REPORT

Tonkin+Taylor

Ohiti Road Flood Protection Stopbank Works

Ecological Opportunities and Constraints Assessment

Prepared for
Hawkes Bay Regional Council
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Tonkin & Taylor Ltd
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1 Introduction

Hawke's Bay Regional Council (HBRC) is proposing flood protection stopbank works ("the works") at Ohiti Road and Taihape Road in Omāhu, Hastings District. The works involve an upgrade and extension to the existing Chesterhope Upper stopbank at Omāhu subdivision, installation of a new stopbank at Ohiti Road subdivision, and associated swales and road upgrades at stopbank crossing points.

The works are one of a number of regional projects to increase flood resilience following severe weather events in 2023, during which both subdivisions flooded. The stopbank upgrade works are proposed to help mitigate flooding to properties south of Taihape Road, as shown in Figure 1.1.

Tonkin & Taylor Ltd (T+T) has been engaged to prepare an assessment of ecological opportunities and constraints associated with the proposed flood protection stopbank works[1]. The purpose of this report is to provide a high-level overview of ecological characteristics of the site and Okawa Stream to inform future consenting requirements. We also identify ecological opportunities as appropriate. Due to ongoing design developments, ecological observations and assessment focused on the whole area which is hereafter referred to as "the site".

This Opportunities and Constraints (O&C) report is not an Ecological Impact Assessment (EcIA) report. For this project, if an EcIA report is required, this will be provided retrospectively alongside any required Assessment of Environmental Effects (AEE) report. The EcIA report will assess the effects/impacts of construction activities on the identified ecological values and, if required, provide management measures to implement at the site to manage adverse ecological effects. Section 1.2 provides further information on the recommended ecological management measures for this project and Section 1.3 provides an overview of the proposed works.

[1] Email from Dugan Weitz (HBRC) to Jamie Yule (T+T), Re: Ohiti Rd Ecology, 5 August 2025.

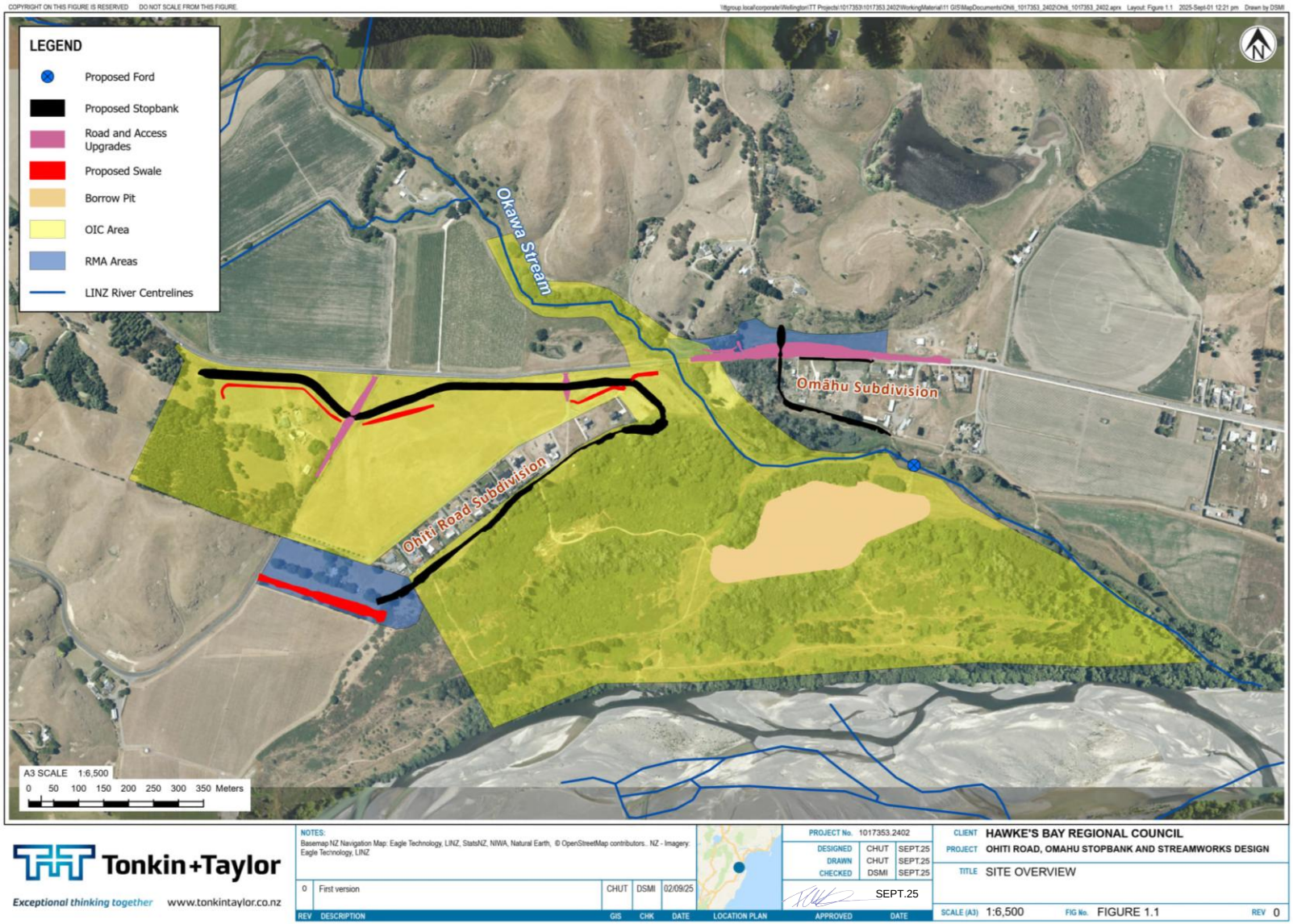


Figure 1.1: The Order in Council (OiC) and Resource Management Act 1991 (RMA) areas with the proposed flood protection stopbank works.

1.1 Site description

To the west of Okawa Stream, the Ohiti Road subdivision sits along the edge of a terrace, above the original Ngaruroro floodplain to the south. The Omāhu subdivision is east of the Ohiti Road subdivision. The Okawa Stream flows between the two subdivisions, then along the south of the Omāhu subdivision. The existing Chesterhope Upper stopbank sits between the Omāhu subdivision and the Okawa Stream and Ngaruroro floodplain.

The footprint of the proposed stopbank works is largely used for grazing. Areas of cropping and vineyards are also nearby. Land cover within the site is mapped on HBRC online maps as "primarily pastural", with no areas of native vegetation mapped nearby, which is consistent with our site observations. Land cover classification and the main habitat types within the vicinity of the site are shown on Figure Appendix A.1.

The Okawa Stream is a 4th order stream where it flows through the site, which becomes 6th order where it enters the Ngaruroro River (NIWA, 2024). From where the Okawa Stream enters the Ngaruroro River, it is a short distance (~18 km) to the coast in the east. The catchment hydrology is relatively complex, with several lakes (e.g., Lake Rūnanga) and swamps (e.g., Kautuku and Hurimoana) influencing flows at Omahu.

There are 11 priority wetlands in Hawke's Bay (New Zealand Government, 2020). HBRC has responsibility for management of some of them (e.g., Pekapeka Swamp and Waitangi Estuary) and works with private landowners on others to enhance biodiversity. No priority wetlands are located on the site. However, two large priority wetlands are located nearby (Oingo and Rūnanga Lakes located c. 1.8 km and 1 km away, respectively).

1.2 Statutory context

The works to be completed at the site will be undertaken under an Order in Council[2] (OiC) framework which HBRC has been granted via central government. The OiC allows the works at the site to be completed as a controlled activity, with any required AEE and EcIA reporting to be retrospectively prepared once works are completed. However, specific Ecological Management Plans (EMP) are required to be implemented to manage and mitigate potential effects from the proposed works. The required EMP will be included in the Construction Environmental Management Plan (CEMP), which is a requirement of Clause 10 of the OiC.

The CEMP is the guiding document in implementing and delivering the flood works and will address measures required in the conditions of consent to avoid, remedy or mitigate adverse environmental effects during construction.

Several clauses in the OiC relate specifically to the management of ecology within a works site; these include:

- Clause 25 Project Ecologist.
- Clause 26 Ecology principles.
- Clause 27 Ecological survey and assessment.
- Clause 28 Managing ecological loss.

The CEMP also includes further management outcomes which may influence the management and/or mitigation of effects on the ecology of the site, including:

[2] Severe Weather Emergency Recovery (Hawke's Bay Flood Protection Works) Order 2024. https://www.legislation.govt.nz/regulation/public/2024/0083/latest/whole.html.

- An Erosion and Sediment Control Plan or Plans (ESCP) (Clauses 13, 14 and 15).
- Specific provisions for works in and/or adjoining a watercourse including the requirement for works and structures in and/or adjoining the beds of watercourses (Clauses 18 and 19).
- River gravel extraction activities (Clause 20).

This Operations and Constraints Assessment (O+C) meets the requirements of the ecological scoping surveys required by OiC Clause 27 (1) a) and (2).

Due to design refinements, two additional areas have been included in the project which are outside the identified OiC area. These two areas, the Taihape Road upgrades and 39 Ohiti Road (see Figure 1.1), fall under the standard requirements of the Resource Management Act 1991 (RMA). The RMA resource consent process for these areas will be managed in conjunction with the OiC process.

The Hawke's Bay Regional Resource Management Plan (RRMP) (2006, amended 2025) includes policies, objectives, and rules for the sustainable management of natural and physical resources in the region. It also provides definitions for ecological features such as wetlands and water bodies, which are useful for consistent assessment and defining ecological features.

While an Order in Council (OiC) can override or modify RRMP policies under certain conditions, the definitions provided in the RRMP remain relevant, particularly for assessing ecological features and potential adverse effects. Wetlands are additionally defined in the RMA, while natural inland wetlands are specifically defined under the National Policy Statement for Freshwater Management (NPS-FM).

Most indigenous terrestrial vertebrate fauna species (e.g., bats, birds, lizards) and some indigenous invertebrate species are legally protected under the Wildlife Act 1953 (Wildlife Act). A Wildlife Act Authority (WAA) is required to handle and salvage fauna protected by the Wildlife Act. This is usually required only for species which poor capacity to naturally disperse from construction works, such as lizards. Wildlife Act requirements are separate from RMA requirements.

1.3 Description of works

The proposed flood protection stopbank works have been refined and as of August 2025 the design is as shown in Figure 1.1. This design involves the following works:

- Ohiti Road subdivision:
  - Construction of a stopbank between the subdivision and Taihape Road, Okawa Stream and the floodplain of the Ngaruroro River.
  - Upgrade works to Ohiti Road and subdivision access from Taihape Road for crossing the stopbank.
  - Swales associated with the stopbank crossings at Ohiti Road and Taihape Road access, and at the southwest end of the stopbank.
- Omāhu subdivision:
  - Upgrades to the existing Chesterhope Upper stopbank, including crossing Taihape Road.
  - Upgrades to realign and raise Taihape Road at the Chesterhope Upper stopbank crossing.
  - Combining two driveway entrances on the north side of Taihape Road (174 Taihape Road) to allow for traffic entering/exiting the raised road at one point only.

- Potential use of the Okawa Stream ford between the proposed borrow pit and the Chesterhope Upper stopbank and Taihape Road upgrades.
    - Use of the Okawa Stream ford would require upgrades to allow heavy vehicle access through the ford.

2 Assessment methodology

A site walkover was completed by two T+T ecologists on 28 and 29 February 2024 encompassing the site and wider area starting just north of Taihape Road, extending to below the subdivisions on Ohiti and Taihape Roads. A 150 m section of the Okawa Stream was also surveyed.

The following terrestrial and freshwater assessments were completed during the February site visit and described in full further below:

- General site vegetation descriptions.
- Fauna habitat observations and mapping which included:
  - Identifying potential bat roost trees.
  - Identifying potential avifauna habitat.
  - Identifying areas of potential lizard habitat.
- Identifying areas of potential wetland, as indicated by vegetation, soils and hydrological indicators in accordance with the Wetland Delineation Protocol (Ministry for the Environment, 2022).
- Stream fauna surveys which included:
  - Electrofishing the Okawa Stream.
  - Macroinvertebrate sample collection.
  - Ecological DNA (eDNA) collection.

Targeted terrestrial fauna surveys for long-tailed bats (*Chalinolobus tuberculatus*, Threatened – Nationally Critical (O'Donnell et al., 2023)) and native skinks were conducted at a later date (April to May 2024, see Section 2.2) to further inform the site constraint assessment and effects management recommendations. Long-tailed bats and native skinks are fully protected under the Wildlife Act.

Following refinement of the proposed stopbank designs a further site visit was completed by a T+T ecologist on 11 August 2025 to undertake general site observations of the additional areas affected by the updated design (Figure Appendix A.1). The following terrestrial assessments were completed for these areas during the August site visit:

- General site vegetation descriptions.
- Fauna habitat observations and mapping which included:
  - Identifying potential avifauna habitat.
  - Identifying areas of potential lizard habitat.

2.1 General habitat observations

Freshwater and terrestrial ecological features, including broad vegetation types and potential fauna habitat were noted within the site. Large trees (>15 cm Diameter at Breast Height (DBH)) were assessed on site by a suitably qualified T+T ecologist with bat competency 3.3[3]. Trees were assessed for bat roost features (e.g., flaking bark, dead wood, cracks, splits). Areas of potential lizard habitat were noted in the field. Potential lizard habitat objects such as logs were overturned and searched. Additionally, any avifauna habitat was noted, and incidental bird observations were recorded.

[3] Competency can only be certified by the NZ DOC Bat Recovery Group (NZ DOC Bat Recovery Group, 2022).

2.2 Targeted terrestrial fauna surveys

2.2.1 Long-tailed bats

Acoustic bat monitor survey

A total of 15 acoustic bat monitors (ABMs) that can detect bat calls were deployed over the project area for a three-week period on 18 April 2024 (locations shown in Figure Appendix A.1). ABMs were placed around the site to target potential bat roost trees and potential flyways (e.g., rows of trees and river margins). ABMs were set to record for a period from one hour before sunset to one hour after sunrise. They were collected on 9 May 2024.

ABM data analysis

Audio recording spectra from the ABMs were processed using a machine learning tool developed by T+T to automatically detect long-tailed bat calls (AutoBat version 0.3). The tool's performance has been verified against a database of more than 26,000 manually classified recordings obtained at a variety of locations. For this database, on average 98 % of bat calls are successfully detected using the tool. Recordings identified as potentially containing long-tailed bat calls, or cases which are sufficiently ambiguous (< 0.95 'prediction confidence' as determined by the software) are then manually reviewed for quality assurance purposes.

Standard Department of Conservation (DOC) protocols (DOC Bat Recovery Group, 2021) have weather requirements that must be met for a survey night to be considered 'valid':

- Temperature 10 °C or greater for the first four hours after sunset time.
- Precipitation <2.5 mm in the first two hours after official sunset, and <5 mm in the first four hours after official sunset.

In order to determine whether survey nights were valid, rainfall and temperature data was obtained from a nearby NIWA CLIFO weather station[4] (see Table Appendix B.1).

2.2.2 Skinks

To gauge the potential for skinks to be present in the proposed impact area, 53 foldable tracking tunnels with tracking cards (i.e., a card with ink that shows the footprints of visitors) were deployed across the site (locations shown in Figure Appendix A.1). Tracking tunnels were placed at locations targeting possible skink habitat (e.g., dense vegetation). Tracking cards were baited with banana and left in place for a three-week period, being set 19 April 2024 and collected on 9 May 2024.

No surveys were undertaken for native geckos as habitat on site is considered unsuitable due to lack of native vegetation and lack of connectivity to any other areas of native vegetation.

2.3 Potential wetlands

After the initial site walkover, areas noted to have vegetation indicative of wetlands (e.g., areas containing potential wetland grass species) or possible wetland characteristics (e.g., vegetation in a depression) were revisited to establish vegetation plots. On 29 February 2024 four 3x3 m plots were established in the field and vegetation assessed using the Wetland Delineation Protocols (WDP[5]; Ministry for the Environment, 2022) (locations shown in Figure Appendix A.1).

[4] NIWA. 2024. The National Climate Database: Maraekakaho Cws (Station 40256; -39.63795 176.68206). https://cliflo.niwa.co.nz/ accessed 10/05/24.

[5] The WDP assesses wetlands against the RMA definition of a wetland, while the NPS-FM provides additional exclusions to define natural inland wetlands.

Three of the vegetation plots were located in a historic stream backwater to the north of Taihape Road, and one alongside Taihape Road to the west of the site. In certain instances, a hole was dug nearby the vegetation plot to assess soil. Soil hardness did not always allow for holes to be easily dug, due to it being late summer and very dry.

2.4 Stream fauna surveys

Four 15 m reaches (60 m total) were electrofished on the Okawa Stream using a NIWA electrofishing machine backpack (EFM), starting just upstream of the Taihape Road bridge (locations shown in Figure Appendix A.1). The four 15 m reaches were staggered along a 150 m length of stream targeting different habitat types, such as pools, riffles and runs. For each reach, the percentage of each habitat and the proportion of fine sediment was recorded. The total fishing time, shock time and EFM settings were also recorded. Captured fish were measured to the nearest mm and released downstream. Kōura (*Paranephrops planifrons*) and freshwater shrimp (*Paratya curvirostris*) were counted and released.

One composite macroinvertebrate sample was collected in the Okawa Stream upstream of the Taihape Road bridge in accordance with semi-quantitative methods in the New Zealand protocols (Stark et al., 2001), utilising the soft-bottomed protocol P2. A composite sample was collected targeting mostly bank side vegetation (e.g., watercress and grasses) and in-stream macrophytes. The sample was analysed by Environment Impact Assessments Ltd in Auckland, and macroinvertebrate community index (MCI) score was calculated.

A six replicate eDNA sample was taken using mini eDNA kits at the Taihape Road bridge (Figure Appendix A.1). The methodology was in accordance with the recommendations from Wilderlab current at the time of survey. A volume of 1 L of water was able to be filtered for each sample. Samples were sent to Wilderlab for analysis.

3 Terrestrial habitat and wetland characteristics

3.1 Site vegetation

Terrestrial vegetation across the site was exotic dominated. Vegetation for the majority of the site comprised exotic, grazed pasture species and annual weeds. Sheep, horses and beef cattle were observed grazing during the site visit. Large trees (>15 cm DBH) were rare in areas of pasture, with approximately eight large trees, primarily crack willow (*Salix* × *fragilis*) and English oak (*Quercus robur*) distributed in patches. Along the southwest boundary was a row of Lombardy poplars (*Populus nigra*) (Photograph 3.1: Row of Lombardy poplars along the southwest boundary of the site. Photograph taken 11 August 2025.), while a row of very large macrocarpa (*Hesperocyparis macrocarpa*) between the poplars and the farmhouse had been recently felled in August 2025 (Photograph 3.2: A row of large macrocarpas had recently been removed. Photograph taken 11 August 2025.). Trees appear to have been established as specimen trees and hedgerows and not for the purposes of erosion control.

Photograph 3.1: Row of Lombardy poplars along the southwest boundary of the site. Photograph taken 11 August 2025.

Photograph 3.2: A row of large macrocarpas had recently been removed. Photograph taken 11 August 2025.

To the north of Taihape Road, between the driveways at 174 Taihape Road, were exotic willows and a stand of mature blackwood (*Acacia melanoxylon*), with a phoenix palm (*Phoenix caniariensis*), Chinese privet (*Ligustrum sinense*), blackberry (*Rubus fruticosus*) and old man's beard (*Clematis vitalba*) (Photograph 3.3: Blackberries and old man's beard under willows at 174 Taihape Road, blackwoods in the background. Photograph taken 11 August 2025.). No understorey was present under the blackwoods (Photograph 3.4: Blackwoods and phoenix palm between driveways at 174 Taihape Road. Photograph taken 11 August 2025.).

Photograph 3.3: Blackberries and old man's beard under willows at 174 Taihape Road, blackwoods in the background. Photograph taken 11 August 2025.

Photograph 3.4: Blackwoods and phoenix palm between driveways at 174 Taihape Road. Photograph taken 11 August 2025.

Vegetation on the banks of the Okawa Stream near the Taihape Road bridge was covered in rank grasses and large areas of fleabane (*Erigeron bonariensis*), Chinese mugwort (*Artemisia veriotiorum*), and blackberry. Mature large trees, primarily poplars (*Populus* spp.) and crack willows were also present along the streambanks.

The existing Chesterhope Upper stopbank behind the Omāhu subdivision has exotic trees (mainly willows) between the stopbank and Okawa Stream. Trees lining the bottom edge of the stopbank have been felled but stumps remain. A large macrocarpa and two deciduous exotic trees have branches overhanging the stopbank near Taihape Road.

Just south of the Ohiti Road subdivision, bordering the Ngaruroro River (and originally part of the Ngaruroro floodplain) was a large area of overgrown exotic dominated forest. Crack willow, Chinese privet in varying stages of maturity, barberry (*Berberis vulgaris*) and blackberry were the main species in the forest. There were patches of gorse in places, particularly around the southwest edge. Occasional native trees, primarily mature cabbage trees (*Cordyline australis*) were also scattered throughout.

A botanical survey was not within the scope of this assessment. However, no significant natural areas (SNAs) are located within or adjacent to site and no Threatened or At Risk plant species were observed. Several species present on site are listed as pest species under the Hawke's Bay Regional Pest Management Plan 2018-2038 (RPMP). Old man's beard is listed as an unwanted organism for progressive containment while blackberry, Chinese privet and gorse are listed as pest species for sustained control.

3.2 Terrestrial fauna habitat and survey results

3.2.1 Long-tailed bats

The nearby Ngaruroro River and Okawa Stream and large exotic trees between the two, provide potential commuting pathways and feeding areas for native bats. Two potential bat roost trees (both crack willows) were identified in areas of pasture, see Photograph 3.5 and Photograph 3.6. No bat roost features were identified in oak trees or other exotic trees within the pasture areas. Lombardy poplars located behind the Ohiti Road subdivision and at the southern boundary also contained trees with cracks and deadwood.

The DOC Bat Roost Protocols (updated in October 2024 after ABM survey completion) (NZ DOC Bat Recovery Group, 2024) recommend bat management if bats have been detected within 25 km in the previous ten years. Bat surveys are recommended where lack of bat records are due to lack of survey effort.

No long-tailed bats were detected during the acoustic survey undertaken between 18 April 2024 and 8 May 2024 (refer to Figure Appendix A.1 for ABM locations). However, of the 21 nights the ABMs were deployed, 14 were invalid. This was largely due to minimum temperatures dropping below 10 °C in the first four hours after sunset, with one night invalidated due to rainfall (Table Appendix B.1). The updated DOC Bat Roost Protocols (DOC Bat Recovery Group, 2024) updated the weather requirements to a minimum temperature of 8°C for the North Island. This change only increased the valid weather nights of the survey from seven to eight valid nights.

There are no records of long-tailed bats in the immediate vicinity of the site within the last ten years. Acoustic surveys undertaken in 2024 at Waiohiki (c.7 km east of the site) (T+T, 2024) and Pakowhai (c.8 km east of the site) (T+T, 2025) did not record bats.

The failure of this survey to detect bats as well the as recent nearby surveys, mean it is considered highly unlikely that long-tailed bats use the site. As a result, further bat management is not required.

Photograph 3.5: Broken wood at the top of a crack willow branch. Photograph taken 28 February 2024.

Photograph 3.6: Splitting and a crack in a willow tree limb. Note the spiderwebs in the crack as indicated by the red circle. Photograph taken 28 February 2024.

3.2.2 Avifauna

Common native birds were seen or heard during both site visits. In February 2024 most birds were exotic, with only Not Threatened (Robertson et al., 2021) fantail (*Rhipidura fuliginosa*) and spur winged plover (*Vanellus miles*). Fantail and spur-winged plover were noted again during the August 2025 visit, along with Not Threatened (Robertson et al., 2021) Australasian harrier (*Circus approximans*), bellbird (*Anthornis melanura*), grey warbler (*Gerygone igata*), tūī (*Prosthemadera novaeseelandiae*), silvereye (*Zosterops lateralis*) and welcome swallow (*Hirundo neoxena*). A full list of all bird species recorded on site is provided in Table Appendix C.1.

The paddock habitat is not considered suitable for wetland birds, however, two ponds to the north of the site may be suitable for visiting ducks and pūkeko (*Porphyrio melanotus*) (shown in Photograph 3.7 and Photograph 3.8).

New Zealand pipit (*Anthus novaeseelandiae*, At Risk – Declining (Robertson et al., 2021)) have been recorded in the vicinity of the site. Pipit inhabit rough pasture and open habitats and breed in rank grass and dense low-growing vegetation. Suitable breeding habitat for pipit exists on site, particularly in rank grass around the edges of the proposed borrow pit and adjacent to the ford.

Dabchick (*Poliocephalus rufopectus*; Threatened – Nationally Increasing (Robertson et al., 2021)) have been sighted nearby at the Matapiro Dam (Hawke's Bay Today, 2019) but have a low likelihood of visiting the ponds due to their small size and lack of overhanging vegetation (Photograph 3.7 and Photograph 3.8). The Okawa Stream may provide habitat for dabbling birds such as grey duck (*Anas superciliosa*, Threatened-Nationally Vulnerable), however pure grey duck are generally found in "wild" rather than pastoral landscapes (Williams, 2023) and are unlikely to breed in the vicinity of the site.

Most native birds are protected under the Wildlife Act (1953). While birds are generally mobile and can disperse during disturbance, they become vulnerable during breeding season when nesting occurs. Peak bird breeding season is September to January inclusive for forest birds and ducks. If works were to occur in peak bird breeding season, management of birds would be required.

Photograph 3.7: Largest of the two ponds located next to the vineyard. Dead and barely alive raupō and juvenile willows on the lake margin. Photograph taken 28 February 2024.

Photograph 3.8: Smallest of the two ponds. Photograph taken 28 February 2024.

3.2.3 Skinks

Northern grass skink (*Oligosoma polychroma*) and northern spotted skink (*Oligosoma kokowai*) have been recorded in the Napier area, both of which could utilise the habitats observed on site. It is noted that the site was inundated by flooding during cyclone Gabrielle and therefore any potential lizard populations that were present on the site may have been removed due to flooding and subsequent habitat degradation. Northern grass skinks have a conservation status of Not Threatened and spotted skink are At Risk – Relict (Hitchmough et al., 2021). Small populations of both species were presumed by an MWH ecologist to be present along the Ngaruroro River at very low densities, with numbers being impacted by predation and habitat degradation (MWH, 2011). However, previous surveys undertaken in 2011 for skinks and geckos at sites along the Ngaruroro River failed to find any individuals or sign.

Several areas of potential skink habitat were identified across the site during the site visits. This included large areas of rank grasses and weeds in the paddocks adjacent to Ohiti and Taihape Roads

(Photograph 3.9), areas of exotic trees and shrubs with dense understorey, and a large pile of woody debris (Photograph 3.10). Talking with the landowner (personal communication, 29 February 2024), the paddock became fully submerged (i.e., order of 2 m water depth) during the cyclone in February 2023. If skinks were there before February 2023, they would have been impacted by the flood.

No skink footprints were present on the 53 tracking tunnel cards (refer to Figure Appendix A.1 for tracking tunnel locations). All tracking cards had high rat and mouse activity, suggesting very high predator numbers. Given the lack of skink sign on the tracking cards, and the points stated above, skinks are considered highly unlikely to be present on site. As such, native skink management and a WAA for native skink relocation are not considered necessary.

Photograph 3.9: Rank grasses and tall weeds that might provide habitat for skinks. Photograph taken 28 February 2024.

Photograph 3.10: A pile of woody debris that may provide habitat for skinks. Photograph taken 28 February 2024.

3.3 Potential wetlands

Two main areas were identified for investigation for potential RMA wetlands (and further to that, natural inland wetlands) following the initial site visit on 29 February 2024. This included a low-lying depression near the two ponds and the edge of a paddock near the roadside.

Three vegetation plots (Plots 1, 2, and 3) were established in the depression near the ponds (Photograph 3.11and Photograph 3.12) and one plot ("Edge of paddock") was established in a paddock next to Taihape Road (Photograph 3.13) (locations shown in Figure Appendix A.1). A full species list for each plot is provided in Table Appendix D.1.

Plot 2 failed all wetland tests Photograph 3.12), including the rapid test, dominance test, prevalence index test, the hydric soils test, hydrology test, threatened species test and the pasture test, making it definitively non-wetland (Table 3.1). Plots 1 and 3 failed all tests, but the dominance test. The dominance test is passed if more than 50 % of the dominant species across all strata in a plot are wetland plants (i.e., are rated OBL, FACW or FAC). Plots 1 and 3 had a high proportion (30 % and 50 % of total plot plant cover, respectively), of clustered dock (*Rumex conglomeratus*), a facultative plant (FAC) (i.e., found equally in wetlands and non-wetland). Clustered dock is a common perennial weed throughout New Zealand. Plot 2 only marginally missed passing the dominance test (i.e., the dominance test was 50 %).

Photograph 3.11: Location of Plot 1 in the landscape. The red tufts are the clustered dock seedheads. Photograph taken 29 February 2024.

Photograph 3.12: Location of Plot 2 in the landscape. Photograph taken 29 February 2024.

The plot established in the paddock next to Taihape Road failed all wetland tests (Photograph 3.13). The dominant species in the plot with 75 % total plant cover was upland browntop (*Agrostis castellana*), which is a species not associated with wetlands (i.e., plant status of upland (UPL)). The soils at this location were extremely dry and friable and not characteristic of hydric soils (Photograph 3.14).

All four plots failed the pasture exclusion test, meaning the plots all had less than 50 % cover of specified 'dryland' pasture species that are included in the pasture exclusion assessment methodology when assessing natural inland wetlands (Ministry for the Environment, 2022). This meant that the plots were subject to further plant and soils tests to determine the presence of natural inland wetlands. Following further tests, all four plots came out as Non-Wetland as per Table 3.1 below, meaning there are no RMA wetlands or natural inland wetlands in the areas that would be impacted by the proposed works.

Photograph 3.13: Location of the "Edge of Paddock" plot. Photograph taken 29 February 2024.

Photograph 3.14: Soil profile of the "Edge of Paddock" plot. Photograph taken 29 February 2024.

The two ponds located north of Taihape Road appeared deliberately constructed (see Photograph 3.7 and Photograph 3.8 above). There were no culverts or outflow pipes around the ponds. The large pond receives runoff from the vineyard directly above it. It had dead and barely alive raupō and juvenile willows on its margin (Photograph 3.7). Given the ponds are artificially constructed and were not constructed to specifically offset the impacts on wetlands elsewhere, they are excluded from the natural inland wetland definition under the NPS-FM. They may be considered wetlands under the RMA and the RRMP, but as they have now been excluded from the works area they are not discussed any further.

Table 3.1: Wetland Delineation Protocol results and the outcome for each plot surveyed

Test type	Rapid test	Dominance test		Prevalence test		Hydric soils test	Hydrology test	Threatened sp. test	Pasture test	Outcome
Site	Pass/Fail	Index	Pass/Fail	Index	Pass/Fail	Pass/Fail	Pass/Fail	Pass/Fail	Pass/Fail	Classification
Edge of paddock	Fail	0 %	Fail	4.8	Fail	Fail	Fail	Fail	Fail (16 %)	Non-Wetland
Ponds - Plot 1	Fail	67 %	Pass	3.6	Fail	Fail	Fail	Fail	Fail (5 %)	Non-wetland
Ponds - Plot 2	Fail	50 %	Fail	3.6	Fail	Fail	Fail	Fail	Fail (3 %)	Non-wetland
Ponds - Plot 3	Fail	100 %	Pass	3.3	Fail	Fail	Fail	Fail	Fail (12 %)	Non-wetland

4 Stream characteristics

4.1 Stream habitat

The assessed reach of the Okawa Stream is a low-grade channel, with a fairly uniform wetted width (around 5 m). The stream exhibited some meandering and appeared largely unaltered (Photograph 4.1). The instream habitat was primary a mixture of fast and slow runs, and pools (Photograph 4.2). A few small areas of riffle were present.

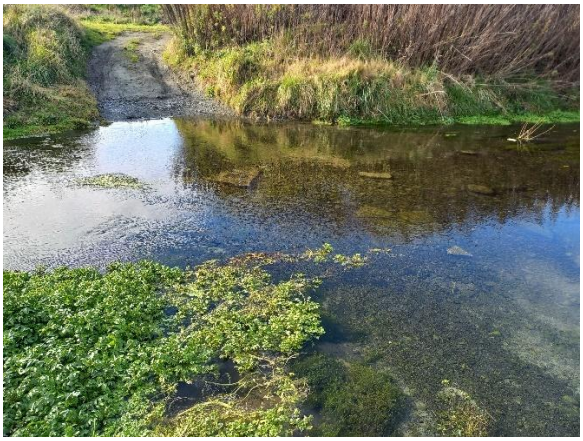
Most of the channel banks are grassed. Bottom substrate was predominantly small gravels, with some sand. There was a reasonable amount of in-stream habitat present for freshwater fauna, including bankside vegetation, macrophytes, fine gravels, root mats, undercut banks, and in-stream willows. Stream shading was generally low and was provided by the stream banks and tall grass or other vegetation in the riparian margins.

Photograph 4.1: Okawa Stream had a uniform wetted width across most of the assessed reach. The stream had some meandering. 29 February 2024.

Photograph 4.2: Pool habitat under a crack willow just upstream of the Taihape Road bridge. 29 February 2024.

A ford on the Okawa Stream by the Omāhu subdivision is used locally by the farmer (Photograph 4.3 and Photograph 4.4). The track to the ford on either side of the stream is worn into the stream bank, and the crossing is wide and shallow. Riparian vegetation at the ford consists of rank grass and weedy vegetation.

Photograph 4.3: The track and the ford looking north from the true right of the Okawa Stream. Photograph taken 11 August 2025.



Photograph 4.4: The ford through the Okawa Stream looking north from the true right bank. Photograph taken 11 August 2025.

4.2 Stream fauna

Five freshwater fauna species were captured during electrofishing, including common bully (*Gobiomorphus cotidianus*), kōura (*Paranephrops planifrons*), longfin eel (*Anguilla dieffenbachii*), shortfin eel (*Anguilla australis*), and freshwater shrimp (*Paratya curvirostris*) (Table 4.1). Longfin eels have a threat status of At-Risk – Declining, while all other species are considered Not Threatened (Dunn et al., 2018; Grainger et al., 2018). A total of 27 fish were captured from an area of *c.* 313.5 m^2, with more seen in the reach that evaded capture. One kōura and several freshwater shrimp were also captured. No fish passage barriers were seen along the section of stream assessed.

Results of eDNA sampling generally identified the species captured by the electrofishing (Table Appendix E.1), with the addition of common smelt (*Retropinna retropinna*), īnanga (*Galaxias maculatus*), gambusia (*Gambusia affinis*), goldfish (*Carassius auratus*), black flounder (*Rhombosolea retiaria*) and rainbow trout (*Oncorhynchus mykiss*) (Table 4.1). Common bullies, shortfin eel and longfin eel had the highest number of eDNA readings (refer to Table Appendix E.1), which is unsurprising given they were the main fish species captured during electrofishing. The New Zealand Freshwater Fish Database (NZFFD) records also indicated that the dwarf galaxias (*Galaxias aff. divergens "northern";* At Risk - Declining) could be in the Okawa Stream, as they have been captured in the Ngaruroro River and are distributed throughout the Napier/Hawke's Bay region. However, dwarf galaxias were not detected with electrofishing or eDNA, suggesting this species is unlikely to be in the section of the Okawa Stream surveyed.

Table 4.1: Summary of fish and invertebrate species detected using electrofishing and eDNA

Common name	Scientific name	Threat status *	Method	
			Electrofishing	eDNA
Longfin eel	*Anguilla dieffenbachii*	At Risk - Declining	✓	✓
īnanga	*Galaxias maculatus*	At Risk - Declining		✓
Shortfin eel	*Anguilla australis*	Not Threatened	✓	✓
Common bully	*Gobiomorphus cotidianus*	Not Threatened	✓	✓

Common name	Scientific name	Threat status *	Method	
			Electrofishing	eDNA
Common smelt	*Retropinna retropinna*	Not Threatened		✓
Black flounder	*Rhombosolea retiaria*	Not Threatened		✓
Rainbow trout	*Oncorhynchus mykiss*	Introduced and Naturalised		✓
Goldfish	*Carassius auratus*	Introduced and Naturalised		✓
Gambusia	*Gambusia affinis*	Introduced and Naturalised		✓
Kōura	*Paranephrops planifrons*	Not Threatened	✓	✓
Freshwater shrimp	*Paratya curvirostris*	Not Threatened	✓	

*Threat status from Dunn et al., (2018) and Grainger et al., (2018).

The Macroinvertebrate results showed soft-bottomed MCI scores of 85.2 and a QMCI score of 2.3, indicating fair and poor water quality, respectively (Table Appendix E.2). A very high number of *Potamopyrgus* snails were in the sample (203 out of 224 individuals counted). There were also very high readings for mud snails (*Potamopyrgus antipodarum*) in the pooled eDNA sample. *Potamopyrgus* snails are native to New Zealand and are the most widespread water snail in the country, being found in most streams and rivers (Landcare Research, 2024). High population densities of *Potamopyrgus* are indicative of a long period since disturbance (e.g., flooding).

4.3 Streamworks considerations

As the proposed stopbank designs have progressed, the requirements for potential streamworks have changed. As of August 2025, no works are proposed within the Okawa Stream, with the exception of the potential use of the Okawa Stream ford between the proposed borrow pit and the existing Chesterhope Upper stopbank.

Potential streamworks (including the removal or addition of substrates (e.g., gravels), rock placement, stream realignment and use of the ford) within the Okawa Stream should consider any resident or migrating freshwater fauna, stream water quality, and in-stream fauna habitat. Streamworks that disturb substrates pose a risk to freshwater fauna, particularly if no controls are put in place. Fish and invertebrates (e.g., kōura), can be killed or injured during streamworks like those which have been proposed within the Okawa Stream. Fish relocation is therefore recommended before streamworks commence. The approach taken to reduce impacts on resident fish should be further developed through the EMP.

Due to the presence of migratory fish (such as eels and īnanga), it is preferable from an ecology perspective that any streamworks, including broader works requiring regular ford crossings, be completed outside of peak migration timings for the fish community present in the catchment.[6] Fish migration (both upstream and downstream) within the Okawa Stream catchment occurs throughout the year, with peak migration occurring between September to November (inclusive).

Streamworks water quality impacts can affect fish movement primarily through the increase in suspended solids and the associated decrease in water clarity. The fish species that are most likely to migrate within the peak migration period include īnanga and common smelt, these species have a greater susceptibility to fluctuations in water clarity and quality. Therefore, streamworks and

[6] It should be noted that outside of these fish species migration timings fish are still moving (both upstream and downstream) between habitats.

crossing activities are likely to have a lower level of effect on the Okawa Stream fish community if undertaken outside of this peak migration period, particularly during December to February (inclusive) when only shortfin and longfin eels are migrating upstream.

If avoiding the peak migration period isn't achievable due to project timelines, further in-river works management options should be considered. This may include setting a stand down period where machinery cannot operate within the river, to allow suspended sediment to settle and move through the system. Any stand down period should be practical and achievable within the timelines of the project and could include restricting the period of in-river works to a set limit within any 24-hour period and/or the number of consecutive days. The approach taken to reduce impacts on migrating fish should be further developed through the EMP.

In-stream habitat features such as willows (Photograph 4.2) and undercut banks are important habitat for freshwater fauna, particularly eels. Ideally streamworks should avoid removing these features where possible.

5 Ecological constraints and opportunities

This section provides an overview of ecological constraints, risks and opportunities for the project, and for consideration by the wider project team. In particular, we note ecological constraints which may impact project timelines and/or design requirements.

5.1 Constraints

5.1.1 Terrestrial constraints

- As some RPMP weed species are present on site care will need to be taken not to spread weed seeds or fragments around or between sites.
- Due to ABM survey results and nearby recent surveys detecting no bat activity it is highly unlikely that long-tailed bats utilise the site. As a result, no bat management is required.
- Avifauna can typically be managed through clearing habitat outside the peak bird breeding season. Peak bird breeding season is between **September to January inclusive** for forest birds and **August to February inclusive** for New Zealand pipit. Most native birds are fully protected under the Wildlife Act.
  - New Zealand pipit breeding habitat (long grass and dense low-growing vegetation) can be managed by grazing or mowing before the pipit breeding season commences. It should be kept short throughout the pipit breeding season to avoid pipit breeding habitat developing.
  - If vegetation needs to be cleared during peak bird breeding season (i.e., due to programme), bird nest checks should be undertaken by an ecologist prior to clearance.
- While potential native lizard habitat was identified on site, due to the lack of nearby skink records, the recent severe flooding, high predator densities and no skinks being found in targeted skink surveys, native skinks are considered highly unlikely to be present on site. As such, a WAA for native skink relocation is not considered necessary.
  - To ensure skinks do not colonise the site in future, we recommend keeping areas of grass and annual weeds within the site short (through grazing or progressive mowing). Initial mowing to a height of approximately 5 cm would need to commence between **October and April inclusive** when lizards are more active.

5.1.2 Wetland constraints

- No RMA wetlands or natural inland wetlands were identified using the wetland delineation protocols in the paddock areas surveyed. No further wetland considerations are required.

5.1.3 Streamworks constraints

- Due to potential impacts on freshwater fauna from any streamworks, such as upgrades to the ford, fish relocation is recommended before any streamworks commence.
- Important ecological timings have been identified within this O+C, some of which may impact on streamworks that are proposed within the Okawa Stream. These include river bird nesting (**September to January**) and peak fish migration (**September to November**). Ideally (from an ecology perspective) any streamworks or works that require regular fording of Okawa Stream that are to occur within the Okawa Stream are best to be undertaken between **February to August inclusive**. This avoids the peak fish migration period, including the upstream migration of species more susceptible to streamworks derived water quality effects. Similarly, this avoids the river bird nesting timings. If this streamworks time period is not possible, we consider undertaking streamworks outside of the peak fish migration period to be of higher importance. This could extend the potential streamworks period to **December to August**

inclusive. Any approach taken to reduce the impacts on ecologically important timings will be further developed through the EMP process of the OiC.

A summary of recommended effects management options for terrestrial and freshwater fauna is provided in Table 5.1 below.

Table 5.1: Summary of recommended effects management options for terrestrial and freshwater fauna

Fauna type	Species are protected under the WAA and require management	May require management under the EMP process of the OiC to reduce overall effect	Summary of effects management options
Long-tailed bats	✓	**X** Protected under the WAA but not recorded during surveys and presumed to be absent from site.	No bat management required.
Native freshwater fish	**X**	✓	A Freshwater Management Plan (FMP) should be prepared for any instream works to manage effects on freshwater fauna.
Native skinks	✓	**X** Protected under the WAA but not recorded during surveys and presumed to be absent from site.	No skink salvage required. Mowing or grazing are recommended to manage the very low but potential risk of lizards entering the site from neighbouring habitats. Grass should be reduced to approximately 5 cm high, beginning between October and April and continuing until completion of works.
Native birds	✓	✓	Bird nest checks are to be carried out by an ecologist prior to vegetation clearance during peak breeding season for forest birds and ducks (**September to January inclusive**) and for New Zealand pipit (**August to February inclusive**).

5.2 Opportunities

Opportunities exist to involve mana whenua during the works and after the construction of the stopbank, and to create the Net Positive ecological outcomes sought by the OiC. Identified opportunities include:

- Riparian vegetation along the Okawa Stream banks is currently exotic dominated, comprising largely exotic willows, rank grasses, blackberry, Chinese mugwort and fleabane. There is potential to undertake riparian planting along the streambanks with appropriate indigenous species (e.g., māhoe; *Melicytus ramiflorus*) to replace the exotic dominated vegetation. Planting provides an opportunity to improve streambank stability and biodiversity values (e.g., increase stream shading, which is currently low).
- If not considered a maintenance issue, the areas surrounding the stopbank could be planted with indigenous vegetation. The vegetation could increase biodiversity values by providing potential habitat for avifauna, lizards and invertebrates.

- If trees are required to be felled onsite, they could be cut up into rounds to provide potential habitat enhancements for invertebrates and skinks, if they recolonise. Additionally, they could be mulched to provide mulch for future plantings. Mulch helps to retain soil moisture, which may improve plant survival in the dry, summer months.
- There is a potential to save the topsoil layer during stopbank construction. The topsoil layer contains important soil microbial activity and invertebrates (e.g., worms). The topsoil layer could be relocated elsewhere during stopbank construction and placed back on top of the stopbank, once complete. This could provide cost-savings and allows for a 'nature-based-solution' if planting along the stopbank is proposed.
- There is an opportunity to inform and involve mana whenua with the ecology works (e.g., freshwater fauna).

6 Recommendations

Based on our review we have the following recommendations for the next stages of the project.

- The EMP should contain biosecurity protocols to ensure that vehicles and equipment are clean and avoid spreading pest plant species between or around sites.
- Finalisation of the stopbank design as early as possible may increase the likelihood of vegetation removal and streamworks occurring during their ideal ecological timeframes.
- Although native bird nesting habitat has been identified, this potential constraint can be manged through appropriate project design. In the first instance this would involve excluding areas of suitable bird nesting habitat from the project footprint or minimising the amount of suitable bird nesting habitat impacted by the project design. If this cannot be achieved, then impacts on birds from removal of these habitats can be managed by including suitable avifauna protocols in the EMP. Suitable protocols include:
  - New Zealand pipit breeding habitat (long grass and dense low-growing vegetation) can be managed by grazing or mowing before the pipit breeding season commences and then kept short throughout the pipit breeding season.
  - Bird nest checks should be undertaken by an ecologist prior to vegetation clearance.
- There is a very low, but potential risk of native ground-dwelling lizards re-colonising the site. To reduce the risk of lizards recolonising the site, all areas within the chosen stopbank footprint containing rank grasses and tall weeds should ideally be mown or grazed to keep the grass short. Mowing would need to commence between October and April when lizards are more active, and maintain grass to a height of approximately 5 cm throughout the works period.
- If streamworks within the Okawa Stream are to occur, the effects of these works on freshwater fauna will need to be considered in the EMP. The EMP should state how any identified effects on freshwater fauna are going to be managed. It is likely that any management will occur prior to streamworks occurring at the site (e.g., fish salvage) and will need to be completed by a suitably qualified ecologist (and potentially with the assistance of mana whenua – if appropriate).
- Streamworks involving gravel disturbance (removal or addition) should ideally be undertaken outside of peak fish migration times. If this isn't feasible, the amount of time spent in the river with heavy machinery should be controlled to ensure that there is a break in gravel disturbance. This is to allow the stream to reset back to “normal" in terms of water clarity and suspended solid concentrations.
- Preparation of an EMP as required by the OiC consent. Components of an EMP may include any required management of freshwater or terrestrial species (e.g., bird nest checks during breeding season).

7 Applicability

This report has been prepared for the exclusive use of our client Hawkes Bay Regional Council, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

Tonkin & Taylor Ltd
Environmental and Engineering Consultants

Report prepared by:	Authorised for Tonkin & Taylor Ltd by:
	
.....	.....
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Appendix A Ecological survey map

- **Figure Appendix A.1: Ecological Survey Map**

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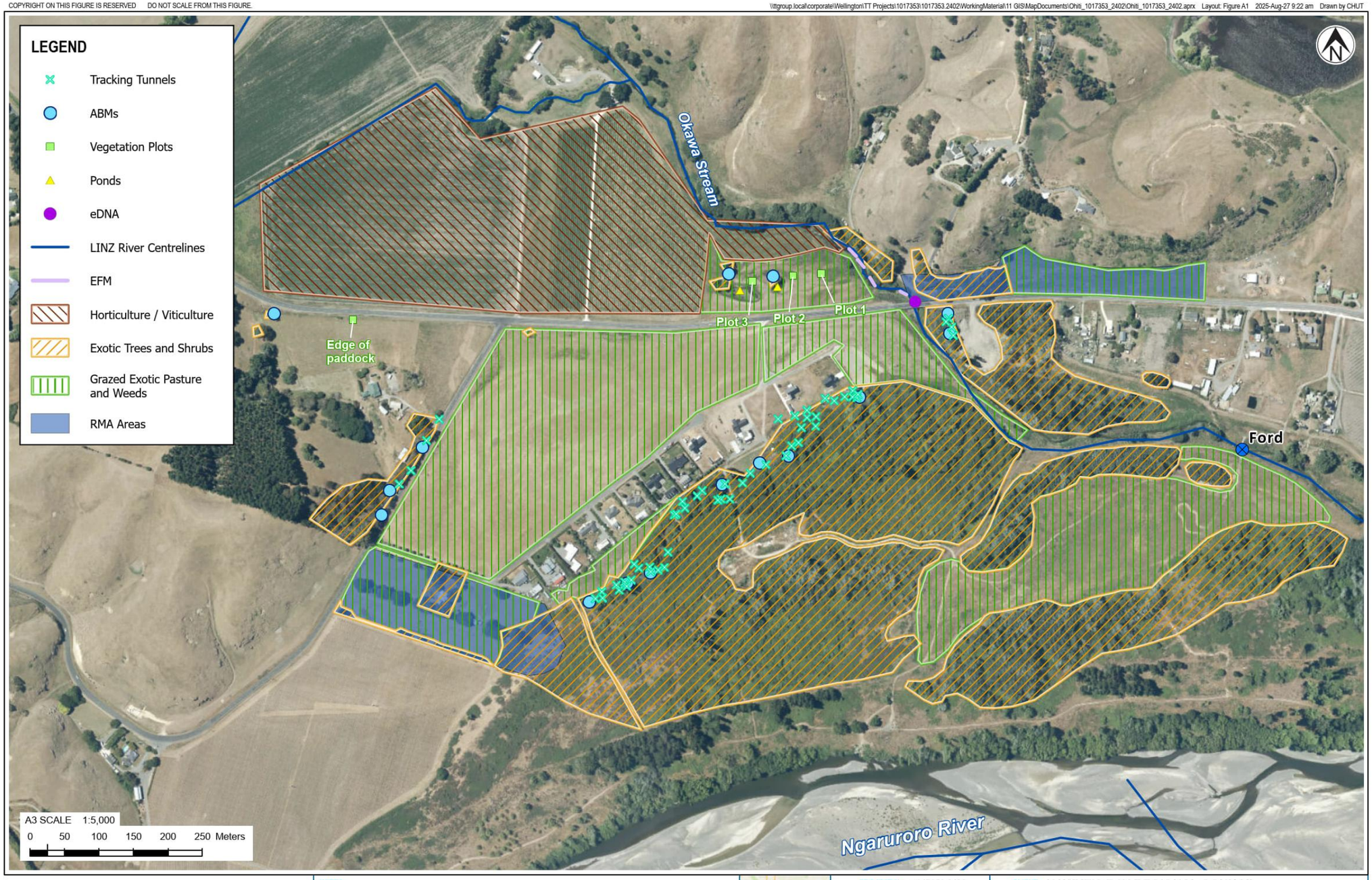

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NOTES:
Basemap NZ Navigation Map: Eagle Technology, LINZ, StatsNZ, NIWA, Natural Earth, © OpenStreetMap contributors.. NZ - Imagery: Eagle Technology, LINZ

REV	DESCRIPTION	GIS	CHK	DATE
0	First version	CHUT	CHSA	27/08/24

PROJECT No.	1017353.2402		
DESIGNED	CHUT	AUG.25	
DRAWN	CHUT	AUG.25	
CHECKED	CHSA	AUG.25	
APPROVED	SEPT.25		

CLIENT	HAWKE'S BAY REGIONAL COUNCIL
PROJECT	OHITI ROAD, OMAHU STOPBANK AND STREAMWORKS DESIGN
TITLE	ECOLOGICAL SURVEY MAP
SCALE (A3)	1:5,000
FIG No.	FIGURE A1
REV	0

Figure Appendix A.1: Ecological survey map

Appendix B Weather conditions

Table Appendix B.1 : Weather conditions for the 21-night ABM survey period.

Night No.	Date	Official sunset time	Min temperature first 4 hours after sunset (°C)	Rainfall 2 hours after sunset (mm)	Rainfall 4 hours after sunset (mm)	Valid weather night (Y/N)
1	18/04/2024	5:39:00 PM	5.8	0	0	**N**
2	19/04/2024	5:37:00 PM	9.5	0	0	**N**
3	20/04/2024	5:36:00 PM	13.7	0	0	Y
4	21/04/2024	5:34:00 PM	11.6	6.8	7.8	**N**
5	22/04/2024	5:33:00 PM	12.5	0	0	Y
6	23/04/2024	5:32:00 PM	5.1	0	0	**N**
7	24/04/2024	5:30:00 PM	5	0	0	**N**
8	25/04/2024	5:29:00 PM	16.1	0	0	Y
9	26/04/2024	5:28:00 PM	11.4	0	0	Y
10	27/04/2024	5:27:00 PM	4.1	0	0	**N**
11	28/04/2024	5:25:00 PM	5.4	0	0	**N**
12	29/04/2024	5:24:00 PM	6.9	0	0	**N**
13	30/04/2024	5:23:00 PM	10.3	0	0	Y
14	1/05/2024	5:22:00 PM	11.4	0	0	Y
15	2/05/2024	5:20:00 PM	7.5	0	0	**N**
16	3/05/2024	5:19:00 PM	9.5	0	0	**N (2021)/Y(2024)**
17	4/05/2024	5:18:00 PM	3.8	0	0	**N**
18	5/05/2024	5:17:00 PM	6.2	0	0	**N**
19	6/05/2024	5:16:00 PM	12.3	0	0	Y
20	7/05/2024	5:15:00 PM	5.6	0	0	**N**
21	8/05/2024	5:14:00 PM	3.4	0	0	**N**

Appendix C Bird species seen or heard on site

Table Appendix C.1: Bird species seen or heard during site visits in February 2024 and August 2025.

Insert heading	Heading	Heading
Australasian harrier	*Circus approximans*	Not Threatened
Bellbird	*Anthornis melanura*	Not Threatened
Fantail	*Rhipidura fuliginosa*	Not Threatened
Grey warbler	*Gerygone igata*	Not Threatened
Tūī	*Prosthemadera novaeseelandiae*	Not Threatened
Silvereye	*Zosterops lateralis*	Not Threatened
Spur winged plover	*Vanellus miles*	Not Threatened
Welcome swallow	*Hirundo neoxena*	Not Threatened
Australian magpie	*Gymnorhina tibicen*	Introduced and Naturalised
Californian quail	*Callipepla californica*	Introduced and Naturalised
Chaffinch	*Fringilla coelebs*	Introduced and Naturalised
Eurasian blackbird	*Turdus merula*	Introduced and Naturalised
Eurasian skylark	*Alauda arvensis*	Introduced and Naturalised
House sparrow	*Passer domesticus*	Introduced and Naturalised
Indian myna	*Acridotheres tristis*	Introduced and Naturalised
Yellowhammer	*Emberiza citrinella*	Introduced and Naturalised

Appendix D WDP data

Table Appendix D.1 : Species lists for each vegetation plot.

Site	Stratum	Vegetation species	Common name	% cover	Rating	Pasture sp.	Biostatus origin
Edge of paddock	Herb	*Agrostis castellana*	Upland browntop	75 %	UPL		Exotic
		Lolium perenne	Perennial ryegrass	10 %	FACU	Y	Exotic
		Paspalum dilatatum		3 %	FACU	Y	Exotic
		Holcus lanatus	Yorkshire fog	1 %	FAC	Y	Exotic
		Trifolium pratense	Red clover	1 %	FACU	Y	Exotic
		Cirsium arvense	Californian thistle	1 %	FACU		Exotic
		Rumex conglomeratus	Clustered dock	1 %	FAC		Exotic
		Ranunculus repens	*Ranunculus repens*	1 %	FAC		Exotic
Ponds - Plot 1	Sapling/shrub	*Salix x fragilis*	Crack willow	1 %	FACW		Exotic
	Herb	*Rumex conglomeratus*	Clustered dock	30 %	FAC		Exotic
		Plantago major	Broadleaf plantain	2 %	FACU		Exotic
		Cynodon dactylon	Bermuda grass	30 %	FACU		Exotic
		Cirsium arvense	Californian thistle	2 %	FACU		Exotic
		Chenopodium Album	Lambsquarters	5 %	UPL		
		Ranunculus repens	Buttercup	1 %	FAC		Exotic
		Trifolium repens	White clover	2 %	FACU	Y	Exotic
		Persicaria maculosa	Redshank	2 %	FACW		Exotic
		Trifolium pratense	Red clover	2 %	FACU	Y	Exotic
Ponds - Plot 2	Herb	*Polygonum arenastrum*	Doorweed	20 %	UPL		
		Rumex conglomeratus	Clustered dock	60 %	FAC		Exotic
		Plantago lanceolata	Ribwort Plantain	1 %	FACU	Y	Exotic
		Erigeron sumatrensis	Fleabane	1 %	FACU		Exotic
		Foeniculum vulgare	Fennel	1 %	UPL		
		Cynodon dactylon	Bermuda grass	10 %	FACU		Exotic
		Holcus lanatus	Yorkshire fog	1 %	FAC	Y	Exotic
		Trifolium pratense	Red clover	1 %	FACU	Y	Exotic
Ponds - Plot 3	Herb	*Rumex conglomeratus*	Clustered dock	50 %	FAC		Exotic
		Plantago lanceolata	Ribwort Plantain	5 %	FACU	Y	Exotic
		Polygonum arenastrum	Doorweed	5 %	UPL		
		Trifolium pratense	Red clover	3 %	FACU	Y	Exotic
		Malva neglecta	Dwarf mallow	1 %	UPL		
		Persicaria hydropiper	water pepper	1 %	FACW		Exotic
		Persicaria maculosa	Redshank	1 %	FACW		Exotic
		Erigeron sumatrensis	Fleabane	1 %	FACU		Exotic
		Cynodon dactylon	Bermuda grass	2 %	FACU		Exotic
		Myosotis scorpioides	Water Forget-Me-Not	1 %	FACW		Exotic
		Dactylis glomerata	cat grass	1 %	FACU	Y	Exotic
		Plantago major	Broadleaf plantain	1 %	FACU		Exotic
		Poa annua	Unknown	5 %	FACU		Exotic
		Conium maculatum	Hemlock	1 %	FAC		Exotic

Appendix E eDNA and macroinvertebrate results

Table Appendix E.1 : Summary eDNA results for fish species and kōura.

Species name	Common name	Sample No./readings					
		Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
Gobiomorphus cotidianus	Common bully; tīpokopoko; toitoi	3482	3323	2934	3791	2673	2752
Anguilla australis	Shortfin eel; tuna; hao; aopori; hikumutu	1416	548	603	297	515	487
Anguilla dieffenbachii	Longfin eel; tuna; kūwharuwharu; reherehe; kirirua	265	332	134	368	503	432
Retropinna retropinna	Common smelt; ngaore; paraki; pōrohe	284	176	0	130	113	72
Galaxias maculatus	Inanga; īnanga	272	26	43	107	176	0
Gambusia affinis	Mosquitofish	0	190	18	39	56	77
Paranephrops planifrons	Koura; freshwater crayfish; kēwai; kōura; koeke; kēkēwai; karawai	0	0	0	128	0	0
Carassius auratus	Goldfish; morihana	0	0	0	0	0	63
Rhombosolea retiaria	Black Flounder; freshwater flounder	0	0	0	27	0	16
Oncorhynchus mykiss	Rainbow trout; taraute;tarauta; hāmana; tāmana	0	0	34	0	0	0
Gobiomorphus	Bullies	17219	18295	15445	16463	14693	15715
Anguilla	Eels	0	22	0	24	0	130
Eleotridae	Bullies	0	0	53	0	0	0

Table Appendix E.2 : Macroinvertebrate results for the Okawa Stream sample.

Taxa	MCI	MCI-sb	Number
	Score	Score	Number of individuals
Mayfly Austroclima	9	6.5	3
Mayfly Zephlebia	7	8.8	2
Caddisfly Aoteapsyche	4	6	2
Caddisfly Triplectides	5	5.7	2
Bug Sigara	5	2.4	1
True Fly Austrosimulium	3	3.9	1
Crustacea Paracalliope	5	0	2
SPIDERS Dolomedes	5	6.2	1
Mollusc Physella (Physa)	3	0.1	6
Mollusc Potamopyrgus	4	2.1	203
PLATYHELMINTHES (Flatworms)	3	0.9	1
Number of Taxa		11	
EPT Value		4	
Number of Individuals		224	
% EPT		4.02	
% EPT Taxa		36.36	
Sum of recorded scores		53.00	
Count of recorded scores		11.00	
Sum of individuals with scores		224.00	
MCI Value		96.36	
Sum of abundance load		915.00	
QMCI Value		4.08	
Sum of recorded scores		42.60	
Count of recorded scores		10.00	
Sum of individuals with scores		222.00	
SBMCI Value		**85.20**	
Sum of abundance load		500.80	
QMCI-sb Value		**2.26**	

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