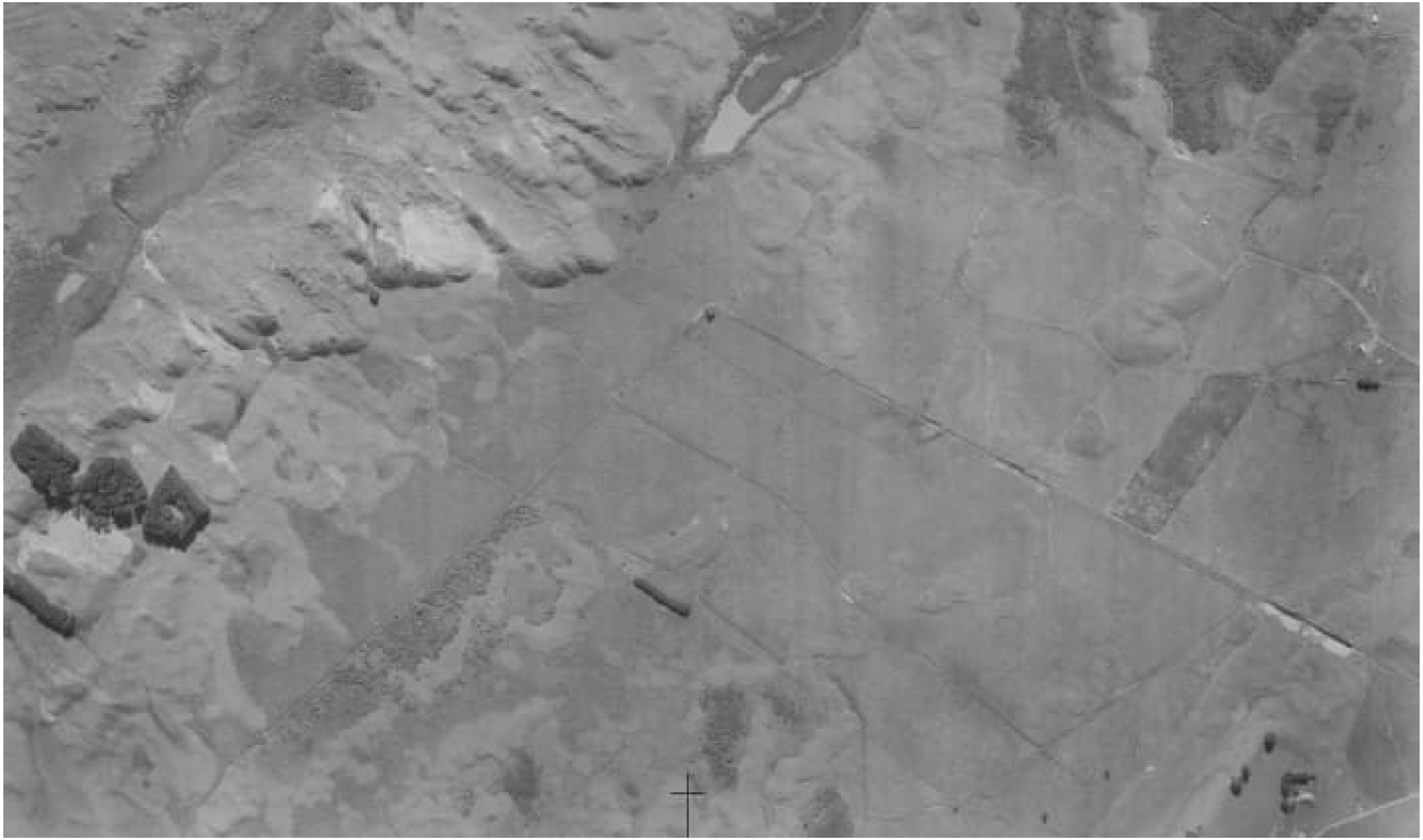


Figure 21. 1948 aerial imagery of the site, showing the drainage network across the eastern part of the site (sourced from Retrolens).

Plate 12a. Ngarara Stream (W1), a highly modified stream at its lower reaches. Where it crosses the property, it forms a long straight stretch of deep, slow flowing pool habitat with steep, excavated banks. Historically excavated spoil mounds are visible in places as elevated ground on either side of the stream.

Plate 13. W1.1 (top left image), W1.1.2 (top right), W1.11 (lower left) and W1.2 (lower right), examples of artificial watercourses (drains) that are not a 'river' under the NRP and RMA. Most have no flow outside of rainfall, and moderate shading due to a flax, poplar, and willow riparian margin on one bank. W1.11 has poor shading, and extends into wetland 2.3.

Plate 14. Watercourses 1.9 and 1.12, examples of artificial ephemeral watercourses that are not a 'river' under the NRP and RMA. They carry water only after recent rainfall, and have vegetated beds (prior to ploughing).

Table 8. Watercourses onsite, including stream condition, summary of fish present and TICI score.

Watercourse	Type	Length (m)	Width (m)	Riparian diversity[1]	Channel shade[2]	In stream habitat[3]	Bed characteristics[4]	Overall condition[5]	Fish present	TICI rating[6]
W1 Ngarara Stream	Highly modified river	1,378.0	4.5	Poor-Moderate	Moderate	Moderate	Poor	Moderate	5 species, (2 At Risk)	Average
W1.1	Drain	774.4	1.3	Poor-Moderate	Moderate	Poor	Poor	Poor-Moderate	4 species, (2 At Risk)	Poor-Average
W1.1.1	Drain	381.3	1.5	Poor-Moderate	Moderate	Poor	Very Poor	Poor	No	-
W1.1.1.1	Drain	103.9	0.7	Poor-Moderate	Moderate	Poor	Very Poor	Poor	-	-
W1.1.2	Drain	463.7	0.9	Poor-Moderate	Moderate	Poor	Poor	Poor	No	-
W1.1.3	Drain and Ephemeral watercourse that is not a river	26.0	0.5	Poor-moderate	Moderate	Poor	Very Poor	Poor	-	-
W1.1.4	Drain	225.6	0.8	Poor-Moderate	Moderate	Poor	Very Poor	Poor	-	-
W1.1.5	Drain	142.7	0.5	Poor-Moderate	Poor-Moderate	Poor	Very Poor	Poor	No	-
W1.1.6	Drain	51.4	1.0	Poor-Moderate	Moderate	Poor	Poor	Poor-Moderate	No	-
W1.1.7	Drain	27.9	2.0	Poor	Very Poor	Very Poor	Very Poor	Very Poor	No	-
W1.2	Drain	636.5	1.9	Poor-Moderate	Moderate	Poor	Very Poor	Poor	1 species (At Risk)	-
W1.3	Drain	135.9	1.2	Poor-Moderate	Poor	Poor	Very Poor	Poor	No	-
W1.4	Drain	138.2	1.5	Poor-Moderate	Moderate	Poor	Very Poor	Poor	No	-
W1.7	Drain	180.4	1.0	Poor	Very Poor	Poor	Very Poor	Poor-Very Poor	-	-
W1.8	Drain	65.1	0.8	Poor-Moderate	Poor-Moderate	Poor	Poor	Poor	-	-
W1.9	Drain and Ephemeral watercourse that is not a river	59.3	0.8	Poor	Very Poor	Very Poor	Poor	Very Poor	-	-

Watercourse	Type	Length (m)	Width (m)	Riparian diversity[1]	Channel shade[2]	In stream habitat[3]	Bed characteristics[4]	Overall condition[5]	Fish present	TICI rating[6]
W1.10	Drain	93.0	1.5	Poor	Poor	Poor	Poor	Poor	-	-
W1.11	Drain	104.4	0.5	Poor	Poor	Poor	Poor	Poor	-	-
W1.12	Drain and Ephemeral watercourse that is not a river	133.4	1.5	Poor - Moderate	Moderate	Very Poor	Very Poor	Poor	-	-
W1.13	Drain	43.8	0.8	Poor	Very Poor	Very Poor	Very Poor	Poor-Very Poor	-	-
W1.14	Drain	111.0	1.6	Poor	Poor	Poor	Very Poor	Poor	-	-
W1.15	Drain	21.5	1.2	Poor	Poor	Poor	Very Poor	Poor	-	-
W1.16	Drain	61.5	1.3	Poor	Poor	Poor	Very Poor	Poor	-	-
W1.17	Drain	138.8	1.3	Poor	Poor	Poor	Very Poor	Poor	-	-

1. Riparian diversity assessed as: no vegetation (very poor), pasture or grass or monoculture of low weeds (poor), several woody plant species either native or exotic (moderate), many woody plant species; mixed exotic/native/successional species (good); highly diverse range of native plant species forming a mature or maturing canopy with understorey and ground tiers (very good).
2. Channel shade assessed as: fully open; lack of canopy cover (very poor); <20 % water surface shaded (poor); 20 – 60 % water surface shaded; mostly open with shaded patches (moderate); 60 – 80 % water surface shaded; mostly shaded with some open patches (good); > 80 % water surface shaded; full canopy (very good).
3. In stream habitat assessed as: favourable habitats (woody debris, rooted aquatic vegetation, leaf packs, undercut banks, root mats, stable habitat) limited and coverage <10 % channel (very poor); favourable habitat diversity limited to 1-2 types; woody debris rare, coverage 10 – 30 % of channel (poor); moderate variety of habitat types (3-4 types) covering 30 – 50 % channel (moderate); most habitat types present, covering 50 – 75 % channel (good); all habitat types present covering >75 % of channel (very good).
4. Bed characteristics assessed as: Very high loading of un-natural silt and uniform hydrologic conditions (very poor); un-natural siltation with limited variety of hydrological conditions (poor); mostly natural bed substrates with moderate variety of hydrologic conditions (moderate); natural bed substrates with a good variety of pools, runs, riffles (good); natural bed substrates with the full range of hydrologic conditions present (deep and shallow pools, chutes, runs, riffles) (very good).
5. Overall condition assessed as a combination of the four key characteristics with scores all or predominately of 'poor' returning an overall poor condition or very poor, scores predominantly or mostly of 'moderate' returning an overall moderate condition, and scores all or predominately of 'good' returning an overall good condition
6. The Wilderlab TICI (Taxon-Independent Community Index) is an eDNA-based measure of stream ecological health by comparing the overall DNA community composition to national reference conditions. Scores below 80 indicate very poor condition, 80–90 poor, 90–100 average, 100–110 good, 110–120 excellent, and above 120 pristine, reflecting progressively higher ecological integrity and biodiversity.

3.3.3 Wetlands

The site was assessed for wetlands, with the exception of farmed land which had undergone recent pasture management at the time of survey. The entire site has been cleared, drained, and farmed as pasture for over 75 years (as visible on 1948 aerial imagery, Figure 21). Parts of the site developed partial cover of rushes prior to recent change in land ownership and farming activities to bring the land back into productive farming.

Twenty-one (21) areas meet the classification of natural inland wetland under the NPS-FM (Figure 22). Wetland delineation plot data is presented in Appendix E.

These wetlands are grouped into six clusters (Table 9), with wetlands of each type having comparable species, condition, wetland type and ecological value, as described in Table 10 and the following descriptions of each wetland cluster.

Wetlands onsite are largely groundwater influenced, with surface water inputs and significant fluctuations in water table. Within the period of groundwater monitoring, water tables have been close to the ground surface at times in winter in Wetland Cluster 2 and much of the eastern flats. Peat is present in Te Harakeke Swamp (WC1), Ngarara Stream wetland (WC2), and Peka Peka Road Swamp (WC6), but absent from the mineral dominated soils of the dune edge (WC4) and eastern wetlands (WC5) (Table 10, Figure 8).

Table 9. Wetlands on site (including the stormwater easement area), with cluster groupings.

Wetland	Wetland Cluster	Area (m^2)
W1.1	WC1	57,078.9
W1.2	WC1	66,214.6
W1.3	WC1	17,555.9
W2.1	WC2	27,505.9
W2.2	WC2	3,807.9
W2.3	WC2	21,886.0
W2.4	WC2	1,546.2
W2.5	WC2	1,726.9
W3	WC4	1,569.1
W4	WC4	644.5
W5	WC5	3,314.5
W6	WC2	6,531.7
W9	WC5	1,735.6
W10	WC5	1,936.7
W11	WC6	6,390.2
W13	WC5	6,172.2
W14	WC5	2,526.6
W15	WC5	216.2
W16	WC3	12,758.6
W17	WC3	137.7
W18	WC3	10,580.0
Total		251,835.8

Table 10. Hydrological characteristics of monitored wetlands (adapted from the Hydrological Report).

Wetland	General ground level	Ground water level	Ground water influenced	Surface watercourse inputs	Peat presence	Comment
W1.1	RL3.5 – 3.1	RL2.15 – 1.88	Likely, seasonally	Yes, from the north	Yes	Surface water 0.1 - 0.5 m + observed in Sept 2025
W1.2	RL3.3 – 3.0	RL2.67 – 1.54	Likely, seasonally	Yes, from the north	Yes	Surface water 0.1 - 0.5 m + observed in Sept 2025
W2.1, W2.2	RL5.1 – 5.0	RL5.1 – 2.96	Yes	Yes, small inflow from the north – may dry up in summer months. Ngarara Stream adjacent.	Yes Depth 1 - 2m	Receives runoff from the west
W2.3, W2.4	RL5.2 – 5.0	RL5.1 – 4.0	Yes	Yes, small inflow from the north – may dry up in summer months. Ngarara Stream adjacent.	Yes Depth 1 - 1.5m	Receives runoff from the west
W4	RL4.0	Untested – estimated RL4	Unlikely	No	Not tested	Suspected perched water table.
W11	RL5.4 – 5.2	RL5.1 – 3.8	Yes	No	Yes Depth 1 - 2.5m	Drains to the north, very small overflow to the south. Surface water 0.1 - 0.3 m + observed in Sept 2025
W13	RL6.5	RL5.1 – 4.5	Unlikely	No	No	Potentially perched water table
W14	RL5.8 – 5.5	RL5.5 – 5.1	Yes	Yes, small flow from local water course.	No	
W16	RL4.9	Approx. RL4.8 – 4.1	Yes	No	Not tested	
W18	RL5.1 – 4.8	Approx. RL4.8 – 4.1	Yes	No	Not tested	

Figure 22. Wetlands at the site (cyan polygons), wetland delineation plot locations (blue squares), and soil-core-only locations (white circles). Note, plot locations in W4 and W5 are obscured by wetland labels. Plots WPOct25-8B and 8A are labelled in white. Wetland clusters are labelled in text boxes (wetland cluster 4 – Dune edge wetlands includes W4 and W5, Wetland cluster 5 – Eastern wetlands includes W5, W9, W10, W13, W14, W15). W19 falls outside the project area, but is included for context.

3.3.3.1 Wetland Cluster 1 - Te Harakeke Swamp complex

Te Harakeke Swamp consists of wetlands W1.1 and W1.2 (coinciding with the SNA overlay) and W1.3, which is less intact. Te Harakeke Swamp is a large dune hollow swamp dominated by indigenous obligate wetland species. Vegetation communities in the core include large areas of mixed raupō (*Typha orientalis*) reedland, *Carex secta* tussockland and *Phormium tenax* flaxland (Plate 15). The understorey was almost completely dominated by *Isolepis prolifera* during a period of high water tables in spring 2025, but during an extended dry spell in summer and autumn 2024, *Persicaria hydropiper*, *Ludwigia palustris* and various dryland plants were co-dominant, particularly where shallow open water habitat previously existed (Plates 16 and 17). The eastern margins are dominated by mānuka, *Coprosma propinqua* and *C. rigida* shrubland, with small patches of sand dune kānuka and māhoe, and an understorey of *Carex geminata*, flax, Yorkshire fog and creeping bent grass (*Agrostis stolonifera*).

Water levels in Te Harakeke Swamp fluctuated markedly during survey periods, with no surface water present in April 2024, with large areas of bare, cracked organic soils present which were previously inundated. Dryland plant invasion throughout the wetland indicated low water levels had existed for some months. The reason for these low water tables in Te Harakeke swamp onsite in 2024 was due to a combination of severely dry conditions caused by extended low rainfall in the region (NIWA daily climate maps) and the clearance of Ngarara Stream downstream (offsite) to improve drainage upstream.

Aerial imagery from the previous twenty years shows that parts of the wetland frequently inundated, with large areas of open water visible in the previous 10 years likely associated with vegetative buildup in the downstream waterway. In the early 2020's, this likely combined with several wetter years to create particularly high water tables extending north of W1.3.

During site visits in winter and spring of 2025, the water table rose again to an intermediate level, sitting 100–200 mm above ground level over much of the wetland, and with small areas of standing water present in the core and eastern margin, but only a fraction of that visible on previous aerial imagery, no inundation in the western arm, W1.3. Although temporarily inundated in the early 2020's, the flat area north of wetland W1.3 is dominated by pasture grass (Yorkshire fog) and white clover, with vegetation plot WPOct25-8B indicating vegetation is not hydric, with a prevalence index of 3.1 and is therefore not considered part of wetland W1.3 (see Figure 22, Plate 17b and Appendix E). This plot also meets the pasture exclusion test, and soils class as 'uncertain'. In comparison, plot WPOct25-8A has a prevalence index of 2.5, fails the pasture exclusion test, has gley hydric soils, and is therefore mapped within wetland W1.3 (Plate 17c).

Te Harakeke Swamp wetland provides high quality habitat for wetland birds (described further in this section) and fish, however this capacity varies markedly with fluctuations in water table. In 2024, there was no suitable habitat for fish or wetland birds, apart from fernbird, while in 2025 areas of suitable shallow water habitat returned. Bittern, crake, dabchick, brown teal and other waterfowl require, or strongly prefer, shallow standing water.

Overall, wetland Cluster 1 is of very high ecological value (Table 11).

3.3.3.2 Wetland Cluster 2 - Ngarara Floodplain Wetland Cluster

The cluster of wetlands around Ngarara Stream (W2.1, 2.2, 2.3, 2.4, W2.5, and W6) are all part of the same historic wetland, but have been fragmented by channelisation of Ngarara Stream and construction of a drain and raised farm track. These wetlands are dominated by exotic grasses, primarily *Holcus lanatus* (Yorkshire fog grass), *Agrostis stolonifera* (creeping bent grass) and *Ranunculus repens (*creeping buttercup*)*, as well as the common native rushes, *Juncus edgariae* (wīwī) and *Juncus sarophorus* (broom rush) (Plates 18 and 19). Wetland W2.4 (Figure 22) meets the pasture exclusion test, as it is dominated by Yorkshire fog, but has been included as wetland due to the intended use of this area for restoration and stormwater management.

Plate 15. The northern part of Te Harakeke Swamp (SNA KO66) in spring of 2025, with water tables generally above the ground surface. Vegetation is dominated by *Isolepis prolifera*, *Carex secta* and harakeke (*Phormium tenax*).

Plate 16. Te Harakeke Swamp in autumn 2024 during a dry spell. The foreground appears as open water on historical aerial imagery, but in this image, they are dry and dominated by *Persicaria* sp. and *Isolepis prolifera*, with several rabbit burrows. Extensive areas of raupō remain.

Plate 17. Dryland plant species invasion in Te Harakeke Swamp, including *Erigeron sumatrensis*, a facultative upland plant, amongst obligate wetland plants *Eleocharis acuta* and *Carex secta*, and the facultative wetland water pepper *(Persicaria hydropiper)*.

Plate 17b. Wetland plot WPOct25-8B, north of wetland W1.3, looking south towards wetland W1.3 (left), and north (right). Yorkshire fog grass (FAC) dominates, with white clover (FACU) present.

Plate 17c. Wetland plot WPOct25-8A, within wetland W1.3, looking south (left), and north (right). Native and exotic FACW rushes, creeping bent grass (FACW), *Lotus pedunculatus* (FAC) and creeping buttercup (FAC) are prevalent, with *Cyperus ustulatus* (FACW) outside the plot.

These wetlands are hydrologically severely degraded by the historic channelisation of Ngarara Stream and excavation of a network of farm drains feeding into it. Sufficient soil moisture remains during the winter months to support facultative wetland plants, but no obligate wetland plants remain outside of the drains. Hydrological monitoring indicates water tables fluctuate over a metre seasonally, coming close to the ground surface in winter, but remaining below ground level (except perhaps in high rainfall events). Groundwater levels are hydrologically linked to Ngarara Stream, and surface water flooding of the wetland is likely to occur in the highest rainfall events (Hydrology Report). Due to historic and ongoing deep channelisation of the stream, this hydrological connection of the stream to the wetland floodplain is impacted and water tables are lowered. The wetland cluster is now sustained primarily through seasonally high groundwater, but with contributions from rainfall and overland surface flows. Peat soils of 0.2 m to 2.5 m depth are found throughout this wetland cluster (Figure 8), which help maintain wetland hydrology by retaining moisture after rainfall events (Hydrology Report).

Due to severe degradation, there is potential for enhancement of hydrology and vegetation in this wetland cluster, particularly given the presence of peat soils.

Wetland Cluster 2 is of moderate ecological value (Table 11).

Plate 18. Wetland W2.1 near Ngarara Stream. Vegetation is dominated by *Holcus lanatus* (Yorkshire fog grass) and *Ranunculus repens* (creeping buttercup), with *Juncus edgariae* (wīwī) locally dominant in patches.

Plate 19. Wetland W2.3 near Ngarara Stream. Vegetation is dominated by *Holcus lanatus* (Yorkshire fog grass), *Agrostis stolonifera* (creeping bent) and scattered native rushes, such as *Juncus edgariae* (wīwī) and *J. sarophorus* (broom rush).

3.3.3.3 Wetland Cluster 3 – Lower Ngarara Floodplain Wetland Cluster

Wetland Cluster 3 consists of wetlands W16, W17 and W18. It is an extension of Wetland Cluster 2 but has been separated due to its presence on the leased stormwater easement, which has been more intensively managed and has almost no native rush cover (Plate 20). There is potential for improvement of hydrology and vegetation in this wetland cluster, but the easement agreement may constrain restoration options.

Similar to WC2, this wetland cluster is a severely degraded swamp, which is grazed throughout and drained by the channelisation of Ngarara Stream and establishment of four tributary farm drains. Vegetation is largely *Holcus lanatus*, *Agrostis stolonifera* and *Dactylis glomerata* exotic grassland, with exotic *Ranunculus repens*, *Rumex obtusifolius* and *Juncus effusus*. Scattered native *J. sarophorus* are present. Wetland 17 is a 138 m^2 patch of *Carex geminata* sedgeland (Plate 21).

Wetland Cluster 3 is of moderate ecological value (Table 11).

Plate 20. Wetland 16 is hydrologically degraded, grazed, and exotic dominated.

Plate 21. Wetland 17 is a small area with *Carex geminata* dominant.

3.3.3.4 Wetland Cluster 4 - dune edge wetlands

Wetland Cluster 4 consists of two relatively small wetlands: W3 and W4. They meet the criteria as palustrine herbfield and rushland marshes on stabilised dunes and are in a degraded state (Plates 22 and 23).

Key features of these wetlands include:

- They are located in depressions immediately adjacent to the high dunes (a line of stable parabolic dunes);
- the soils are mixed organic and sand/silt mineral;
- they experience ephemeral inundation at times of high rainfall, which occurs intermittently instead of seasonally (as indicated by GoogleEarth and observations onsite);
- water inputs largely come from overland surface water runoff from the surrounding dunes and direct rainfall;
- Groundwater monitoring in this area indicates that the main groundwater system is 1–2 m below the ground at these wetlands. It is suspected there is a localised perched water table at these two wetlands (Hydrological Report: Table 1).
- vegetation indicates moderate to high nutrient status;
- the core vegetation consists of exotic-dominated herbfield (*Persicaria hydropiper)*;
- the margin vegetation consists of exotic dominated rushland and grassland (*Juncus effusus, J. sarophorus*, *Holcus lanatus, Agrostis stolonifera*);
- plant species are primarily facultative and facultative wetland;
- the only native species detected were *Juncus sarophorus*, a common rush at up to 40 % cover, and marsh yellowcress (*Rorippa palustris*) a widespread obligate wetland herb at <1 % cover; and
- no Threatened or At Risk species were detected after multiple surveys at different seasons.

A broad interpretation based on landform and ephemeral inundation may consider wetlands 3 and 4 to be dune slack wetlands. Defining characteristics of dune slack wetlands in general include (a) landform – located in depressions between dunes, (b) sandy soil substrate, (c) presence of wind-blown mobile sand resulting in unstable substrate, (d) ephemeral inundation from groundwater and rainfall, and (e) low nutrient status. These features result in a high-disturbance and low nutrient environment which supports (f) an assemblage of rare plant species specifically adapted to these conditions. These rare plant species are essentially pioneer species, intolerant of competition from taller stature plants further along in ecological succession. Dune slack wetlands are classed as a naturally uncommon and endangered ecosystem[22].

We do not consider this the most relevant classification for these features at this site, because the dominant characteristics of wetlands define their class and type, and landform is only one factor to consider. Degradation and stabilisation have altered the nature of W3 and W4 to a degree where they do not meet most characteristics of dune slack wetlands. They are highly modified by stabilisation of the surrounding dunes, stock grazing, pugging, faecal nutrient inputs, fertilizer inputs, and likely by climate change impacts on the frequency and intensity of inundation (as evidenced in 2024 when dryland plant invasion was significant). Flora values are low, and it is not feasible to restore them to a state where they can support the threatened plants characteristic of dune slack wetlands, because the processes of active wind-blown sand movement and low nutrient sandy soils are absent.

[22] EIANZ EciA guidelines. Roper-Lindsay, J., Fuller S.A., Hooson, S., Sanders, M.D., Ussher, G.T. 2018. Ecological impact assessment. EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems. 2nd edition

The removal of disturbance through sand stabilisation and the addition of nutrients has supported the invasion of taller species, both exotic weeds and natives, and development of organic components in the topsoil. Hydrology, although ephemerally inundated, is perched rather than linked to groundwater.

Because of these conditions, we do not consider W3 and W4 to be dune slack wetlands, but rather palustrine herbfield and rushland marshes in stabilised dune depressions. The vegetation composition, hydrology and substrate are comparable to that of Wetland Cluster 5 (eastern) wetlands. Common features include exotic rush and herb dominance, ephemeral inundation, and mixed mineral/organic soils (Plates 24-28). Wetland Cluster 4 is of Moderate (upper) ecological value (Table 11).

Plate 22. Wetland W3 in 2024 (left) and 2025 (right), with bare earth indicating past inundation at the core. Dominant vegetation includes *Juncus sarophorus* and *Persicaria maculosa*.

Plate 23. Wetland W4 in 2025. Dominant vegetation includes *Juncus sarophorus* and *Persicaria hydropiper,* indicating an early successional to mid-successional stage.

3.3.3.5 Wetland Cluster 5 – eastern wetlands

This cluster includes wetlands W5, W9, W10, W13, W14, W15, all located in depressions within the undulating historic low dunes in the east and south of the site. The hydrology of this wetland cluster is groundwater dominated, with marked fluctuations seasonally (Hydrology Report) and also between years (Google Earth analysis), resulting in occasional temporary inundation in wet years. No inundation was observed during our surveys. Although the landform and hydrology of these wetlands are indicative of ephemeral wetlands[23], the vegetation does not reflect the low turf, or sward communities (<30 mm tall), or herbaceous plants adapted to dynamic wet-dry cycles, which help define ephemeral wetlands. Ephemeral turfs often contain rare plant species. The lack of this vegetation community likely reflects infrequent inundation and intensive farming impacts.

All wetlands in this cluster are unfenced, with heavy degradation by cattle grazing and pugging over many years, and vegetation indicative of nutrient enrichment. Ground cover is almost entirely composed of exotic species Yorkshire fog, creeping bent, creeping buttercup and *Lotus pedunculatus,* as well as exotic *Rumex* spp. and soft rush (*Juncus effusus)* (Plate 24 to 28). Wetland 13 is completely dominated by beggar's ticks (*Bidens frondosa*) and *Persicaria hydropiper;* beggar's ticks is an exotic facultative wetland plant listed as an environmental weed by the Department of Conservation (Plate 24).

In 2024, small areas of cracked bare ground and exotic wetland herbs such as *Persicaria hydropiper*, *Ludwigia palustris, Cirsium arvense,* and *Holcus lanatus* were present in the lowest lying parts of most of these wetlands, indicating a dry spell after inundation (Plates 27 and 28). One native herb, marsh yellowcress (*Rorippa palustris*, Not Threatened) was present at 0–1 % cover during this time. The native rushes, *Juncus sarophorus* and *J. edgariae* are common outside the wetland core in most of these wetlands. Overall, these wetlands are exotic-dominated and rate low for representativeness. W14 has been hydrologically degraded by farm drain W1.10, which had lowered the water table for some or all of the year. Soils are a mix of peat and mineral, classifying them as old hydric soils.

This wetland cluster rates moderate for ecological value (Table 11).

3.3.3.6 Wetland Cluster 6 - Peka Peka Road Swamp

Wetland cluster 6 consists of one wetland, Peka Peka Road Swamp (W11). It has features of both a swamp and of a fen, because it is dominated by peat soils and its water table is above ground level during normal conditions. Hydrology is likely to be mostly groundwater dominated, with some inputs from surface water flow and rainfall. Aerial imagery indicates the core of this wetland was shallow open water in the 1940s, but subsequent excavation of drains to the north and south have lowered water tables, and no open water remains on the part of the wetland within the property. Vegetation suggests nutrient levels are now moderate to high. It is fully fenced and has no stock grazing, with fenced buffers ranging from 0–10 m wide.

The wetland and some of its margins (Plate 29) are part of a listed SNA (SNA KO60), described in the District Plan as a 'moderately sized wetland with small area of open water and harakeke flaxland-*Juncus* rushland-*Coprosma* scrub associations'. It is rated in the District Plan as significant for representativeness, rarity (as wetland habitat is a nationally rare ecosystem), and diversity.

[23] Johnson P., Gerbeaux P. (2004). *Wetland Types in New Zealand.* Wellington: Department of Conservation.

Plate 24. Wetland 13, dominated by *Bidens frondosa* and *Persicaria hydropiper*.



Plate 25. Stock damage and exotic grass and herb dominance in wetland 14.

Plate 26. Native rushes *Juncus sarophorus* and *J. edgariae* are common in wetland 9, as well as exotic *Persicaria hydropiper*, *Holcus lanatus,* and *Agrostis stolonifera.* Four planted harakeke are visible.

Plate 27. Wetland 10. (Left) Exotic herbs at the core, bordered by *Juncus sarophorus*. (Right) Stock disturbance and excrement (nutrient inputs).

Plate 28. Wetland W5. (Left) The lowest part of wetland and the margin in 2024, where cover is primarily *Persicaria hydropiper* and *Ranunculus repens,* which have grown after water levels receded. (Right) *Juncus sarophorus* is common on the margins, along with *Cirsium arvense*, *Erigeron sumatrensis* and *Persicaria hydropiper*.

Plate 29. Wetland 11, Peka Peka Road Swamp, a listed SNA (SNA KO60). (Top left) southern core. (Top right) northern core. (Bottom left) a small pocket of eight indigenous trees within the southeastern margin of the SNA, on the wetland margin. (Bottom right) weed dominated non-wetland within the southeastern margin of the SNA.

Approximately 20 % of this wetland is located on the application site, and vegetation in the southern and western parts is dominated by cutty grass (*Carex geminata*), tall fescue grass (*Lolium arundinaceum* subsp*. arundinaceum*), flax/harakeke, and blackberry (*Rubus fruticosus* agg.), with grey willow (*Salix cinerea*) primarily around the margins (Plate 29). Towards the northern and eastern (core) parts of the wetland (located on the neighbouring property), vegetation is native dominated, consisting of *Coprosma propinqua*, *Coprosma rigida, Carex secta*, *Phormium tenax*, and *Lemna disperma*.

Hydrology varied markedly when surveyed. In autumn 2024 there was no standing water, and in spring 2025 there was standing water at least 300 mm deep throughout much of the wetland. The mapped area of wetland does not align with the SNA outline, because the eastern margin that is dominated by blackberry, *Muehlenbeckia australis,* and grey willow is deemed not to constitute wetland (see Appendix F).

In an EIANZ values assessment, the wetland rates high for representativeness, being dominated by mature *Carex secta*, *Phormium tenax*, *Carex geminata, Coprosma rigida* and *Muehlenbeckia complexa* in its core. Less than 3 % of swamps remain in the Greater Wellington region, and wetlands are a rare ecosystem nationally. The artificially induced scarcity of these wetland ecosystems results in a high rarity value for W11. Provision of habitat is also high value with detected At Risk – Declining long fin eel and also a wetland bird detection of either a spotless crake or marsh crake. There is also suitable habitat for potential for intermittent use by Australasian bittern, although none was detected.

The wetland rates moderate for diversity. It has a moderately diverse species assemblage and wetland-dryland vegetation gradient, but its margins are degraded by grey and crack willow, blackberry, exotic grass, and exotic herbs. This wetland provides key ecosystem services such as improving water quality, floodwater retention, and carbon sequestration. It connects drain networks flowing north and south (at high flows), but is moderate in size and moderately buffered. The wetland scores moderate for ecological context, and the ecological value of this SNA wetland is high.

Wetland Cluster 6 is of high ecological value (Table 11).

Table 11. Assessment of ecological value for Wetland Clusters, using EIANZ guidelines.

Wetland Cluster	Area (m^2)	Wetland type	Dominant species	Representativeness	Rarity and Distinctiveness	Diversity and Pattern	Ecological Context	Ecological Value
WC1 – Te Harakeke Swamp	140,849	Swamp and Fen	*Isolepis prolifera, Typha orientalis, Carex secta, Phormium tenax, Lemna disperma, Persicaria hydropiper, Juncus sarophorus*	High. Native dominated. Hydrology moderately intact	High. Wetlands are nationally and regionally rare (3 % remaining in Greater Wellington). Supports Threatened and At Risk native bird and fish spp.	High. Spatial and temporal hydrological and vegetation community gradients present. Moderate indigenous species diversity.	High. Compact, large area. Direct connection to wider wetland complex and stream.	Very High (upper)
WC2 – Ngarara Stream Wetland Cluster	63,005	Swamp (degraded)	*Holcus lanatus, Ranunculus repens, Agrostis stolonifera, Juncus sarophorus, Juncus effusus, Persicaria hydropiper*	Low. Exotic dominated, but with low-moderate native rush cover. Severely degraded hydrology.	High. Wetlands are nationally and regionally rare (3 % remaining in Greater Wellington).	Low. Below average species diversity and pattern. Very low indigenous species diversity.	Low-Moderate. Not compact, moderate-large area. Border Ngarara Stream and WC3 to the south. Poorly buffered by exotic pasture.	Moderate (lower)
WC3 – Lower Ngarara Stream Wetland Cluster	23,476	Swamp (degraded)	*Holcus lanatus, Ranunculus repens, Juncus effusus, Agrostis stolonifera*	Very Low. Exotic dominated; native species rare. Severely degraded hydrology.	High. Wetlands are nationally and regionally rare (3 % remaining in Greater Wellington).	Very low. Below average species diversity and pattern. Very low indigenous species diversity.	Low-Moderate. Not compact, moderate area. Bordering Ngarara Stream and wetland 6 to the north. Poorly buffered by exotic pasture.	Moderate (lower)
WC4 - Dune edge Wetland Cluster	2,214	Ephemeral (degraded)	*Persicaria hydropiper, Juncus sarophorus, Juncus effusus, Holcus lanatus, Ranunculus repens, Agrostis stolonifera*	Moderate. Exotic dominated but with high native rush cover, and one Not Threatened native herb species.	High. Wetlands are nationally and regionally rare (3 % remaining in Greater Wellington). Ephemeral wetlands are naturally uncommon nationally,	Low - Moderate. Temporal hydrological and vegetation community gradients present but degraded by exotic invasion. Very low indigenous	Low-Moderate. Partly buffered by exotic scrub. No surface connection to streams or other wetlands but	Moderate (upper)

					but are relatively common in the Foxton ED in a degraded state.	species diversity. Very low indigenous species diversity.	contiguous with dune ecosystem.	
WC5 - Eastern Wetland Cluster	15,902	Marsh and Ephemeral (degraded)	*Holcus lanatus, Ranunculus repens, Persicaria hydropiper, Agrostis stolonifera, Bidens formosa, Juncus sarophorus.*	Low - Moderate. Exotic dominated but with moderate cover of native rushes and one Not threatened native herb. Hydrology degraded - moderately intact.	High. Wetlands are nationally and regionally rare (3 % remaining in Greater Wellington). Ephemeral wetlands are naturally uncommon nationally, but are relatively common in the Foxton ED in a degraded state.	Low - Moderate. Temporal hydrological and vegetation community gradients present but degraded by exotic invasion. Very low indigenous species diversity.	Low. Various small, mostly isolated wetlands. No buffering. Poor to no surface connection to streams.	Moderate
WC6 -Peka Peka Road Swamp	6,390	Swamp and Fen	*Carex secta, Coprosma rigida, Carex geminata, Phormium tenax, Holcus lanatus, Rubus fruticosus* agg., *Lolium arundinaceum, Salix cinerea*	High. Native dominated core, exotics on margins. Hydrology moderately intact.	High. Wetlands are nationally and regionally rare (3 % remaining in Greater Wellington). Provides habitat for At Risk birds and fish.	Moderate. Moderate indigenous species diversity. Hydrological and vegetation community gradients present but degraded by exotic invasion.	Moderate. Compact, moderate area. Moderate buffering by native and exotic mix. Connects catchments to north and south when water high.	High (upper)

3.4 Summary of ecological values

Ecological values onsite are summarised in Table 12. The highest values relate to:

- Te Harakeke (WC1) and Peka Peka Road Swamp (WC6), due primarily to their high level of intactness and dominance of indigenous species, as well as provision of high quality habitat for Threatened and At Risk bird species and At Risk fish species. Threatened and At Risk birds present at Te Harakeke Swamp include North Island fernbird, an unidentified crake species (spotless or marsh crake), and black shag. Threatened bird species that may be present at Te Harakeke Swamp intermittently include Australasian bittern, brown teal and New Zealand dabchick. Peka Peka Road Swamp provides potential habitat for fernbird, spotless crake, marsh crake and bittern. Both wetlands are listed Significant Natural Areas in the District Plan based on the RPS criteria;
- Indigenous dune vegetation, including scattered trees and scrub, which are naturally uncommon ecosystems due to their presence on stable sand dunes, and meet the rarity and distinctiveness significance criterion under the RPS and NPS-IB. Indigenous dune scrub also provides high quality habitat for a small population of native northern grass skink and potential habitat for New Zealand pipit;
- Sand dune kānuka, *Kunzea amathicola*, an At Risk tree species present in Te Harakeke Swamp margins as well as two individual trees on the eastern flats; and
- At Risk -Declining fish species; īnanga and longfin eel, present in Ngarara Stream (W1) and drain W1.1, and with the potential to be present in other tributary drains as well as Te Harakeke Swamp. Brown mudfish may be present onsite in Te Harakeke Swamp but not within Ngarara Stream and its tributary drains and wetlands.

Table 12. Summary of ecological value of ecosystems, communities and At Risk and Threatened species present or likely to be present onsite. Species that may be present but were not detected during our surveys are denoted by an asterisk.

Ecosystem component	Ecological Value
Streams	
Highly modified stream (Ngarara Stream – W1)	Moderate
Artificial drain W1.1	Moderate
Other artificial drains	Low
Wetlands	
Wetland Cluster 1 *(Te Harakeke Swamps 1.1, 1.2, 1.3)*	Very high
Wetland Cluster 2 *(Ngarara wetlands 2.1, 2.2, 2.3, 2.4, 2.5, 6)*	Moderate
Wetland Cluster 3 *(lower Ngarara wetlands 16, 17, 18)*	Moderate
Wetland Cluster 4 *(dune edge wetlands 3, 4)*	Moderate

Wetland Cluster 5 *(eastern wetlands 5, 9, 10, 13, 14, 15)*	Moderate
Wetland Cluster 6 *(Peka Peka Rd wetland 11)*	High
Indigenous terrestrial vegetation	
Scattered indigenous trees on dunes *(ngaio, māhoe, cabbage tree)*	High
Indigenous dune scrubland *(pōhuehue, knobby clubrush, bracken)*	High
Kunzea amathicola *(sand dune kānuka)*	High
SNA vegetation to be removed *(weed dominated buffer of Wetland 11)*	Moderate
Avifauna species	
Spotless crake	High
Marsh crake	High
North Island fernbird	High
Black shag	High
Brown teal*	High
Australasian bittern*	Very High
New Zealand dabchick*	Very High
Freshwater fish species	
Longfin eel	High
Īnanga	High
Brown mudfish*	High
Giant bully*	Moderate-High
Lizards	
Northern grass skink	Low

*Species that may be present but not detected during our surveys.

4.0 Ecological effects assessment

4.1 Development project description

The project is an urban subdivision that will provide approximately 1,200 residential allotments (including medium density residential development and the option of two future apartment blocks), 11 commercial lots, and 4 jointly-owned access lots. Land use consent is sought for the subsequent residential development of the subdivision, including for medium density residential development. The proposal will also provide a commercial centre and an associated community space.

The proposal will be supported by the provision of requisite infrastructure, including roading, open space reserves, and stormwater areas, and will take place over 17 stages (indicative) (Figure 23 and Figure 40).

In summary, the following activities are planned as part of the proposal:

- Bulk earthworks involving the removal of large volumes of peat soils and the addition of sand and hard fill;
- Earthworks that will disturb or infill some wetlands, sections of Ngarara stream, a network of artificial farm drains and a small part of one SNA;
- A comprehensive suite of stormwater management measures;
- Flood hazard mitigation works to ensure that, as a minimum, hydraulic neutrality can be achieved. A bund and a twin culvert (with associated “high flow” weir) will be constructed on Ngarara Stream at the southern end of the stormwater easement for flood management purposes;
- Creation of open spaces areas;
- Provision of shared pedestrian and cycle facilities (including a connection to the neighbouring State Highway cycleway, walkway and bridleway, and to Paetawa Road, which will cross several wetlands and Ngarara Stream);
- Provision of a connected and integrated internal roading network that supports multi-modal transport;
- Re-meandering, raising stream water level, bank recontouring and restoration of a reach of Ngarara Stream; and realignment of two major drains feeding into the stream;
- Removal of existing culverts, and the construction of new culverts over the stream and drains for road crossings, providing for fish passage;
- Construction of five permanent pedestrian/cycleway bridges over Ngarara Stream, and one temporary haul road bridge during construction;
- The creation of natural wetland areas within low lying parts of the site; and restoration of existing degraded wetlands on the eastern parts of the site, as well as enhancement of two high value SNA wetlands; and
- Restoration and enhancement of indigenous dune vegetation on the high dunes to offset losses.

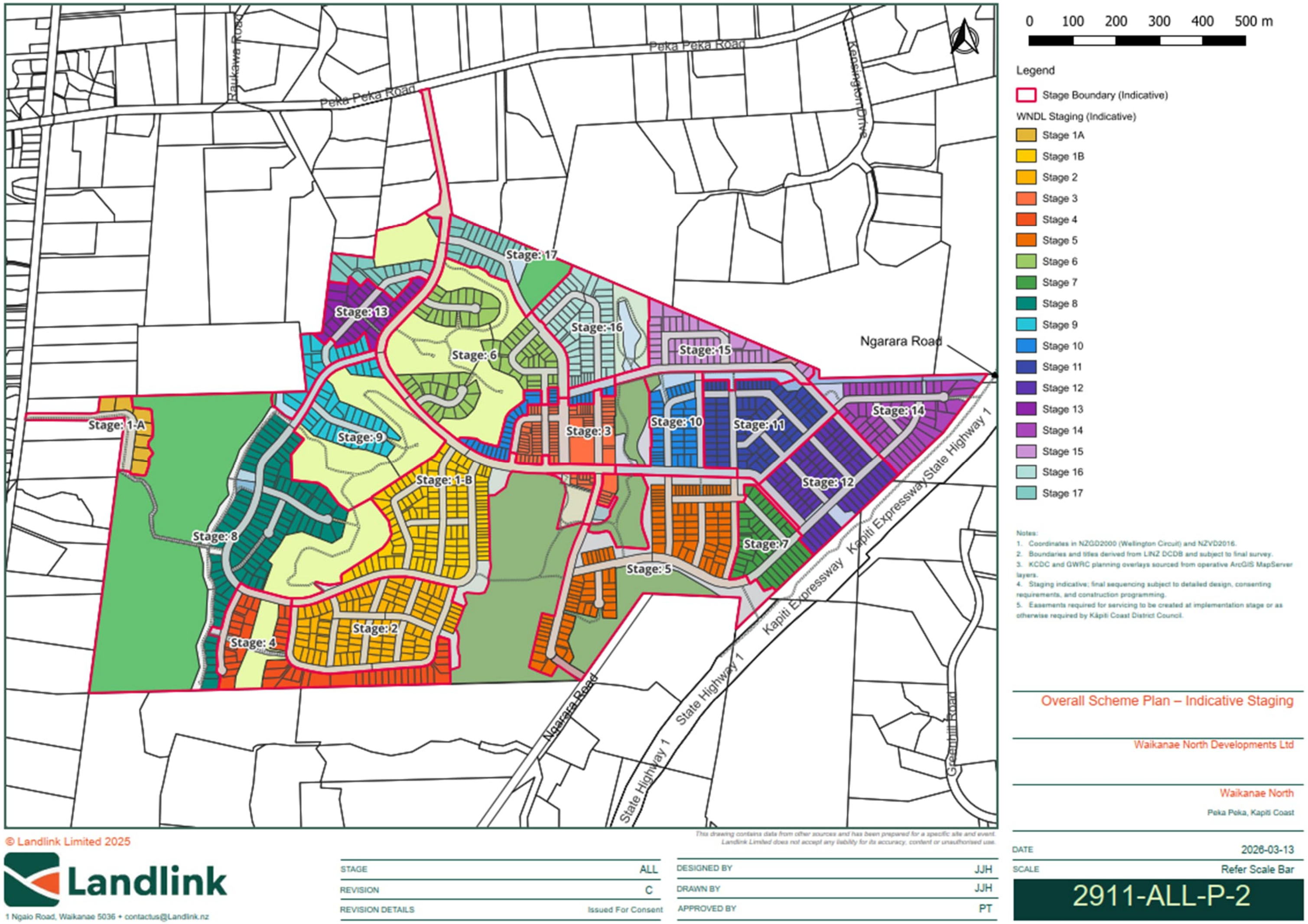


Figure 23. Overall Scheme Plan for Waikanae North Developments, indicating staging (image courtesy of Landlink Ltd.).

Conceptual design for the site has been an iterative process involving RMA Ecology Ltd and the design, planning and engineering teams, with an acknowledged focus on avoiding adverse effects on features with ecological protection status and features of significant ecological value, and endeavouring to achieve ecological enhancement where feasible.

Lot layout and associated infrastructure were generally planned around the ecological features of the site, as far as practicable. Functional and operational requirements, for instance certain road layout requirements, meant that all ecological features could not be avoided. Engineering and urban design justifications for removal and clearance of ecological features are detailed in the Master Plan Design Report. The most valuable ecological features of the site, such as the larger swathes of indigenous dune vegetation, the Te Harakeke Swamp complex, and Peka Peka Road Swamp are preserved (adverse effects are avoided). Where effects cannot be avoided reasonably due to constraints around urban design (to achieve well-functioning urban environments with transport routes and integrated neighbourhoods), planning, economic (development feasibility), and engineering requirements and constraints, the affected ecological features are of moderate or lower value, and the effects management hierarchy has been applied to ensure that remediation and mitigation are considered, as well as offsetting for residual adverse effects.

The earthworks footprint (Figure 24) provides a spatial representation of where direct adverse effects will occur. Indirect effects on features outside of the development footprint are also addressed within this report. Where there are significant residual effects after measures are applied to avoid, minimise, and mitigate, offsetting has been applied within the WNDL property.

4.2 Ecological effects and management

This section details the Ecological Impact Assessment in general accordance with the Environment Institute of Australia and New Zealand (EIANZ) Ecological Impact Assessment guidelines (Roper-Lindsay *et al.* 2018). This considers the ecological values of the site and assesses the level of effects the proposed development may have on the ecological features and values. See Appendix G for the values, magnitude, and level of effect tables utilised in this assessment.

A summarised categorisation of adverse effect quantities and mitigation measured quantities, as well as additional benefits as part of the project package, are presented in Table 13.

A summary of development activities proposed, their potential and actual effects on ecology values prior to mitigation, and the areas affected are presented in Table 14.

A summary of mitigation measures, including avoidance, remediation, and mitigation, are presented in Table 15.

These effects and measures to mitigate them are described in detail in the following sections.

Further details of the primary ecological features impacted and the magnitude and level of effect are presented in Appendix F.

Figure 24. Earthworks footprint (pink shaded polygons).

Table 13. Summary values for potential and actual adverse effects and corresponding ecological mitigation and offsetting values. Also, a summary of ecologically beneficial activities that are additional and are being proposed by the Applicant as separate benefits that are not required to manage an ecological effect. Stream and wetland planting, and additional dune vegetation planting measurements provided by LocalCollective.

Category	Adverse Effects	Quantities	Mitigation & Offsetting	Quantities
Wetlands	Wetland removal	16,852 m^2 (1.69 ha)	Wetland creation for extent offset	16,852 m^2 (1.69 ha)
	Suburban development	approx. 1200 lots	Wetland creation for value offset	1.79 ha
			Wetland buffer planting	72,598 m2 (7.26 ha)
			Eastern wetlands average buffer planting width	9.7 m
			Pekapeka Road SNA wetland average buffer planting width	10.4 m
			Te Harakeke SNA wetland average buffer planting width	20 m
			Fish salvage and relocation	All works in wetlands
SNA	Exotic-dominated SNA vegetation clearance	261 m^2	Wetland buffer planting	3,538 m^2
			Wetland average buffer width	10.4 m
Streams	Stream removal -	979 m un-culverted length 2965 m^2 un-culverted bed	Stream realignment and remediation	974 m un-culverted length 3895 m^2 un-culverted bed area
			Stream buffer planting (excl wetland buffer planting within stream buffers)	27,366 m^2 (2.74 ha)
			Stream average buffer planting width	10.3 m
	culvert installation (5)	76.9 m length	Stream culvert removal (2)	14.4 m length
			Fish salvage and relocation	All works in watercourses
Vegetation	Dune shrubland and rushland clearance	1,773 m^2	Dune shrubland and rushland planting	2,660 m^2 (1:1.5 area)
	Dune treeland clearance	1,187 m^2	Dune treeland planting	6,900 m^2 canopy cover (1:5 area) with 550 trees (1:10 number)
			Pest plant control	Site-wide
Lizard habitat	Lizard habitat - high quality	5,700 m^2 (0.57 ha)	Dune shrubland and rushland planting	11,400 m^2 (1.14 ha) (1:2 high quality)
	Lizard habitat - moderate quality	52,400 m^2 (5.24 ha)	Lizard salvage and relocation	249,800 m^2 (all lizard habitat)
	Lizard habitat - low quality	191,700 m^2 (19.17 ha)	Dune reserve area (lizard habitat and release)	113,300 m^2 (11.33 ha)
			Pest animal control	113,300 m^2 (11.33 ha)
			Habitat enhancement through stock exclusion	113,300 m^2 (11.33 ha)

		Habitat enhancement with log stacks	60 stacks
Wetland birds	Disturbance	Wetland buffer planting and walkway screening	20 m width
	Cat and dog predation	Pet deterrent fencing of SNA wetlands	See landscape design report
		Pest animal control	
Category		Additional benefits – in addition to mitigation/offsets	Quantities
Wetlands		Wetland extent creation and planting for enhancement*	8,344 m^2 (0.83 ha)
		Wetland enhancement through hydrology improvements	65,200 m^2 (6.52 ha)
		Retained wetland enhancement through pest control	21.4 ha
		Retained wetland enhancement planting	Up to 2.36 ha
Vegetation		Dune shrubland/rushland planting	Up to 0.4 ha
		Dune treeland planting	Up to 1.43 ha

*A small portion of this area constitutes wetland value offsetting and is not entirely an additional benefit. Due to late updates, the exact area has not been determined.

Table 14. Table of potential ecological effects due to the proposed development, prior to mitigations.

Ecological Feature	Development activity	Type of effect	Quantity
Wetlands	Wetland removal by infilling or excavation, and vegetation clearance	Actual loss of wetland extent and value; Actual habitat loss and fragmentation; Potential hydrological storage loss; Potential loss of function – filtration to streams	1.69 ha of wetland extent
	Residential and commercial development, including land recontouring, stormwater, roading, leading to increased impervious surfaces, peat excavation and replacement with hardfill and sand, or inundation from stormwater detention.	Potential effects on hydrological regime in remaining wetlands through changes in surface and ground water quantity	N/A
	Construction of floodwater control structure and berm (double culvert and weir) on Ngarara Stream	Loss of wetland extent Hydrological enhancement	Included in 1.69 ha total wetland loss
	Earthworks, residential and commercial activity near wetlands	Potential discharge of sediment and other contaminants to wetlands during and after construction, influencing function and composition.	N/A

Ecological Feature	Development activity	Type of effect	Quantity
Streams	Stream infilling and riparian vegetation clearance	Actual habitat loss and fragmentation; Actual loss of stream value and function, Potential sediment discharge during construction	979 m un-culverted length loss 2,965 m^2 un-culverted stream bed area loss (prior to realignment)
	Culvert and weir establishment	Actual partial loss of stream value and function Potential sediment discharge during construction	4 roading and one weir culvert on streams, comprising a total of 76 m culvert length
	Stream realignment within peat soils	Potential short term and ongoing impacts on stream chemistry (nutrients, metals, acidification) and bank erodibility.	
	Pedestrian bridge establishment	Potential sediment discharge during construction	5 pedestrian bridges (2 - 3 m wide)
	Earthworks along stream banks, especially for bank recontouring	Actual loss of riparian vegetation Potential sediment discharge during construction	385 m of bank recontouring
	Residential and commercial activity	Potential water quality impacts from discharge of residential stormwater contaminants	N/A
Artificial watercourses (drains)	Drain infilling or realignment	Loss of potential and actual habitat; Potential loss of function – change in hydrological regime to stream and wetlands.	N/A
Freshwater fish	Construction activities within streams including realignment, stream bed re-contouring, culvert removal and establishment, weir establishment, and infilling of artificial drains.	Potential direct fish mortality Potential reduction in fish passage	N/A
Indigenous dune vegetation	Vegetation clearance and earthworks in central dunes	Loss of stable dune ecosystems (nationally endangered)	1,187 m^2 of indigenous ngaio treeland and scattered trees 1,773 m^2 of indigenous scrub and rushland.
Rare plants	Vegetation clearance and earthworks	Loss of At Risk -Declining *Kunzea amathicola* trees east of the dunes.	2 trees

Ecological Feature	Development activity	Type of effect	Quantity
Lizards	Vegetation clearance and earthworks	Direct mortality of lizards	N/A
	Vegetation clearance and earthworks	Loss of lizard habitat in the central dune area	0.57 ha of high quality habitat 5.24 ha of moderate quality habitat 19.17 ha of low quality habitat
Avifauna	Vegetation clearance, wetland infilling and stream realignment	Potential direct nest mortality, especially in wetlands and riparian margins	N/A
	Earthworks and construction activities	Disturbance of wetland birds around Te Harakeke Swamp (W1) and Peka Peka Road Swamp (W11), particularly during nesting	N/A
	Residential activities	Potential increased predation of wetland birds by cats, dogs and mammalian pests Potential disturbance of wetland birds around Te Harakeke Swamp (W1) and Peka Peka Road Swamp (W11) by people and dogs, particularly during nesting	N/A

[a]*EIANZ matrix tables 5 or 7, and 6.*

[b]*EIANZ matrix table 8; measured in the context of the catchment (streams) or District (terrestrial values).*

[c]*EIANZ matrix table 10*

Table 15. Potential and actual effects on ecological features.

Feature	Activity	Type of effect	Applied mitigation
Wetlands	Wetlands – Earthworks and drainage	Loss of wetland extent and value due to infilling	Avoidance of disturbance to SNA wetland extents, and to other wetlands where there are practicable alternative locations. Management of residual effects after mitigation addressed in offset section of this report, and detailed in Ecological Restoration Management Plan.
	Residential and commercial development, including land recontouring, stormwater, roading	Potential effects on hydrological regime through changes in surface and ground water quantity by flow diversion, increased impervious surfaces, peat excavation and replacement with hardfill or sand, or inundation from stormwater detention.	Comply with Hydrological Report and Stormwater Management Plan, incorporating: - Catchment area analysis and flood modelling for wetlands - Shallow swale excavations within W2 and constructions of log weirs in drains to retain surface water and promote soakage to peat; raise groundwater, or lower ground level to seasonal groundwater level. - Raising of subsurface or surface drainage inverts at wetlands W2 to raise water tables within these wetlands.
	Construction, residential and commercial activity	Water quality effects during and after construction - discharge of sediment and other contaminants.	Compliance with sediment and contaminant management specified within ESCP and SMP. Establishment of vegetated buffers averaging at least 10 m in width, as specified in Ecological Restoration Management Plan.
Highly modified stream	Stream realignment	Loss of stream habitat extent – 979 m length (plus 14 m of culverts), 2,965 m^2 bed area	Realignment of stream (approx. 979 m length plus 14 m culverts), specified in Engineering Plans, Hydrological Report, Infrastructure Report, and Ecological Restoration Management Plan.
	Stream realignment within peat soils	Potential short term and ongoing impacts on stream chemistry (nutrients, metals, acidification) and bank erodibility.	Restoration planting within 10 m buffers, and addition of woody debris and gravel substrate, dense bank planting and temporary sediment fencing along banks to manage erosion, as detailed in Hydrological Report, Infrastructure Report, Ecological Restoration Management Plan and Engineering Plan.
	Earthworks	Sediment discharge during construction	Sediment control detailed in Erosion and Sediment Control Plan (ESCP)
	Residential and commercial activity	Water quality impacts from discharge of urban stormwater contaminants	Stormwater treatment detailed in the Hydrological Report, Stormwater Management Plan (SMP)
Artificial watercourses (drains)	Infilling or realignment	Loss of poor-moderate condition drain habitat.	Low level of effect – no mitigation needed, other than fish salvage, specified in the Native Freshwater Fauna Salvage and Relocation Plan.

Freshwater fish	Stream realignment, stream bed re-contouring, infilling of artificial drains	Potential direct fish mortality due to construction activities within streams and potentially wetlands	Native Freshwater Fauna Salvage and Relocation Plan, specifying salvage and relocation practices.
	Culvert construction on streams 1 and 1.1	Potential direct fish mortality due to construction and reduction in fish passage from culvert and weir construction.	Culvert designs comply with NES-F Subpart 3, and fish passage guidelines, enabling fish passage. Compliance with Native Freshwater Fauna Salvage and Relocation Plan, specifying salvage and relocation practices.
Indigenous dune vegetation	Vegetation clearance and earthworks in central dunes	Loss of endangered naturally uncommon ecosystem, including 1,187 m^2 of indigenous trees (largely ngaio) (90 % of those on site), and 1,773 m^2 (42 %) of indigenous scrub and rushland.	Project design avoids 58 % of indigenous dune scrub. Planting in accordance with dune restoration detailed in the Ecological Restoration Management Plan will significantly expand and connect native dune scrub, with a focus on lizard habitat, and to restore and increase area of dune forest.
Rare plants	Vegetation clearance and earthworks	Loss of two At Risk -Declining *Kunzea amathicola* trees east of the dunes.	Dune and wetland margin restoration planting detailed in management plans will incorporate *Kunzea amathicola.*
Lizards	Vegetation clearance and earthworks	Direct mortality of lizards	Avoiding most high quality habitat. Compliance with best practice salvage and relocation methods, specified in the Lizard Management Plan (LMP).
	Vegetation clearance and earthworks	Loss of moderate and high quality habitat in the central dune area	Habitat enhancements, detailed in Lizard Management Plan and Ecological Restoration Management Plan, including dune revegetation, addition of habitat features (log stacks), and predator control.
Avifauna	Vegetation clearance, wetland infilling and stream realignment	Potential direct nest mortality, especially in wetlands and riparian margins	Compliance with Ecological Restoration Management Plan, specifying avoidance of earthworks during breeding season where feasible, earthworks buffers around high value habitats during breeding season, pre-clearance nest survey by suitably qualified and experienced ecologist, buffers applied around active nests.
	Earthworks and construction activities	Disturbance of wetland birds during and after construction	Ecological Restoration Management Plan, specifying seasonal earthworks buffers around wetlands, restoration planting of margins for visual screening, wetland fencing to exclude dogs and people.
	Residential activities	Increased predation of wetland birds by cats, dogs and mammalian pests.	Ecological Restoration Management Plan, specifying domestic dog and cat management measures, and ongoing feral pest control.

[a]*EIANZ matrix tables 5 or 7, and 6.*

[b]*EIANZ matrix table 8; measured in the context of the catchment (streams) or District (terrestrial values).*

[c]*EIANZ matrix table 10.*

4.3 Terrestrial ecosystems

Earthworks and vegetation clearance generally will remove existing exotic pasture, exotic shelterbelt and exotic scrub vegetation on the site, which are of low ecological value and require no mitigation. Vegetation clearance will also remove moderate and high lizard habitat, and a Lizard Management Plan has been prepared in response. Additionally, effects and mitigations for areas of moderate and high ecological value are described in the following sections.

4.3.1 Loss of indigenous vegetation on stable sand dunes

Earthworks will result in the clearance of indigenous stable dune vegetation, including 1,187 m^2 of scattered indigenous trees (primarily ngaio (*Myoporum laetum*)) and 1,773 m^2 of fragmented indigenous scrub and rushland (Figure 25, Table 16 and Appendix F). Stable sand dunes with indigenous vegetation are considered naturally uncommon ecosystems which are threatened (endangered) [24] [25].

Impacts will be minimised by avoiding most areas of dune shrubland, and by clearly marking vegetation removal boundaries using ground pegs and tagged vegetation. Impacts will be mitigated through partial revegetation of existing stable sand dune landforms outside the development footprint; these dunes are presently dominated by exotic scrub and rank grassland. This dune restoration area covers 16.83 ha, primarily on the steeper leeward slopes of the dunes, with some sections on exposed windward slopes. A total of 1.83 ha of this area will be planted in 'nodes' of native shrubland and treeland (Figure 26) appropriate to the ecosystem and the ecological district, as specified below and further detailed in the ERMP.

A minimum of 550 indigenous trees will be planted, resulting in approximately 0.69 ha of indigenous forest and treeland to make up for clearing 55 trees (44 ngaio and 11 māhoe, and scattered taupata, karo, tī kōuka and mamaku), comprising 0.12 ha of treeland and scattered tree canopy cover within the earthworks footprint. This generous mitigation applies a conservative ratio of 10:1 for the number of trees (and 5:1 for the predicted canopy cover area at maturity), reflecting time lags, ecological uncertainty, and the potential risk of planting failure.

A separate area of revegetation will be undertaken to plant 1.14 ha in indigenous shrubland and rushland communities (Table 16), which will replace lizard habitat removed by the proposed development. The creation of lizard habitat will be achieved through the use of dense, low-growing species such as *Muehlenbeckia complexa*. In addition, the planting palette incorporates a selection of At Risk and Threatened dune species, contributing to the restoration of regional coastal biodiversity and increasing ecological resilience within the development area. A draft list of potential restoration species is presented in Appendix N and is reflected in the Landscape Plan.

Because the proposed stable sand-dune mitigation areas are contiguous with the retained dune habitats, natural dispersal of seeds and movement of lizards from the retained areas are expected to facilitate reoccupation of the restored sites. Revegetation of areas set aside for restoration of indigenous vegetation on stable parabolic sand dunes is feasible when appropriate species are

[24] Wiser, S. K., Buxton, R. P., Clarkson, B. R., Hoare, R. J. B., Holdaway, R. J., Richardson, S. J., Smale, M. C., West, C., & Williams, P. A. (2013). *New Zealand's naturally uncommon ecosystems.* In J. R. Dymond (Ed.), *Ecosystem services in New Zealand – conditions and trends* (pp. 49-61). Manaaki Whenua Press, Lincoln, New Zealand.

[25] Holdaway, R. J., Wiser, S. K., & Williams, P. A. (2012). Status assessment of New Zealand's naturally uncommon ecosystems. Conservation Biology, 26(4), 619–629.

planted (see planting plan in Appendix N), as evidenced by successful stable dune restoration projects nearby on the Kapiti Coast and Foxton ED, including at QEII Park and Pharazyn Reserve.

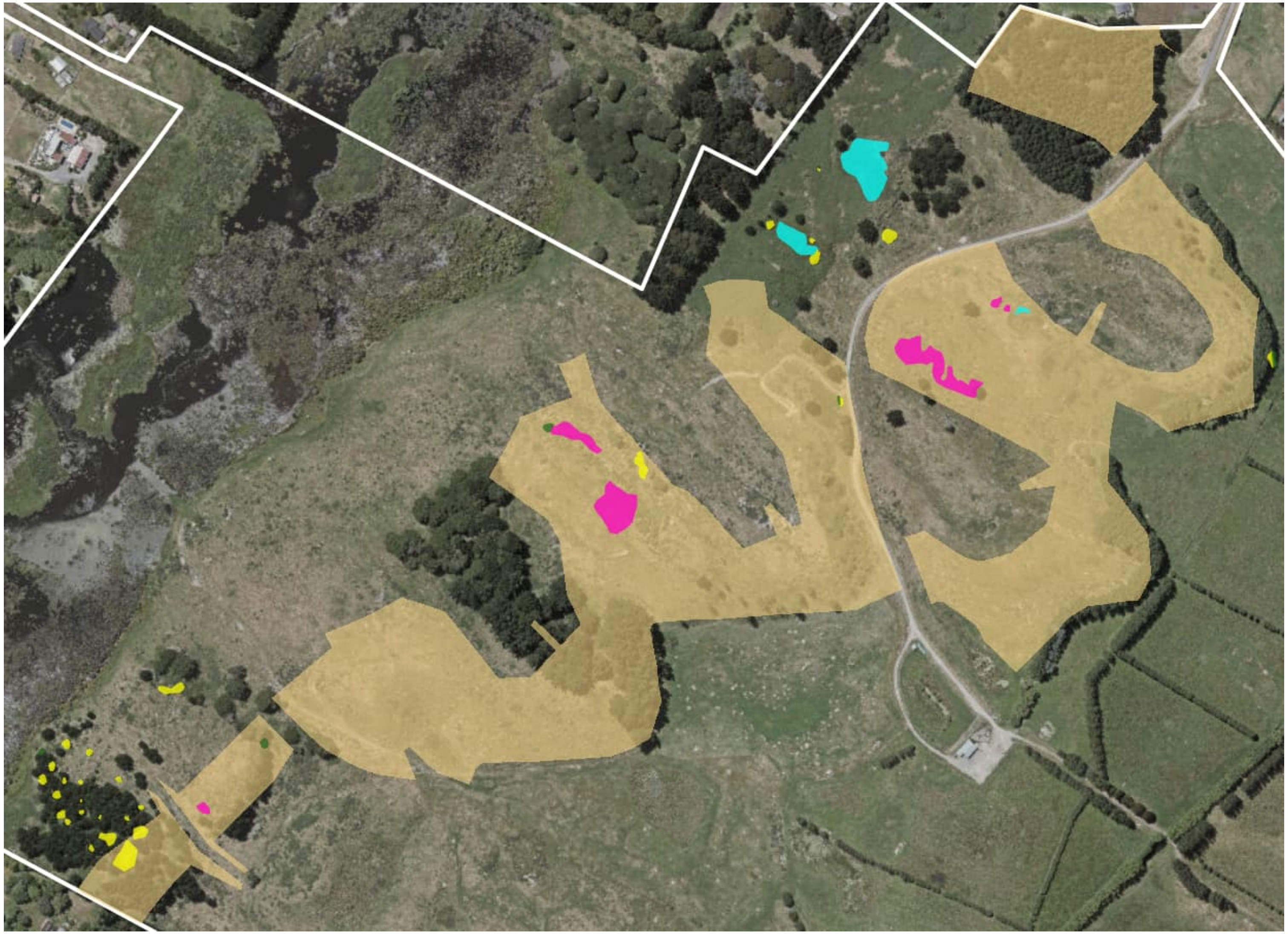


Figure 25. Indigenous dune scrub and rushland proposed to be removed (cyan) and retained (crimson). Scattered indigenous trees proposed to be removed (yellow) and retained (dark green). The dune reserve area where restoration management will be applied (beige).

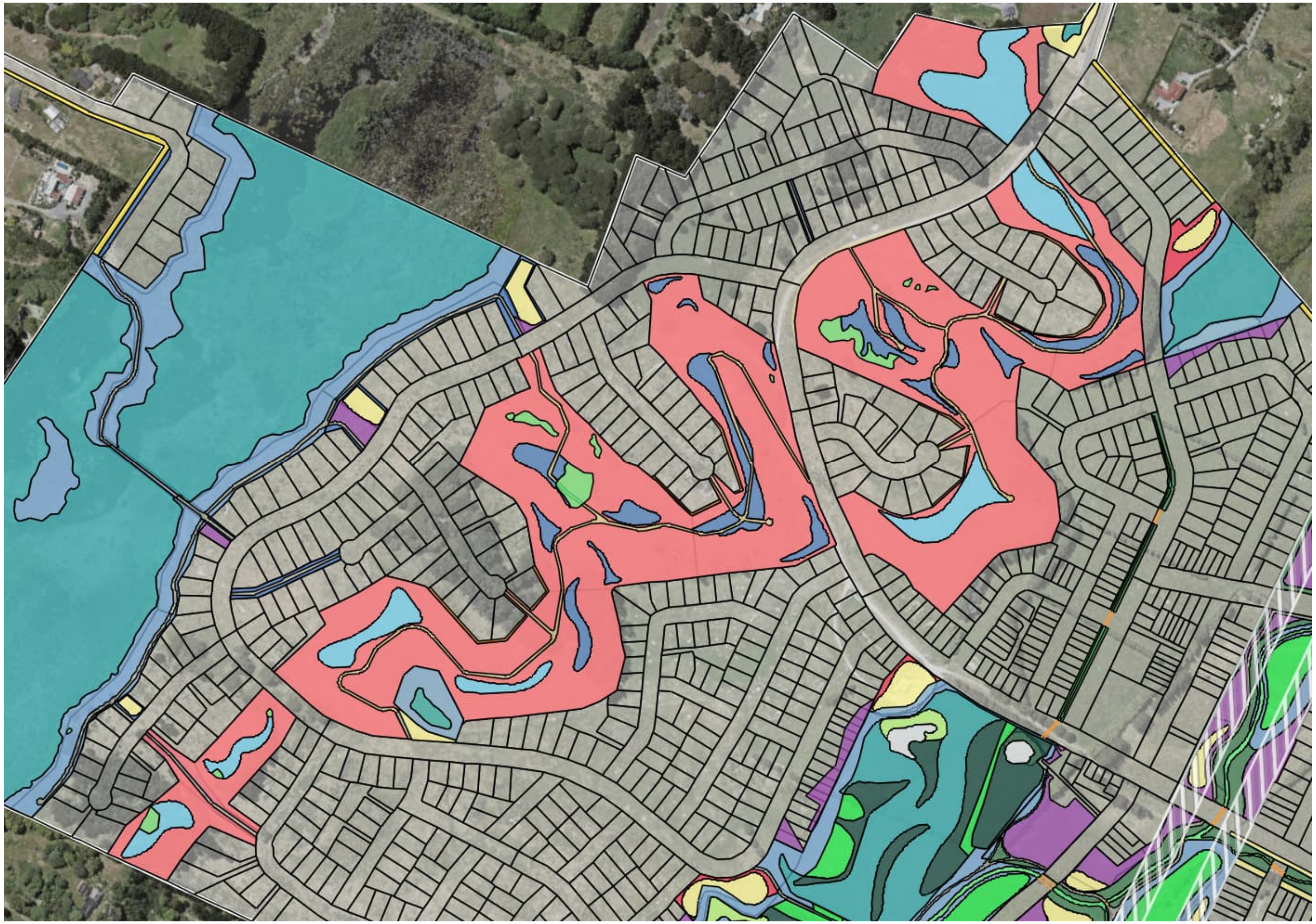


Figure 26. Indigenous dune shrubland planting zones (mid blue polygons), dune treeland planting zones (light blue polygons), and retained areas of indigenous shrubland and treeland (light green polygons)), within the dunes open space reserve area (surrounding pink polygon). Note, these indicative zones include required ecological mitigation planting as well as additional landscape planting providing ecological enhancements (specified in Table 13). The enhancement/landscape components will not necessarily be planted at standard ecological planting densities.

Table 16. Indigenous dune vegetation removal and proposed gain through restoration planting. Mitigation areas and number of trees indicate minimum required for ecological mitigation. Landscape plantings will be additional.

Community	Dune shrubland and rushland	Dune treeland
Existing (ha)	0.42	0.13
Proposed removal (ha)	0.18	0.12
Removal of existing veg. community (%)	41.9	90.2
Mitigation planting (ha)	1.14	0.70
Number of trees lost	N/A	55
Number of trees to be planted	N/A	550

Restoration actions will be set out in the ERMP, and the developer will retain active management responsibility until 80 % canopy cover is achieved (in required mitigation planting areas only). Legal mechanisms to secure the long-term protection of the open space and ecological restoration areas are still to be finalised.

4.3.2 Threatened plants

No significant impacts on threatened plants are likely, as the development footprint avoids the majority of sand dune kānuka (*Kunzea amathicola*, At Risk - Declining) trees along the margins of Te Harakeke Swamp. Two (2) isolated *Kunzea amathicola* on the eastern flats will be removed to construct the main arterial route, resulting in a low level of impact to the population at this site and locally. Although the values assessment detected no mistletoe, a repeat survey for dwarf mistletoe will occur during clearance of these two kanuka (as specified in the ERMP).

Restoration planting along wetland margins and dune restoration areas will include *Kunzea amathicola*, as well as other dune species, including sand daphne (*Pimelea villosa*, At Risk - Declining), sand coprosma (*Coprosma acerosa,* At Risk – Declining), coastal tree daisy (*Shawia solandri,* At Risk – Declining), shore spurge (*Euphorbia glauca,* Threatened – Nationally Vulnerable), and the wetland species swamp maire (*Syzygium maire,* Threatened – Nationally Vulnerable). After this mitigation, a net positive effect is expected for threatened species onsite through a considerable increase in the numbers established and the area occupied by these species.

4.3.3 Loss of SNA area

Vegetation clearance and earthworks within the Peka Peka Road Swamp SNA are proposed to allow for construction of a secondary collector road. Impacts on this SNA have been minimised by locating the road as far from the SNA as practicable without causing undue modification to the dune landform. A 261 m^2 area of the weed-impacted terrestrial margin of the wetland will be permanently impacted by vegetation clearance and infilling. Appendix F details the values and impacts.

Planned mitigations include restoration of a buffer zone around the wetland (Figure 27). It will average more than 10 m wide, resulting in an area of 3,538 m^2 being planted outside the existing SNA boundary (over 13:1 ratio of gain to loss). It will be planted with appropriate native species (Appendix O), and maintained through extensive weed and pest control within the margin and the wetland, resulting in an overall net-positive effect on the wetland and margins. Pest control will include willow and blackberry, which presently dominate parts of the wetland margins.

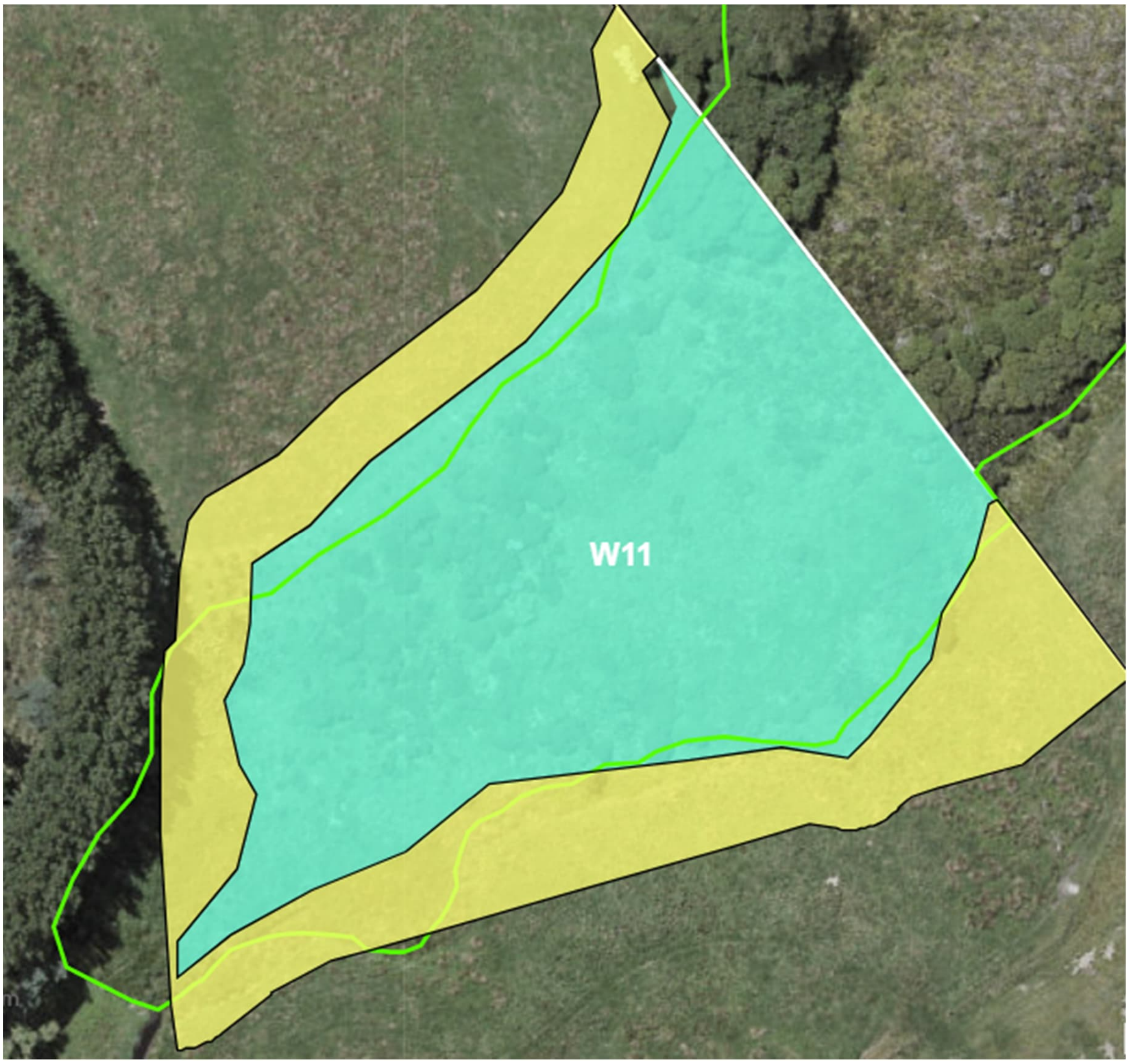


Figure 27. Peka Peka Road Swamp SNA (green outline), wetland area (cyan polygon) and buffer areas to be planted (yellow margins).

4.4 Aquatic ecosystems

4.4.1 Loss of stream extent and value

The 993 m long upper reach of the highly modified and straightened Ngarara Stream (W1) will be realigned to form a meandering 1,051 m reach, including culverts. It will extend downstream from the northeastern property boundary, under the transmission lines and alongside wetland 2.1 (Figure 28 and 29). The realigned reach will extend the total stream length by 62.5 metres, including culverts. This equates to a 5 m loss of moderate quality un-culverted stream length (SEV 0.42), representing a 0.3 % reduction in un-culverted stream length over the site, and a 57.5 m increase in culverted stream length (SEV 0.2). The realigned stream bed will be designed and of sufficient area to ensure that there will be a net gain in terms of overall stream extent, value and function.

The new alignment will deliver a substantial improvement in ecological condition and habitat value compared to the existing degraded reach. Enhancements will include increased channel sinuosity, improved flow variability and habitat heterogeneity, the addition of woody debris and gravel substrates, and the establishment of diverse riparian vegetation for both reaches. These measures are detailed in Section 7 of the Hydrological Report and in the Ecological Restoration Management

Plan (ERMP) and are expected to significantly enhance aquatic habitat quality and ecological function within the Ngarara Stream corridor.

In addition, bank recontouring is proposed along the remaining 385 m downstream section of Ngarara Stream (Figure 29 and 30). Recontouring will improve flood flows and restore a more natural stream profile to the existing highly modified steep-sided profile.

Existing culverts within streams consist of two culverts totalling 16.7 m length to be removed from Ngarara Stream (W1). Four new culverts totalling 76.9 m are proposed to be installed in Ngarara Stream (Table 17 and Figure 28). This will result in an additional culvert length of 62.5 m.

Table 17. Culverts in Ngarara Stream.

Culvert	Length (m)	Diameter (m)	Existing or proposed
C1	7.2	1.3	existing
C2	7.2	1.6	existing
CP1	12.3	2.4	proposed
CP1.1	20.9	2.7	proposed
CP3	17.1	2.7	proposed
CP4	12.2	3	proposed
Twin-box culvert under weir	14.4	2 × 2.8 m (W)	proposed
Total existing	14.4		existing
Total proposed	76.9		proposed
Additional culvert length	62.5		proposed

Installation of 76.9 m of new culverts within the stream will result in a reduction in stream habitat quality. This will be partly mitigated through the use of appropriately sized culverts that are at least 25 % embedded to allow the retention and development of a natural streambed substrate. This design will maintain more natural hydraulic and ecological conditions, supporting fish passage and benthic habitat continuity.

The proposed culvert design therefore represents a substantial improvement over the existing structures, which currently provide little natural substrate within the culvert bed. All culverts will comply with NES-FM clause 70 to provide fish passage. Although culverts are deemed to have lower ecological value (SEV 0.2) than natural open stream reaches, short well-designed culverts are readily utilised by fish and can provide quality refuges from predators.

In addition, the reduction in stream value associated with the 62.5 m additional length of culverts will be mitigated by the increase in length, width and value of Ngarara Stream associated with re-meandering and corresponding mitigation measures. Almost all additional culvert length will be compensated for by this additional stream length, resulting in only a 5 m loss in un-culverted stream length, and a substantial increase in bed area in Ngarara Stream.

A temporary bridge will be established to provide haul road access during construction. This bridge will be 5.6 m wide, and will not disturb the stream bed or impact fish passage. Five pedestrian bridges across the stream will also be established. These bridges will have no more than a minor impact on stream value, as they are either temporary or narrow (2-3 m), do not impact the streambed, and will be constructed with suitable sediment control.

4.4.2 Loss of artificial drains

Two artificial watercourses (drains 1.1/1.1.6 and 1.1.1) will be realigned along the majority of their course over the site, but will retain steeper bank profiles similar to the existing drains. They will be enhanced through buffer planting averaging 5 m wide, and addition of meander, thereby maintaining and improving fish habitat (Figures 28 and 39).

Watercourses within Wetland Cluster 2 will be partly obstructed with a series of log weirs to improve wetland hydrology while maintaining fish passage. The southern reach of drain 1.2 will be retained and enhanced through establishment of log weirs, widening of pools upstream of weirs, and adjacent wetland planting, thereby maintaining and improving habitat for eels and potentially brown mudfish.

All other watercourses on the site (permanent and ephemeral artificial drains with low ecological value) will be removed. Although no fish were detected in these drains, fish salvage will be undertaken (as specified in the NFFMP). Stormwater will be managed as described in the project's Stormwater Management Plan.

An additional 12 culverts will be installed within realigned drains, and will also comply with NES-FM standard 70. Nine existing culverts in drains will be removed.

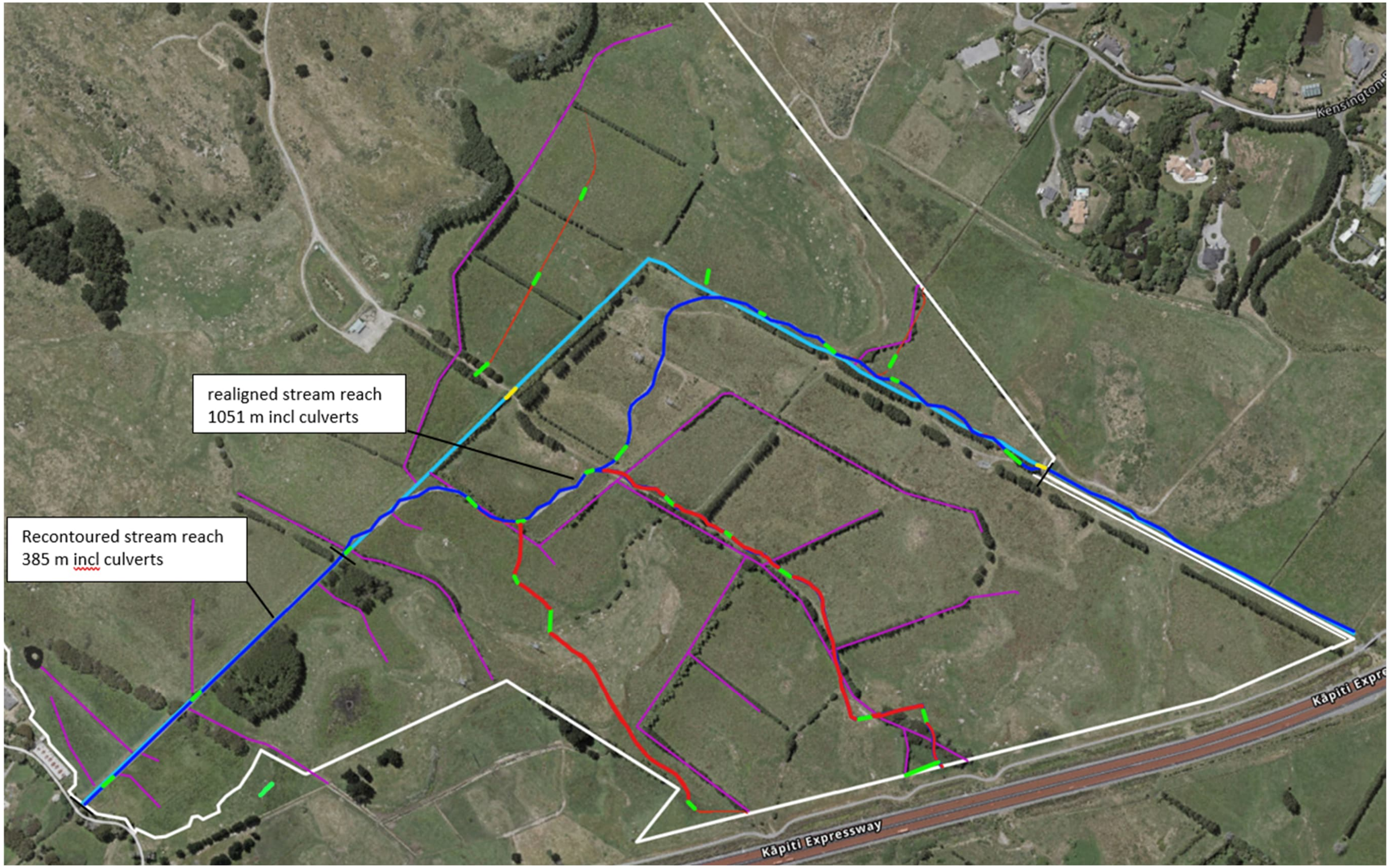


Figure 28. Proposed watercourse alterations, showing existing stream (light blue lines) and proposed stream and drains (dark blue lines), existing drains (purple lines) and proposed drains (red lines), existing stream culverts (yellow lines) and proposed culverts and bridges (green lines). Black lines indicate the upper and lower extents of the realigned and recontoured reaches.

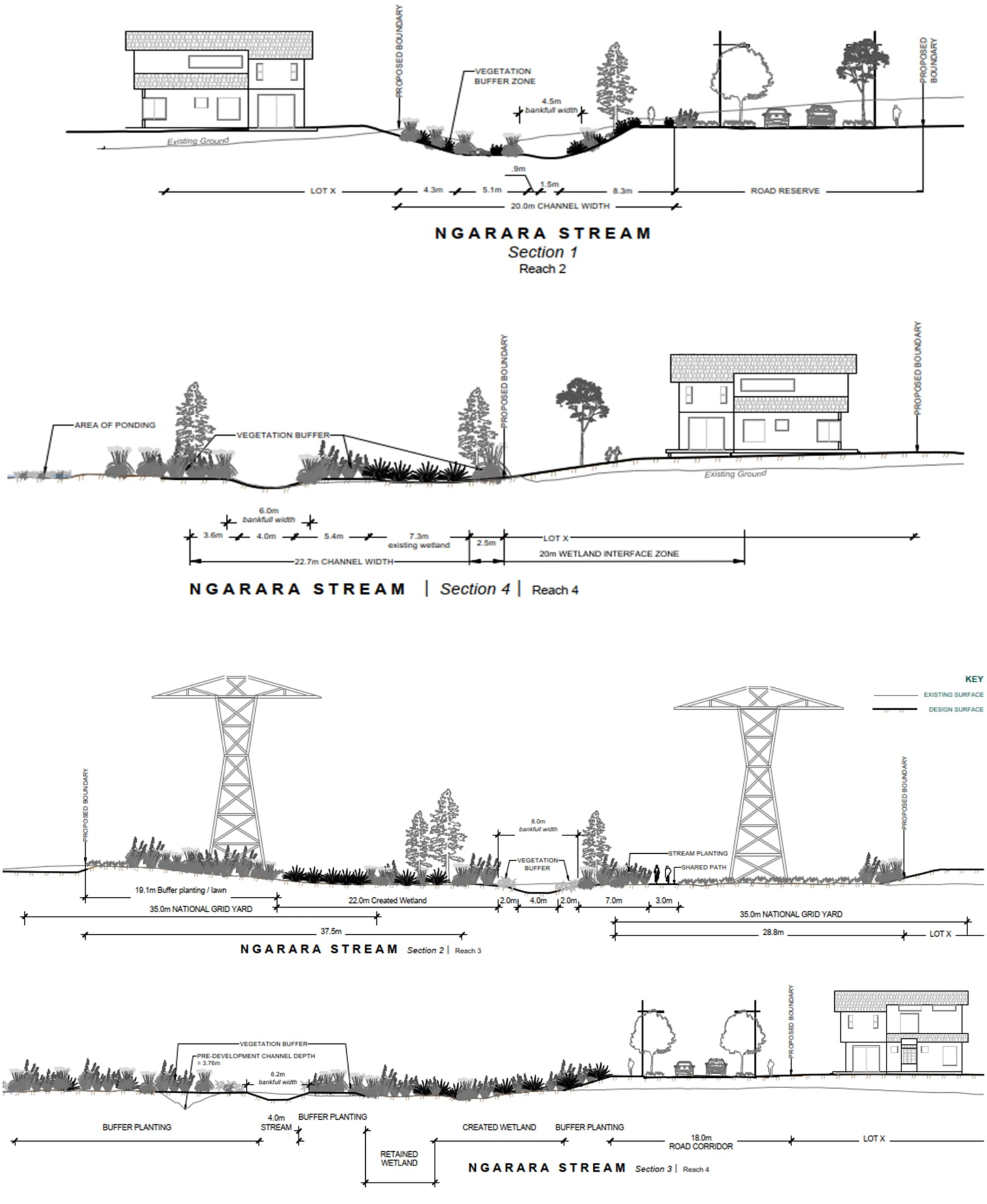
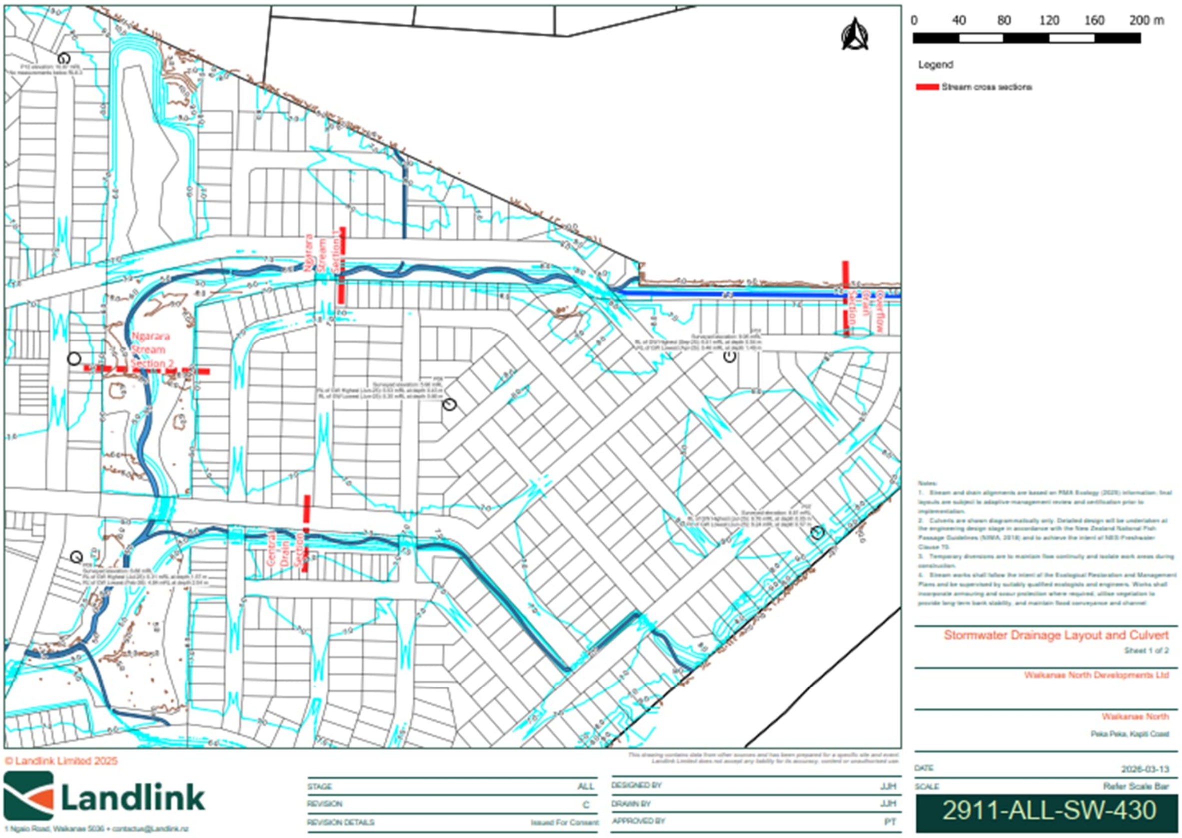


Figure 29. Proposed watercourse cross-section profiles, from top to bottom: at CH-200 (200 m downstream of the state highway chainage) which will be realigned, CH-645 – realigned reach, CH-910 – realigned reach, CH-1510 – bank recontouring and raised invert. Refer to Figure 30 for locations of cross-sections. Average bed width is 4m.



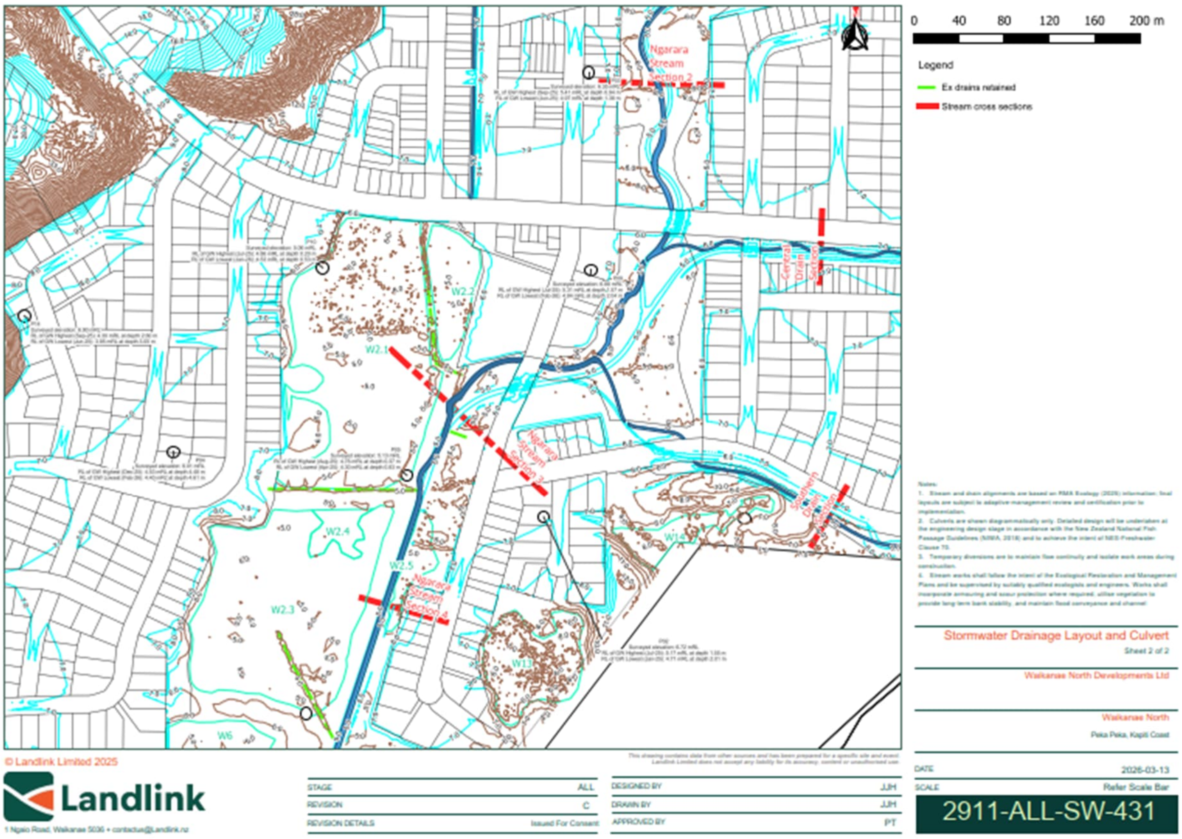


Figure 30. Ngarara Stream plan view maps, showing locations of Ngarara Stream cross-section profiles, from upstream to downstream.

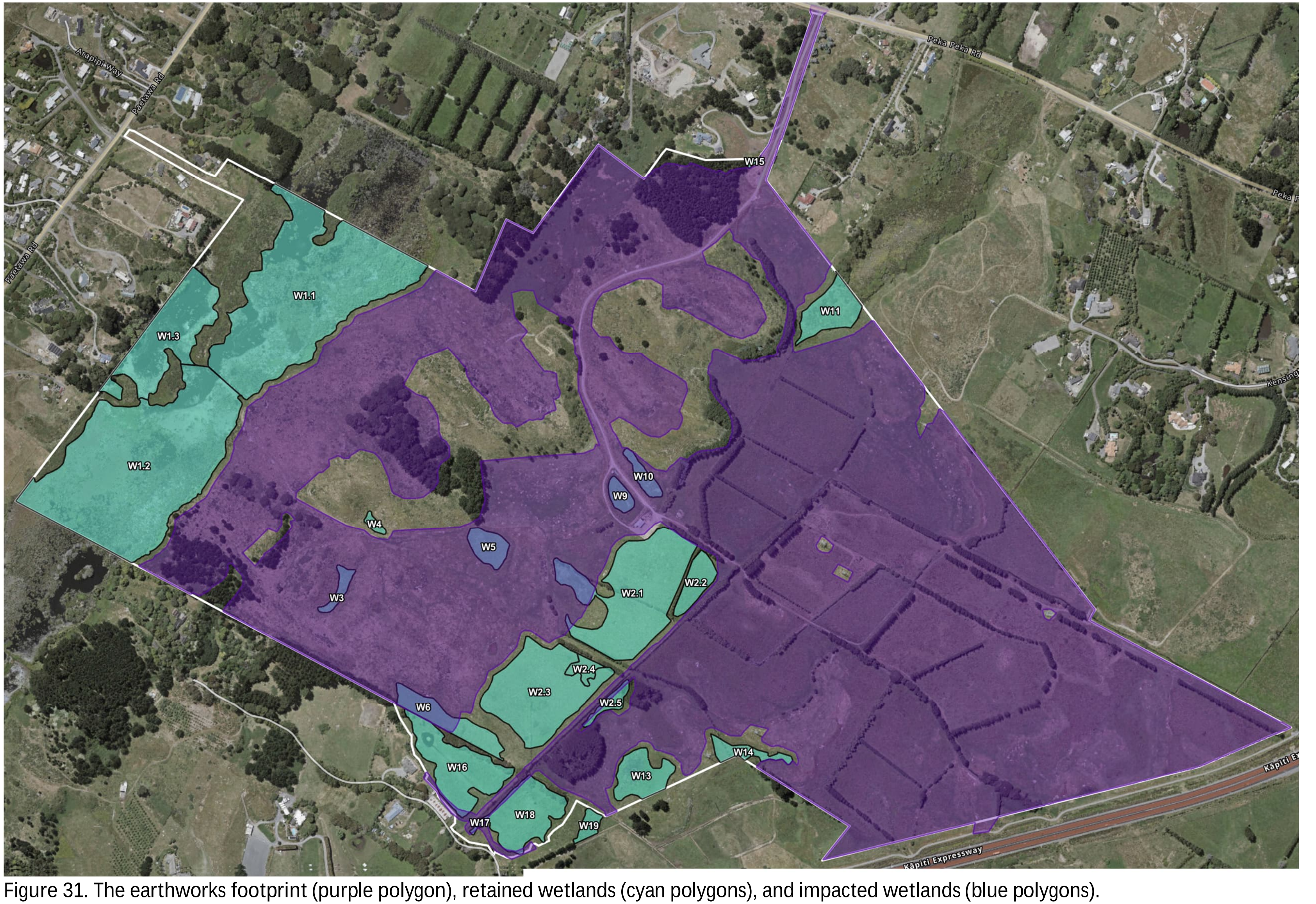


Figure 31. The earthworks footprint (purple polygon), retained wetlands (cyan polygons), and impacted wetlands (blue polygons).

4.4.3 Loss of wetland extent and value

Four wetlands (W3, W5, W9 and W10) and parts of Wetland Clusters 2 and 3 will be removed by infilling, totalling 1.69 ha of wetland loss (Figure 31). All of these wetlands are low or moderate ecological value as they are grazed, most are dominated by exotic plant species, and do not provide quality habitat for wetland wildlife.

The removal of this wetland extent cannot be fully mitigated, and more than minor residual effects remain. The effects on wetland extent and value will be managed through offsetting, as described in section 4.4 and by hydrological enhancement described in the Hydrological Report.

4.4.4 Wetland hydrological mitigation and enhancement

Potential adverse effects on hydrological regimes of retained wetlands may result from increases in impervious surfaces, excavation of peat soils in the surrounding development, and alterations in wetland catchment sizes due to bulk earthworks and land recontouring.

The Hydrology Report includes a number of remediations and mitigations which it states will result in no negative effects on wetlands on the Te Harakeke Swamp (WC1) and the eastern wetlands (WC5). These mitigations include:

- replacement of excavated peat with compacted sand fill, which will offset the volume lost over the site and result in hydrological neutrality. This process will occur in small steps, excavating peat in the development footprint in small scale patches and replacing the excavations with compacted sand prior to excavating the next patch. This will limit hydrological impacts on wetlands spatially and temporally to a low level;
- a stormwater network designed to achieve catchment neutrality or in some cases a slight net increase in flow to wetlands (such as W4 and parts of W2.1 and W2.3) (Figure 31); and
- feeding treated stormwater flows into wetlands, via diffuse outlets rather than direct discharge to streams or drains where feasible, to avoid flow diversion and maximise recharge during rain events (as above).

These hydrological mitigations and enhancements are described in greater detail below.

Within the low-lying central and eastern zone, the area proposed for urban development will be extensively earth-worked to remove approximately 475,000 m^3 of existing peat. The removed peat will be replaced with compacted sand fill to provide a geotechnically stable foundation for construction. An additional estimated 250,000 m^3 of fill will be required to raise the development surface above estimated future flood levels. Peat removal has the potential to influence water tables in the surrounding area, including streams and wetlands. In the western zone, adjacent to Te Harakeke Swamp, no peat removal is planned, because soils within the development area are sandy.

Further measures will result in hydrological enhancement of the Ngarara Stream floodplain Wetland Clusters 2 and 3, elevating water tables above existing levels, thereby resulting in ecological benefits (beyond that required to manage effects) by partly restoring these severely hydrologically degraded wetlands. These measures include:

- construction of a double box culvert with high flow weir within the stormwater easement at the south of the site, which will throttle flood flows at the downstream end of the site, resulting in deeper and more frequent inundation of Wetland Clusters 2 and 3, within the Ngarara Stream floodplain (Figures 33 and 34).

- Raising the Ngarara Stream bed level (invert) alongside Wetland Clusters 2 and 3 by up to 0.4 m. The weir culvert invert will also be raised above the existing bridge invert to raise stream water levels. As the stream and groundwater are closely interconnected, this is expected to raise the water table within the adjacent restoration wetland areas by an equivalent amount.
- raising the water level in drains W1.2, W1.11 and W1.12 with the use of low, weir type structures, created with buried logs, so that maximum soil moisture for the enhanced wetlands in this zone is achieved. Angled logs will reduce downstream scour.
- A series of shallow swales will be excavated within the northern and western parts of WC2, to increase retention of surface water flows from treated stormwater discharges, allowing water to soak into the peat layer which sustains this wetland system.

The two shared cycle-walkway crossings of Ngarara floodplain wetland (WC2) and Te Harakeke Swamp Wetland (WC1) will be constructed as boardwalks, to enable natural laminar flow to maintain hydrological connection and avoid channelisation and associated scour and drainage. The existing raised farm track across WC2 will be partly removed and replaced with board walk to restore surface flows south across WC2. Detailed designs are provided in the Infrastructure Report.

The proposed weir and bund at the base of the catchment on the lower Ngarara Stream will restrict flood flows at higher flow events. The weir has a double box culvert allowing for unrestricted base flows, set with an invert 0.4 m above the existing invert of the bridge, which will raise groundwater levels at base flows (Figure 33).

This weir and bund design will also raise groundwater levels during high flow events, and lead to surface water ponding during larger events. In a 50 % AEP (2-year flood) event, this flow throttling is expected (see Section 5 of the Hydrological Report and the Awa Ltd flood modelling report) to cause a moderate increase in depth and extent of surface flooding within most of the Ngarara Stream and lower Ngarara Stream (Wetland Clusters 2 and 3) (Figure 34).

Two-year flood levels are presently modelled at 10–20 mm depth in the north of the Wetland Cluster, and 150 mm in the south. Two-year flood levels under the proposed development will remain relatively unchanged at 10–30 mm in the northern 40 % of Wetland Cluster 2, but will increase to 300 mm in the southern parts of the Wetland Cluster (Figure 33).

Constructed swales within WC2 will be ephemeral, and will create habitat for brown mudfish, waterfowl and Regionally Threatened wetland birds such as spotless crake, marsh crake, and bittern. Swale depth will be guided by topsoil and peat depth, aiming to remove topsoil and avoid or minimise peat removal. Ephemeral inundation is expected. Bank gradients will be very low to mimic natural open water areas within wetlands (such as Te Harakeke Swamp). Margins will be planted with eco-sourced indigenous wetland vegetation. In addition to hydrological improvements, these swales will also provide ecological benefits in the form of improved habitat diversity, community and species diversity.

In addition, the retained dune wetland (W4) is expected to see a slight hydrological enhancement through a slight increase in catchment area due to treated stormwater dispersal to the wetland. The above engineering design elements aim to mitigate changes triggered by the proposed development on hydrological issues, as well as providing additional enhancement for Wetland Clusters 2 and 3, resulting in positive benefits. These elements have been developed with ecological input and will require further ecological input at detailed design, and on-going adaptive management processes to maximise overall positive ecological outcomes.

Hydrological enhancement of Te Harakeke Swamp wetland was considered to reverse recent offsite drainage impacts not associated with this development. However, this is not practicable, because flow in the wetland is laminar with no defined channel. Any measures to raise the water table onsite, such as bunding, would involve significant impacts to this SNA-listed high value wetland and may affect neighbouring properties.

4.4.5 Effects of earthworks around wetlands and streams

Extensive earthworks including significant cut, fill and land recontouring will occur within 100 m of wetlands and streams, as will removal and construction of culverts and bridges. Compliance with the Construction Management Plan and the associated Erosion and Sediment Control Plan will minimise sediment discharge downstream to acceptable standards. The Infrastructure report details further measures to manage the potential sediment discharge impacts on wetlands and streams, including:

- Staged earthworks. Earthworks will be staged and areas of disturbance will be minimised at any one time. Each development stage will involve certification of a separate detailed ESCP, prior to works commencing for that stage.
- Targeted controls by soil type, recognising the differing behaviour of dune sands and peat soils, taking into account expected earthworks methodology, equipment, surface water controls etc.
- Sensitive-edge protection using super silt fence and bund systems adjacent to wetlands, drains and watercourses, in conjunction with associated separation.
- Batters will be stabilised primarily through revegetation, but also using dried peat on several sandy dune batters.
- Adaptive management linked to flood-storage monitoring and expected changes in flood storage patterns resulting from progressive filling in low-lying areas, watercourse realignments and the construction of the Ngarara Stream outlet culvert and overflow weir infrastructure.
- Risk-based monitoring, will be undertaken to ensure their effectiveness, including temporary telemetry at key outlets during higher-risk phases.
- A requirement for certification of each construction stage prior to commencement, supported by inspection, maintenance, and monitoring programmes.

The realigned section of Ngarara Stream will cut into the existing peat layer to reach the design invert levels. When peat is exposed to oxygenated water, decomposition can occur, with potential discharge of nutrients (reducing stream oxygen levels), heavy metals, and sulphur, which can acidify the water. These risks have management solutions.

A detailed ESCP will be certified prior to the relevant stage of earthworks to manage sediment erosion and peat decomposition risks. The new channel will be constructed in isolation from existing stream flows, and so the risk of sediment release from this activity is relatively low. The ESCP for the relevant stage will address potential scour from low and moderate flood flows using temporary silt fences to control bank velocities, and dense bank revegetation planting.

The new invert levels of the Ngarara Stream realignment will be within the existing peat layer. To improve bed substrate, 0.15–0.2 m of material below the invert will be removed and replaced with an uncompacted graded river metal backfill which will prevent scour at the 0.25–0.5 m/s flow velocities expected in 2-year and 5-year flood events. This capping will separate the stream flow from the underlying peat material. As the underlying peat material will remain within the groundwater system, exposure to stream flow oxygenated water is expected to be minimal (Hydrology report).

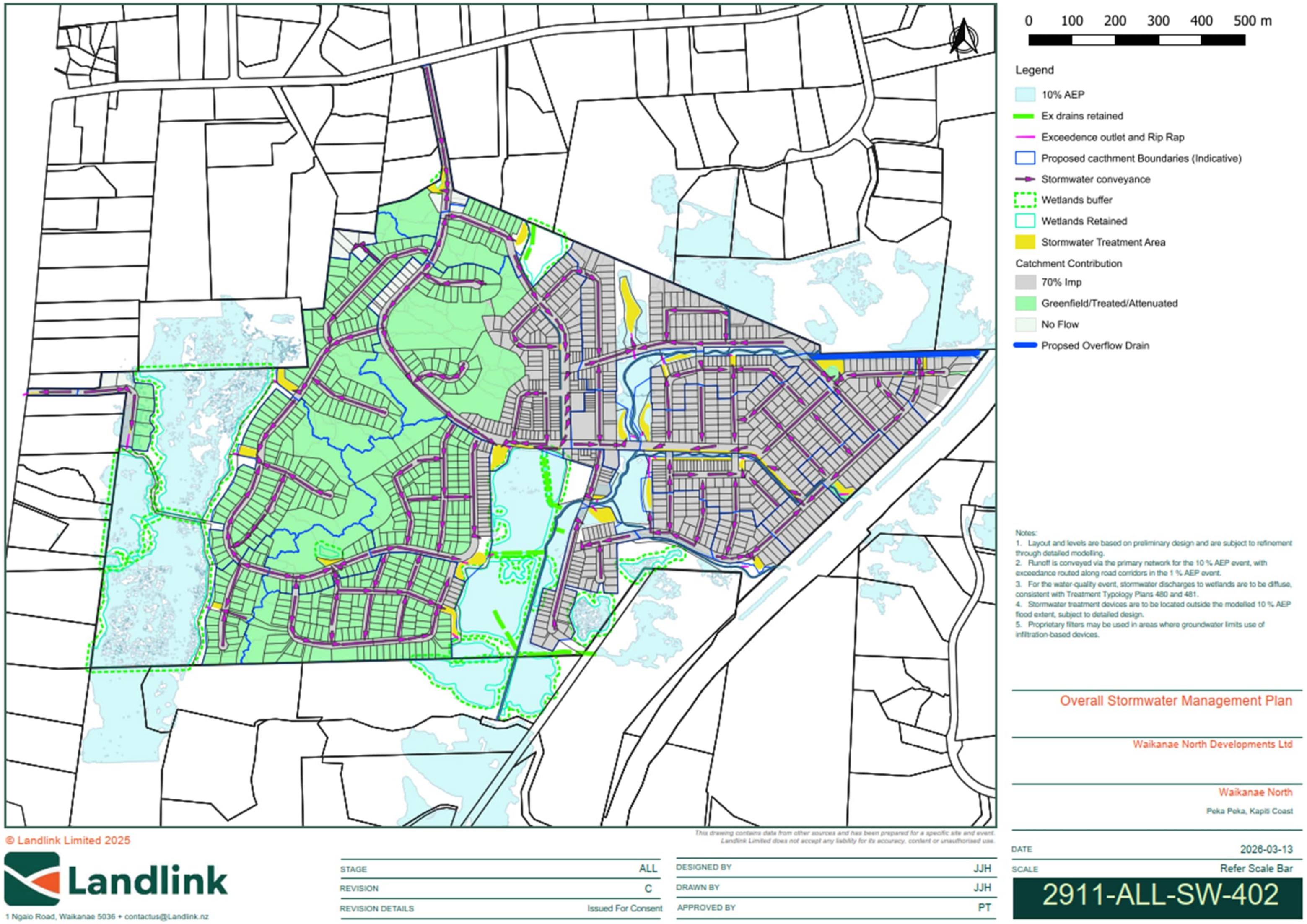


Figure 32. Proposed stormwater network onsite (courtesy of Landlink Ltd).

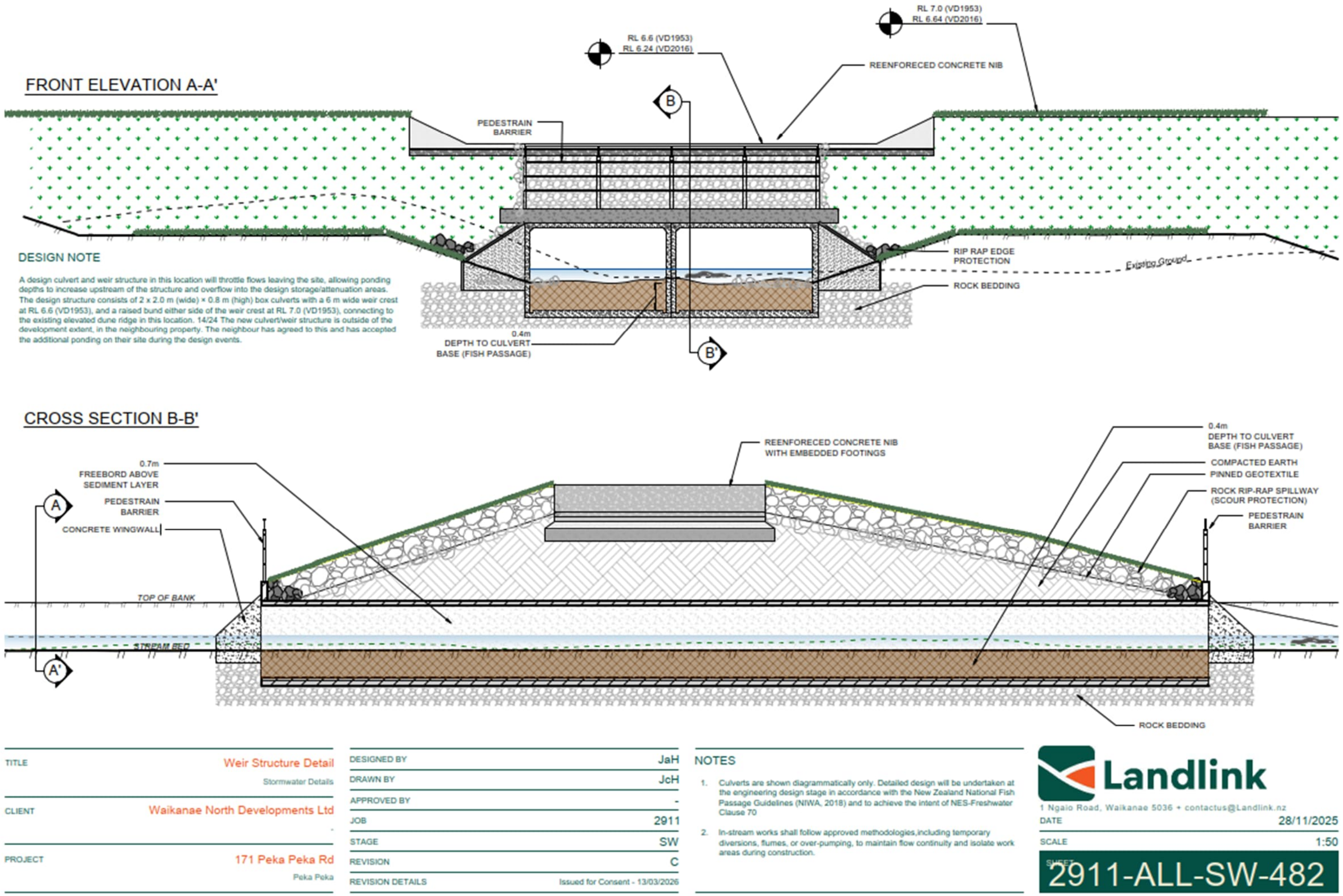


Figure 33. Detail of weir design (provided by Landlink).

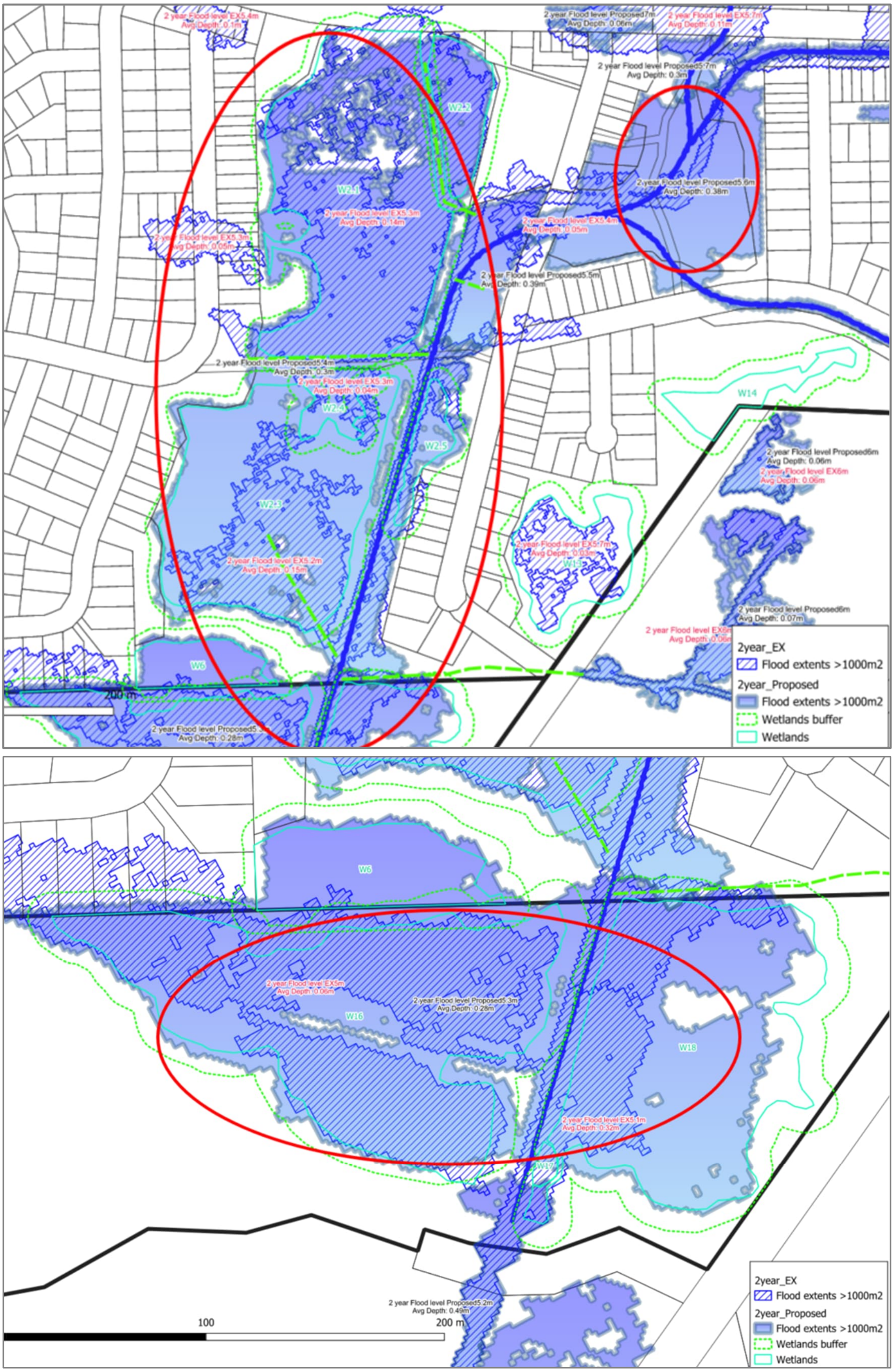


Figure 34. Modelled flood extents and water levels for a 2-year AEP event under the existing scenario and proposed scenario - with addition of bund, weir, and stream channel realignments and recontouring. (Above) Within the Ngarara Wetland Cluster (WC2). (Below) Within the lower Ngarara Wetland Cluster (WC3) in the stormwater easement. Circled areas indicate increases in depth and/or extent of flooding. Provided by Landlink/Awa.

Banks will be planted with dense riparian vegetation to further reduce erosion. Temporary silt fences will be placed at about 15–20 m spacing along the corridor shoulders to control velocity and erosion, and to protect plantings until they have established.

4.4.6 Water quality effects on wetlands and streams

The Stormwater Management Plan (SMP) applies best practice principles to treat stormwater to accepted standards prior to discharge to streams and wetlands. The SMP aligns with relevant standards, principles and legislation including KCDC SDPR12, Schedule 29 of PC1 to the Natural Resources Plan, GD04 Water Sensitive Design, and TP10/GD01 – treatment-device design criteria.

The proposed stormwater management system incorporates the following types of public treatment devices:

1. Bioretention swales – linear devices located within road reserves, treating carriageway runoff; these do not include forebays.
2. Bioretention basins – serving larger contributing catchments; always including a sediment forebay for coarse particle capture and maintenance access.
3. Bioretention basins with soakage – in selected catchments (those requiring soakage to the 1 % AEP), basins are coupled with subsurface soakage systems to provide both treatment and infiltration.

In addition, on-lot attenuation tanks provide incidental treatment through detention and first-flush capture, consistent with GD04 principles of integrated flow and water-quality management.

Bioretention swales and basins will mitigate both water quality effects (contaminants) and water quantity (increased flow flashiness caused by catchment hardening). Each treatment device consists of:

- a detention pond with treatment wetland;
- a piped low flow dispersed outflow, designed to simulate existing diffuse flows; and
- a piped high flow outlet for rainfall events exceeding a 10-year AEP, with riprap scour protection and native planting (Figure 35)

Treatment wetlands and outflows are proposed to be located outside of a 10 m buffer around wetlands, except for two outflows on the western side of WC2, where this is not practically feasible (Figure 36).

The stormwater management system has been designed to capture and treat the water quality volume (WQV) equivalent to one third of a 50 % AEP storm event. This approach will provide effective treatment for around 90 % of rainfall events by frequency, consistent with recognised best practice for contaminant removal (ARC TP10; GWRC Water Sensitive Design guidance). The treatment train will reduce sediment, metals, and hydrocarbon inputs to receiving wetlands, managing the most frequent and contaminant-rich storm events.

Flows more than the WQV will be conveyed through a piped system designed for 10-year ARI storms (10 % AEP), reducing the risk of erosion and uncontrolled discharges into sensitive habitats. Larger, infrequent storm events (>10-year ARI) will be managed via designated overland flow paths with low gradients which are not susceptible to scour.

Further refinement to stormwater systems will occur at the detailed design stage to confirm device footprints, outlet details, and tailwater levels, and to integrate ecological outcome requirements identified in this report.

Overall, with direct discharges to natural wetlands being avoided, and treatment, attenuation, and secondary flow routing implemented in accordance with best practice, the proposed system will avoid or at least mitigate adverse water quality effects on wetland ecosystems to an acceptable level.

4.4.7 Wetland buffer restoration

Pekapeka Road wetland and Te Harakeke Swamp wetland, will have planted buffers averaging 10.4 and 20.3 m wide, respectively (Table 18). All other restored and created wetlands onsite (excluding the stormwater easement) will have a planted buffer averaging 9.7 m wide. Locally appropriate native species will be used. A species list for wetland buffer planting is presented in Appendix O, wetland community 3.

These planting buffers will restore natural ecological gradients and provide multiple ecological benefits to protect the wetlands and mitigate subdivision effects. Dense indigenous plantings proposed (rush–sedge margins grading to shrub and canopy species) will improve wetland health by intercepting and retaining sediment, nutrients, and contaminants from overland flow, providing a final polishing after stormwater treatment during high flow events, improving water quality, and protecting wetland and stream biota. Root systems stabilise soils and reduce bank erosion. The vegetated setback buffer will shade margins, moderate temperatures, and dampen wind and light penetration, reducing edge effects (desiccation, weed invasion, algal growth) while keeping earthworks, mowing, and structures out of the wetland ecotone.

The buffer will add habitat complexity and food resources, supporting invertebrates, lizards, and terrestrial and wetland birds, and will function as a movement corridor linking terrestrial and aquatic habitats, providing broader landscape connectivity. The buffer will also provide a visual and physical barrier to reduce human disturbance of wetland birds. In combination with ongoing pest-plant and predator control, the proposed native buffer will measurably improve ecological integrity and resilience of the wetland and will mitigate the magnitude of subdivision-related effects.

At Te Harakeke Swamp, the pedestrian walkway is located within 20 m of the wetland boundary in places, with buffer planting continuing 1-4 m wide on the other side of the pathway. At the Paetawa Road lots, Lot boundaries will be set back 15 m from the boundary of Te Harakeke Wetland. A 20 m wide planted buffer will be created around Te Harakeke wetland, including approximately 5 m extending onto private land. A boundary fence will be installed along the outer edge of the 20 m setback. Both the planting and fencing will be secured through a consent notice to ensure their ongoing protection and maintenance. The consent notice will also require the landowner to permit planting within the buffer area and allow the buffer to be managed as part of the wider wetland restoration and planting programme, initially by the project proponent and potentially in the future by an appropriate entity such as the Council, QEII National Trust, or a similar conservation body. These Lots will have a requirement to establishment wetland buffer species listed in Appendix O to 80 % canopy cover.

Within the southern stormwater easement, buffer planting is not feasible due to the lease arrangement, meaning that the lower Ngarara floodplain wetland cluster cannot be fully restored.

In several locations in the non-SNA wetlands, a full width 10 m buffer is not practicable, due to engineering requirements that encroach into an ideal 10 m wide buffer. To balance these encroachments, buffer widths will be increased elsewhere, resulting in an average buffer width of 9.7 m (see Figure 37 and Table 18). Note, buffer widths decrease slightly (to 9.7 m) due to an increase in created wetland area (additional to required offsets) in the latest design update. In cases where there is a minor infringement of a Lot boundary into the 10 m margin, there will be an encumbrance added to the lot title to restrict development of impervious surfaces in the lot to outside of the 10m wetland setback.

Buffer widths and areas are listed in Table 18, resulting in a total buffer planting area of 7.26 ha. Note, the calculated wetland buffer also provides riparian buffering, falling within 10 m of Ngarara Stream along some sections.

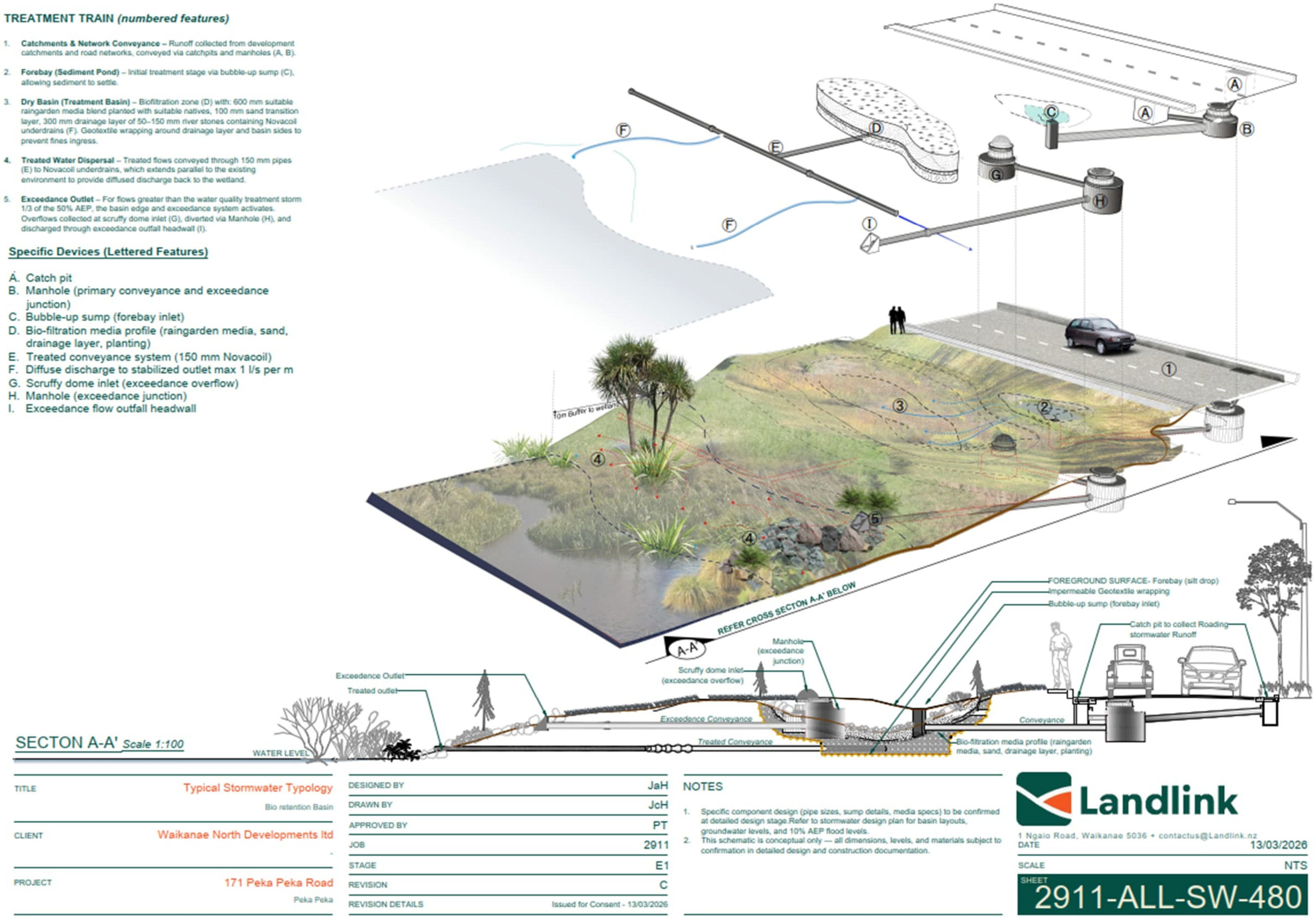


Figure 35. Engineering design graphic of stormwater treatment device and outflow

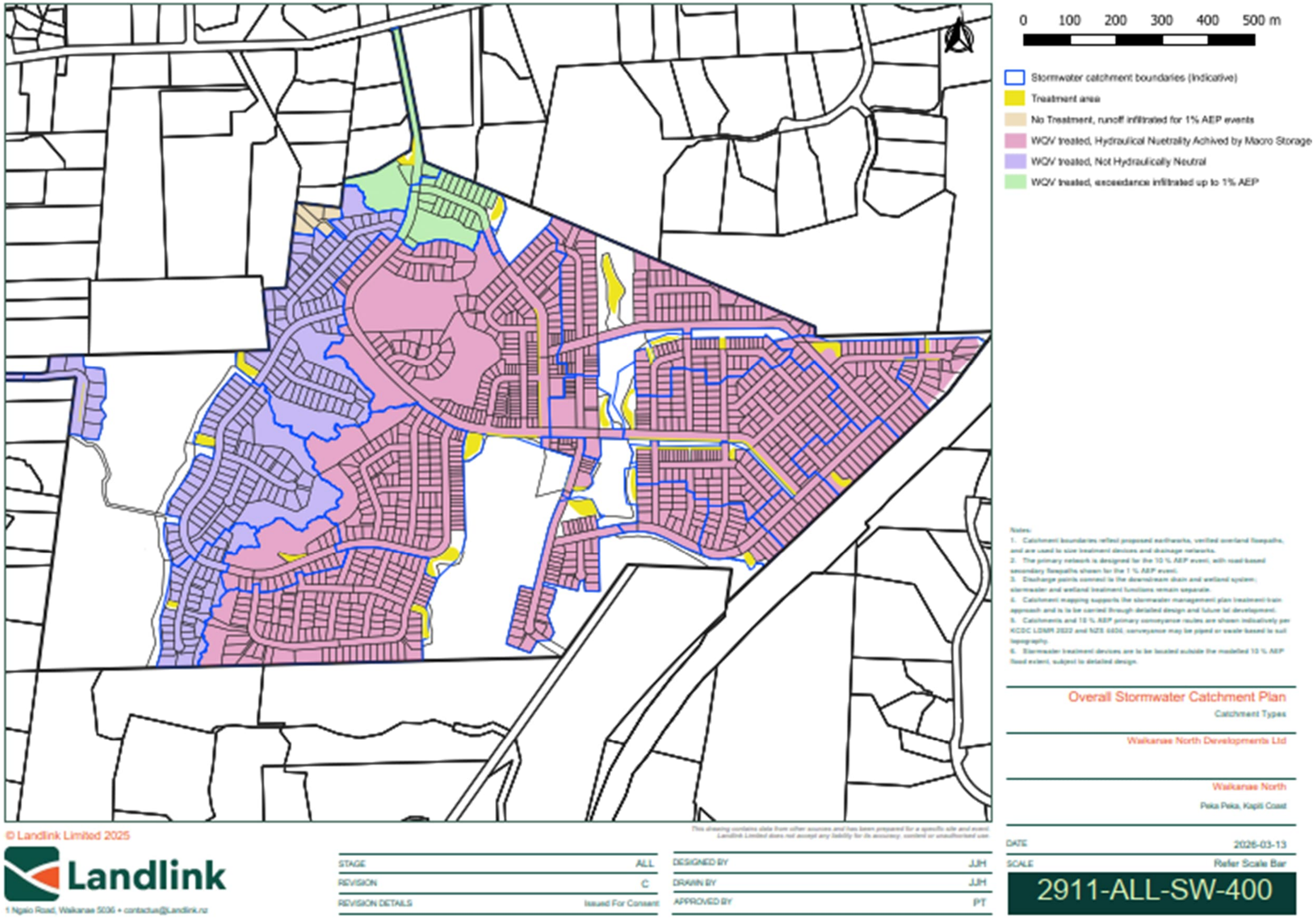


Figure 36. Location of stormwater treatment devices (yellow polygons). Provided by Landlink Limited.

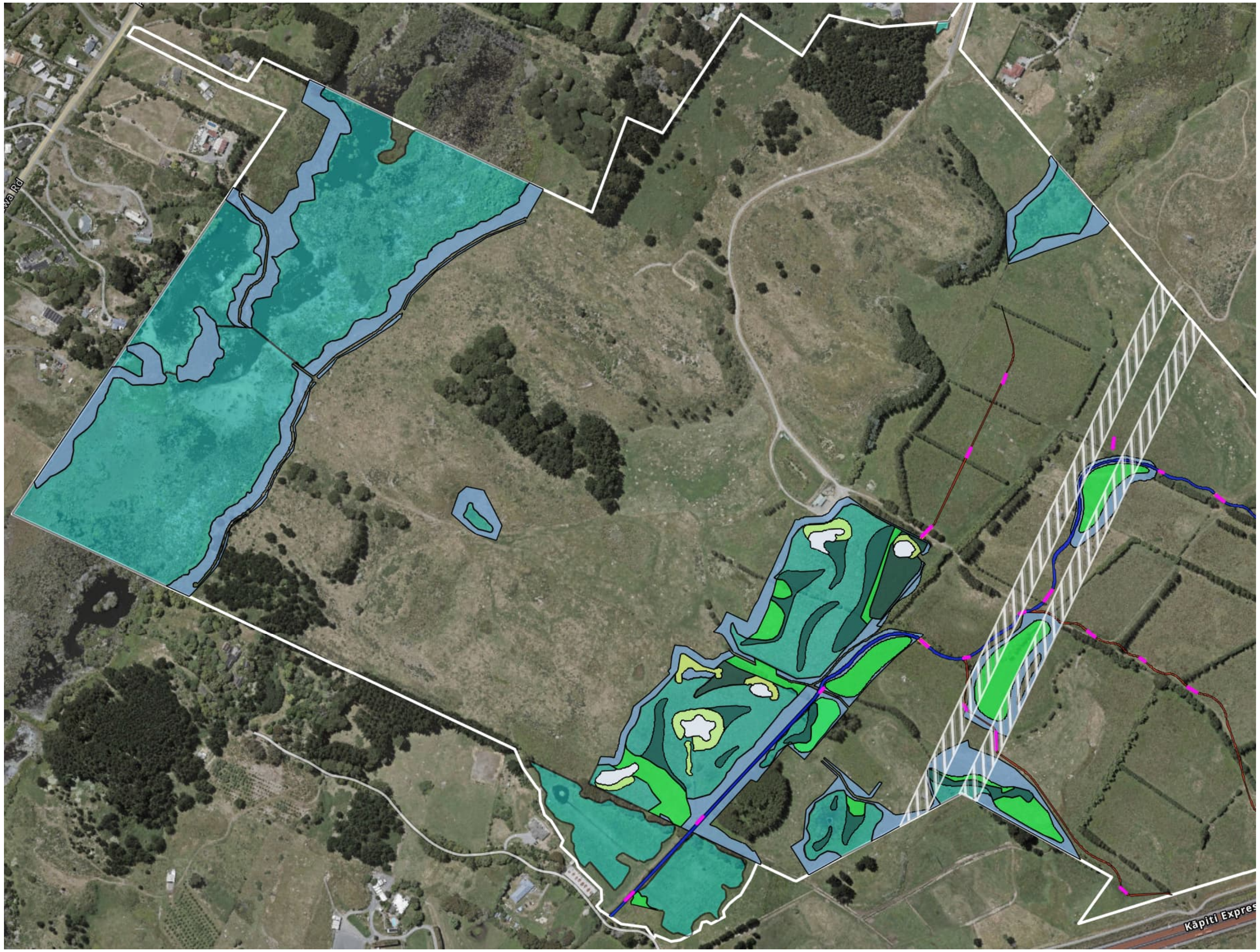


Figure 37. Proposed buffer planting (blue polygons) around retained wetlands (cyan) and constructed offset wetlands (light green polygons). Also shown are enrichment planting zones within retained wetlands (white, lime and dark green polygons). The national grid transmission yards are shown in white hatch. Note, planted buffers are not feasible or considered necessary around wetlands within the leased stormwater easement.

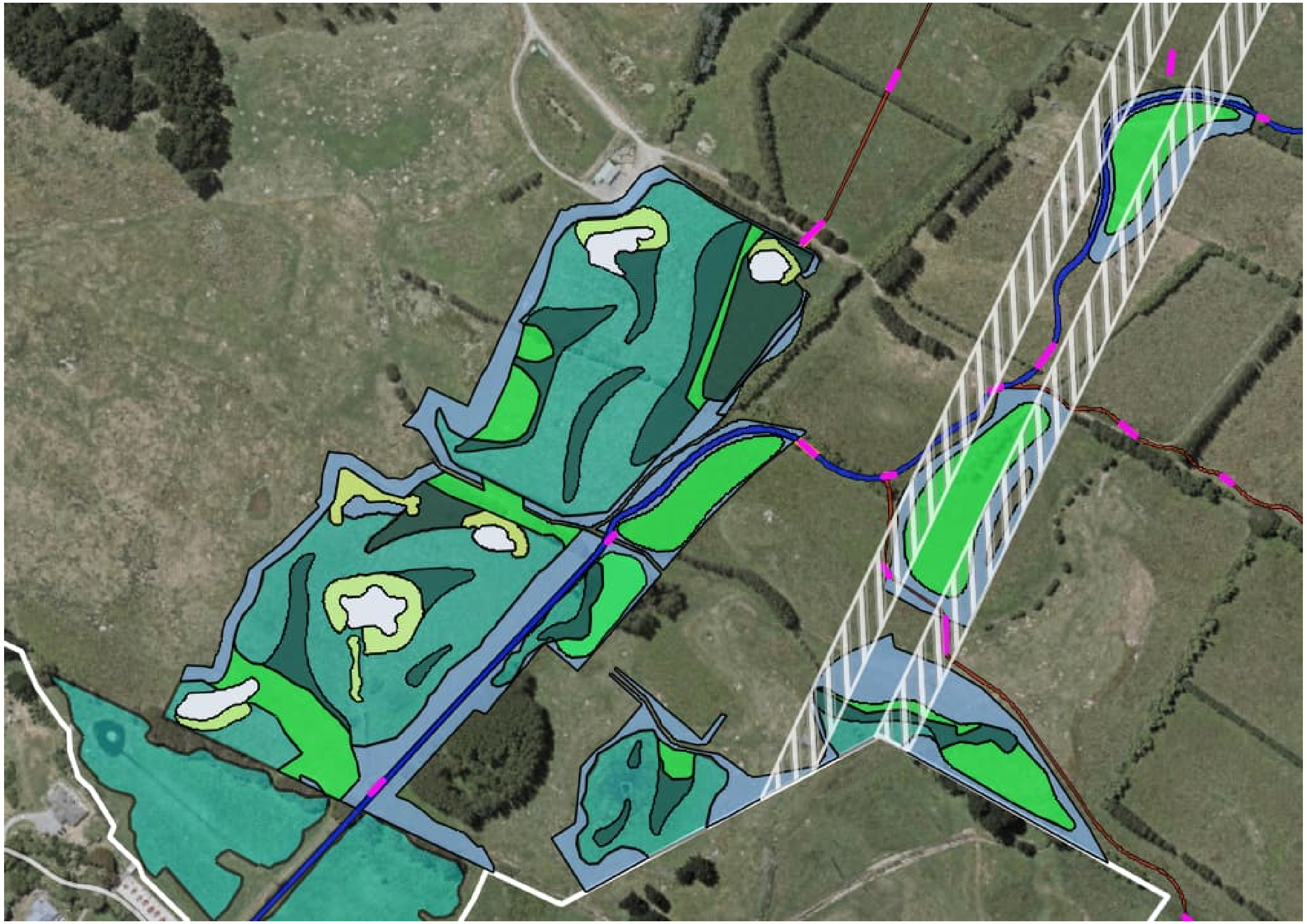


Figure 38. Enrichment planting areas for retained wetlands, including constructed swales (white, wetland vegetation community 1), wetland planting (vegetation community 2), and discharge buffer/swale edge planting (vegetation community 4), and national grid transmission yard, with planting height restrictions. Note, the retained wetland enrichment planting zones (additional benefit) will not necessarily be planted at standard ecological planting densities in their entirety. Also shown are constructed offset wetland planting zones (bright green polygons, wetland vegetation communities 1 and 2).

Table 18. Summary of ideal vs design wetland buffer planting areas.

	Te Harakeke wetland	Pekapeka Road wetland	Non-SNA wetlands	Total wetlands
Ideal buffer area (m^2)	35140	3303	34072	72515
Design buffer area (m^2)	35932 [1]	3538	33128 [2]	72598
Ideal average buffer width (m)	20.00	10.00	10.00	-
Design average buffer width (m)	20.45 [1]	10.70	9.72 [2]	-

[1] Includes 3 m width low dune vegetation planting if cat deterrent fence option incorporated

[2] Includes height-restricted vegetation planting under national grid yard

Wetland margin planting beneath the high-voltage transmission lines will be height-restricted to comply with the Electricity (Hazards from Trees) Regulations 2003. As a result, parts of Offset Constructed Wetland Clusters 2 and 3 fall within the transmission corridor and will be subject to planting constraints. The area of height restriction will be influenced by line swing, and species permitted depends on line sag at each location. Within areas where conductors have lower clearance, low-stature buffer species will be established, including mingimingi (*Coprosma propinqua*) and mānuka (*Leptospermum scoparium*), with swamp coprosma (*Coprosma tenuicaulis*) planted along wetter margins. Where sandy substrate associated with historic low dunes exists along wetland margins (such as wetland 14), low-stature dune shrubland species may be incorporated (Appendix N). In sections where line clearance is greater, taller species consistent with Wetland Vegetation Community 3 will be planted (refer Appendix O). The Wetland Ecological Value (WEV) score for these wetlands is not affected by the height restrictions, as the methodology requires a buffer comprising 'trees or shrubs' without specifying minimum height.

4.4.8 Wetland planting

The total area (1.74 ha) of wetlands constructed for offset of value and extent will be planted at high density to achieve 80 % canopy cover (Figure 38), as will the additional 0.7 ha of constructed wetland which provides additional ecological benefit, providing a total constructed wetland planted area of 25,196 m^2 (2.52 ha). Indicative planting plans are presented in Appendix O. The ERMP details planting plans, principles, methods and areas.

Enrichment planting of indigenous species will take place in the degraded wetlands in Wetland Clusters 2, 4, and 5 to enhance diversity and cover of native vegetation and to create or improve habitats of indigenous fauna, such as wetland birds (particularly fernbird, marsh crake, spotless crake and bittern) and fish (including mudfish). This enhancement constitutes a strong net positive effect in addition to the required mitigation and offset package for wetlands. Planting plans for three restoration communities within wetlands are based on hydrology, and are summarised in Appendix O. Enrichment planting will occur over approximately 2.36 ha of the total 6.5 ha area of retained non-SNA wetlands (Wetland Clusters 2, 4, and 5), but not necessarily at standard ecological planting densities (Figure 38).

The ERMP expands upon these plans, and details the areas planted, and principles and methodologies employed. A schematic illustration of wetland planting zones is presented in Appendix Q.

Dense planting of voluminous species such as flax can reduce flood detention capacity due to displacement. As the proposed planting is in nodes, covering less than 15 % of the retained wetland areas, and is dominated by low bulk sedges and rushes, displacement is likely to be well under 15 %, and the displacement also will be partly offset by increases in storage volume by excavating swales and constructed wetlands.

Planting within wetlands inside the high voltage transmission corridor will be subject to height restrictions. This is expected to have minimal impact on the overall revegetation species composition (wetland communities 1 and 2, Appendix O), as these communities are predominantly comprised of low-stature rushes, reeds, sedges, and shrubs. However, taller species such as kahikatea and tī kōuka will not be appropriate within the restricted zone due to their mature height. Portions of Offset Wetland Clusters 2 and 3 will be affected by these height constraints.

4.4.9 Stream buffer restoration

Riparian planting averaging 10.3 m wide on either side of Ngarara Stream will contribute to significant improvements in stream condition. The total area of riparian planting within 15 m of streams is 2.74 ha (excluding stream bed area, including wetland buffer planting). Riparian restoration will mitigate earthworks and vegetation removal impacts and ensure an increase in ecological condition and value for the realigned reach, as well as retained recontoured reaches. Riparian buffers help to trap sediment and nutrients from surrounding land, reducing pollution and improving water clarity. Native plants stabilise banks and provide shade, keeping water cool for native fish and invertebrates. Over time, these buffers restore habitat complexity, biodiversity, and ecological connectivity in degraded waterways such as Ngarara Stream. Stream and wetland plantings onsite provide a key link between indigenous ecosystems on the coast at Pharazyn Reserve, through Te Harakeke Swamp and the dunes reserve to extensive areas of native revegetation around the state highway, and remnant areas of forest, through to the forested ranges.

Native planting is proposed along Ngarara Stream where it flows over the property (Figure 39). An indicative riparian species list is presented in Appendix P, focusing on riparian and floodplain sedge, shrub, and tree species appropriate to the ecological district. Planted riparian buffers are not feasible around the stream reach within the leased stormwater easement.

Riparian areas within 10 m of streams which overlap with wetland buffer planting areas will be planted with wetland margin species including kahikatea, tī kōuka and swamp maire (Appendix O), rather than riparian species, because these areas will be subject to more frequent and prolonged inundation, associated with stormwater detention and wetland hydrological restoration. These areas are being restored closer to their original wetland state, and will not be well suited to riparian trees intolerant of occasional waterlogging.

Stormwater detention dry basins within 10 m of streams will be planted with wetland margin species which can tolerate occasional short-term inundation. Species will include kahikatea, swamp maire, and tī kōuka on the margins (wetland vegetation community 3, Appendix O). Deeper parts of the stormwater basin may include wetland and stormwater discharge planting communities (wetland vegetation communities 2 and 4, Appendix O). These overlaps constitute approximately 5% of wetland buffers, with the vast majority of buffers available for the full wetland buffer community species complement (wetland vegetation community 3, Appendix O).

Riparian planting under the high voltage power transmission lines (effectively the realigned reach) will also be restricted in height to align with Electricity (Hazards from Trees) Regulations 2003, Within areas where conductors have lower clearance, low-stature shrub and groundcover planting buffer species will be established (riparian vegetation community 1; Appendix P). In sections where line clearance is greater, taller species consistent with Riparian Vegetation Community 2 will be planted (Appendix P). The Stream Ecological Value (SEV) score for these wetlands is not affected by the height restrictions, as the methodology requires a buffer comprising 'trees or shrubs' without specifying minimum height. At several locations, lot boundaries overlap with 10 m stream buffers (Figure 39). Lots within 10 m of the stream channel will be issued with consent notices requiring indigenous vegetation coverage within the 10 m riparian buffer area. Covenants will also preclude the planting of species listed within the National Pest Plant Accord (NPPA), Greater Wellington Regional Pest Management Plan (RPMP), or the Department of Conservation list of environmental weeds in New Zealand (2024). Examples include yellow flag iris (*Iris pseudacorus*), lupins (*Lupinus* spp.), Agapanthus (*Agapanthus praecox* and hybrids), Tradescantia (*Tradescantia fluminensis*), grey willow (*Salix cinerea*), crack willow (*Salix fragilis*), and alder (*Alnus spp.*). These species are widely recognised as environmental weeds in New Zealand wetlands.

4.5 Fauna

The indigenous fauna at the site includes At Risk and Threatened species and is of high ecological value. A key mitigation action will be the capture and relocation of wildlife prior to impacts on vegetation, streams and wetlands which will reduce the magnitude of effect from moderate to low or negligible.

4.5.1 Direct mortality or injury of fauna during construction

Salvage and relocation of native freshwater fauna is a standard process that is governed by the Ministry for Primary Industries. A Native Freshwater Fauna Salvage and Relocation Plan (NFFSRP) is included with this application. Release sites for salvaged fauna have been identified in the plan. All of the stream and wetland areas that will be protected and enhanced as part of the proposed development have habitat that is suitable for freshwater fauna release, and the quality of habitat for aquatic fauna in those areas is expected to improve considerably with the exclusion of stock, and from offset planting proposed across many of these waterbodies. Where native aquatic fauna salvage and relocation is undertaken to a high standard, the potential impact on native aquatic fauna will be very low or negligible.

Likewise, the salvage and relocation of native lizards is required by the Department of Conservation (DOC) which administers the Wildlife Act, and under which all native lizards are deemed to be absolutely protected species. There is a standard process through DOC to obtain a Wildlife Act Authority to capture and relocate native lizards. For this project, salvaged native lizards will be released within the protected dune open space area, where landscape planting and management will be directed at creating and enhancing lizard habitats. The details of this are contained within the Lizard Management Plan (LMP) that accompanies this application.

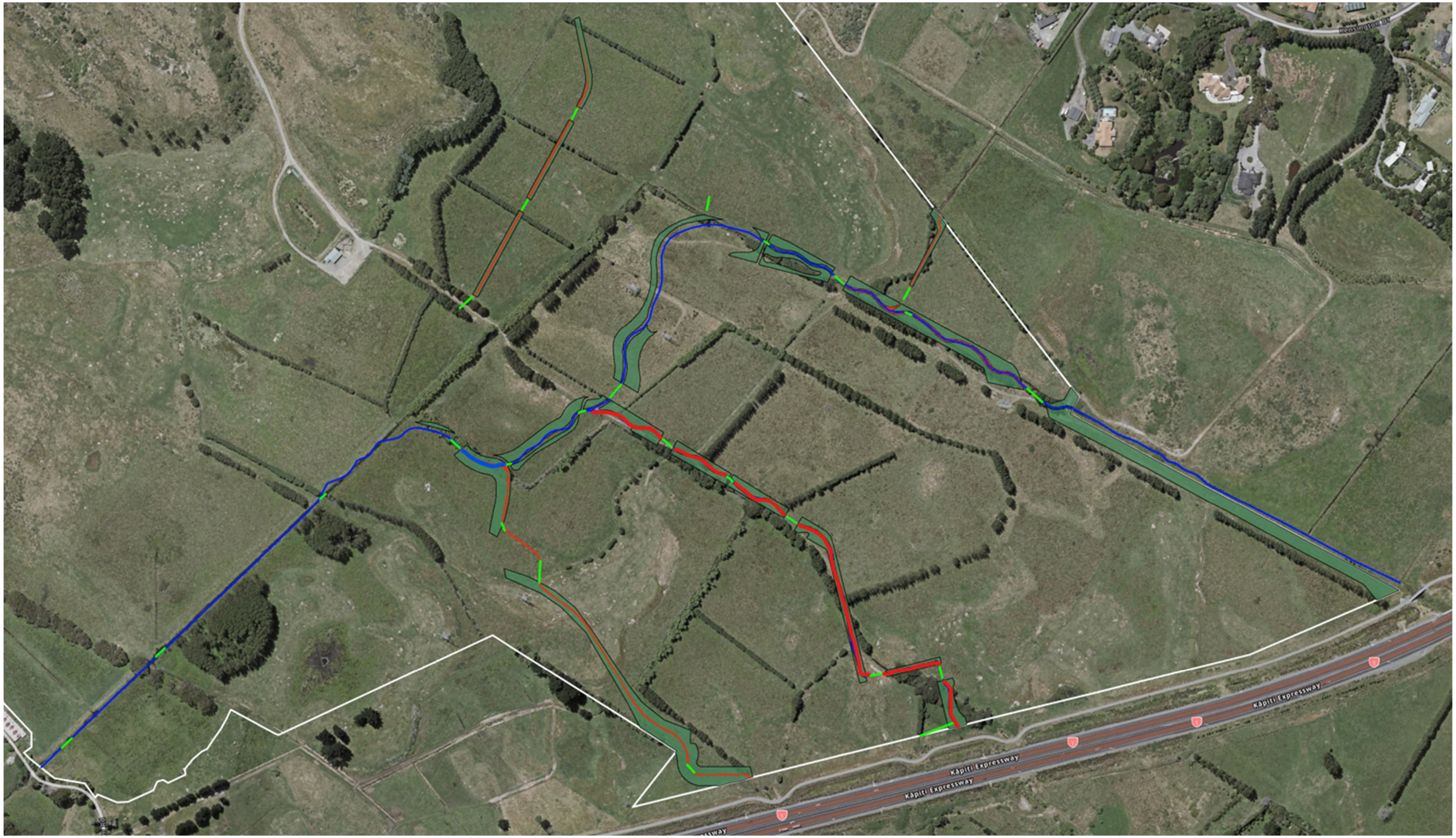


Figure 39. Approximate 10 m riparian planting buffer (green polygon) proposed along both banks of Ngarara Stream (blue line), and riparian plantings along realigned drains (red lines).

Most native birds are also protected under the Wildlife Act. Although an Authority is not usually required from DOC, it is usual to minimise potential injury or death to native birds by 1) limiting vegetation clearance to the period outside of the native bird nesting season (the bird nesting season is generally accepted as being from September through to February), and 2) if vegetation clearance needs to occur between September and February (inclusive), a survey for native bird nests must be undertaken by a qualified ecologist, and any active nests are avoided, and a 20 m buffer around active nests are avoided, until either the chicks have fledged or the nest has failed.

4.5.2 Indirect mortality and injury of indigenous fauna associated with increased domestic cat and dog ownership

Some domestic cats from surrounding lifestyle properties, and some feral cats, are likely to already visit the site (cats were observed at site during field surveys). However, urbanisation associated with the proposed subdivision will inevitably lead to increased cat presence in the local area. Average cat ownership in New Zealand is 0.68 cats per household[26]. At 1,170 sections, 800 domestic cats could potentially be added by the proposed development. Average dog ownership nationally is 0.43 dogs per household, potentially resulting in 500 dogs within the development (although urban dog ownership rates are likely to be slightly lower). The addition of hundreds of cats and dogs is likely to increase predation pressure and disturbance of native birds of high and very high ecological value – such as wetland bird species (this has been shown from studies elsewhere)[27].

Without appropriate management of domestic cats and dogs, the magnitude of predation and disturbance effects on the High bird values of Te Harakeke Swamp and Peka Peka Road Swamp are likely to be moderate on a regional scale, resulting in a High potential level of adverse effect. There are records of threatened bird species in Te Harakeke Swamp wetland. Even if those records are offsite, we know domestic cats travel 10 km or more, so it should be a potential adverse effect that is addressed.

The potential for WC2 and other restored wetlands to support significant native bird values would also be severely restricted if domestic pets were not managed appropriately.

Measures to mitigate the risk of predation and disturbance from domestic and feral animals on indigenous fauna will combine domestic pet controls with ongoing pest-management programmes, and will be detailed in the ERMP.

The ERMP will specify the level of domestic animal management for all new residents, including options such as:

- Dogs to be kept on leash at all times outside the fenced dog park;
- Tall buffer planting around wetlands, and along walkways crossing wetlands, particularly Te Harakeke Swamp wetland;
- Cats to be microchipped and contained indoors at night or within cat-proof enclosures;
- A no-cat covenant;
- A pet control fence along significant wetland areas; and
- Resident information packs explaining the ecological importance of the wetlands and responsible pet-ownership practices.

[26] Include reference

[27] Include reference

A pest animal control programme will be implemented by the applicant for 10 years (if a pet control fence is installed around SNA wetlands) or for the duration of the consents (35 years) if no pet control fence is installed, after which time pest management will be passed onto Council or the Landowners association. Coverage will include SNA and restoration areas, focusing on wetland margins and the lizard release site within the dune reserve area, to reduce predation pressure on lizards and wetland birds. While existing trapping effort by the landowner provides a helpful baseline, the catch data indicates persistent predator presence, reinforcing the need for intensive and landscape-scale pest-management programme, as described in the ERMP.

Cats (both feral and domestic, if within the wildlife protection areas) will be caught in live cage traps. Feral cats will be humanely euthanized. Microchipped domestic cats will be returned to their owner, who will also be reminded of their obligation to keep their cat under control. If a domestic cat is caught more than twice, they be humanely euthanised. Additional options, such as partial fencing, and cat-free status of lots near high value wetlands are described in the ERMP.

Pest management will be coordinated with adjacent landowners and, where feasible, integrated into wider community or council-led pest-control networks to maximise landscape-scale effectiveness.

For the lizard release management area, it is assumed that DOC will require assurance that domestic and feral cats (and other pests) will be removed or kept out of the release site. Ecological monitoring will be undertaken to assess predator abundance, allowing management actions to be adaptively refined if needed.

4.5.3 Indirect disturbance of indigenous birds

During construction: To avoid or minimise indirect disturbance effects on high-value wetland birds, the ERMP includes seasonal earthworks buffers around wetlands. Where practicable, earthworks will be scheduled outside the breeding season of Threatened and At Risk wetland bird species.

Prior to any earthworks and vegetation clearance within the breeding season, a suitably qualified and experienced ecologist will carry out a presence-absence survey of At Risk and Threatened wetland birds to determine if crakes and fernbirds are still present, and if any birds listed as likely to be present periodically are present (particularly bittern).

Nest surveys for these species in dense wetland vegetation are not practicable, and nesting can be reasonably presumed to occur if these species are present. If At Risk or Threatened bird species are detected, a minimum buffer distance of 200 m from the wetland margin is recommended for earthworks during the breeding season.

After construction: potential visual and noise disturbance effects on indigenous wetland birds arising from the proximity of residential development, human activity, and domestic pets will be minimised through a combination of physical barriers, spatial buffers, buffer planting, and access management:

- Dogs are required to be restrained on a leash in all areas other than private lots and the fenced dog park. This requirement will be enforced through subdivision covenants and signage, to minimise disturbance while still allowing controlled recreation.
- Restoration planting along wetland margins and development boundaries (averaging 20 m wide at Te Harakeke Swamp wetland and 10 m wide for all other wetlands) will establish dense native vegetation buffers that deter direct human access to sensitive nesting and foraging areas, and provide visual screening between residential areas and wetlands, reducing bird responses to movement, noise, and lighting.

- Defined access paths and viewing areas will direct pedestrian activity away from the most sensitive wetland zones, maintaining opportunities for residents to experience the natural environment without causing disturbance.
- Walking and cycling accessways through wetlands are avoided where practicable. Both of the walking and cycling paths crossing through Ngarara Wetland Cluster (WC2) and Te Harakeke Swamp will be visually screened by vegetation or fencing. Fence screening will consist of a continuous barrier, 1.8 - 2 m high, which is visually impermeable, with the exception of viewing slots (100 mm high horizontal, every 3 – 5 metres) or windows (one-way glass). The location of screening is to be finalised, but will focus on areas of open water providing the best waterfowl and wetland bird habitat, which is not able to be effectively screened by dense tall vegetation.

These measures will be specified in the overarching ERMP, which will also include protocols for wetland fencing maintenance, planting establishment, and compliance monitoring. These mitigations will reduce the magnitude of disturbance effects from high to low.

4.5.4 Loss of lizard habitat

Clearance and removal of 0.57 ha of high quality lizard habitat (Figure 40, and Tables 19 and 20) will be mitigated by habitat improvements. A minimum of 1.07 ha of the high dunes will be restored through ecological planting, with a focus on provision of high quality lizard habitat. At least 0.57 ha of indigenous dune shrubland will be established adjacent to the retained fragments, corresponding to the area of high value lizard habitat lost through development (Figure 40). In addition, a further 0.57 ha of indigenous dune shrubland planting will take place elsewhere in the central dune reserve area, providing connections within the site and to adjacent areas of dune ridge to the north and south. This will result in a total of 1.14 ha of shrubland planting in the dunes area, at a loss-gain ratio of 1:2. Planting will occur in nodes, each containing plants spaced at 1.4 m for shrubs, and 0.5 m for herbs. Additional landscape planting provided for in the Landscape Plan will further contribute to these areas and utilise the same species list. However, this planting falls outside the scope of the required ecological mitigation and is therefore considered an additional enhancement benefit.

Revegetation will increase the suitable habitat availability, providing refuges and structural complexity. Planting will be dominated by *pōhuehue* to provide adequate habitat; with oioi, knobby club rush and scattered intermixed divaricating shrubs to supplement complexity and refuges. Given how quickly oioi and pōhuehue establish and spread, it is expected that lizard habitat removed within the footprint will be replaced through plantings within 5 – 7 years.

The remaining open areas of the dunes reserve will be subject to weed control, and will support rank grass, which are expected to transition to native vegetation over time as the planting nodes progressively expand through natural processes. The existing populations of lizards at the proposed release site are likely suppressed by animal pest pressure, as well as a lack of habitat refuges and complexity. Therefore, releasing additional lizards should be in conjunction with habitat provision and enhancement, livestock removal, and a pest animal control plan.

The 5.8 ha release area for lizards salvaged during the development will be subject to an intensive pest control regime. The target species are browsing pests (possums, hares, rabbits) and predatory pests (rats, mustelids, hedgehogs, and feral cats). Ungulates such as deer, goats, and pigs are absent. A combination of bait stations and traps will be used to target pest animals at the site and within the lizard release area.

Stock exclusion through fencing will prevent trampling, disturbance, and grazing of release areas, allowing revegetation to thrive, especially plantings of pōhuehue, oioi, and divaricating shrubs.

Habitat features such as logs and woody debris will be introduced throughout the dunes restoration area to enhance the habitat and provide protection from predators. Predator control throughout the dunes will further enhance lizard habitat. Restoration planting, weed and pest control will be undertaken by the applicant for 15 years, after which management will pass to the Residents Association.

These enhancements are detailed in the Lizard Management Plan (LMP). The application site contains a semi-continuous band of lizard habitat outside of the planned earthworks extent (Figure 41). The 5.8 ha area was selected according to a range of factors (Table 19).

Table 19. Release site suitability.

Suitability factor	Release site description
Habitat	The release site area includes 1.4 ha of high quality habitat and 4.4 ha of moderate quality habitat, (Section 3.2.5).
Long-term protection	The release site is currently owned by the developer and will be encumbered by a consent notice to ensure that the release site will be physically protected in perpetuity regardless of current land ownership or any future ownership or tenure changes. There are no plans for its development.
Accessibility	The release site is within the same property and very accessible to all other salvage locations, including a few minutes driving time or maximum half an hour walking.
Size	The release site area is approximately 5.8 hectares. It currently includes a range of habitats, but it is not connected to other sites. It is large enough to accommodate the relocated lizards alongside the current lizard population, with habitat potential for population increase.
Existing lizard populations	The existing population of lizards at the proposed release site is considered to be severely depleted.
Predator control	Predator control has been intermittent at the site. It is likely that a range of exotic predators are present and that lizard populations are consequently constrained. Control of introduced mammalian predators will commence prior to the release of lizards into the release site.

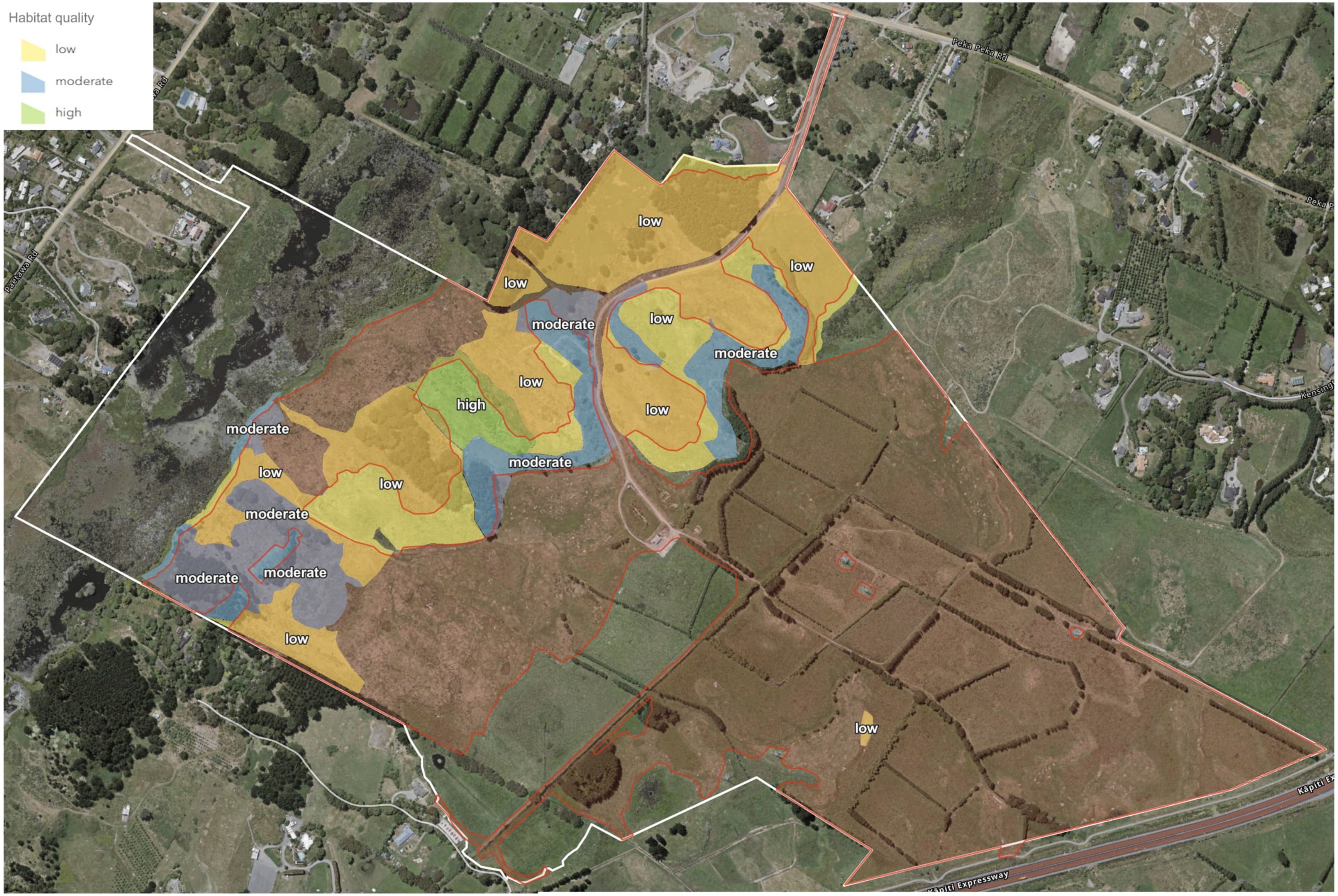


Figure 40. Suitable lizard habitat across site, classified as low (yellow), moderate (blue) and high (green) quality. Earthworks extent at site (red shade and outline).

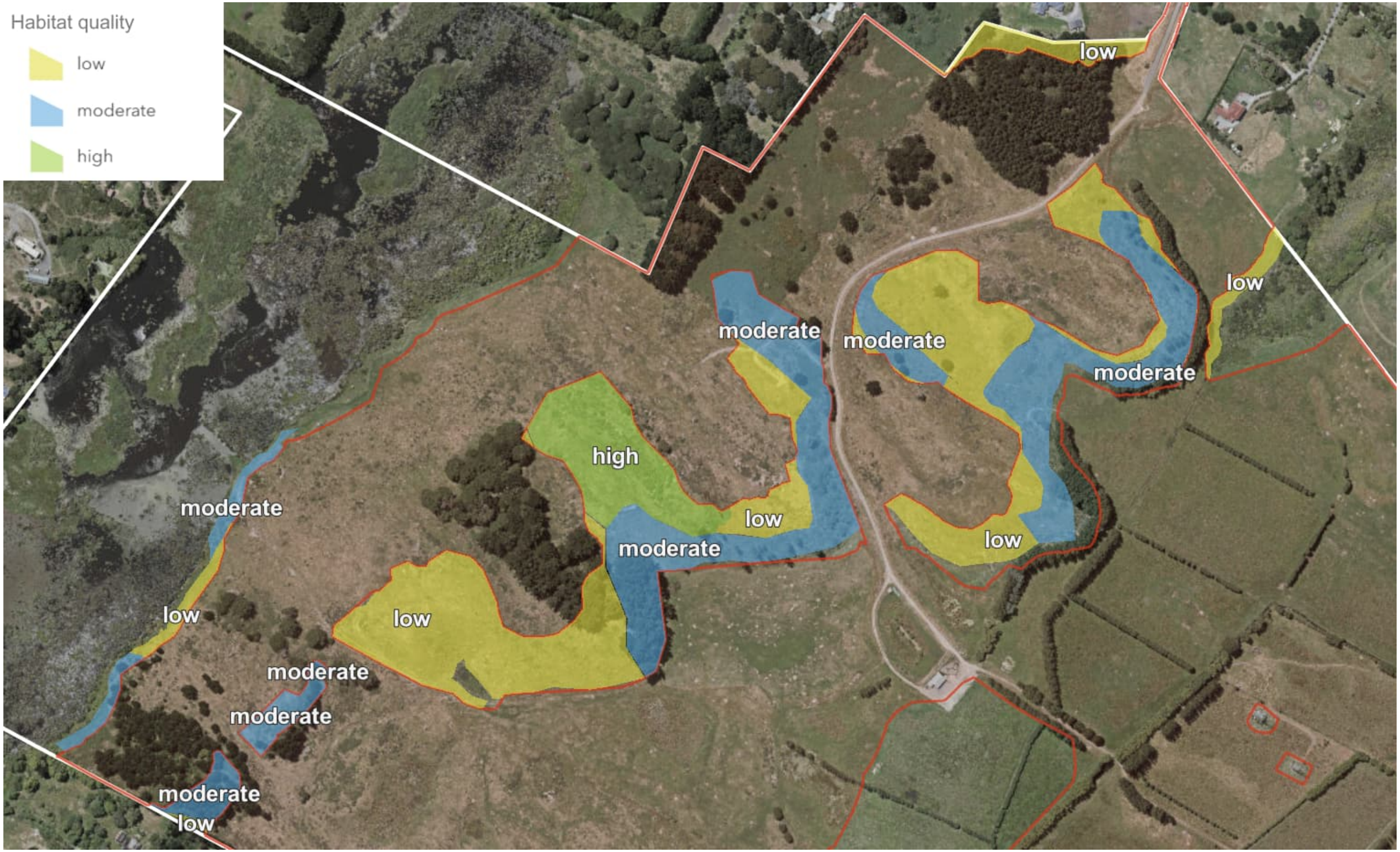


Figure 41. Release site areas, composed of protected habitat outside of proposed earthworks: low (yellow), moderate (blue) and high (green) habitat quality.

4.6 Assessment of effects after mitigation

Table 21 summarises the values of ecological features, and assesses the magnitude and level of effect on these features using the EIANZ matrix method, both prior to the application of mitigations, and after mitigation.

Under EIANZ (2018) guidance and RMA practice, residual adverse effects which have a low, very low or negligible level, are considered to represent no more than minor ecological effects. Residual effects which are moderate, high or very high are residual effects which require further management through offsetting or compensation.

After mitigation measures have been applied, there are more than minor residual effects remaining for wetland removals, which will be managed through offsetting as described in the following section. More than minor effects will also remain for potential mortality of indigenous fauna (wetland birds).

Significant net gains are expected for native dune vegetation, SNA margin vegetation, native wetland bird habitat, and some wetland areas where increased groundwater will provide greater soil moisture and wetland quality.

Table 20. Lizard habitat summary statistics, in particular, lizard habitat areas and proportions which overlap with the 102 ha of earthworks (impact).

Lizard habitat	Total area (ha)	Proportion of all habitat (%)	Impact area (ha)	Proportion of impact (%)	Proportion of original habitat (%)	Area remaining (ha)	Proportion of original habitat remaining (%)
High	1.95	5.2	0.57	2.3	29.2	1.38	70.8
Moderate	10.20	27.6	5.24	21.0	51.4	4.95	48.6
Low	25.41	67.7	19.17	76.7	75.4	6.25	24.6
Total	37.56	100	24.98	100		12.58*	

*12.58 ha of lizard habitat is outside the proposed earthworks extent, and 5.8 ha will be used as cohesive release habitat (Figures 26 and 41).

Table 21. Assessment of ecological effects using the EIANZ effects assessment method[28], for habitats and species both prior to, and following, the application of mitigations. Refer to Tables 13 and 14 for areas of impact and mitigation. Note that this table describes residual effects after mitigation as a filter to assessing the need for offsetting and/or ecological compensation.

Factor	Ecological value[29]	Magnitude of effect[30] (without mitigation)	Level of effect[31] (without mitigation)	Mitigation that will be applied	Magnitude of effect (after mitigation)	Level of effect (after mitigation)
Loss of wetlands	Moderate	High	High	Avoid highest value wetlands; mitigate potential hydrological impacts	Moderate	High
Streams	Moderate	High	Moderate	Realignment, re-naturalisation (including increased length) and restoration	Positive	Net gain

[28] EIANZ EciA guidelines. Roper-Lindsay, J., Fuller S.A., Hooson, S., Sanders, M.D., Ussher, G.T. 2018. Ecological impact assessment. EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems. 2nd edition

[29] EIANZ matrix tables 5 and 6

[30] EIANZ matrix table 8; measured in the context of the catchment (streams) or District (terrestrial values)

[31] EIANZ matrix table 10

Factor	Ecological value[29]	Magnitude of effect[30] (without mitigation)	Level of effect[31] (without mitigation)	Mitigation that will be applied	Magnitude of effect (after mitigation)	Level of effect (after mitigation)
Discharge of sediment or contaminants into wetlands or streams	High	High	Very high	Erosion and sediment control plan and infrastructure plan measures to manage peat decomposition and sediment discharge downstream during construction and operation of stormwater treatment devices after construction	Moderate	Low
Loss of native dune vegetation	High	High	Very High	Remediation of cut and fill batters; Restoration planting of dune reserve	Positive	Net gain
Loss of SNA margin vegetation	Moderate	Moderate	Moderate	Restoration planting minimum 10 m margin of SNA wetland	Positive	Net gain
Loss of habitat for indigenous birds	High	Low	Low	Avoid highest value wetlands; wetland restoration and offset planting	Positive	Net gain
Loss of habitat for indigenous lizards	Low	Moderate	Low	Restoration of dune vegetation for lizards and provision of habitat features	Positive	Net gain
Loss of habitat for indigenous fish	High	Moderate	High	Realignment and restoration of stream W1 and drain W1.1	Low	Low
Disturbance of indigenous birds during construction and from domestic pets and pest animals	Very high	Moderate	High	Fencing of wetlands, planting screening buffers, restrictions on construction timing near wetlands	Negligible	Low
Direct mortality or injury of indigenous fauna during construction	High	Moderate	High	Salvage of freshwater fauna and lizards; nesting birds will be avoided	Low	Very low

Factor	Ecological value[29]	Magnitude of effect[30] (without mitigation)	Level of effect[31] (without mitigation)	Mitigation that will be applied	Magnitude of effect (after mitigation)	Level of effect (after mitigation)
Indirect mortality or injury of indigenous fauna associated with increased domestic cat ownership	Very High	Moderate	High	Live traps will catch feral and domestic cats within wetlands and their margins, and dune restoration areas; Lizard habitat improvements.	Very Low	Low

4.7 Residual effects management

Residual adverse effects which are more than minor after mitigation has been applied include:

- Loss of wetland extent and value.

For these effects, biodiversity offsetting or compensation or both is proposed. The detail of how this appropriate offsetting and compensation is derived is laid out in the following sections.

4.7.1 Offsetting of wetland extent and values

A wetland accounting model was used to assess the minimum wetland offset extent and value needed to achieve a no-net-loss outcome for wetland extent and value adversely affected by the project.

The accounting model used to address the residual effects through offset of wetlands is the ECR:WEV model which incorporates the Wetland Ecological Valuation (WEV) tool[32]. There is currently no standard approach for determining an appropriate multiplier for the loss of wetland values. An equivalent—albeit much simplified—version of the Stream Ecological Valuation offsetting tool, the WEV, has been developed by RMA Ecology Ltd in conjunction with Auckland Council and applied to several dozen wetland offsetting projects in the Auckland region, and has recently been applied to, and accepted by Greater Wellington Regional Council, for the Plimmerton Farm Stage One consented land development project at Plimmerton, Wellington. The assessment method is thorough and based on the Clarkson Handbook for Monitoring Wetland Condition (Clarkson *et al.* 2003).

As with an SEV, a WEV gives a wetland a score based on ecological functionality. The WEV score can be used for developing a model for any mitigation or offsets that may be required if a wetland is to be adversely affected by a development.

The model is a standard area-condition calculation based on the NPS-FM wetland delineations and the WEV condition scoring tool. The currency of change in condition is calculated as a proportion of the expected enhanced state. The future state is incorporated into the model by estimating a potential state of the wetlands (see below for assumptions and justification of potential states).

The WEV method uses 'before' and 'after' WEV scores from wetlands at impact and offset sites to calculate an Ecological Compensation Ratio (ECR). This ratio represents a multiplier to be applied to an offset site wetland area to meet equivalence properties so that the exchange achieves a no-net-loss outcome.

The ECR formula is:

$$ECR = \frac{Impact\ Site\ Potential - Impacted\ State}{Offset\ Site\ Potential - Offset\ Site\ Current} \times Discount\ Multiplier$$

In the like-for-like wetland offsetting, the corresponding variables are as follows:

- *WEVi-P* = *Impact Site Potential* = Predicted future ecological value of the impact wetland.
- *WEVi-I* = *Impacted State* = Post impact value of the impact wetland.
- *WEVm-P* = *Offset Site Potential* = Predicted future ecological value of the offset wetland.

[32] Add reference to WEV method

- *WEVm-C = Offset Site Current* = The current ecological value of the offset wetland.
- *DM = Discount Multiplier* = Based on a 1.5 multiplier that incorporates time lags, risk and uncertainty over a 15-year period of gains achieved from enhancement and uplift.

Once all the impacts and all the available offsets have been documented, an exhaustive-based allocation algorithm computes how impacted wetlands can be offset in extent and value with available offset wetlands.

The allocation algorithm (Appendix M) matches each impact to the available offset sites by converting impact area into an ECR-scaled offset value and then drawing down each site's remaining capacity until the impact is covered or all capacity is exhausted.

1. For each impact, the algorithm iterates through offset sites in a chosen order. It first avoids invalid pairings where the offset has no achievable gain.
2. For valid pairings, it computes an Ecological Compensation Ratio (ECR) specific to that impact–offset pairing: *ECR = ((WEVi-P – WEVi-I) / (WEVm-P – WEVm-C))* × *DM*. The discount multiplier (DM) is set at 1.5 based on potential state in 15 years, aiming to address outcome uncertainty (as is standard for the SEV accounting method). This ECR scales the impact's remaining area relative to the offset (ECR × remaining impact area).
    i. If the offset site has remaining capacity of at least that amount, the impact can be fully allocated; the site's capacity is reduced accordingly and the impact is marked complete.
    ii. Otherwise, the offset site is partially used: the algorithm allocates impact value to all remaining capacity from the offset site, converts the remaining impact value back to an equivalent raw area of impact, reduces the remaining impact area accordingly, and proceeds to the next site.

The algorithm continues until impacts have been allocated or offsets have been used up.

To achieve no net loss of wetland area, wetland extent will be offset by constructing an area of wetland equal to or greater than the area of wetland removed. The area of wetland removal is 1.69 ha, none of which is listed as KCDC SNA.

Figure 42 shows where the areas of wetland loss are located. The quality of wetlands proposed to be removed is low, being highly degraded pugged and grazed exotic pasture with exotic and native rushes, and hydrology severely impacted by a network of drains, with very low habitat value for native birds and fish, other than eels.

The wetlands on site were clustered into groups of similar wetland type, biodiversity state, history, current land management, and projected management to form six wetland clusters that were used as the basis for wetland offsetting calculations (Appendix I).

Future potential states were calculated for each of these wetland clusters under (a) a baseline 'stewardship' state under assumptions in Appendices F and J, and (b) a potential restored state after 15 years of management. Restoration areas will be maintained by the applicant for a minimum of 10 years and will be monitored to assess success, with regular reporting to Council. Ongoing maintenance is assumed in order to ensure that wetland restoration areas (and those involving forest and stream restoration sites) maintain and improve their ecological development. Monitoring will be paired with on-going groundwater monitoring and informal stream flood flow behaviour to link wetland performance to the hydrological assessment set out in the Hydrological Report as the two are intrinsically linked.

The assumptions of these potential states are provided in Appendix L. The WEV ECR model uses a 1.5 multiplier to account for the time-lag for delivery of the biodiversity outcomes.

An area of wetland creation totalling 17,409 m^2 (1.74 ha) is modelled to offset the loss of wetland value at the site, of which 16,852 m^2 will offset loss of wetland extent. Constructed wetlands will be of significantly higher value than lost wetlands, which explains the similarity between wetland loss and gain required to offset value, even when incorporating a multiplier. In addition to extent and value offsets, there is sufficient area to provide an additional increase in wetland extent of 8,344 m^2 (Table 22) - so there can be no doubt that there is sufficient capacity to achieve a net gain in wetland extent and values. The final details will be settled at the detailed design stage and approved through the certified ERMP.

This constructed offset wetland consists of three clusters (Table 22 and Figure 37):

1. Offset Wetland Cluster 1 (OWC1) consists of four areas along the realigned reach of Ngarara Stream. These areas will be subject to periodic flood flows which will support wetland plant communities and also provide flood detention benefits. These areas retain peat soils up to 2 m deep and were historically a part of a wider wetland complex spanning the eastern flats.
2. Offset Wetland Cluster 2 (OWC2) is located adjacent to existing Wetland Cluster 2, and will expand this wetland, and link disconnected components by excavating several dune ridges, and most of a raised farm track causeway. These areas retain peat soils up to 1 m deep.
3. Offset Wetland Cluster 3 (OWC3) is located adjacent to existing Wetland Cluster 5, and will expand the two retained wetlands (W13 and W14) within this cluster on the southern boundary of the subdivision. Some of these areas have peat soils.

Table 22. Wetland area removed and created, by Wetland Cluster. Note, these areas include offsets and additional enhancements.

Wetland loss through infilling or reclamation		Areas available for wetland creation	
Cluster	Area (m^2)	Cluster	Area (m^2)
WC2	−7,182	OWC1	8,819
WC3	−1,118	OWC2	12,958
WC4	−1,569	OWC3	3,419
WC5	−6,982		
Total loss	16,852	Total area available	25,196
		The available for wetland creation demonstrates that a net gain of extent is achievable	

The existing vegetation at all proposed wetland areas is currently cultivated exotic pasture which does not have wetland vegetation. All offset wetland clusters will be formed by excavating down to the groundwater table. The project hydrologist confirms that reducing the RL ground level of these areas will result in underlying groundwater intersecting and providing sufficient water for the new wetlands. The substantial boundary shared with the retained wetland area that is proposed to be restored will further ensure that the hydrology of the new wetlands will be similar to that of the wider restored wetland area.

Offset Wetland Clusters 1 and 2 will form part of the stormwater detention area. Stormwater from the proposed development areas will be pre-treated within each development area prior to discharge into natural or restored wetlands. Therefore, the created wetland will not require maintenance for stormwater management and will be able to function as a natural wetland. No biomass will need to be removed (except weeds) for the wetland to maintain its stormwater functionality.

All of these created and restored wetlands will have stock excluded, be planted or enhanced with native vegetation, and have an average planted buffer width of approximately 10 m.

The WEV summary scores for wetland clusters are provided in Appendix J, and WEV–ECR calculations are provided in Appendix K. The three clusters of constructed wetlands fully offset the loss of area and value of impacted wetlands, because they have a much higher potential WEV score (Table 22).

Currently, WEV scores range from 0.39 (Wetland Clusters 2 and 3) to 0.72 (Wetland Cluster 1: Harakeke Swamp). Stock access, exotic vegetation, and pasture grasses are some of the main factors for low valuations. If minimal regulatory actions were implemented in the degraded wetlands, such as fencing and stock exclusion, these wetlands would likely attain WEV values between 0.47 and 0.72 (Table 23). However, with the restoration management actions suggested here and detailed in the ERMP, the WEV scores of degraded wetlands at site will attain between 0.70 and 0.81 at 15 years (Table 23). The additional restoration actions include hydrological modification and enhancement, enhancement planting, constructing detention swales, weed control and pest control, and buffer planting, among others.

Table 23. WEV scores associated with the current and potential states of wetland clusters at site depending on different management actions.

Wetland state	Management action	WEV score range (median)
Current wetland state	Agricultural and Forestry	0.39–0.72 (0.51)
Potential wetland state	Minimal regulatory actions	0.47–0.72 (0.55)
Potential wetland state	Offset recommendations	0.70–0.81 (0.78)

Note, late design updates resulted in an additional 126 m^2 of degraded wetland loss (SEV 0.47), and 7,270 m^2 of additional wetland creation (SEV 0.78). These changes are not incorporated in the reported ECR model calculations, but are included in the tables of total areas. Given the small area of loss and its low value score, and the large area of wetland creation and its high value score, there is no doubt this represents a substantial ecological net gain in both wetland area and value.

Table 24. Summary of offset calculations regarding extent feasibility (1a–c) and WEV–ECR allocations (2a–d).

Summary	Calculation	Wetland area (m^2)
1a) Impact extent	*sum*	16,726.1
1b) Creation extent availability	*sum*	17,926.4
1c) Creation balance	*1b – 1a*	1,200.3
2a) Offset capacity	*sum*	17,926.4
2b) Minimum ECR requirement	*WEV–ECR*	17,409.0

2c) Offset stock consumed	*sum*	17,409.0
2d) Total offsets remaining	*2a – 2c*	517.5

Enhancements of the extensive existing wetlands (retained wetlands) do not form part of this offset package as the ecological benefits that will be achieved in those areas are provided as additional benefit separate from residual effects management.

The extensive enhancement of existing degraded wetlands across the site will be undertaken as part of the ecological objectives of this project and will result in a significant ecological benefit that is substantially more than required to manage the identified adverse ecological effects.

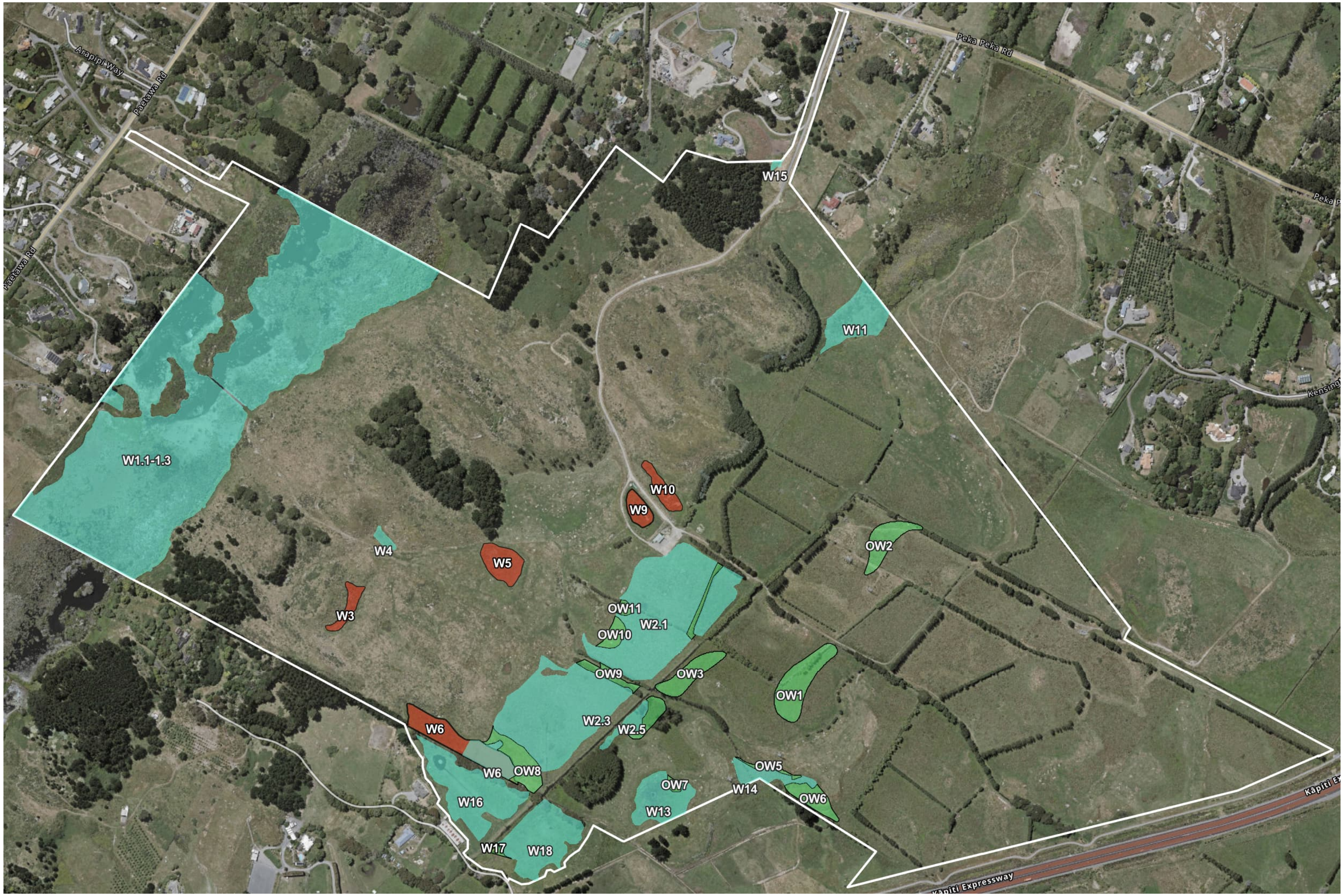


Figure 42. Wetlands retained (cyan polygons), removed (red polygons) and created (green polygons).

5.0 Monitoring and reporting

5.1 Monitoring

Monitoring will be undertaken to track progress towards targets and to enable the identification of management issues so that corrective actions can be taken. In certain cases, adaptive management approaches will be taken.

5.1.1 Revegetation Monitoring

The targets for wetland and stream buffer mitigation planting programmes, dune shrubland mitigation planting, are to reach 80 % canopy cover and maintain 80 % of planted species diversity over the areas specified for ecological mitigation. The target for dune treeland planting is to establish the specified number of trees (550) to at least 2 m height, and to maintain 80 % of planted species diversity.

Monitoring will be undertaken at 3 months, and annually for 5 years after planting until the relevant targets are achieved. Monitoring will apply to all mitigation plantings, including node planting and dense planting across wetland, stream and wetland margin, as well as terrestrial plantings undertaken for ecological purposes. Amenity or landscape planting that provides ancillary benefits will not be subject to compulsory monitoring or the 80 % cover target.

Monitoring methods and timelines are detailed in the ERMP.

5.1.2 Offset wetland monitoring

Wetland offsetting calculations were analysed using the ECR:WEV method. The ECR method includes a discount multiplier which incorporates a 15-year time horizon for addressing uncertainty. Monitoring will be completed at years 1, 2, 5, 10, and 15 after wetland creation. Monitoring will reassess WEV scores of the offsetting wetlands. The targets will be the WEVm-P values in the ECR:WEV model in this report (see Section 4.3.1; Appendix K).

Attributes in the WEV assessment relating to neighbouring property activities, or attributes of catchment wide processes will be excluded from the assessment if they have deteriorated. Instead, attributes related to neighbouring properties will be incorporated at baseline values used for the ECR modelling in this report.

Monitoring methods and timelines are detailed in the ERMP.

5.1.3 Retained wetland monitoring

The target is no deterioration in value or extent of retained wetlands. Monitoring will be undertaken as a baseline within 3 months of commencing earthworks, and then twice-yearly during the duration of earthworks, and once within 9 months following the completion of earthworks.

Monitoring will follow NPS-FM wetland assessment protocols, and will be undertaken in retained wetlands. This includes a 3 m × 3 m wetland vegetation plot in the main vegetation communities which are representative of the wetland. In the plot, plant species are assessed based on wetland status rankings, and metrics are calculated, including tests of wetland plant Dominance and Prevalence.

Species composition is expected to change; deterioration of value is determined when the NPS-FM wetland assessment protocol rejects wetland status. If deterioration is determined, then adaptive management will be triggered, the cause investigated and remediated. Similarly, wetland extent will also be assessed for any sign of contraction or unwanted deposition. If extent has been adversely affected, then adaptive management will be triggered, the cause investigated and remediated.

5.1.4 Stream monitoring

The realigned reach of Ngarara Stream will be subject to SEV monitoring to ensure the current SEV of 0.422 is matched or exceeded (Appendix D). Monitoring will be completed at years 1, 2, 5, and 10 after stream realignment, and will take place over at least three 100 m reaches of the realigned reach.

Stream buffer riparian planting will be subject to the same monitoring requirements as other revegetation components (section 5.1.1) and is detailed in the ERMP.

Stream water quality monitoring is outlined in the ESCP/ Hydrology/Stormwater Management Plan.

5.1.5 Pest control monitoring

Pest animal and plant control monitoring is specified in the ERMP.

5.1.6 Additional enhancement monitoring

Where enhancements are undertaken within degraded wetlands, dune vegetation and drains, and the enhancements are additional to mitigating adverse effects, targets are excluded. Maintenance will be required for the first three years post-planting, and monitoring will be required at years one (1) and two (2).

5.2 Reporting

Written confirmation will be provided to GWRC, within 30 days following final completion of the restoration and enhancement works.

A monitoring report will be submitted to GWRC after each monitoring season, with all monitoring components within that year. The monitoring report will include:

- The date(s) of the inspection(s);
- The type(s) of inspection(s);
- The person(s) carrying out the inspection(s) and their qualifications;
- The results of the monitoring described above; and
- Recommended changes to the management regime.

At the completion of the canopy cover target monitoring period, and the 15-year wetland offsetting period, a report will be submitted to the Council by a suitably qualified ecologist summarising the outcomes of the planting and maintenance in accordance with this plan. At this point a decision will be made by the consent holder and GWRC as to the ongoing scope and duration of the monitoring and maintenance programme.

5.3 Mechanisms for protection

The ecological features onsite will be vested as private open space:

- The dune restoration area (including the Lizard release site) will be vested as Private Open Space (Dune Ridgeline); and
- SNA wetlands and their planted buffers will be vested as Private Open Space (Ecological); and
- All other wetlands and their buffers will be vested as Private Open Space (Wetland Restoration), with the exception of wetland 4, which lies within the Private Open Space (Dune Ridgeline);

In cases where there is an infringement of a Lot boundary into the 10 m margin, a Wetland Interface Zone Covenant will be placed on the lot title to restrict development of impervious surfaces in the lot to outside of the 10 m wetland setback., which limits planting to specific species (See Landscape Planting report and package). Maps are provided in Appendix R.

At the Paetawa Rd development, areas within 20 m of Te Harakeke Swamp wetland will have a Buffer Covenant placed on the lot title to restrict development of impervious surfaces to outside of the 20m wetland setback, and to require establishment of wetland buffer vegetation, with the same densities and species compliments as specified for wider wetland buffer planting (specified in the ERMP).

The lizard release site (Figure 42) will be encumbered by a consent notice to ensure it will be physically protected in perpetuity regardless of current land ownership or any future ownership/tenure changes. Physical protection will apply regardless of whether any lizards are salvaged or released.

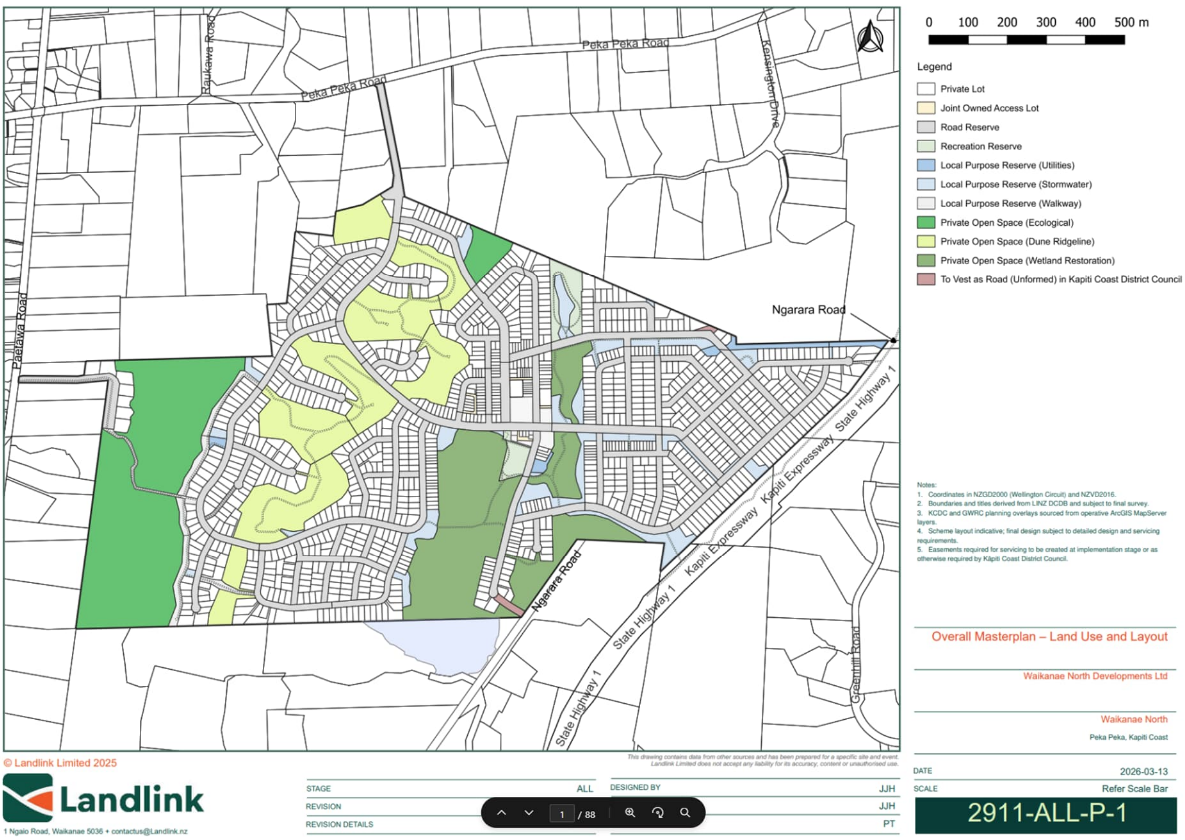


Figure 40. Site Master Plan illustrating legal status of ecological features (courtesy of Landlink Ltd).

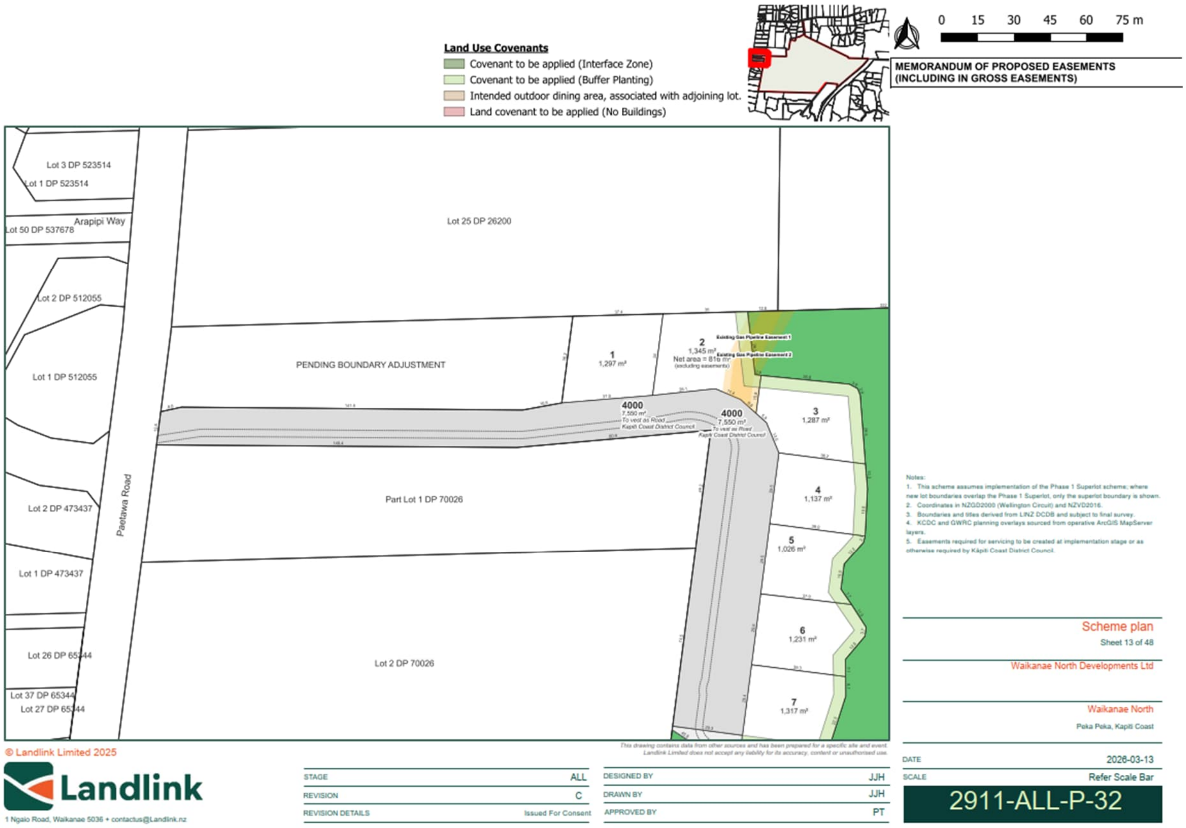


Figure 41. Location of Buffer Covenants on parts of the Paetawa Road lots within 20 m of Te Harakeke Swamp (courtesy of Landlink Ltd).

Figure 42. Lizard release site (green outline), dune ridgeline private open space reserve (pink polygon), dune shrubland planting zones (violet blue polygons), dune treeland planting zones (light blue polygons), retained dune shrubland/tussockland (light green polygons), and retained dune treeland (dark green polygons).

6.0 Conclusions and recommendations

WNDL is developing its landholding at 169-171 Peka Peka Road, which it intends developing into suburban housing with a commercial centre and associated infrastructure, as well as proposed ecological restoration and enhancement. The development will be staged over ten phases.

The development area is currently an active farm, having had most of the original native vegetation removed, and is now dominated by exotic pasture. Native wetland vegetation exists within two SNA wetlands. Fragments of native terrestrial scrub, rushland, and scattered trees exist on a stable dune ridge. Native northern grass skink is present within dune areas. At Risk classified crake and fernbird exist within the Te Harakeke Swamp wetland. Access by stock to all areas has resulted in severely degraded wetlands and diminished ecology.

The proposed development is extensive and includes roads, and urban and commercial areas with associated infrastructure. The footprint of the project will avoid most of the high and moderate value ecological features at the site. However, there are some adverse effects due to the engineering constraints to manage landforms in order to provide access roads, building platforms, and stormwater management. Adverse effects include the permanent reclamation of 1.685 ha of wetland, the removal of 979 m of stream (2,965 m^2 stream bed area), the culverting (including weir culvert) of 76.9 m of stream, the clearance of 1,187 m^2 of indigenous trees and 1,773 m^2 of indigenous scrub and rushland on stable dunes, and the removal of 261 m^2 of the exotic-dominated KCDC SNA bordering Peka Peka Road Swamp (W6). Clearance of some high value lizard dune habitat will occur with potential effects on native lizards. An increase in domestic pets has the potential to impact on crake, fernbird and other wetland birds.

6.1 Mitigation and offsetting

Mitigation will minimise or remedy the severity of losses and reduce or eliminate the risk of adverse effects on most ecology values, including through:

- the use of erosion and sediment controls to prevent sediment from discharging into watercourses; and
- the salvage and relocation of native freshwater fauna and native lizards; and
- appropriate timing of earthworks near wetland habitats with high bird values; and
- onsite remediation of stream extent and values by realigning and restoring 979 m of un-culverted highly modified stream length (2,965 m^2 stream bed area) to 974 m of un-culverted meandered and naturally contoured stream and sufficient additional stream bed area to ensure that there will be a net gain in terms of overall stream extent, value and function; and
- the removal of 14.4 m of existing farm culverts over streams and the establishment of 76.9 m of culverts over streams, representing an overall increase of 62.5 m of low-value (SEV 0.2) stream habitat, with only a 5 m reduction in moderate value (SEV 0.42) un-culverted habitat.
- the bank recontouring and restoration planting of riparian margins along 384 m of retained lower Ngarara stream reach; and

- buffer planting of wetlands (totalling 7.26 ha) and streams (2.74 ha); and
- onsite mitigation of terrestrial indigenous vegetation through the planting of a minimum of 1.14 ha of dune shrubland or rushland and 0.7 ha of dune treeland; and
- pest animal control including control of domestic cats and dogs in sensitive SNA wetland habitat and dune restoration areas through requirements for dog leashes, trapping, and potentially partial cat exclusion fences.

This will result in a net gain of terrestrial indigenous vegetation extent, and overall, stream extent and values.

Residual losses to biodiversity will still occur despite these extensive mitigation measures. These include the loss of 1.69 ha of wetland area and the values and functions associated with those wetlands, all of which are highly degraded.

These wetland losses will be offset through the creation of new wetland areas adjoining and linking existing restoration wetland sites, to achieve no-net-loss of values. The available area for wetland offsetting totals 2.52 ha, which is 0.834 ha more than is needed to replace loss of wetland extent and values. Therefore, there can be a high degree of confidence of a net positive outcome when this additional is 0.834 ha of additionally available wetland restoration is undertaken.

The offset package to address residual effects on wetlands was calculated using an offset accounting tool. The package of enhancements estimated to provide for at least a no-net-loss outcome in values and extent includes the creation of 1.74 ha of high ecology value wetland.

The management actions required to establish and maintain these offset areas include stock exclusion and restoration planting of a margin averaging 10 m wide around wetlands, 10 m around both sides of streams, control of ecological weeds, control of animal pests (including domestic and feral cats within restoration areas), control of plant pests in planted areas, and active planting of ecologically appropriate native trees, shrubs, and ground cover species to protect and restore margins and edges, and to re-create habitat.

Restoration areas will be maintained by the applicant for a minimum of 15 years for planted areas and stream and wetland restoration sites, and will be monitored to assess success, with regular reporting to Council.

Assuming all of the mitigation and offsetting that is described in this document is undertaken, then the result will be a clear net-gain result for biodiversity across the site, through the replacement, increase, and enhancement of indigenous vegetation, providing habitats of indigenous species.

6.2 Management Plans

In order to effectively execute the mitigation and offsetting that is required, a suite of management plans accompany this application including the:

- Lizard management plan (LMP) – which prescribes the locations from which lizards will be salvaged, the methods and techniques used, the location at which salvaged lizards will be released, and the pest animal control and habitat enhancement that will be undertaken at the release location onsite. The lizard salvage programme will be managed by an appropriately experienced and qualified herpetologist;

- Native freshwater fauna salvage and relocation plan (NFFSRP) – which prescribes the locations from which native freshwater fauna will be salvaged, the methods and techniques used, the location at which salvaged freshwater fauna will be relocated to, and the habitat enhancement that will be undertaken at the site to support the population. The freshwater fauna salvage programme will be managed by an appropriately experienced and qualified freshwater ecologist;
- Ecological Restoration Management Plan (ERMP) – which describes the areas of wetland that will be restored and created, the areas of dunes that will be revegetated, the control of feral and domestic pests and pests to protect ecology values, the management that will be applied to weed, fence, and plant the restoration areas, maintenance to ensure successful establishment, including weed control and infill planting, and monitoring and reporting requirements. The monitoring component will draw in the underlying offset calculation basis for streams and wetlands, as well as setting WEV offset model outputs as management targets. The plan also incorporates revegetation monitoring, prescribing the methods, timing, frequency.

If the effects management package is applied as is recommended in this report, including the various actions to avoid, mitigate, and offset adverse effects, the resultant outcome will be the effective minimisation of impacts on ecology across the site, and the replacement, enhancement, restoration and protection of streams, shrublands, and wetlands to a level that results in a substantial net-gain outcome for the extent, values, connectivity and functions of indigenous ecological systems and native species at this site.

In addition, extensive additional areas of currently degraded wetland can be restored and managed for ecological gain. The resulting ecological gain from these additional available wetlands is not needed to address any effect of this project – rather, the gains from enhancing and protecting these additional wetlands would constitute a considerable net-benefit for ecology from this project.

Additional dune restoration planting is proposed as part of Landscape planting, utilising the same suite of species proposed for ecological restoration of dune treeland and shrubland/tussockland communities. These restoration areas will be undertaken as a programme of works by the Applicant that sits outside of this effects assessment and consenting process.

Appendix A - GWRC significance criteria

Significance criteria for indigenous vegetation and habitat in the Greater Wellington Regional Policy Statement.

3 **Policy 23: Identifying indigenous ecosystems and habitats with significant indigenous biodiversity values – district and regional plans**

District and regional plans shall identify and evaluate indigenous ecosystems and habitats with significant indigenous biodiversity values; these ecosystems and habitats will be considered significant if they meet one or more of the following criteria:

(a) **Representativeness:** the ecosystems or habitats that are typical and characteristic examples of the full range of the original or current natural diversity of ecosystem and habitat types in a district or in the region, and:

- (i) are no longer commonplace (less than about 30% remaining); or
- (ii) are poorly represented in existing protected areas (less than about 20% legally protected).

(b) **Rarity:** the ecosystem or habitat has biological or physical features that are scarce or threatened in a local, regional or national context. This can include individual species, rare and distinctive biological communities and physical features that are unusual or rare.

(c) **Diversity:** the ecosystem or habitat has a natural diversity of ecological units, ecosystems, species and physical features within an area.

(d) **Ecological context of an area:** the ecosystem or habitat:

- (i) enhances connectivity or otherwise buffers representative, rare or diverse indigenous ecosystems and habitats; or
- (ii) provides seasonal or core habitat for protected or threatened indigenous species.

(e) **Tangata whenua values:** the ecosystem or habitat contains characteristics of special spiritual, historical or cultural significance to tangata whenua, identified in accordance with tikanga Māori.

Appendix B – Lizard ACO survey results

Table B1. Recorded lizards from ACO triple-stacks during five days of survey checks on 6 - 10 October 2025.

Date	Centroid	ACO	Species	Sex	SVL (mm)	Original (mm)	Re-grown tail (mm)	Weight (w/ 3g bag)	Weight (g)	Notes
2025-10-06	3	3a	Northern grass skink		42	51		4.4	1.4	subadult
2025-10-06	14	14a	Northern grass skink							adult escaped
2025-10-06	11	11c	Northern grass skink		40	55		4.6	1.6	subadult
2025-10-06	11	11d	Northern grass skink	F	45	54		4.8	1.8	adult
2025-10-06	22	22c	Northern grass skink	M	56	59		7.3	4.3	adult
2025-10-06	22	22d	Northern grass skink	M	56	36	31	7.1	4.1	adult
2025-10-06	22	22d	Northern grass skink	F	48	57		5.9	2.9	gravid adult
2025-10-06	19	19c	Northern grass skink	M	57	20	35	7.2	4.2	adult
2025-10-06	19	19c	Northern grass skink							adult escaped
2025-10-06	19	19d	Northern grass skink							subadult
2025-10-06	19	19d	Northern grass skink							subadult
2025-10-06	19	19d	Northern grass skink	F						gravid adult
2025-10-06	19	19a	Northern grass skink	F						adult
2025-10-06	21	21d	Northern grass skink	M						adult
2025-10-06	21	21c	Northern grass skink							subadult

Date	Centroid	ACO	Species	Sex	SVL (mm)	Original (mm)	Re-grown tail (mm)	Weight (w/ 3g bag)	Weight (g)	Notes
2025-10-06	21	21a	Northern grass skink							subadult
2025-10-06	21	21a	Northern grass skink							subadult
2025-10-06	21	21a	Northern grass skink	M						adult
2025-10-06	20	20c	Northern grass skink	M						adult
2025-10-07	13	13c	Northern grass skink							adult escaped
2025-10-07	13	13b	Northern grass skink							adult escaped
2025-10-07	14	14b	Northern grass skink	M						adult
2025-10-07	20	20c	Northern grass skink	M						recapture
2025-10-07	21	21d	Northern grass skink							recapture
2025-10-07	21	21c	Northern grass skink							subadult
2025-10-07	19	19d	Northern grass skink							recaptured adult
2025-10-07	19	19d	Northern grass skink							recaptured subadult
2025-10-07	22	22c	Northern grass skink	M						recaptured adult
2025-10-07	9	9c	Northern grass skink							adult escaped
2025-10-09	13	13a	Northern grass skink							adult escaped
2025-10-09	14	14b	Northern grass skink							adult escaped

Appendix C – eDNA infographics

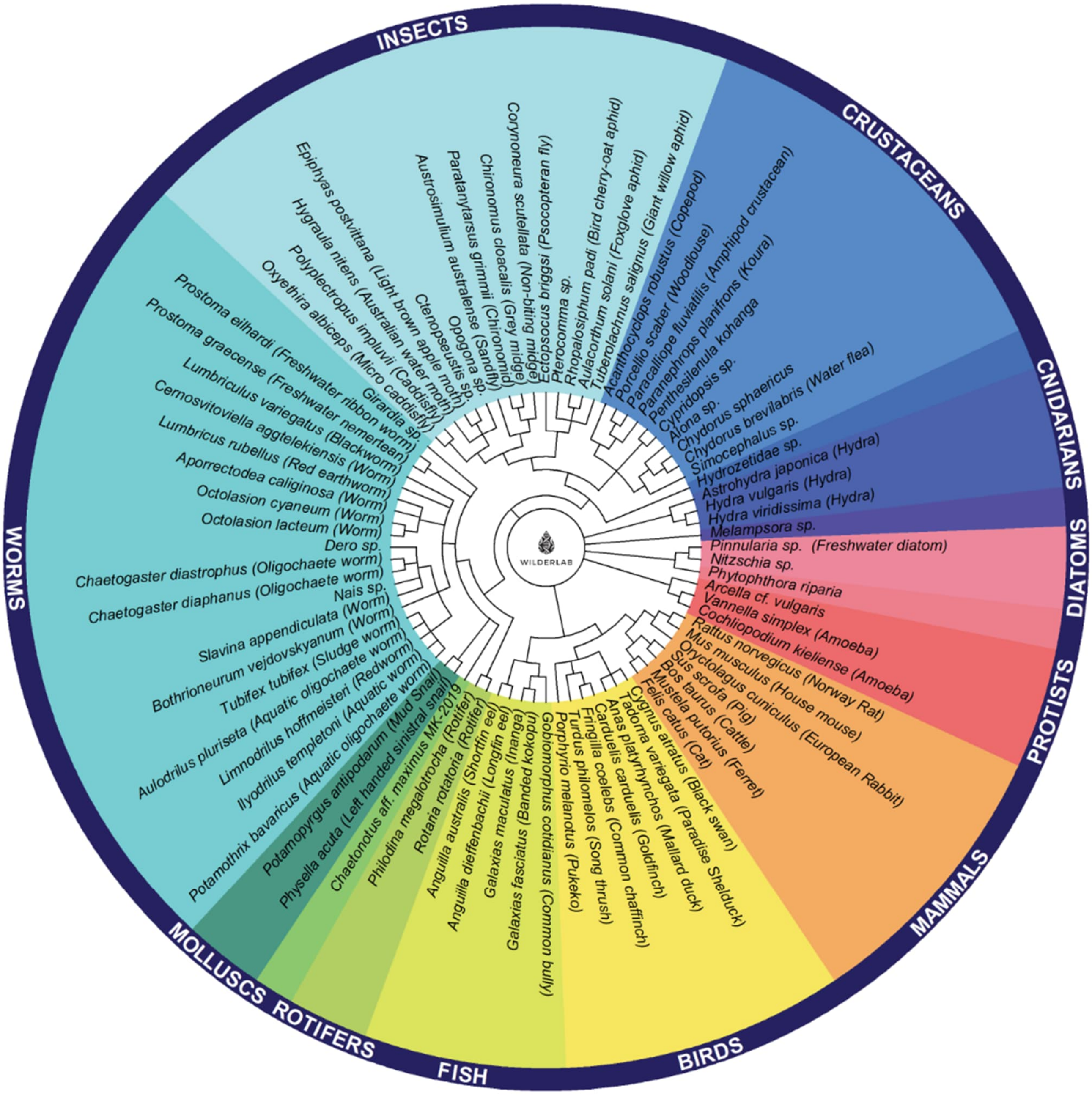


Figure C1. Detected taxa in Ngarara Stream (W1) from a 2024 sample, using Wilderlab eDNA kit and analyses. Species can go undetected in eDNA analyses; this may be incomplete.

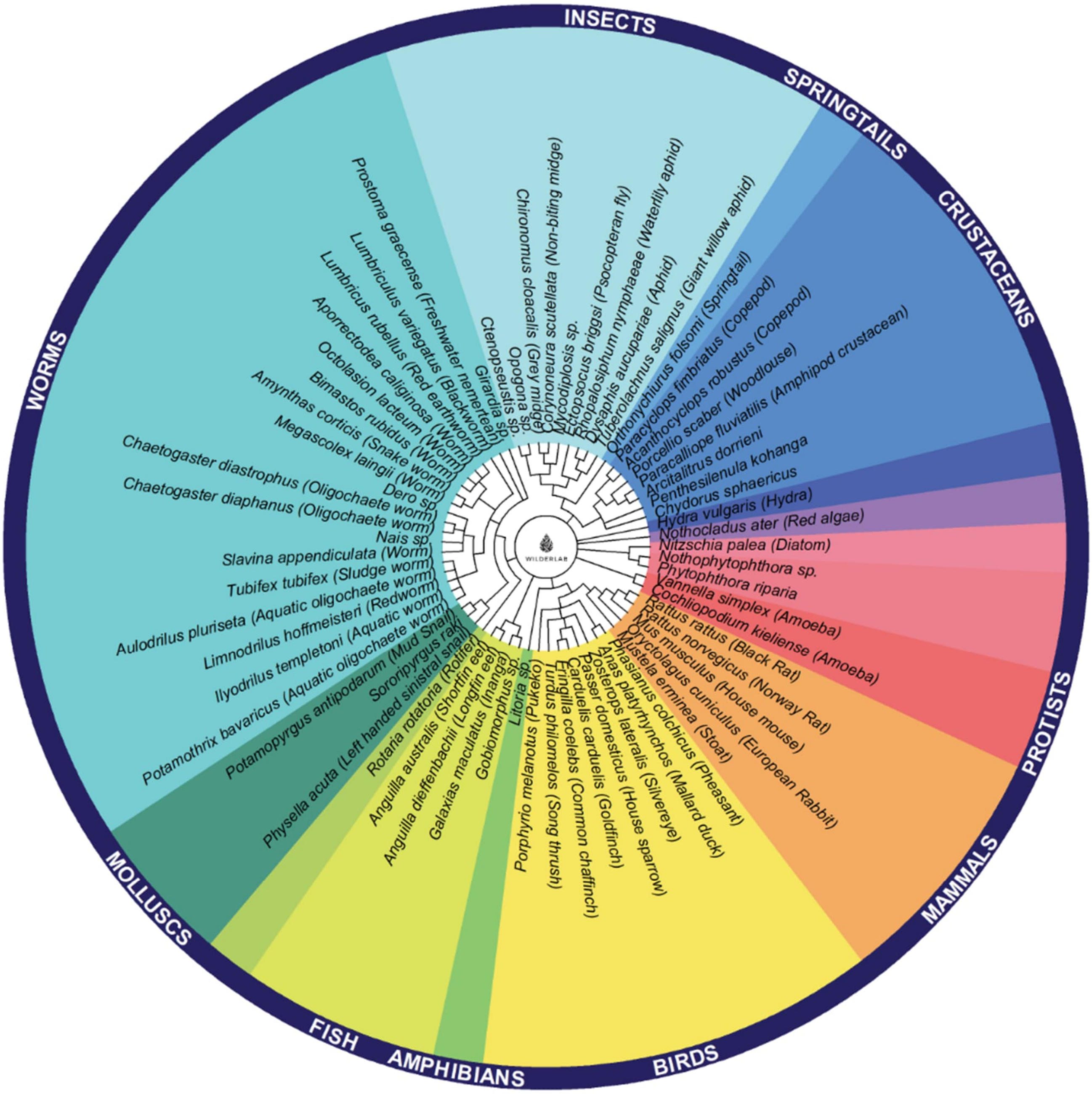


Figure C2. Detected taxa in an artificial watercourse (drain W1.1) from a 2024 sample, using Wilderlab eDNA kit and analyses. Species can go undetected in eDNA analyses; this may be incomplete.

Appendix D – SEV data for main watercourses

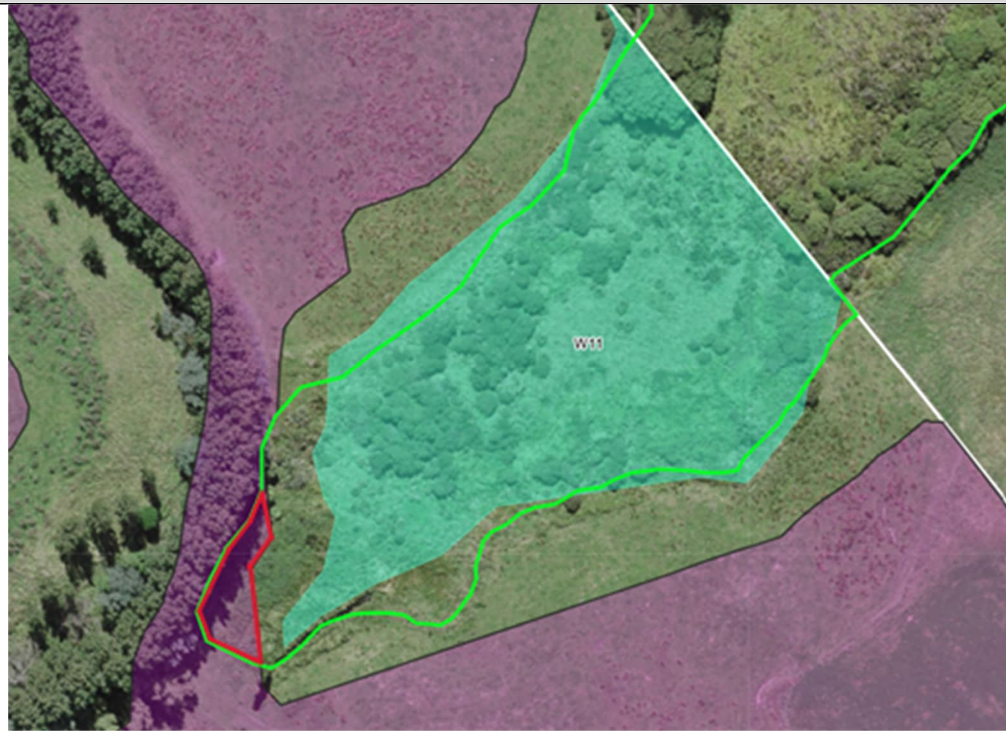
Function category	Report section*	Function	Variable (code)	Site name/number		
				W1 Ngarara Stream	W1.1 N drain	W1.1.1 S drain
			Vchann	0.10	0.10	0.10
			Vlining	0.80	0.80	0.80
			Vpipe	1.00	1.00	1.00
Hydraulic	4.1	NFR	=	**0.33**	**0.33**	**0.33**
			Vbank	0.20	0.20	0.20
			Vrough	0.57	0.63	0.64
Hydraulic	4.2	FLE	=	**0.11**	**0.13**	**0.13**
			Vbarr	1.00	1.00	1.00
Hydraulic	4.3	CSM	=	**1.00**	**1.00**	**1.00**
			Vchanshape	0.20	0.20	0.20
			Vlining	0.80	0.80	0.80
Hydraulic	4.4	CGW	=	**0.60**	**0.60**	**0.60**
			Hydraulic function mean score	**0.51**	**0.51**	**0.52**
			Vshade	0.40	0.40	0.46
biogeochemical	4.5	WTC	=	**0.40**	**0.40**	**0.46**
			Vdod	0.68	0.40	0.34
biogeochemical	4.6	DOM	=	**0.68**	**0.40**	**0.34**
			Vripar	0.27	0.25	0.22
			Vdecid	0.10	0.11	0.14
biogeochemical	4.7	OMI	=	**0.15**	**0.14**	**0.13**
			Vmacro	0.89	0.31	0.13
			Vretain	0.20	0.20	0.20
biogeochemical	4.8	IPR	=	**0.20**	**0.20**	**0.13**
			Vsurf	0.45	0.72	1.00
			Vripfilt	0.70	0.70	0.70
biogeochemical	4.9	DOP	=	**0.58**	**0.71**	**0.85**
			Biogeochemical function mean score	**0.40**	**0.37**	**0.38**
			Vgalspwn	0.00	0.00	0.00
			Vgalqual	0.00	0.00	0.00
			Vgobspwn	0.20	0.10	0.10
habitat provision	4.10	FSH	=	**0.10**	**0.05**	**0.05**
			Vphyshab	0.44	0.39	0.39
			Vwatqual	0.30	0.12	0.11
			Vimperv	0.80	0.80	0.40
habitat provision	4.11	HAF	=	**0.50**	**0.42**	**0.32**
			Habitat provision function mean score	**0.30**	**0.24**	**0.19**
			Vfish	-	-	-
Biodiversity	4.12	FFI	=	-	-	-
			Vmci	-	-	-
			Vept	-	-	-
			Vinvert	-	-	-
Biodiversity	4.13	IFI	=	-	-	-
			Vripcond	-	-	-
			Vripconn	-	-	-
Biodiversity	4.14	RVI	=	-	-	-
			Biodiversity function mean score	-	-	-
Overall mean SEV score (maximum value 1)				**0.422**	**0.398**	**0.394**

Appendix E – Wetland delineation plot data

	Site	Peka Peka Farm																																													
	Common name	Species	Indicator score	WP01	WP02	WP03	WP04	WP05	WP06	WP07	WP08	WP09	WP10	WP11	WP12	WP13	WP14	WP15	WP16	WP17	WP18	WP19	WP20	WP21	WP22	WP23	WP24	WP25	May25-1	May25-2	May25-3	May25-4	May25-5	WPOct25-7A	WPOct25-7B	WPOct25-7C	WPOct25-7D	WPOct25-8A	WPOct25-8B	WPOct25-8C	WPOct25-8D	WPOct25-8E	WPOct25-8F	WPOct25-8G	WPOct25-9A	WPOct25-9B	WPOct25-9C
Sapling / Shrub Stratum	mingimingi	*Coprosma propinqua* FAC	3																									10%																			
	mānuka	*Leptospermum scoparium* FAC	3																																						1%						
Herb Stratum	yarrow	*Achillea millefolium* FACU	4																													20%															
	creeping bent	*Agrostis stolonifera* FACW	2	15%	20%			25%	25%	3%	10%				18%							10%	18%			15%	80%		11%		14%		20%		15%			25%				15%	10%	20%	15%		10%
	beggars' ticks	*Bidens frondosa* FACW	2			20%																																									
	swamp kiokio	*Blechnum minus* FACW	2																																						2%						
	purei	*Carex secta* OBL	1																									30%													85%						
	cutty grass	*Carex geminata* FACW	2																									15%																4%			
	Starwort	*Callitriche stagnalis* OBL	1									3%																																			
	sneezeweed	*Centipeda cunninghamii* FACW	2									1%																																			
	mouse-ear chickweed	*Cerastium fontanum* FACU	4				2%					1%																																			
	fat hen	*Chenopodium album* FACU*	4															5%																													
	Californian thistle	*Cirsium arvense* FACU	4	2%									2%	3%		2%																															
	Scotch thistle	*Cirsium vulgare* FACU	4	4%			1%					3%		8%		1%																															
	cabbage tree	*Cordyline australis* FAC	3																													3%				17%											
	giant umbrella sedge	*Cyperus ustulatus* FACW	2																																30%	20%											
	cocksfoot	*Dactylis glomerata* FACU	4										1%																		10%		40%														
	wheki	*Dicksonia squarrosa* FACU	4																																	25%											
	tall willowherb	*Epilobium ciliatum* FAC	3																																					2%	2%						
		Erigeron sumatrensis FACU	4									1%														25%						2%															
	tall fescue	*Festuca arundinaceum subsp.*	3																																		12%										
	scrambling fumitory	*Fumaria Muralis subsp muralis*	5																																		20%										
	cleavers	*Galium aparine* FACU	4																													1%			7%	1%	2%										
	marsh bedstraw	*Galium palustre* OBL	1								12%	6%		28%		2%																												5%	12%		2%
		Geranium sp. FACW	2				1%																																								
	glaucous sweetgrass	*Glyceria declinata* OBL	1																																									30%			
	water fern	*Histiopteris incisa* FAC	3																																	12%	40%										
	Yorkshire fog	*Holcus lanatus* FAC	3	30%	2%	35%	20%			70%		2%			27%	2%	5%	7%	10%		25%	7%	12%	4%		5%		10%	15%	44%	10%	36%			5%	7%	15%	25%	85%			50%	35%		55%	75%	25%
		Hydrocotyle novae-zeelandiae FAC	3																																										3%		
		Isolepis prolifera OBL	1																																					100%	10%						
	soft rush	*Juncus effusus* FACW	2											8%	15%							12%				20%	40%		25%	1%	20%							20%	4%								
		Juncus sarophorus FACW	2		40%	50%		3%		30%	20%	10%			25%	12%				20%	3%	30%	55%	50%					30%									17%				7%	40%			25%	5%
	wind grass	*Lachnagrostis sp.* FAC*	3																																							1%					
	duckweed	*Lemna disperma* OBL	1																									25%												2%							
	perennial ryegrass	*Lolium perenne* FACU	4				30%	15%	12%				10%				2%																														
	lotus	*Lotus pedunculatus* FAC	3		1%		2%	2%	2%	2%	2%	2%			2%		4%				4%	3%				5%			2%	2%	5%				5%		5%	20%	3%		5%	3%		8%	10%	15%	7%
	water purslane	*Ludwigia palustris* OBL	1									22%								5%					30%																						
	loosestrife	*Lythrum hyssopifolia* FACW	2																								2%																				
	water forget-me-not	*Myosotis laxa* OBL	1											25%																																	
		Myriophyllum propinquum	1									1%																																			
	paspalum	*Paspalum dilatatum* FACU	4																			7%										10%															
	mercer grass	*Paspalum distichum* FACW	2																			30%																									
	water pepper	*Persicaria hydropiper* FACW	2									15%		12%				18%	55%	60%	3%	3%		30%	90%																1%		1%	40%			35%
	willow weed	*Persicaria maculosa* FACW	2																							60%																					
		Persicaria punctata FACW	2			50%																																									
	harakeke / swamp flax	*Phormium tenax* FACW	2																																	12%											
	inkweed	*Phytolacca octandra* FACU	4															5%																													
	narrow leaved plantain	*Plantago lanceolata* FACU	4	2%												1%		3%	4%				7%																						2%		
	necklace poplar	*Populus deltoides* FACU	4	60%																																											
	creeping buttercup	*Ranunculus repens* FAC	3	25%	55%		12%	25%	35%	18%	45%	1%		4%	6%	1%	15%	7%		1%	45%	20%	10%	13%			5%	10%	15%	38%	40%		30%					15%				35%	20%	15%	10%	10%	10%
	marsh yellow cress	*Rorippa palustris* OBL	1													5%		10%	12%	3%																								2%			
	blackberry	*Rubus fruticosus* FAC	3	2%	5%																														40%	10%											
	clusted dock	*Rumex conglomeratus* FAC	3																																							2%			10%		
	broad-leaved dock	*Rumex obtusifolius* FAC	3	4%			7%	5%	10%	1%	3%	1%		2%		4%	2%	25%	8%	8%	20%	2%		1%					2%	1%	1%	2%	3%					2%	1%								
	grey willow	*Salix cinerea* FACW	2																															55%	15%		60%										
	velvety nighshade	*Solanum chenopodioides* FAC	4										2%					12%																													
	poroporo	*Solanum laciniatum* FACU*	4																																						1%						
	black nightshade	*Solanum nigrum* FACU	4															5%	5%																												
	prickly sow thistle	*Sonchus asper* FACU	4															5%																													
	sow thistle	*Sonchus oleraceus* FACU	4																7%																												
	chickweed	*Stellaria media* FACU	4																			2%										1%	7%														
	dandelion	*Taraxacum officinale* FACU	4											1%																																	
	white clover	*Trifolium repens* FACU	4				2%		1%			2%						1%			1%																		10%								
	raupō	*Typha orientalis* OBL	1																									3%													5%						
	Total cover			144%	123%	155%	77%	75%	85%	124%	92%	71%	15%	91%	93%	30%	28%	103%	101%	97%	101%	126%	102%	98%	120%	130%	127%	93%	100%	86%	100%	75%	100%	55%	117%	104%	154%	124%	103%	104%	112%	113%	106%	124%	117%	125%	94%
	% pasture grasses			32%	3%	35%	54%	17%	15%	72%	2%	6%	11%	0%	29%	3%	11%	11%	14%	0%	30%	17%	19%	4%	0%	10%	0%	10%	17%	46%	25%	66%	40%	0%	10%	32%	20%	45%	98%	0%	5%	53%	35%	8%	67%	90%	32%
	Prevalence Index (Hydrophytic vegetation ≤3)			3.4	2.5	2.2	3.4	2.8	2.9	2.7	2.4	1.8	4	1.7	2.4	2.3	3.1	3	2.4	2	3	2.4	2.4	2.2	1.8	2.5	2	1.6	2.3	3	2.8	3.5	3.3	2	2.5	2.9	2.9	2.5	3.1	1	1.2	2.8	2.5	1.9	2.7	2.8	2.4
	Pasture exclusion			No	No	No	Yes	No	No	Yes	No	No	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No	Yes	No	No	No	No	No	No	Yes	No
	Dominance test score (>50%) for OBL, FACW, or FAC			Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Prevalence Index (≤ 3.0)			No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	All or most dominants FAC?			Yes	No	No	No	No	No	Yes	No	No	No	No	No	No	Yes	No	No	No	Yes	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No	Yes	No
	Hydric Soil Present			No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	-	-	-	Yes	Uncertain	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Wetland Hydrology Present			No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	-	-	-	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	NPSFM wetland (Yes or No)			No	Yes	Yes		Yes	Yes		Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
	RMA Wetland (Yes or No)			No			Yes			Yes			No																			Yes							No							Yes	
	pasture grasses	*denotes species with no indicator rating. Expert judgement / similar taxa used to assign suggested rating																																													

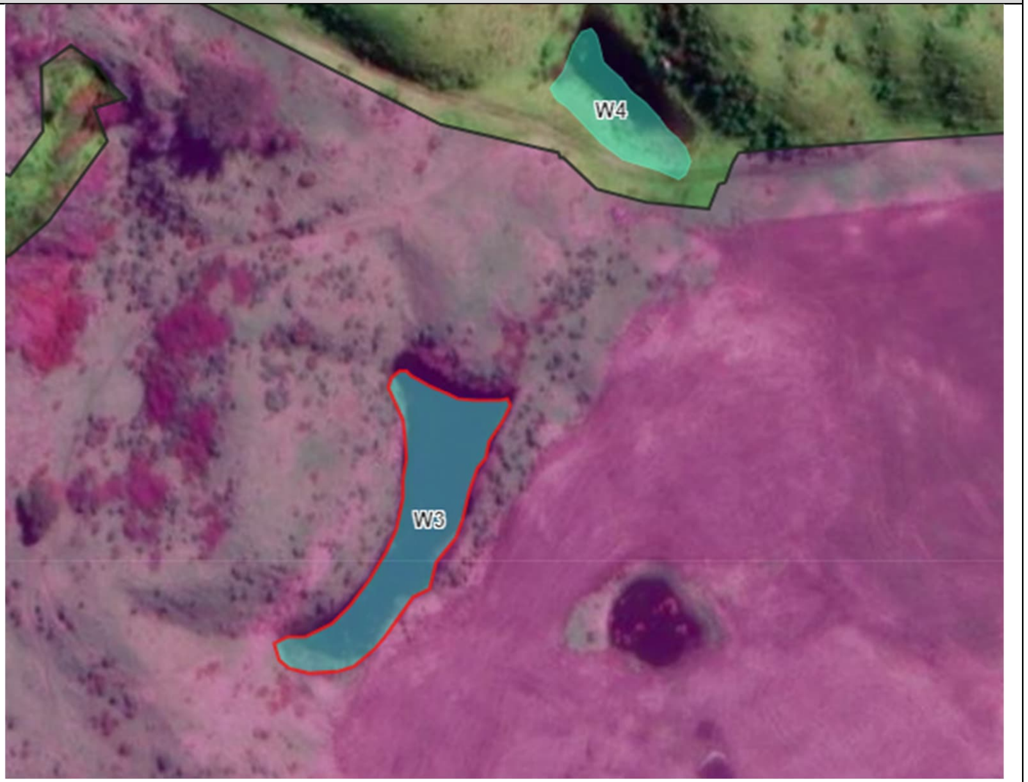
Appendix F - Details of proposed losses of ecological features

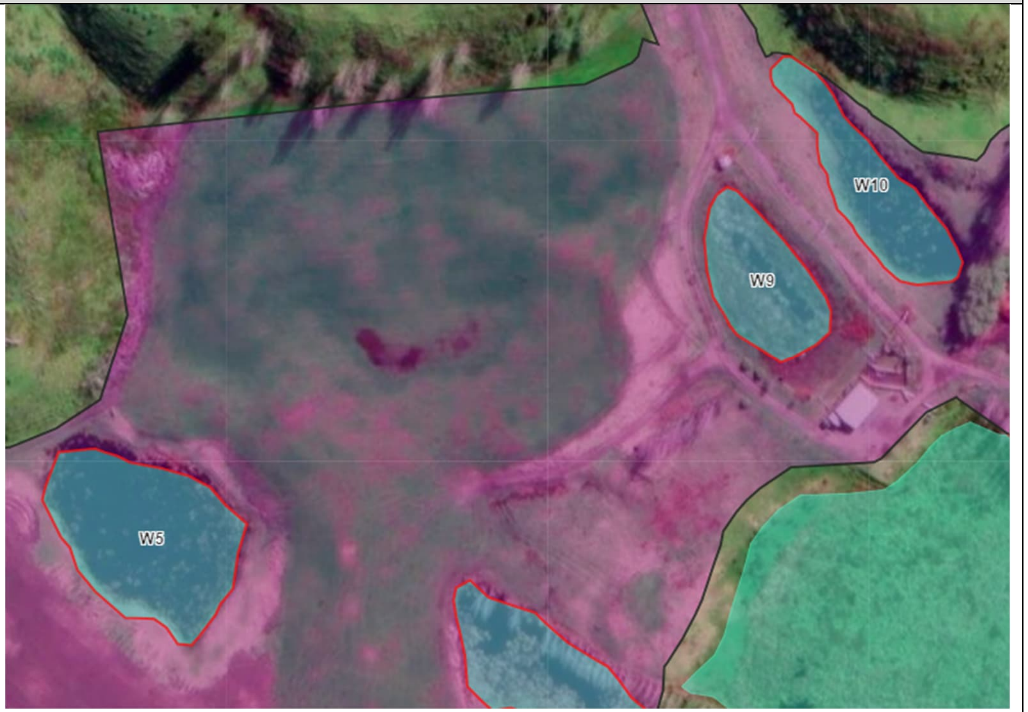
Table E1. Affected ecological features, the level of effect, and justification for loss.

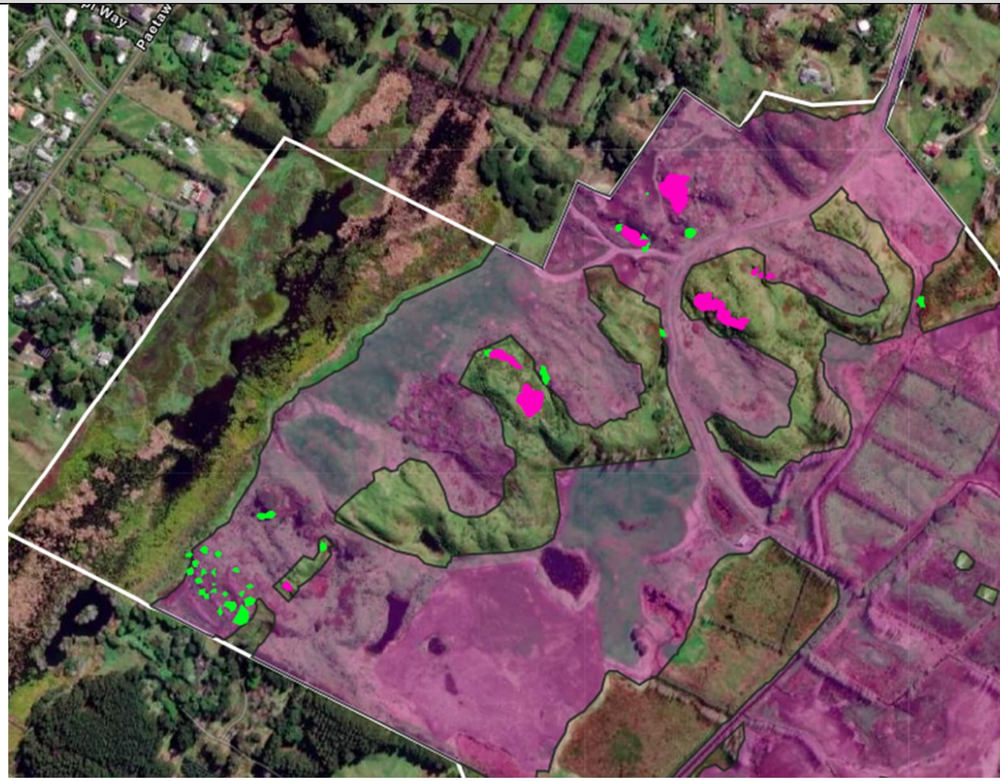
Feature	Ecological value, magnitude of effect, consequent level of effect	Map showing affected components of feature
SNA K060 Peka Peka Road wetland (W11)	Clearance of 261 m^2 of non-wetland bordering wetland 11. The area is dominated by exotic weeds, including blackberry and grey willow, as well as a patch of *Muehlenbeckia australis*, several mature flax bushes, and a cluster of four mature *Cordyline australis* and four *Dicksonia squarrosa.* The impacted SNA area provides key ecosystem services such as buffering the wetland, filtering runoff and reducing edge effects. The ecological value of this wetland margin is moderate. This SNA has an area of 4.4 ha of which 0.0261 ha (0.59 %) will be permanently lost. The magnitude of the effect is low. The consequent level of effect is moderate.	 Wetland 11 (cyan polygon), SNA (green outline), earthworks extent (purple polygon). The area of vegetation loss is delineated by the red outline.
WC2 Ngarara Stream Wetland Cluster	These wetlands are dominated by native broom rush (*Juncus sarophorus*) amongst exotic pasture with Yorkshire fog (*Holcus lanatus*), creeping bent (*Agrostis stolonifera*) and creeping	

Feature	Ecological value, magnitude of effect, consequent level of effect	Map showing affected components of feature
	buttercup (*Ranunculus repens*), therefore the site scores low-moderate for representativeness. Around 97 % of wetlands have been lost in the Wellington Region meaning that this ecosystem type is regionally threatened. Also, swamps are particularly impacted nationally; therefore, the site scores high for rarity/distinctiveness. These wetlands are moderately large in size, are buffered only by pasture, and are not stock excluded. They provide key ecosystem services such as improving water quality for the adjacent Ngarara Stream, floodwater retention and carbon sequestration (with peat soils present); the wetlands therefore score high for ecological context. The ecological value of this wetland cluster is moderate. This wetland cluster has an area of 6.3005 ha, of which 0.7181 ha (11.4 %) will be permanently lost. The magnitude of the effect is high. The consequent level of effect is moderate.	 Area of wetland removal (outlined in red) and wetlands (cyan polygons), earthworks extent (purple polygon). Note, W5 is part of WC5, described below.

Feature	Ecological value, magnitude of effect, consequent level of effect	Map showing affected components of feature
WC3 Lower Ngarara Stream Wetland Cluster	This wetland is severely degraded by drainage, and dominated by exotic pasture, with very few native species. The ecological value of this wetland cluster is moderate. This wetland cluster has an area of 2.3476 ha of which 0.1118 ha (4.8 %) will be permanently lost. The magnitude of the effect is moderate. The consequent level of effect is moderate.	 Area of wetland removal (outlined in red) and wetlands (cyan polygons), earthworks extent (purple polygon).

Feature	Ecological value, magnitude of effect, consequent level of effect	Map showing affected components of feature
WC4 dune edge Wetland Cluster	The ecological value of these wetlands is moderate. This wetland cluster has an area of 0.2214 ha, of which 0.1569 ha (71 %) will be permanently lost. The magnitude of the effect is very high. The consequent level of effect is high.	 Area of wetland removal (outlined in red) and wetlands (cyan polygons), earthworks extent (purple polygon).

Feature	Ecological value, magnitude of effect, consequent level of effect	Map showing affected components of feature
WC5 Eastern Wetland Cluster	The ecological value of this wetland cluster is moderate This wetland cluster has an area of 1.5902 ha, of which 0.6987 ha (44%) will be permanently lost. The magnitude of the effect is very high. The consequent level of effect is high.	 Area of wetland removal (outlined in red) and wetlands (cyan polygons), earthworks extent (purple polygon).

Feature	Ecological value, magnitude of effect, consequent level of effect	Map showing affected components of feature
Indigenous dune vegetation	Small pockets of indigenous vegetation within the central dune ridge include individual of groups of 2-3 native ngaio, māhoe and cabbage trees, as well as patches of *Muehlenbeckia complexa*, *Ficinia nodosa* scrub, and rushland, providing habitat to native northern grass skink. Indigenous vegetation on stable dunes is an endangered ecosystem type, and constitutes indigenous vegetation on an Acutely Threatened land environment, which score the site high for rarity/distinctiveness and ecological context. Representativeness and diversity and pattern are moderate, due to the isolated and/or weedy state of these pockets of indigenous vegetation. The ecological value of these areas of indigenous vegetation on stable dunes is high. This indigenous dune vegetation has an area of 1315 m^2 of indigenous trees on the property, of which 1,187 m^2 (90 %) will be lost, and 4,226 m^2 of indigenous scrub and rushland on the property, of which 1,773 m^2 (42 %) will be lost. The magnitude of the effect is very high. The consequent level of effect is very high.	 Indigenous trees (green polygons), indigenous scrub and rushland (solid crimson polygons), and earthworks extent (purple polygon). The area of clearance is the intersection of earthworks extent and indigenous dune vegetation.

Appendix G – EIANZ effects assessment tables

Table 5 Factors to consider in assigning value to terrestrial species for EcIA

Determining factors	
Nationally Threatened species, found in the ZOI either permanently or seasonally	Very High
Species listed as At Risk – Declining, found in the ZOI, either permanently or seasonally	High
Species listed as any other category of At Risk, found in the ZOI either permanently or seasonally	Moderate
Locally (ED) uncommon or distinctive species	Moderate
Nationally and locally common indigenous species	Low
Exotic species, including pests, species having recreational value	Negligible

Table 6. Scoring for sites or areas combining values for four matters in Table 4.

Value	Description
Very High	Area rates High for 3 or all of the four assessment matters listed in **Table 4**. Likely to be nationally important and recognised as such.
High	Area rates High for 2 of the assessment matters, Moderate and Low for the remainder, or Area rates High for 1 of the assessment maters, Moderate for the remainder. Likely to be regionally important and recognised as such.
Moderate	Area rates High for one matter, Moderate and Low for the remainder, or Area rates Moderate for 2 or more assessment matters Low or Very Low for the remainder Likely to be important at the level of the Ecological District.
Low	Area rates Low or Very Low for majority of assess-ment matters and Moderate for one. Limited ecological value other than as local habitat for tolerant native species.
Negligible	Area rates Very Low for 3 matters and Moderate, Low or Very Low for remainder.

Table 8. Criteria for describing magnitude of effect (Adapted from Regini (2000) and Boffa Miskell (2011))

Magnitude	Description
Very high	Total loss of, or very major alteration to, key elements/features/ of the existing baseline conditions, such that the post-development character, composition and/or attributes will be fundamentally changed and may be lost from the site altogether; AND/OR Loss of a very high proportion of the known population or range of the element/feature
High	Major loss or major alteration to key elements/features of the existing baseline conditions such that the post-development character, composition and/or attributes will be fundamentally changed; AND/OR Loss of a high proportion of the known population or range of the element/feature
Moderate	Loss or alteration to one or more key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be partially changed; AND/OR Loss of a moderate proportion of the known population or range of the element/feature
Low	Minor shift away from existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances or patterns; AND/OR Having a minor effect on the known population or range of the element/feature
Negligible	Very slight change from the existing baseline condition. Change barely distinguishable, approximating to the 'no change' situation; AND/OR Having negligible effect on the known population or range of the element/feature

Table 10. Criteria for describing level of effects (Adapted from Regini (2000) and Boffa Miskell (2011))

Ecological Value ▶ Magnitude ▼	Very high	High	Moderate	Low	Negligible
Very high	Very high	Very high	High	Moderate	Low
High	Very high	Very high	Moderate	Low	Very low
Moderate	High	High	Moderate	Low	Very low
Low	Moderate	Low	Low	Very low	Very low
Negligible	Low	Very Low	Very low	Very low	Very low
Positive	Net gain	Net gain	Net gain	Net gain	Net gain

Appendix H – Wetland WEV scoring and assumptions

Table F1. Wetland Ecological Valuation scoring table across the three (3) main components: Catchment, Wetland, and Buffer.

WEV - Catchment				
1. Catchment				
Component	ID	Attribute	Explanation or Description	Scoring
Catchment Descriptors				
Catchment descriptor	*1.1*	Land use affecting catchment hydrology	Upstream contributing sub-catchment linked directly to wetland. All sub-scores for proportion of catchment under land use must add to 1	% Urbanised - housing, infrastructure, built developments % Grazing pasture % Cropping, orchards, amenity, shelterbelts, rank pasture (not grazed) % Plantation forest % Shrublands or forest - native or exotic (not plantations) 1.1 land use score
Catchment descriptor	*1.2*	Diversion of flows	Presence of bores, drains, stormwater drains that divert water away from the wetland	0 Catchment heavily drained and flows diverted 3 Some drains diverting flows from wetland 5 No drains diverting flows from wetland
Catchment descriptor	*1.3*	Water quality in catchment	Signs or odours alluding to inflow of sediments, chemicals, excessive nutrients from e.g., septic tanks, roofs, stock, landfills, quarries, industrial sites	0 Severe pollution 1 Probable severe pollution 2 Probable moderate pollution 3 Possible mild pollution 4 Good water quality 5 Excellent water quality - no sign of sediment, pollutant, algae, or odours

Catchment descriptor	*1.4*	Mammalian predators in catchment	Suitable habitat is mostly woody vegetation, scrub, hedge lines or urban areas. Open ground, pasture, young pine forest is less suitable	0 Very high numbers, no control, a lot of suitable habitat (>50 %). 1 High numbers, little control and a lot of suitable habitat (>50 %). 2 Moderate–high numbers, little control and little suitable habitat (<50 %), or regular control but a lot of suitable habitat (>50 %). 3 Moderate numbers, some regular control, very little suitable habitat (<25 %). 4 Few numbers, intensive control, some key pests absent. 5 No mammalian predators in catchment.
Catchment descriptor	*1.5*	Key undesirable plants in catchment	Plants listed as invasive species in regional or national plant pest control plans	0 Catchment dominated by weeds. 1 5+ in moderate amounts. 2 5+ in low amounts. 3 1–4 undesirable species in low amounts. 4 A few (1–3). 5 None.
Catchment descriptor	*1.6*	Percentage of impervious surfaces in catchment	Use topographic map or aerial to assess within the sub-catchment contributing flow to the wetland	0 >75 % of catchment is in impervious surfaces 1 50-75 % of catchment is in impervious surfaces 2 25-50 % of catchment is in impervious surfaces 3 10-25 % of catchment is in impervious surfaces 4 <10 % of catchment is in impervious surfaces 5 0 % of catchment is in impervious surfaces
Catchment descriptor	*1.7*	% catchment in vegetation of any sort	Use topographic map or aerial to assess land area supporting vegetation vs concrete, bare soil, or other non-vegetative surfaces	0 < 5 % vegetation in whole catchment 1 6- 25 % vegetation in whole catchment 2 26–49 % vegetation in whole catchment 3 50–74 % vegetation in whole catchment 4 > 75 % vegetation in whole catchment 5 Whole catchment in vegetation
Catchment descriptor	*1.8*	Degree of runoff control – flood and first flush	Within the sub-catchment contributing to wetland water quality	0 Low (no control) over most of catchment 1 Mix of low and moderate control over most of catchment 2 Moderate control over most of catchment 3 Moderate control over most of catchment with high over remainder 4 High (much control) over most of catchment with moderate over remainder 5 High (much control) over all of catchment
Catchment descriptor	*1.9*	Wetland connections	Use topographic map or aerial to determine nearest wetland that is greater than 0.5 ha area. Measure from nearest edge of wetland	0 No other wetland >0.5 ha within 5 km radius 1 2.01–4.9 km to nearest wetlands >0.5 ha 2 1.01–2 km to nearest wetlands >0.5 ha 3 501–1000 m to nearest wetlands >0.5 ha 4 101–500 m to nearest wetland >0.5 ha 5 <100 m from other wetlands >0.5 ha

WEV - Wetland				
2. Wetland				
Component	Identifier	Attribute	Explanation or Description	Scoring
Wetland Descriptors				
Size and shape	2.10	Size	Size of wetland affects the range or communities and habitats that the wetland can support, and how sustainable those may be in the long term. Larger wetlands support a greater diversity of biodiversity and are, generally, more sustainable.	Size of wetland: 0 <0.25 ha area 1 0.25–0.5 ha area; 2 0.6–1.0 ha area 3 1.1–2.0 ha area 4 2.1–5 ha area 5 >5 ha area
Size and shape	2.2	Shape	Shape indicates the vulnerability of a wetland to plant invasion on the edges and the likelihood of environmental edge effects influencing interior communities. Divide wetland perimeter length (m) by area (m^2).	Perimeter to area ratio is: 0 >1 1 1–0.1 2 0.1–0.05 3 0.05–0.01 4 0.01–0.005 5 <0.005
Change in hydrology	2.3	Impact of artificial structures	Number, size, depth, effectiveness, and coverage of structures such as dams, drains, stop banks, tide gates etc within the wetland and in the contributing sub-catchment	Degree of modification caused: 0 extreme - totally dominated by structures 1 very high - Dominate wetland 2 high - affect 50-75 % of wetland 3 medium - affect 25 - 49 % of wetland 4 low - affect <25 % of wetland 5 very low to none - not affecting wetland's original condition
Change in hydrology	2.4	Water table depth	Water table change based on long-term plot data or hydrological monitoring data or local knowledge – ask the landowner or site manager, loss or decline of species requiring high water table e.g., aquatic and semi-aquatic species such as bladderwort.	Degree of modification to expected natural state: 0 extreme — Unable to be easily measured throughout season. Now a 'dryland' or totally flooded. 1 very high — very low or high for most of the year, not recharged fully by high rainfall events. Average water table much lower than previously. 2 high — Lowered or raised for long periods during dry-wet spells or has changed noticeably over time 3 medium — Noticeably higher or lower for short periods during dry-wet spells 4 low — lower or higher only occasionally and temporarily 5 very low to none — no detectable change from original condition

Change in hydrology	2.5	Dry-land plant invasion	Presence or detected increase of dryland vegetation (e.g. privet, gorse, pampas, māhoe, māpou, wattle, pine, kānuka, koromiko, ponga, browntop, sweet vernal, fireweeds, hawksbeard, clover).	Degree of modification to expected natural state: 0 extreme — all species in community are dryland species 1 very high — >75 % of wetland has dryland plants present 2 high — 50–75 % of wetland has dryland plants present 3 medium — 25–49 % of wetland has dryland plants present 4 low — <25 % of wetland has dryland plants present 5 very low —no dryland plants in wetland
Change in water or soil quality or state (physicochemical parameters)	2.6	Degree of sedimentation and erosion	Recent earthworks or freshly dug drains in the catchment. Abrupt change in soil colour if you dig a hole. Plants partially buried by sediment, or stained, or dirty looking from recent silt-laden floods. Water looks dirty. Soft mud easily disturbed underfoot or gumboots sink readily into deep mud.	0 All wetland character lost due to prolonged extreme turbidity, almost total infilling by sediment, or unchecked erosion and scouring or sedimentation. 1 Water clarity >160 NTU; or sediment over >75 % of wetland; Or widespread erosion, scouring or sedimentation. 2 Water clarity 121–160 NTU; or sediment in 50–75 % of wetland; Or widespread erosion or scouring or sedimentation over > 50 % of area. 3 Water clarity 81–120 NTU; or sediment in 25–49 % of wetland; Or erosion spots linked and causing minor structural damage. 4 Water clarity 41–80 NTU; or visible sediment deposits in <25 % of wetland; Or some minor spot erosion visible. 5 None: high water clarity (<40 NTU), no visible sediment, stable banks and soil.
Change in water or soil quality or state (physicochemical parameters)	2.7	Nutrient levels	Algal blooms or surface scum, stagnant water. High numbers of waterfowl or stock fouling wetland. Loss or decline of plants typical of low-nutrient (oligotrophic) conditions e.g. tangle fern, wire rush, sundews, *Baumea teretifolia* – compare with old species lists. Presence of tall or dense stands of high nutrient species e.g. most wetland weeds, along with raupō, flax, blue-green algae. Recent fires based on landowner account, charred trunks of woody species, visible ash deposits.	0 All wetland character lost due to nutrients or fire: now just a pond or dryland with no higher wetland plants present. 1 >75 % of wetland is almost continuous algal blooms or single species stands of high-nutrient plants. Or recent fires (<2 yr) affected over >75 % of wetland. 2 50–75 % of area shows algal blooms, increased nutrients or vegetation change to high-nutrient species. Recent fires (<2 yr) affected 50–75 % of wetland. 3 25–49 % of area shows algal blooms, increased nutrients or vegetation change to high-nutrient species. Recent fires (<2 yr) affected 25–49 % of wetland. 4 Localised (<25 %) or infrequent signs of algal blooms or changes in nutrient concentrations or veg. composition. Recent fires (<2 years) removed vegetation in <25 % of wetland. 5 No evidence of eutrophication or recent fire.

Change in ecosystem intactness	2.8	Loss in area of original wetland	Evidence from old maps or aerial images, areas of developed flat land or damp pasture adjacent to the wetland – particularly with drains through them. Presence of remnants of wetland vegetation. Obvious reclamation.	0 Wetland lost, or almost lost but remnants completely modified. 1 >75 % of original area lost, remnants still retain some original character. 2 50–75 % of original area lost. 3 25–49 % of original area lost. 4 <25 % of original area lost. 5 No loss: original wetland area essentially intact.
Change in ecosystem intactness	2.9	Recent vegetation damage or clearance	Areas of sprayed (brown or yellow) standing native vegetation, piles of slashed or crushed vegetation in or beside the wetland, signs of equipment having been in wetland to haul or bulldoze vegetation, charred or blackened vegetation. Don't confuse seasonal dieback of e.g. raupō or willow with sprayed vegetation.	0 All vegetation recently cleared from the wetland or dead from spraying or burning. 1 >75 % cleared or dead. 2 50–75 % cleared or dead. 3 25-49 % cleared or dead. 4 <25 % of wetland vegetation cleared or dead. 5 No clearance or spraying of native vegetation.
Change in ecosystem intactness	2.10	Hydrological barriers and connectivity	Presence of tide gates, stop banks, weirs, perched culverts separating wetland from riverine connections to other wetlands. Ring drains and box culverts around margin isolate wetland from catchment runoff and groundwater. Loss of riparian vegetation and buffer vegetation connecting wetlands to native forests, lakes and rivers.	0 Isolated: all former connections to other water bodies lost. 1 >75 % of connection lost with some minor links remaining. 2 50–75 % of upstream or downstream connection lost. 3 25–49 % of upstream or downstream connection lost. 4 <25 % of upstream or downstream connection lost. 5 None: All natural upstream and downstream connections retained.
Change in amount of animal damage and harvest by humans	2.11	Damage by stock or feral hoofed animals	Animals or detection of animals (dung) wetland. Browse damage to foliage, branchlets; soft, herbaceous, palatable plant species absent or greatly reduced in number and stature. Damage to bark, e.g., biting and scratching. Disturbance to substrate, e.g., deer wallows, pig rooting, pugging. Presence and effectiveness of stock fencing.	0 All wetland character lost due to severity of browsing and trampling activity. 1 >75 % of wetland heavily damaged. 2 50–75 % of wetland medium-heavily damage. 3 25–49 % of wetland showing medium-heavy damage. 4 <25 % of wetland showing light-medium damage; or very light or localised browsing or trampling damage throughout wetland, or heavy only at edge. 5 No domestic or feral animal damage.

Change in amount of animal damage and harvest by humans	2.12	Introduced predator impacts on wildlife	Presence of effective pest barriers, e.g. pest-proof fence or wetland on pest-free island. Information from pest or native bird monitoring data, or landowner accounts. Indirect evidence from predator tracks, scat counts. Presence of sensitive species such as fernbird, bittern, banded rail indicate low predator impacts.	0 Extreme: most native wildlife species extinct in wetland. Predator detection highly visible. 1 Severe declines in wildlife population and species number, or no predator control. Very high reinvasion from catchment predators and signs visible. 2 High declines in populations or loss of 1 or 2 wildlife species, or both; no or ineffective predator control; high reinvasion from catchment. 3 Medium predator impact, decline in numbers of some wildlife species; or control very intermittent or not all predators. Medium reinvasion from catchment. 4 Low levels of predators — susceptible wildlife species still present; or pulsed predator control. Low predator reinvasion from catchment. 5 No or virtually no predator access or impact; or wetland & catchment under long term effective predator control.
Change in amount of animal damage and harvest by humans	2.13	Harvesting levels	Includes harvest of eels, flax, whitebait, sphagnum moss, etc. Information from landowner, evidence of whitebait stands, tracks through the wetland, clearings where vegetation has been harvested, machinery or evidence of its use to harvest moss. Comparison with past species records and fauna and flora descriptions.	0 All wetland character lost due to harvesting activity, or at least 1 species now locally extinct. 1 >3 species regularly taken, or 1–3 species taken in high amounts, or moss harvest >50 % of the wetland. 2 1–3 species regularly taken in low to moderate amounts, or moss harvest from 25–50 %. 3 1–2 occasionally taken in moderate amounts, or >3 occasionally taken, or moss harvest from <25 % of the wetland. 4 1–2 species occasionally taken in small amounts. 5 No harvesting of native plants, birds, fish from site.
Change in dominance of native plants	2.14	Introduced plant canopy cover	Based on amount of wetland mapped as exotic vegetation types, e.g. willow forest, Glyceria reedland, or as seen from aerial photos or high vantage points. If exotics dominate a percentage of the wetland and are scattered through the rest, apply the next lowest score.	0 All canopy plants are introduced. 1 As above but for >75 % of the wetland. 2 As above but for 50–75 % of the wetland. 3 As above but for 25–49 % of the wetland. 4 <25 % of the wetland has canopy cover dominated by introduced plants, or introduced plants are present in the canopy throughout <25 % of the wetland. 5 All plants are native.
Change in dominance of native plants	2.15	Introduced plant understorey cover	If only one tier present, then score the same for canopy and understory. If exotics dominate a percentage of the wetland and are scattered through the rest, apply the next lowest score.	0 All or virtually all (>99 %) plants in understorey are introduced. 1 As above but for >75 % of the wetland. 2 As above but for 50–75 % of the wetland. 3 As above but for 25–49 % of the wetland. 4 <25 % cover of the understory is dominated by introduced plants, or introduced plants are present throughout <25 % of the wetland in the understorey. 5 Very few to no (<1 %) plants in understorey are introduced.

WEV - Buffer				
3. Buffer				
Component	Identifier	Attribute	Explanation or Description	Scoring
Buffer Descriptors				
Buffer descriptor	*3.1*	Animal damage	Animal presence detected in buffer. Browse damage to foliage, branchlets; soft, herbaceous, palatable plant species absent or greatly reduced in number and stature. Damage to bark, e.g., biting and scratching. Disturbance to substrate, e.g., deer wallows, pig rooting, pugging. Presence and effectiveness of stock fencing.	0 Animal (e.g. cattle, sheep, horse, deer, pig) trampling or grazing is severe around most of the perimeter, in places the actual wetland edge is hard to make out. 2.5 A few patches of severe trampling or grazing at the edge, or light damage around much of the edge. 5 No animal damage (e.g. if because wetland is securely fenced, or surrounded by wide drains, or not in grazing land).
Buffer descriptor	*3.2*	Weeds	Based on amount of buffer mapped as exotic vegetation types, or as seen from aerial photos or high vantage points. If exotics dominate a percentage of the buffer and are scattered through the rest, apply the next lowest score.	0 Most of the edge plants are weeds (non-native species), in any vegetation tier (canopy, shrub layer, ground layer). 2.5 Many exotic species (>3), or extensive patches of weeds, but mostly native plants at the edge. 5 No weeds, or a few 2–3 or exotic plants scattered around the edge (ignore weeds in pasture adjacent to the wetland).
Buffer descriptor	*3.3*	Canopy dieback	Based on a walkthrough assessment, aerial photos or high vantage points.	0 Severe dieback, many large patches (>3 strides long) of dead or dying native plants, or smaller patches scattered around most of the edge, or no woody vegetation canopy present. 2.5 Occasional small patches (<3 strides long) of dieback, or occasional dead native plants scattered at edge, or many plants with moderate dieback (< half plants are dead). 5 No apparent die-back on edge zone (first 3 m), or occasional native plants showing some dieback
Buffer descriptor	*3.4*	Buffer	Proportion of the length of the perimeter that has forest or scrub present	0 No buffer, or small portion (<25 % of wetland) has forest or scrub buffer 20 m wide. 2.5 25–75 % of wetland has forest or scrub buffer 20 m wide. 5 75–100 % of the wetland has forest or scrub buffer 20 m wide
Buffer descriptor	*3.5*	Drains	Presence of bores, drains, stormwater drains that divert water away from a wetland	0 Drains around or extending from the wetland with water visibly seeping from the sides or flowing along the drain. 2.5 Drains present, and some flow of water but little side seepage. 5 No perimeter drains, or old drains present but mostly filled with sediment and vegetation, or still water.

Appendix I – Summaries of current and potential future states of wetlands

Table G1. Legend for Table G2–G5.

State:
Good
Fair
Poor

Table G2. Current state of existing wetland clusters and offset wetlands (WEV-C).

Wetland Cluster	Wetland vegetation	Stock access	Buffer	Hydrological modification	Catchment land-use	WEV-C value
WC1E	Mostly native	Low	Mostly pasture, some exotic scrub and residential	Low	Mostly pasture, some residential	0.72
WC2E/WC2L	Mostly exotic	High	Mostly pasture, some exotic trees	High	Mostly pasture, some residential and native bush	0.39
WC3E/WC3L	Mostly exotic	High	Mostly pasture, some residential	High	Mostly pasture, some residential	0.39
WC4E/WC4L	Mixed native-exotic	Moderate	Mostly exotic scrub, some pasture	Low	Mostly pasture and scrub	0.56
WC5E/WC5L	Mostly exotic	High	Mostly pasture	Moderate	Mostly pasture	0.45
WC6E	Mostly native	Low	Mostly pasture, some exotic trees	Moderate	Mostly pasture, some residential	0.63
OWC1E	Wetland does not exist presently					0.00
OWC2E	Wetland does not exist presently					0.00
OWC3E	Wetland does not exist presently					0.00

Table G3. Potential state of mitigation wetlands under proposed offset enhancements (WEVm-P).

Wetland Cluster	Wetland vegetation	Stock access	Buffer vegetation	Hydrological modification	Catchment land-use	Proposed vegetation enhancements	Proposed hydrological enhancements	WEVm-P value
WC1E	Mostly native	No	Native	Low	Mostly pasture, some residential	full buffer planting, pest control	-	0.81
WC2E	Mostly native	No	Native	Moderate	Mixed residential, pasture, and some native bush	full buffer and partial wetland planting, pest control	Raise weir, stream & drain inverts, add detention swales	0.76
WC3E	Mostly native	No	Native	Moderate	Mostly pasture, some residential and native bush	pest control	Raise weir and stream inverts	0.70
WC4E	Mostly native	No	Native	Low	Mostly native, some residential	planting, pest control	-	0.78
WC5E	Mostly native	No	Native	Moderate	Mostly residential, some pasture	planting, pest control	-	0.77
WC6E	Mostly native	No	Native	Moderate	Mostly pasture, moderate residential	planting, pest control	-	0.72
OWC1	Mostly native	No	Native	Low	Mostly pasture, some residential and native bush	planting, pest control	Constructed by excavation below seasonal water table	0.78
OWC2	Mostly native	No	Native	Low	Mostly residential, some pasture and native bush	planting, pest control	Constructed by excavation below seasonal water table	0.78
OWC3	Mostly native	No	Native	Low	Mostly residential, some pasture	planting, pest control	Constructed by excavation below seasonal water table	0.78

Table G4. Potential future state of impacted wetlands in the absence of impacts (WEVi-P)

Wetland Cluster	Wetland vegetation	Stock access	Buffer vegetation	Hydrological state	Catchment land-use	Potential future state in absence of impact	WEVi-P value
WC2L	No change	Low	No change	No change	No change	Fencing, stock exclusion, no buffer	0.47
WC3L	No change	Low	No change	No change	No change	Fencing, stock exclusion, no buffer	0.47
WC4L	No change	Low	No change	No change	No change	Fencing, stock exclusion, no buffer	0.60
WC5L	No change	Low	No change	No change	No change	Fencing, stock exclusion, no buffer	0.55

Table G5. Impact state of impacted wetlands (WEVi-I)

Wetland Cluster	Wetland vegetation	Stock access	Buffer vegetation	Hydrological state	Catchment land-use	Potential future state with proposed development impact	WEVi-I value
WC2L	None	N/A	N/A	Infilled	N/A	Wetland removed	0.00
WC3L	None	N/A	N/A	Infilled	N/A	Wetland removed	0.00
WC4L	None	N/A	N/A	Infilled	N/A	Wetland removed	0.00
WC5L	None	N/A	N/A	Infilled	N/A	Wetland removed	0.00

Appendix J – WEV cluster summary scores

		WEV-C	WEV-C	WEV-C	WEV-C	WEV-C	WEV-C	WEV-C	WEV-C	WEV-C	WEVi-P	WEVi-P	WEVi-P	WEVi-P	WEVm-P	WEVm-P	WEVm-P	WEVm	WEVm	WEVm	WEVm	WEVm-P	WEVm	WEVi-	WEVi-	WEVi-	WEVi-I
		WC1	WC2	WC3	WC4	WC5	WC6	OWC1	OWC2	OWC3	WC2	WC3	WC4	WC5	WC1	WC2	WC3	WC4	WC5	WC6	OWC1	OWC2	OWC3	WC2	WC3	WC4	WC5
Component	**Attribute**	Av Score	Av Score	Av Score	Av Score	Av Score	Av Score	Av Score	Av Score	Av Score	Av Score	Av Score	Av Score	Av Score	Av Score	Av Score	Av Score	Av Score	Av Score	Av Score	Av Score	Av Score	Av Score	Av Score	Av Score	Av Score	Av Score
Catchment	Land use affecting catchment hydrology	0.4	0.3	0.3	0.6	0.3	0.3	0.0	0.0	0.0	0.3	0.3	0.6	0.3	0.4	0.2	0.2	0.8	0.3	0.2	0.3	0.2	0.3	0.0	0.0	0.0	0.0
Catchment	Diversion of flows	3.0	1.0	1.0	5.0	4.0	3.0	0.0	0.0	0.0	1.0	1.0	5.0	4.0	3.0	3.0	3.0	5.0	4.0	3.0	5.0	5.0	5.0	0.0	0.0	0.0	0.0
Catchment	Water quality in catchment	3.0	2.0	2.0	3.0	2.0	3.0	0.0	0.0	0.0	3.0	3.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	0.0	0.0	0.0	0.0
Catchment	Mammalian predators in catchment	2.0	2.0	2.0	1.0	2.0	1.0	0.0	0.0	0.0	1.0	1.0	1.0	2.0	3.0	3.0	3.0	3.0	3.0	3.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0
Catchment	Key undesirable plants in catchment	3.0	3.0	3.0	2.0	2.0	3.0	0.0	0.0	0.0	3.0	3.0	2.0	2.0	4.0	4.0	4.0	3.0	5.0	3.0	3.0	4.0	4.0	0.0	0.0	0.0	0.0
Catchment	% impervious surfaces in catchment	4.0	4.0	4.0	5.0	4.0	4.0	0.0	0.0	0.0	4.0	4.0	5.0	4.0	3.0	3.0	3.0	4.0	3.0	3.0	4.0	3.0	3.0	0.0	0.0	0.0	0.0
Catchment	% catchment in vegetation of any sort	4.0	4.0	4.0	5.0	4.0	4.0	0.0	0.0	0.0	4.0	4.0	5.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	0.0	0.0	0.0	0.0
Catchment	Degree of runoff control – flood and first flush	4.0	2.0	2.0	3.0	1.0	3.0	0.0	0.0	0.0	2.0	2.0	3.0	1.0	4.0	3.0	3.0	4.0	3.0	3.0	3.0	3.0	3.0	0.0	0.0	0.0	0.0
Catchment	Wetland connections	5.0	5.0	5.0	4.0	5.0	4.0	0.0	0.0	0.0	5.0	5.0	4.0	5.0	5.0	5.0	5.0	4.0	5.0	4.0	5.0	5.0	5.0	0.0	0.0	0.0	0.0
Wetland	Size and shape	4.0	4.0	3.0	1.0	2.5	2.0	0.0	0.0	0.0	4.0	3.0	1.0	2.5	4.0	4.5	3.0	1.0	3.0	2.0	1.0	0.5	0.0	0.0	0.0	0.0	0.0
Wetland	Change in hydrology	3.7	1.7	1.7	4.3	3.3	2.7	0.0	0.0	0.0	1.7	1.7	4.3	3.3	3.7	3.0	2.0	4.3	3.3	2.7	5.0	5.0	5.0	0.0	0.0	0.0	0.0
Wetland	Change in water/ soil quality or state (physico chemical parameters)	3.5	2.5	2.5	3.0	2.0	4.0	0.0	0.0	0.0	3.5	3.5	3.5	3.5	4.5	4.5	4.5	4.5	4.5	5.0	4.5	4.5	5.0	0.0	0.0	0.0	0.0
Wetland	Change in ecosystem intactness	5.0	3.3	3.3	5.0	4.3	4.7	0.0	0.0	0.0	3.3	3.3	5.0	4.3	5.0	4.0	3.7	4.0	3.3	4.0	5.0	5.0	5.0	0.0	0.0	0.0	0.0
Wetland	Change in amount of animal damage and harvest by humans	4.3	2.0	3.0	2.3	2.0	4.0	0.0	0.0	0.0	3.0	4.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	0.0	0.0	0.0	0.0
Wetland	Change in dominance of native plants	4.5	1.0	1.0	2.5	2.0	3.5	0.0	0.0	0.0	1.5	1.5	2.0	2.0	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	0.0	0.0	0.0	0.0
Buffer	Animal damage	4.0	1.0	1.0	2.0	1.0	4.0	0.0	0.0	0.0	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	0.0	0.0	0.0	0.0
Buffer	Weeds	4.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	3.0	3.0	3.0	3.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	0.0	0.0	0.0	0.0
Buffer	Canopy dieback	4.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	0.0	0.0	0.0	0.0
Buffer	Buffer	2.0	0.0	0.0	2.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	3.0	0.0	4.0	4.0	4.0	4.0	4.0	4.0	0.0	0.0	0.0	0.0
Buffer	Drains	5.0	0.0	0.0	5.0	4.0	4.0	0.0	0.0	0.0	0.0	0.0	5.0	4.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	5.0	5.0	0.0	0.0	0.0	0.0
Overall Mean Score		3.6205	1.9	1.9395	2.785833	2.273333	3.157167	0	0	0	2.365	2.3645	3.019167	2.748333	4.050833	3.787	3.494333	3.904	3.847	3.62	3.914	3.8865	3.889	0	0	0	0
Maximum attainable Score		5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Wetland Condition (WEV score)		**0.7241**	**0.388**	**0.3879**	**0.557167**	**0.454667**	**0.631433**	**0**	**0**	**0**	**0.473**	**0.4729**	**0.603833**	**0.549667**	**0.810167**	**0.7574**	**0.698867**	**0.781**	**0.769**	**0.724**	**0.783**	**0.7773**	**0.778**	**0**	**0**	**0**	**0**

Appendix K – ECR algorithm allocations summary

Table I1. Allocations from impacts to offsets using ECR wetland offset modelling.

Impact ID	Offset ID	Allocation	ECR	Area allocated (m^2)	ECR × area (m^2)	Offset area used (m^2)	Offset area remaining (m^2)	Impact area remaining (m^2)
WC2L_001	OWC1C_001	full	1.00	7,056.58	7,056.58	7,056.58	10,869.85	9,669.52
WC3L_001	OWC1C_001	full	1.00	1,118.16	1,118.16	1,118.16	9,751.69	8,551.36
WC4L_001	OWC1C_001	partial	1.17	111.42	130.60	130.60	9,621.09	8,439.94
WC4L_002	OWC2C_002	full	1.17	1,457.73	1,698.62	1,698.62	7,922.46	6,982.21
WC5L_001	OWC2C_002	partial	1.06	4,816.06	5,108.50	5,108.50	2,813.96	2,166.16
WC5L_002	OWC3C_003	full	1.06	2,166.16	2,296.51	2,296.51	517.45	0.00

Appendix L – WEV assumptions

1.Catchment

Component	Identifier	Attribute	Explanation or Description	Assumptions
Wetland descriptor	1.1	Land use affecting catchment hydrology	Upstream contributing sub-catchment linked directly to wetland. All sub-scores for proportion of catchment under land use must add to 1	Assumes WC2, WC3 are connected to Ngarara Stream, but are also influenced by flow from surrounding area to north and south, and rainfall, as per hydrology report. Assumes OWC1 hydrology will be dominated by the stream as closely connected subsurface, and on surface above base flows
Wetland descriptor	1.2	Diversion of flows	Presence of bores, drains, stormwater drains that divert water away from the wetland	Assumes no diversion of flows from wetlands under proposed development, as per hydrology report.
Wetland descriptor	1.3	Water quality in catchment	Signs or odours alluding to inflow of sediments, chemicals, excessive nutrients from e.g. septic tanks, roofs, stock, landfills, quarries, industrial sites	Assumes best practice water treatment in accordance with NES-FM and relevant stormwater standards and guidelines onsite, but with wider catchment influences operating
Wetland descriptor	1.4	Mammalian predators in catchment	Suitable habitat is mostly woody vegetation, scrub, hedge-lines or urban areas. Open ground, pasture, young pine forest is less suitable	Assumes effective control of domestic cats and dogs, with no increase in predation from domestic predators. Assumes effective control of feral predators to low-mod numbers.
Wetland descriptor	1.5	Key undesirable plants in catchment	Plants listed as invasive species in regional or national plant pest control plans	Assumes control of invasive pest plants to low amounts onsite
Wetland descriptor	1.6	% impervious surfaces in catchment	Use topographic map or aerial to assess within the subcatchment contributing flow to the wetland	Assumes 30% of subdivision is impervious surfaces
Wetland descriptor	1.7	% catchment in vegetation of any sort	Use topographic map or aerial to assess land area supporting vegetation vs concrete, bare soil or other non-vegetative surfaces	Assumes 70% of subdivision is in vegetation
Wetland descriptor	1.8	Degree of runoff control – flood and first flush	Within the sub-catchment contributing to wetland water quality	Assumes some natural runoff control through offsite wetlands, and through dune sands, as per the hydrology report, as well as compliance with the stormwater plan.
Wetland descriptor	1.9	Wetland connections	Use topographic map or aerial to determine nearest wetland that is greater than 0.5 ha area. Measure from nearest edge of wetland	

2. Wetland

Component	Identifier	Attribute	Explanation or Description	Assumptions
Size and shape	2.1	Size	Size of wetland affects the range or communities and habitats that the wetland can support, and how sustainable those may be in the long term. Larger wetlands support a greater diversity of biodiversity and are, generally, more sustainable.	Scoring per wetland in a cluster
Size and shape	2.2	Shape	Shape indicates the vulnerability of a wetland to plant invasion on the edges and the likelihood of environmental edge effects influencing interior communities. Divide wetland perimeter length (m) by area (m2).	Scoring per wetland in a cluster
Change in hydrology	2.3	Impact of artificial structures	Number, size, depth, effectiveness, coverage of structures such as dams, drains, stop-banks, tide gates etc within the wetland and in the contributing sub-catchment	Assumes moderate hydrological enhancement of WC2, mild improvement of WC3, and no change to other wetland clusters (with effects managed through remediation or mitigation)
Change in hydrology	2.4	Water table depth	Water table change based on long-term plot data or hydrological monitoring data or local knowledge – ask the landowner or manager, loss or decline of species requiring high water table e.g., aquatic and semi-aquatic species such as bladderwort.	Assumes hydrological impacts are effectively managed by proposed mitigations at all wetlands, and hydrology is enhanced at WC2 and WC3
Change in hydrology	2.5	Dry-land plant invasion	Presence or increase of dryland vegetation (e.g. privet, gorse, pampas, māhoe, māpou, wattle, pine, kānuka, koromiko, ponga, browntop, sweet vernal, fireweeds, hawksbeard, clover).	Assumes normal climatic conditions (as in spring 2025)

Change in water and soil quality or state (physicochemical parameters)	2.6	Degree of sedimentation or erosion	Recent earthworks or freshly dug drains in the catchment. Abrupt change in soil colour if you dig a hole. Plants partially buried by sediment, or stained, or dirty looking from recent silt-laden floods. Water looks dirty. Soft mud easily disturbed underfoot or gumboots sink readily into deep mud.	Assumes compliance with best practice stormwater and erosion controls
Change in water and soil quality or state (physicochemical parameters)	2.7	Nutrient levels	Algal blooms, surface scum, stagnant water. High numbers of waterfowl or stock fouling wetland. Loss or decline of plants typical of low-nutrient (oligotrophic) conditions e.g. tangle fern, wire rush, sundews, Baumea teretifolia – compare with old species lists. Presence of tall or dense stands of high nutrient species e.g. most wetland weeds, along with raupō, flax, blue-green algae. Recent fires based on landowner account, charred trunks of woody species, visible ash deposits.	Assumes natural state of dune depression wetlands is oligotrophic, and of swamps or fens is mesotrophic. Grazing excluded from Wetland Cluster 3. Assumes some unattenuated nutrient addition from residential discharges and peat decomposition
Change in ecosystem intactness	2.8	Loss in area of original wetland	Evidence from old maps, aerial photographs, areas of developed flat land or damp pasture adjacent to the wetland – particularly with drains through them. Presence of remnants of wetland vegetation. Obvious reclamation.	Assumes wetland hydrology and vegetation of mitigation wetlands are maintained for 10+ years
Change in ecosystem intactness	2.9	Recent vegetation damage or clearance	Areas of sprayed (brown or yellow) standing native vegetation, piles of slashed or crushed vegetation in or beside the wetland, signs of equipment having been in wetland to haul or bulldoze vegetation, charred or blackened vegetation. Don't confuse seasonal dieback of e.g. raupō or willow with sprayed vegetation.	Assumes no clearance or spraying of natives in mitigation wetlands
Change in ecosystem intactness	2.1	Hydrological barriers and connectivity	Presence of tide gates, stop banks, weirs, perched culverts separating wetland from riverine connections to other wetlands. Ring drains and box culverts around margin isolate wetland from catchment runoff and groundwater. Loss of riparian vegetation and buffer vegetation connecting wetlands to native forests, lakes and rivers	Assumes some loss of connection due to drains replaced by stormwater network, but also some improvements related to groundwater uplift in WC2 and WC3, and planting of wetland and stream buffers

Change in amount of animal damage and harvest by humans	2.11	Damage by stock or feral hoofed animals	Animal presence in wetland. Browse damage to foliage, branchlets; soft, herbaceous, palatable plant species absent or greatly reduced in number and stature. Damage to bark, e.g., biting and scratching. Disturbance to substrate, e.g., deer wallows, pig rooting, pugging. Presence and effectiveness of stock fencing.	Assumes no harvest of plants or animals under proposed mitigation
Change in amount of animal damage and harvest by humans	2.12	Introduced predator impacts on wildlife	Presence of effective pest barriers, e.g. pest-proof fence or wetland on pest-free island. Information from pest or native bird monitoring data, or landowner accounts. Indirect evidence from predator tracks, scat counts. Presence of sensitive species such as fernbird, bittern, banded rail indicates low predator impacts.	Assumes effective feral predator control and dog control, mostly offsetting increased domestic cat numbers with semi-effective control
Change in amount of animal damage and harvest by humans	2.13	Harvesting levels	Includes harvest of eels, flax, whitebait, sphagnum moss, etc. Information from landowner, evidence of whitebait stands, tracks through the wetland, clearings where vegetation has been harvested, machinery or evidence of its use to harvest moss. Comparison with past species records and fauna and flora descriptions.	Assumes pūkeko hunting presently undertaken. Assumes no harvesting in mitigated wetlands.
Change in dominance of native plants	2.14	Introduced plant canopy cover	Based on amount of wetland mapped as exotic vegetation types, e.g. willow forest, Glyceria reedland, or as seen from aerial photos or high vantage points. If exotics dominate a percentage of the wetland and are scattered through the rest, apply the next lowest score.	Assumes native planting within all wetlands, including complete coverage in constructed offset wetland clusters, and nodes of enrichment planting in retained wetlands except WC1 and WC6. Assumes control of exotic weeds within wetlands to low levels for a minimum of 15 years, particularly grey willow, crack willow, blackberry, especially in SNA wetlands WC1 and WC6
Change in dominance of native plants	2.15	Introduced plant understorey cover	If only one tier then score will be the same for canopy and understory. If exotics dominate a percentage of the wetland and are scattered through the rest, apply the next lowest score.	Assumes active management and control of exotic weeds within wetlands to low levels for a minimum of 15 years.

3. Buffer

Component	Identifier	Attribute	Explanation or Description	Assumptions
Buffer descriptor	3.1	Animal damage	Animal presence in buffer. Browse damage to foliage, branchlets; soft, herbaceous, palatable plant species absent or greatly reduced in number and stature. Damage to bark, e.g., biting and scratching. Disturbance to substrate, e.g., deer wallows, pig rooting, pugging. Presence and effectiveness of stock fencing.	Assumes the potential state of impact wetlands incorporates best practice wetland fencing without a full 10 m buffer, and no planting
Buffer descriptor	3.2	Weeds	Based on amount of buffer mapped as exotic vegetation types, or as seen from aerial photos or high vantage points. If exotics dominate a percentage of the buffer and are scattered through the rest, apply the next lowest score.	Assumes the impact wetlands potential state incorporates wetland fencing without a full 10 m buffer and no planting or weed control, Assumes effective weed control in mitigation wetland buffers for 15 years
Buffer descriptor	3.3	Canopy dieback	Based on a walkthrough assessment, aerial photos or high vantage points.	Dieback on WC1 margin due to historic high water tables is mostly offset by recent regeneration. Assumes no dieback in mitigation wetlands due to climate change impacts
Buffer descriptor	3.4	Buffer	Proportion of the length of the perimeter that has forest or scrub present	Assumes forest or scrub buffer averaging 12.4 m wide for all mitigation wetlands, but calculated per cluster based on buffer widths
Buffer descriptor	3.5	Drains	Presence of bores, drains, stormwater drains that divert water away from a wetland	Assumes most drains only flow at higher water tables, except for W1 modified stream, as per onsite observations.

Appendix M – Exhaustive allocation algorithm: R code

```
# --- Step 1: Load libraries ---
library(dplyr)
library(ggplot2)
library(readr)
library(stringr)

# --- Step 2: Load Data ---
impacts <- read_csv(impacts.csv)
offsets <- read_csv(offsets.csv)

# Identify new stream creation
offsets <- offsets %> %
    mutate(is_new = ifelse(offset_current == 0, 1, 0)) %> %
    arrange(desc(is_new), priority) %> %
    mutate(offset_remaining = offset_area)

# --- Step 3: Initialize trackers ---
allocations <- data.frame()
impact_summary <- data.frame()
offset_usage <- data.frame()
suffix <- letters

# --- Step 4: Run ECR allocation algorithm ---
for (i in 1:nrow(impacts)) {
  imp <- impacts[i, ]
  imp_id <- imp$impactID
  imp_area_remaining <- imp$impact_area
  sub_idx <- 1
  impact_value_allocated_total <- 0
  total_required_impact_value <- 0

  for (j in 1:nrow(offsets)) {
    if (imp_area_remaining <= 0) break

    off <- offsets[j, ]

    # Avoid divide-by-zero in ECR
    denom <- off$offset_potential - off$offset_current
    if (denom == 0) next

    ECR <- ((imp$impact_potential - imp$impact_result) / denom) * imp$DM
    available_offset_area <- offsets$offset_remaining[j]
    imp_value_needed <- ECR * imp_area_remaining

    if (imp_value_needed <= available_offset_area) {
      # Full allocation
      raw_alloc_area <- imp_area_remaining
      impact_value_allocated <- imp_value_needed
      offsets$offset_remaining[j] <- available_offset_area - impact_value_allocated
      imp_area_remaining <- 0
      total_required_impact_value <- total_required_impact_value + impact_value_allocated
    } else {
      # Partial allocation
      impact_value_allocated <- available_offset_area
      raw_alloc_area <- impact_value_allocated / ECR
      offsets$offset_remaining[j] <- 0
      imp_area_remaining <- imp_area_remaining - raw_alloc_area
      total_required_impact_value <- total_required_impact_value + impact_value_allocated
    }

    # Track allocation only if something was allocated
    if (impact_value_allocated > 0) {
      allocations <- rbind(allocations, data.frame(
        impactID = imp_id,
        impactID_sub = paste0(imp_id, "_", suffix[sub_idx]),
```

```
        offsetID=off$offsetID,
        offsetID_sub = paste0(off$offsetID, "_", suffix[j]),
        raw_area_allocated = raw_alloc_area,
        impact_value_allocated = impact_value_allocated,
        offset_area_remaining = offsets$offset_remaining[j]
      ))

      impact_value_allocated_total <- impact_value_allocated_total + impact_value_allocated
      sub_idx <- sub_idx + 1
    }
  }

  # Compute percentage allocated based on actual allocations
  if (total_required_impact_value == 0) {
    pct <- 0
  } else {
    raw_pct <- (impact_value_allocated_total / total_required_impact_value) * 100
    pct <- ifelse(abs(raw_pct - 100) < 0.1, 100, round(raw_pct, 2))
  }

  impact_summary <- rbind(impact_summary, data.frame(
    impactID = imp_id,
    total_impact_area = imp$impact_area,
    total_impact_value_required = total_required_impact_value,
    impact_value_allocated = impact_value_allocated_total,
    percent_allocated = pct,
    unmet_impact_value = total_required_impact_value - impact_value_allocated_total
  ))
}

# --- Step 5: Add all offsets to the allocations table ---
unused_offsets <- offsets %> %
  filter(!(offsetID %in % unique(gsub("_.*", "", allocations$offsetID_sub)))) %> %
  mutate(
    impactID_sub = NA,
    offsetID_sub = paste0(offsetID, "_unused"),
    raw_area_allocated = 0,
    impact_value_allocated = 0
  ) %> %
  select(impactID_sub, offsetID_sub, raw_area_allocated, impact_value_allocated,
offset_area_remaining = offset_remaining)


# --- Step 6: Table 1. Summary table ---
summary_table <- data.frame(
  impact_area = sum(impact_summary$total_impact_area),
  offset_creation_availability = sum(offsets$offset_area[offsets$offset_current == 0]),
  extent_surplus_deficit = sum(offsets$offset_area[offsets$offset_current == 0]) -
sum(impact_summary$total_impact_area),
  total_impact_value_allocated = sum(impact_summary$impact_value_allocated),
  value_surplus_or_deficit = sum(offsets$offset_area)-sum(allocations$impact_value_allocated)
)

# --- Step 8a: Calculate like-for-unlike offset ---

allocations_both <- allocations_both %> %
  mutate(value_difference = impact_value_allocated-raw_area_allocated)

allocations_new <- merge(allocations_both,offsets,by="offsetID") %> %
  mutate(impact_value_length = impact_value_allocated/offset_width) %> %
  mutate(impact_length_allocated = raw_area_allocated/offset_width) %> %
  mutate(impact_length_difference = impact_value_length - impact_length_allocated)
```

Appendix N - Preliminary species list for stable back dune revegetation.

These species provide habitat for native lizards and birds, through establishing protective cover, structure and food sources, and were recommended by regional planting guides[33]. The threat status is included for Threatened and At-Risk species. Species currently present, and to be planted as part of the species suite to replace existing dune shrubland and treeland loss, are denoted by an asterisk (including specified 'trees of note' in the District Plan, such as māhoe and tī kōuka).

These species lists are provided as a guide. Refinement of these – by adding or removing some species – and through refinement of planting percentages may occur with the development of the overall site management plans.

D1. Dune revegetation community 1: shrubland, rushland and herbfield

Objectives: Mitigation of indigenous dune vegetation loss, and enrichment planting to increase diversity and cover of native vegetation. Provision of high quality lizard habitat and connection of habitat, both onsite and offsite.

Plan: Required ecological mitigation planting of 30 × 62.5 m^2 nodes of 200 plants, with rushes and herbs at 0.5 m spacing, and shrubs at 1.4 m spacing. Nodes are located around retained dune shrubland or rushland areas, and on new sites with wind exposure and sunny north, west and east facing aspects which form ideal shrubland and lizard habitat. Additional landscape planting proposed within mapped planting zones is proposed to extend and connect these nodes, but at the applicant's discretion as to density and extent.

Species and coverage:

New Zealand ice plant (*Disphyma australe*)	3%
Sand daphne (*Pimelea prostrata*)	2%
Sand daphne (*Pimelea villosa*);	5%
Threat status: At Risk – Declining	
Oioi (*Apodasmia similis*)	10%
*Knobby club rush (*Ficinia nodosa*)	15%
Sand coprosma (*Coprosma acerosa*);	5%
Threat status: At Risk – Declining	
*Pōhuehue (*Muehlenbeckia complexa*)	45%
Tauhinu (*Ozothamnus leptophyllus*)	5%
Shore spurge (*Euphorbia glauca*);	5%
Threat status: Threatened – Nationally Vulnerable	
*Mingimingi (*Coprosma propinqua*)	5%

[33] Greater Wellington Regional Council (2010). Wellington Regional Native Plant Guide – Revised edition 2010. Greater Wellington Regional Council, Wellington. ISBN 0-909016-94-1. 60 p.

D2. Dune revegetation community 2: treeland

Objectives: Mitigation of indigenous dune tree loss, and enrichment planting to increase diversity and cover of native vegetation. Provision of high quality terrestrial bird and gecko habitat and connection of habitat, both onsite and offsite.

Plan: Required ecological mitigation planting of 22 × 55 m^2 nodes of 25 shrubs and trees at 1.4 m or 5 m spacing within mapped planting zones. Additional landscape planting proposed within mapped planting zones is proposed to extend and connect these nodes, but at the applicant's discretion as to density and extent.

Species and coverage:

Coastal tree daisy (*Shawia solandri*);	5%
Threat status: At Risk – Declining	
*Taupata (*Coprosma repens*)	10%
Akeake (*Dodonaea viscosa*)	10%
*Ngaio (*Myoporum laetum*)	5%
*Sand dune kānuka *(Kunzea amathicola);*	20%
Threat status: At Risk – Declining	
*Māhoe (*Melicytus ramiflorus*)	10%
Lancewood (*Pseudopanax crassifolius*)	5%

Appendix O – Preliminary species list for wetlands and wetland margin revegetation

These species are locally appropriate and selected for relevant hydrological gradients. They provide structure, bird habitat and food sources. Tree species are recommended for wetland margins, where hydrology is more appropriate, and so they do not restrict habitat suitability for bittern within the wetland core.

W1. Wetland revegetation community 1: Permanently saturated and ephemerally inundated depressions including excavated swales (up to ~1 m depth for ≤3 days).

Objectives: Enhancement and establishment of wetland bird and mudfish habitat. Increase in diversity and cover of native vegetation.

Plan: dense planting spaced at 0.5 m spacing, within 125 m^2 nodes in each of the six to seven constructed swales (plus any additional landscaping planting of the same community at developer's discretion), and over 1.74 ha of constructed offset wetlands (70 % of the total 2.48 ha) to be planted in their entirety.

Species and coverage:

Raupō (*Typha orientalis*)	40 %
Spike rush (*Eleocharis acuta*)	10 %
Pūrei (*Carex secta*)	20 %
Swamp sedge (*Carex virgata*)	10 %
Harakeke/swamp flax (*Phormium tenax*)	20 %

W2. Wetland revegetation community 2: Seasonally saturated and shallowly inundated wetland areas (typically ≤0.3 m flood inundation).

Objectives: buffering of potential impacts, including disturbance of wetland birds, enrichment planting to improve native diversity and cover, and establishment and enhancement of wetland bird habitat (noting the need to set back trees from some open water swales for bittern, crake and waterfowl habitat, but to plant trees close to other swales to provide mudfish habitat).

Plan: dense planting spaced at 0.5 m for ground covers, 1.4 m for shrubs, and 5 m spacing for trees, in (a) nodes across the retained wetlands totalling at least 6000 m^2, and (b) over 0.74 ha of the constructed offset wetlands to be planted in their entirety (30 % of the total 2.48 ha).

Species and coverage:

*Harakeke/swamp flax (*Phormium tenax*)	20 %
Pūrei (*Carex secta*)	20 %
Swamp sedge (*Carex virgata*)	10 %
Oioi (*Apodasmia similis*)	10 %
Toetoe (*Austroderia toetoe*)	10 %
*Tī kōuka/cabbage tree (*Cordyline australis*)	15 %
Kahikatea (*Dacrycarpus dacrydioides*)	15 %

W3. Wetland revegetation community 3: Drier wetland margins and buffers

Objectives: buffering of potential impacts from subdivision, including disturbance of wetland birds.

Plan: dense planting at 0.5 m spacing for ground covers, 1.4 m for shrubs, and 5 m for trees, to cover the entirety of the 7.26 ha of wetland buffer areas.

Species and coverage:

Kahikatea (*Dacrycarpus dacrydioides*)	25 %
Swamp maire (*Syzygium maire*);	10 %
Threat status: Threatened – Nationally Vulnerable	
Mingimingi (*Coprosma propinqua*)	10 %
Mānuka (*Leptospermum scoparium*)	10 %
Karamū (*Coprosma robusta*)	10 %
Kōhūhū (*Pittosporum tenuifolium*)	5 %
Ribbonwood/mānatu (*Plagianthus regius*)	10 %
Māpou (*Myrsine australis*)	10 %
Māhoe (*Melicytus ramiflorus*)	5 %
*Sand dune kānuka (*Kunzea amathicola*);	5 %
Threat status: At Risk – Declining	

W4. Wetland revegetation community 4: Wetland buffer areas below stormwater discharges

Objectives: to promote denitrification of stormwater, and additional sediment attenuation during high flow events.

Plan: dense swarding sedges and rushes planted at 0.5 m spacing, primarily between treated stormwater discharges and constructed swales, covering approximately 0.51 ha.

Species and coverage:

Spike rush (*Eleocharis acuta*)	20 %
Cutty grass (*Carex geminata*)	20 %
Oioi (*Apodasmia similis*)	20 %
Soft rush (*Juncus sarophorus*)	10 %
Wīwī (*Juncus edgariae*)	10 %
Toetoe (*Austroderia toetoe*)	10 %
Harakeke/swamp flax (*Phormium tenax*)	10 %

Appendix P - Preliminary species list for riparian margins

R1. Riparian revegetation community 1: Damp stream edges and floodplains

Objectives: shading of stream channel and buffering of potential impacts. Provision of corridors of habitat for terrestrial birds and waterfowl.

Plan: dense planting at 0.5 m spacing for ground covers, 1.4 m for shrubs, and 5 m for trees, to cover an estimated 70 % of the 2.74 ha stream buffer area, including retained and realigned reaches.

Species and coverage:

Pūrei (*Carex secta*)	20 %
Swamp sedge (*Carex virgata*)	10 %
Harakeke/swamp flax (*Phormium tenax*)	10 %
Oioi (*Apodasmia similis*)	10 %
Toetoe (*Austroderia toetoe*)	10 %
Ribbonwood/mānatu (*Plagianthus regius*)	15 %
Māpou (*Myrsine australis*)	15 %
Kahikatea (*Dacrycarpus dacrydioides*)	10 %

R2. Riparian revegetation community 2: Well drained banks with infrequent flooding

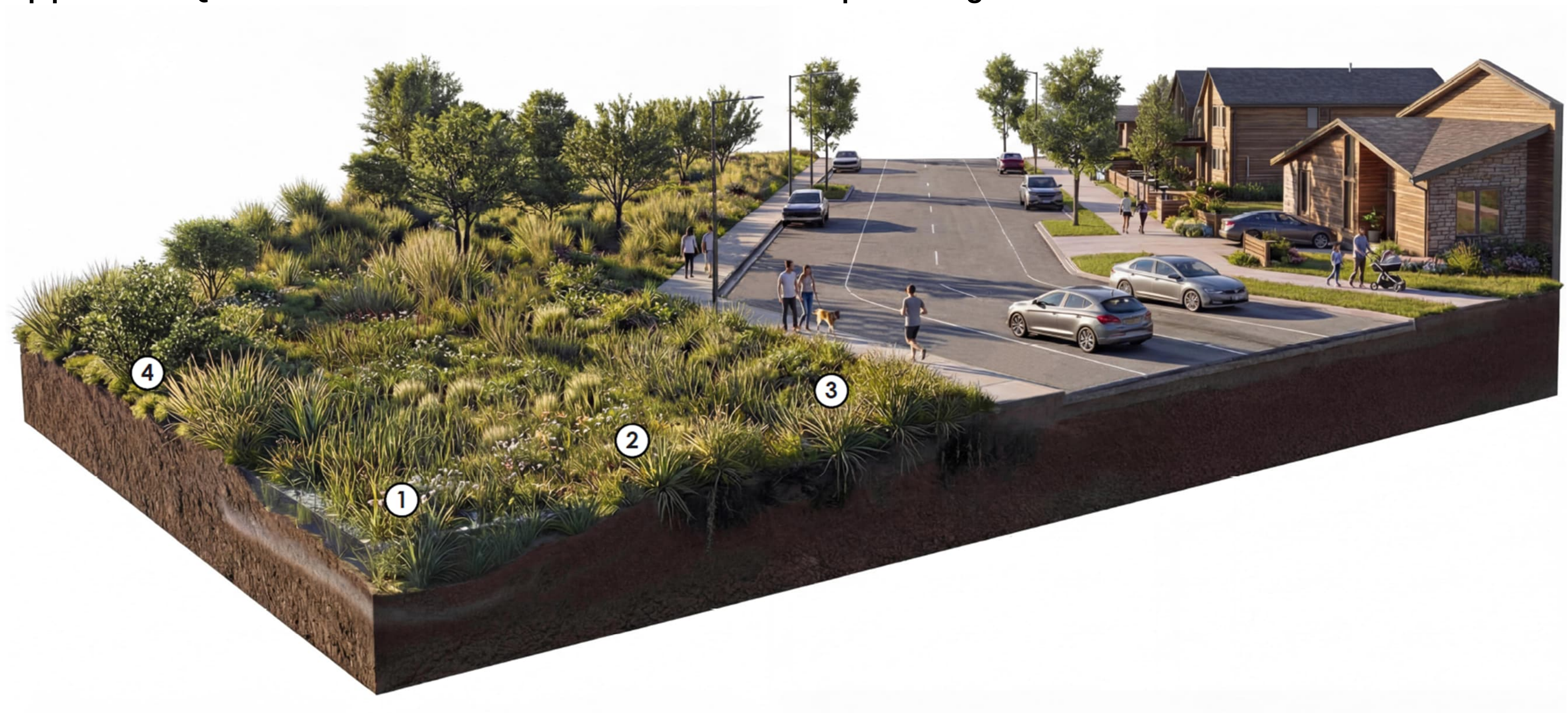
Objectives: shading and of stream channel and buffering of potential impacts. Provision of corridors of habitat for terrestrial birds and waterfowl.

Plan: planting at 5 m spacing to cover an estimated 30 % of the 2.74 ha stream buffer area.

Species and coverage:

Small-leaved kōwhai (*Sophora microphylla*)	35 %
Lacebark/Houhere (*Hoheria sexstylosa*)	35 %
Totara (*Podocarpus totara*)	30 %

Appendix Q - Schematic illustration of wetland planting zones



Wetland community 1:

Constructed swales - permanently saturated and ephemerally inundated (up to 1 m inundation).

Wetland bird and mudfish habitat.

Node planting

- Raupō *(Typha orientalis)*
- Pūrei *(Carex secta)*
- Harakeke/swamp flax *(Phormium tenax)*

Wetland community 2:

Seasonally saturated and shallowly inundated wetland areas (typically ≤0.3 m flood inundation).

Node planting

- Harakeke/swamp flax *(Phormium tenax)*
- Pūrei *(Carex secta)*
- Tī kōuka/cabbage tree *(Cordyline australis)*
- Kahikatea *(Dacrycarpus dacrydioides)*

Wetland community 3:

Wetland buffers

Plant entire buffer

- Kahikatea *(Dacrycarpus dacrydioides)*
- Swamp maire *(Syzygium maire)*
- Mingimingi *(Coprosma propinqua)*
- Mānuka *(Leptospermum scoparium)*
- Karamū *(Coprosma robusta)*
- Ribbonwood/mānatu *(Plagianthus regius)*
- Māpou *(Myrsine australis)*

Wetland community 4:

Below stormwater discharges

Dense swards for denitrification and sediment attenuation

- Spike rush *(Eleocharis acuta)*
- Cutty grass *(Carex geminata)*
- Oioi *(Apodasmia similis)*

Do not scale. Verify dimensions on site before commencing work.

No.	Revision Notes.	Date.
A.	For Information	19.02.26

Not For Construction

McIndoe Urban

local

 level 3, 11 vivian street, wellington, new zealand, 6011 phone: 04801 6437 www.localcollective.nz

North:

Scale: NTS

Issued For: Information

Job Number: 2109-1238

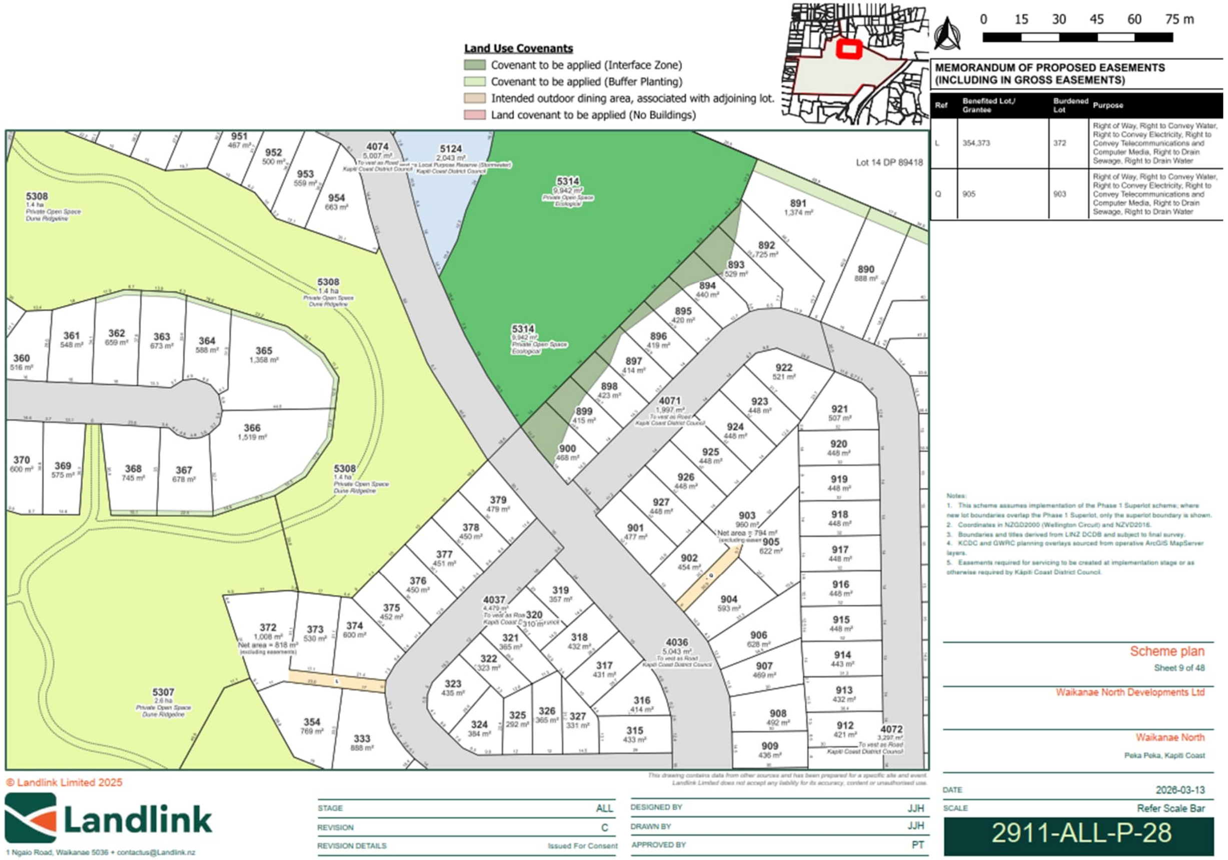
Revision: A

Project: Waikanae North

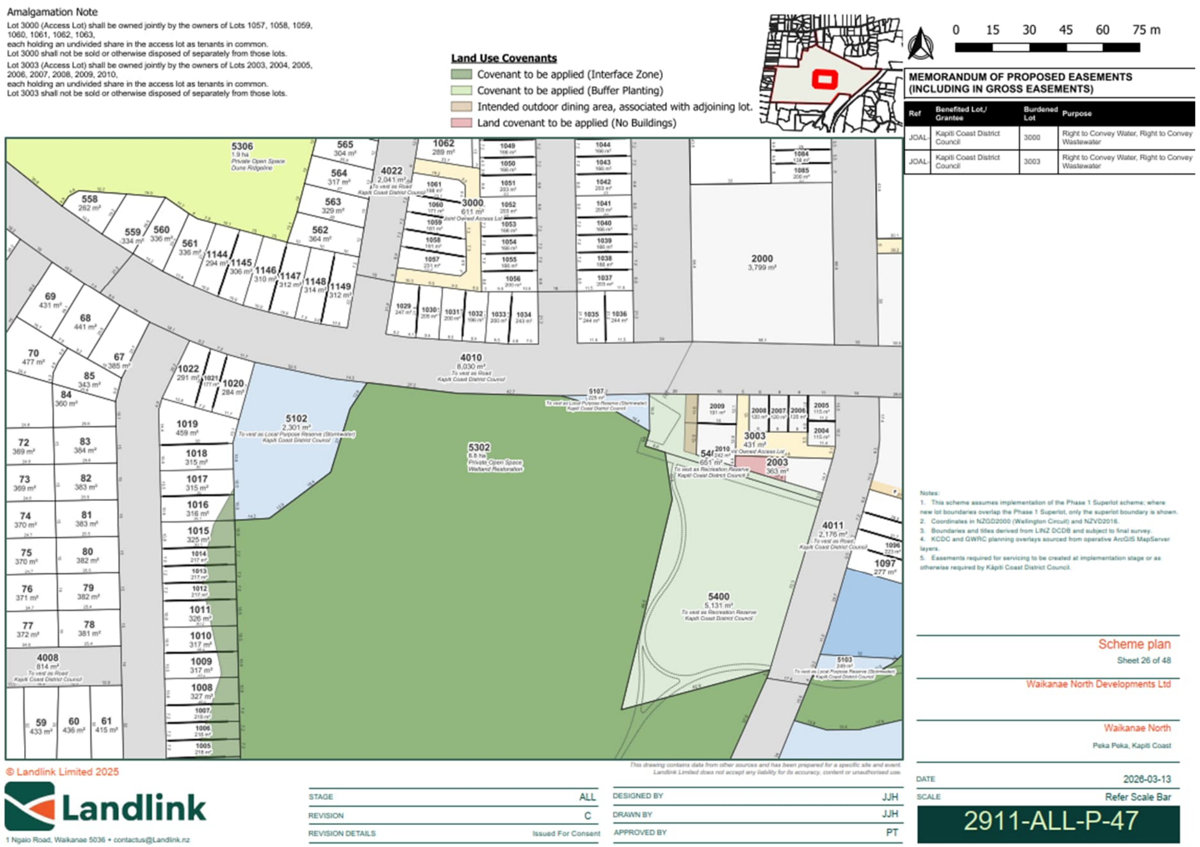
Drawing Title: Illustrative iso view - Wetland communities

Drawing No: LA 8.10

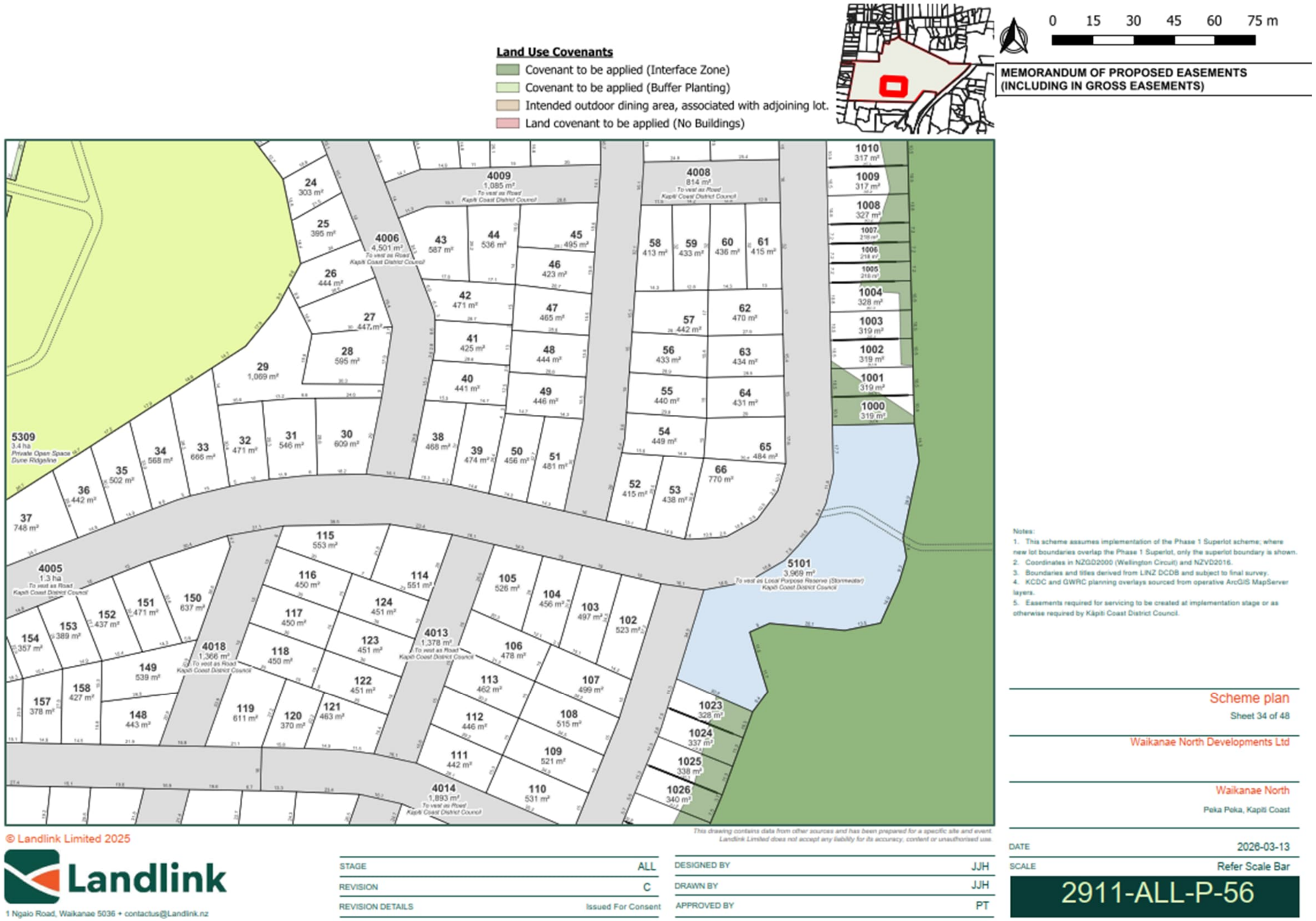
Appendix R – Wetland interface covenant maps



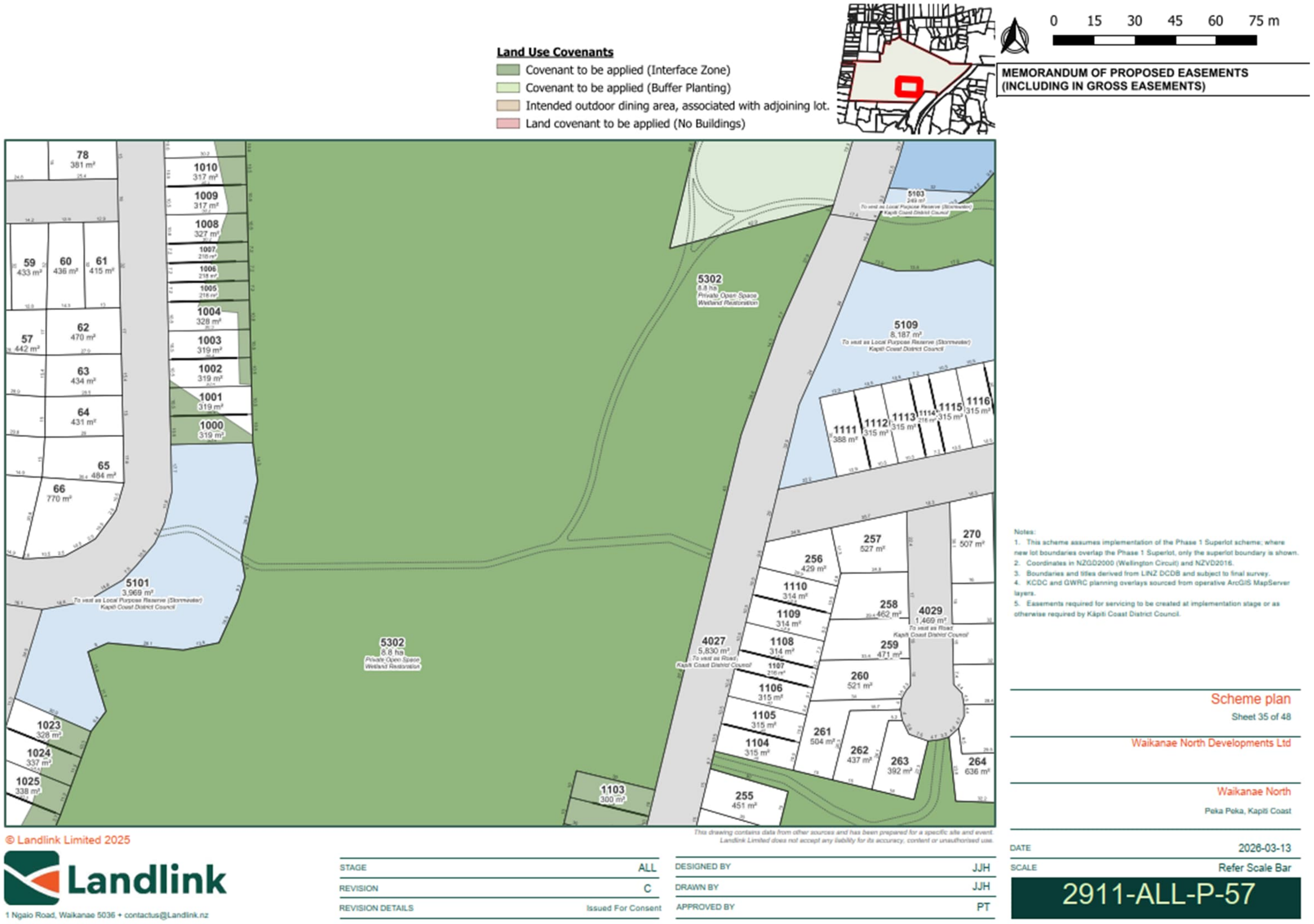
Scheme Plan illustrating location of Interface Zone Covenants on lots adjacent to Pekapeka Road wetland (wetland W11) (courtesy of Landlink Ltd).



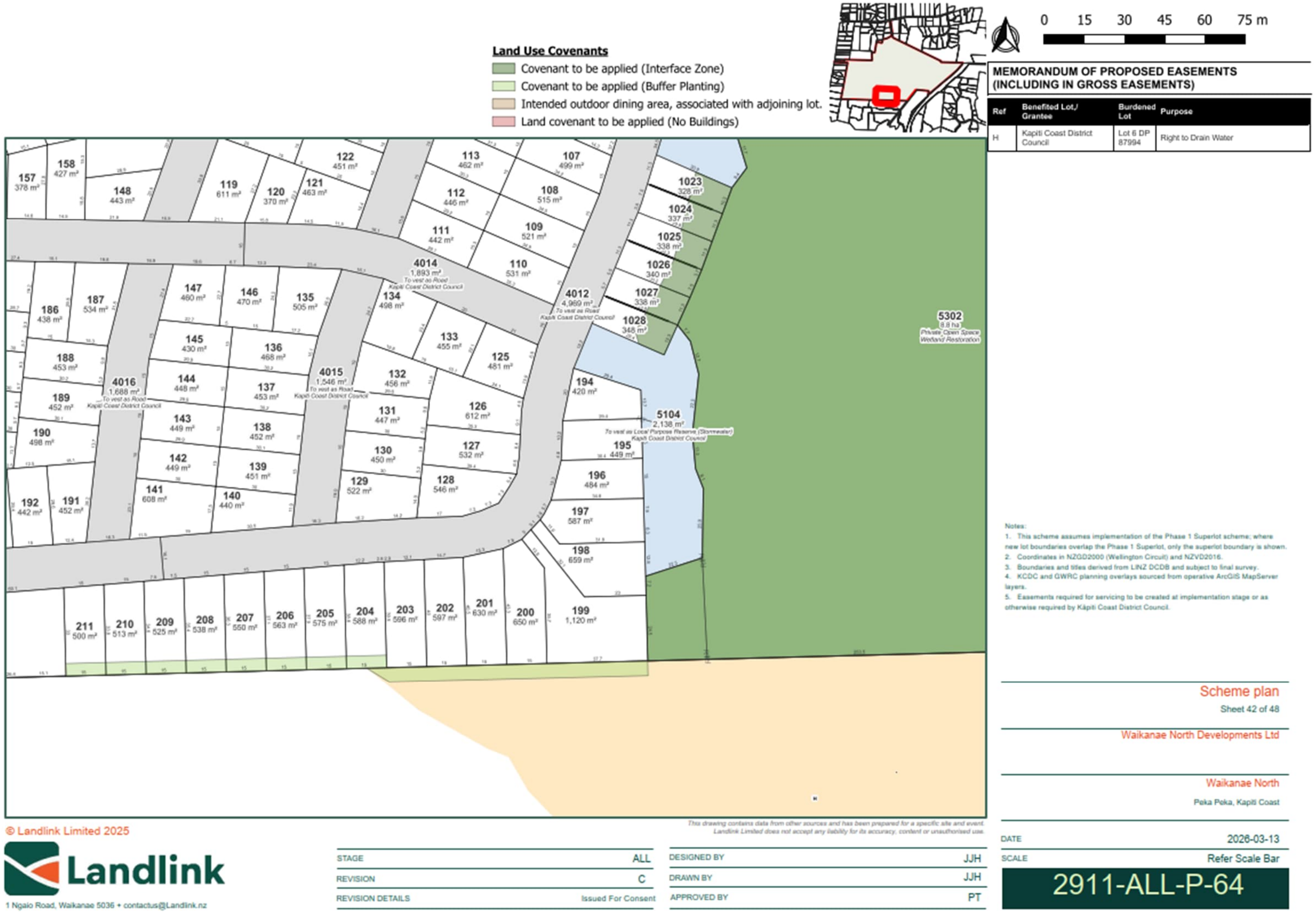
Scheme Plan illustrating location of Interface Zone Covenants on lots adjacent to Ngarara floodplain wetlands (wetland cluster 2) (courtesy of Landlink Ltd).



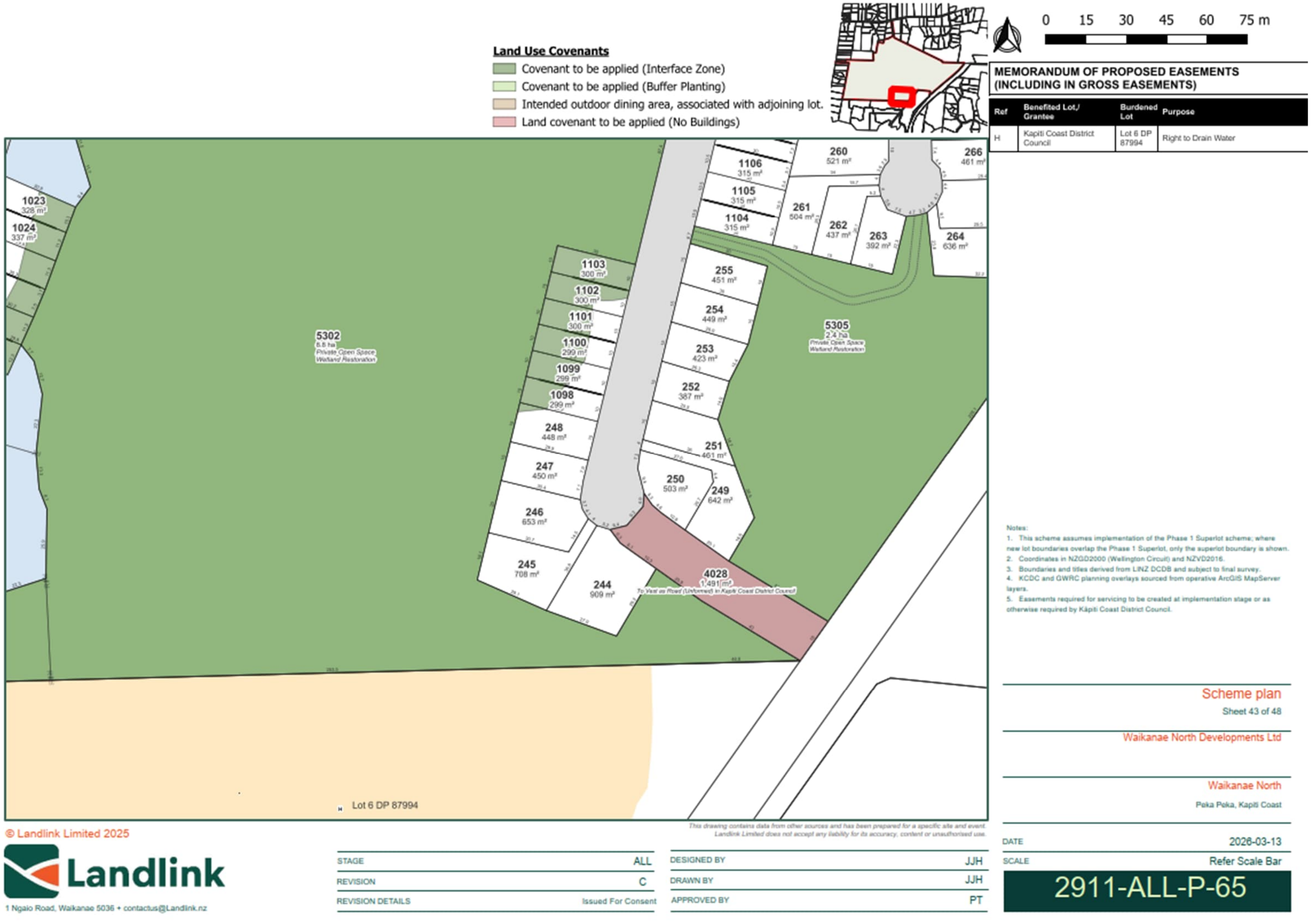
Scheme Plan illustrating location of Interface Zone Covenants on lots adjacent to Ngarara floodplain wetlands (wetland cluster 2) (courtesy of Landlink Ltd).



Scheme Plan illustrating location of Interface Zone Covenants on lots adjacent to Ngarara floodplain wetlands (wetland cluster 2) (courtesy of Landlink Ltd).



Scheme Plan illustrating location of Interface Zone Covenants on lots adjacent to Ngarara floodplain wetlands (wetland cluster 2) (courtesy of Landlink Ltd).



Scheme Plan illustrating location of Interface Zone Covenants on lots adjacent to Ngarara floodplain wetlands (wetland cluster 2) (courtesy of Landlink Ltd).