REPORT

Tonkin+Taylor

Pakowhai Secondary Stopbank

Ecological Scoping Study

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

1.1 Background

Hawke's Bay Regional Council (HBRC) is proposing to construct a secondary stopbank along the left bank of the Waiohiki Drain and Tūtaekurī-Waimate Stream to protect residential properties at Pakowhai. This work forms part of a suite of region-wide projects to increase flood resilience following the severe weather events in 2023.

Tonkin & Taylor Ltd (T+T) has been engaged to prepare an ecological scoping assessment of opportunities and constraints (O+C) associated with the proposed stopbank. This work has been undertaken in accordance with our Letter of Engagement (LOE) dated 5 August 2024 (T+T reference: 1017353.2403).

1.2 Scope

This scoping assessment report has been prepared to provide a high-level overview of the freshwater and terrestrial ecological characteristics of the Waiohiki Drain, Tūtaekurī-Waimate Stream and adjacent areas likely to be affected by construction of the stopbank. The purpose of this assessment is solely to inform the further refinement of the current stopbank design by highlighting key ecological constraints and opportunities present within the Pakowhai stopbank project area.

This scoping assessment report has been informed by three stages of work outlined below:

- **Stage 1:** A desktop assessment of relevant ecological information for the proposed project area.
- **Stage 2:** A site visit to confirm and update information sourced from the desktop assessment within or near the proposed project area:
  - Freshwater and terrestrial habitat assessments within the wider project area to identify and confirm areas of ecological value within and adjacent to the proposed project area.
  - Stream Ecological Valuation (SEV) within the Tūtaekurī-Waimate Stream and Waiohiki Drain catchments, at stream reaches that will potentially be impacted by stream reclamation associated with the proposed stopbank works.
  - Environmental DNA (eDNA) and macroinvertebrate sampling in the Tūtaekurī-Waimate Stream and Waiohiki Drain.
- **Stage 3:** A further site visit to undertake field surveys required to inform this O+C report, including:
  - Bat surveys.
  - Lizard surveys.
  - Wetland surveys.

This report has been prepared in accordance with our scope.

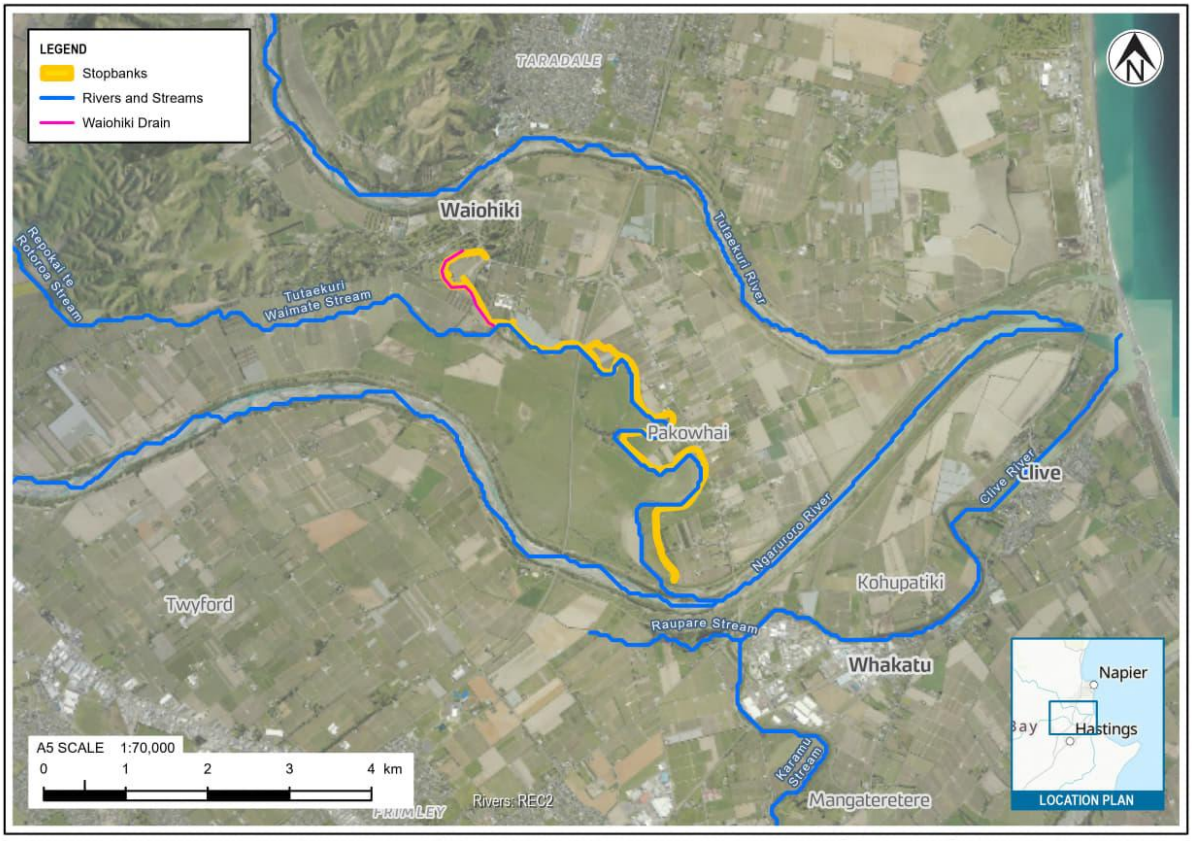

Figure 1.1: The proposed stopbank location along the eastern edge of the Tūtaekurī-Waimate Stream and the Waiohiki Drain, with proposed borrow pit locations.

1.3 Statutory context

The works to be completed at the site (refer to Figure 1.1 for site location) will be undertaken under an Order in Council[1] (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, where specific ecological management plans (EMP) will be required to manage potential effects from the proposed works. The EMPs 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 include all measures required in the conditions of consent to avoid, remedy, mitigate, offset or compensate environmental effects during construction.

Several clauses in the OiC relate specifically to the management of ecology within the project area:

- Clause 25 Project Ecologist.
- Clause 26 Ecology principles:

  (*1) The consent holder must apply the ecology principles set out in subclause (2) in —*

  a) designing all aspects of the flood protection works; and
  b) carrying out all aspects of construction works.

  (2) The ecology principles are as follows:

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

a) to apply the effects management hierarchy to the following potential adverse effects:
  i. permanent habitat loss (including in coastal, terrestrial, and freshwater habitats):
  ii. loss of naturally uncommon and highly depleted ecosystem types, significant indigenous vegetation, significant habitats of indigenous fauna, and habitats for at-risk or threatened species and taonga species:
  iii. habitat fragmentation or habitat barriers (including in coastal, terrestrial, and freshwater habitats):
  iv. impacts on habitat connectivity (including coastal, terrestrial, and freshwater habitats):
  v. impacts on at-risk or threatened species and taonga species:
  vi. effects on water quality (including on kaimoana and mauri) from sediment:
  vii. alteration of natural hydrology patterns, except as necessary to facilitate the flood protection works:
  viii. spread or establishment, or both, of pest plants or animals:
  ix. impacts on habitats that play an important role in the life cycle and ecology of native species:
b) as far as practicable, to create safe habitats, especially for at-risk or threatened species and taonga species:
c) to avoid, remedy, mitigate, or offset (using biodiversity offset) adverse ecological effects in order to achieve, as far as practicable, a net positive ecological outcome:
d) to enhance the positive ecological role of the works area in the wider ecological context, including its role as a buffer that protects or enhances other areas with ecological significance.

- Clause 27 Ecological survey and assessment:

(1) The consent holder must ensure that the Project Ecologist and a suitably qualified and experienced person nominated by the Māori entities representatives work together—

a) to prepare an ecological scoping survey before construction works begin; and
b) as soon as practicable after construction works are completed, to prepare an ecological effects assessment.

(2) The purpose of the ecological scoping survey is to identify all ecological values relevant to applying the ecology principles to the places where construction works are to be carried out and adjoining land and adjacent water bodies and watercourses (and the CMA, if relevant), including the following:

a) all naturally uncommon ecosystems:
b) all at-risk or threatened species:
c) all taonga species that may be significantly adversely affected during or as a result of construction:
d) significant natural inland wetland values:
e) any pest plants or animals that might spread or become established (for example, Chilean needle grass, privet, and yellow bristle grass), having regard to the HBRC Pest Management Plan:
f) any fish, bird nesting areas, bat habitats, or habitats of species protected under the Wildlife Act 1953.

(3) The purpose of the ecological effects assessment is to assess the adverse effects the construction works have had on the ecological values identified by the ecological scoping survey.

- 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:

- 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 O+C assessment meets the requirements of the ecological scoping surveys required by OiC Clause 27 (1) a) and (2).

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). Measures may be required to manage fauna protected by the Wildlife Act, such as fauna surveys or vegetation clearance timing constraints.

2 Assessment methods

2.1 Desktop

Publicly available information and databases were reviewed to inform the ecological opportunities and constraints assessment included within this report. This included a review of the following available information:

- Hawke's Bay Regional Council – Hawke's Bay Maps (Hawke's Bay Maps (hbrc.govt.nz)) (accessed 6 August 2024):
  - Priority Wetlands.
  - Schedule VIII Riparian Protection Rivers.
  - Schedule II Land Cover.
  - Freshwater fish records.
- Hastings District Council GIS – District Plan (Home - Hastings District Plan (Partially Operative with the Exception of Section 16.1 & Appendix 50) (hdc.govt.nz)) (accessed 6 August 2024):
  - Notable Trees.
  - Riparian Land Management Zones.
  - Recommended Areas for Protection.
  - Special Character Zones – Nature Preservation Zone.
- Manaaki Whenua Landcare Research – Our Environment (Maps » Our Environment (scinfo.org.nz)) (accessed 6 August 2024):
  - Protected Areas Network.
  - Threatened Environment Classification.
  - Potential Natural Vegetation.
  - Vegetation Cover.
  - Wetlands.
- NIWA – NZ Local River Names (REC2) layer (https://niwa.maps.arcgis.com/home/item.html?id=9210aae85722443682a6c0adca14ff90) (accessed 1 August 2024).
- NIWA – Fish Passage Assessment Tool (https://niwa.co.nz/fish-passage/fish-passage-assessment-tool) (accessed 1 August 2024).
- Google Earth historic aerials (accessed 2 August 2024).
- Wilderlab eDNA https://www.wilderlab.co.nz/explore (accessed 6 August 2024).
- Land Air Water Aotearoa (LAWA) https://www.lawa.org.nz/explore-data/hawkes-bay-region/river-quality/ngaruroro-river/Tūtaekurī-Waimate-strm-us-ngaruroro-rv-at-chesterhope (accessed 1 August 2024).
- iNaturalist database (https://iNaturalist.org) (accessed 5 and 6 August 2024)
- Bat records from the New Zealand bat distribution database (DOC) (updated 23 August 2024).
- eBird database (https://ebird.org) (accessed 6 August 2024).
- DOC NZ Herpetofauna Atlas Database (updated 5 December 2023).
- New Zealand Freshwater Fish Database (NZFFD) (accessed 1 August 2024).
- Google Earth Pro (accessed 5 March 2025).

2.2 Site visit

An initial site visit was completed by two T+T ecologists over three days from 20 to 22 August 2024. The full length of the proposed stopbanks and the proposed borrow pit areas were visited (refer to Figure 1.1 for site location). Additional site visits were carried out on 12 and 13 November, and 18 December 2024 to undertake targeted fauna surveys and wetland assessments.

The following ecological assessments were completed during the initial site visit:

- Freshwater stream assessment including:
  - General habitat descriptions.
  - Stream Ecological Valuations (SEV) (Storey et al., 2011) at two locations on the Tūtaekurī-Waimate Stream.
- Stream fauna surveys including:
  - Ecological DNA (eDNA) collection at two sites.
  - Macroinvertebrate sampling at two sites.
- Wetland habitat delineation and assessment.
- Terrestrial habitat delineation and assessment.
- Commuting, foraging and roosting habitat assessment for long tailed bats (*Chalinolobus tuberculatus*, Threatened – Nationally Critical (O'Donnell et al., 2023)).
- Bird breeding habitat assessment.
- Incidental bird observations.
- Habitat assessment for native lizards.

Additional site visits in November/December 2024 included targeted surveys for bats and lizards. Further investigation of potential wetlands was also undertaken during this visit (see following sections for detailed methodology).

Potential wetlands, potential bat roosting trees and high value lizard habitat along the proposed stopbank areas were geolocated using ArcGIS Field Maps during the site visit, while areas of multiple potential bat roosting trees, low value lizard habitat and potential wetlands around the proposed borrow pits were geolocated later using aerial imagery (Appendix A).

High-level assessments of vegetation types were completed, with a desktop assessment for records of invasive pest plant species conducted. Due to the extent of the potential works area, a detailed botanical survey for native and pest plant species was not within the scope of this assessment.

2.3 Wetlands

Potential wetland areas were identified during the high-level assessment in August 2024. These were identified based on vegetation and landform. Additional detailed assessments were carried out in November 2024, utilising the Wetland Delineation Protocols (WDPs) (Ministry for the Environment, 2022).

Priority areas for investigation were identified by the client and as such, these additional assessments were limited to potential wetlands downstream of the Hawkes Bay Expressway (State Highway 2). The WDPs in combination with historic aerial imagery from Hawkes Bay Regional Plan maps and Google Earth Pro were used to determine the status of all potential wetlands downstream of the Hawkes Bay Expressway. These were defined in accordance with the Resource Management Act 1991 (RMA) and National Policy Statement for Freshwater Management (2020, amended October 2024) (NPS-FM) wetland definitions.

2.4 Stream Ecological Valuation and stream fauna surveys

2.4.1 Stream Ecological Valuations

Two SEVs (Storey et al., 2011) were completed in the upper and lower reaches of the Tūtaekurī-Waimate Stream.

SEVs provide a semi-quantitative assessment of 14 ecological functions that are divided into four main categories:

- Hydraulic functions.
- Biogeochemical functions.
- Habitat provision functions.
- Biodiversity provision functions.

The SEV method provides a semi-quantitative assessment of the ecological function of a stream by measuring stream habitat variables over multiple transects from a 100 m reach. The recorded data is used to calculate an overall score for the assessed reach. The final score ranges from zero, which is indicative of the survey reach having very low ecological value, to a maximum value of one, which is indicative of very high ecological value.

2.4.2 eDNA

Six replicate eDNA samples were collected from two locations on the Tūtaekurī-Waimate: one approximately 100 meters downstream of the Waiohiki Drain confluence, and another approximately one kilometre from the confluence of the Tūtaekurī-Waimate Stream and the Ngaruroro River.

The methodology implemented was in accordance with the recommendations from Wilderlab current at the time of assessment (Wilderlab NZ Ltd., 2019). Samples were sent to Wilderlab for comprehensive analysis.

2.4.3 Macroinvertebrates

Macroinvertebrates were sampled in accordance with semi-quantitative methods in the New Zealand protocols, utilising hard-bottomed protocol P1 and soft-bottomed protocol P2 as appropriate (Stark et al., 2001). Five samples were collected from SEV Site 1, situated 100 meters downstream of the Waiohiki Drain confluence. An additional five samples were taken from SEV Site 2, near Pakowhai Hall at the proposed sheet piling site. Samples collected targeted mostly bank side vegetation (e.g., watercress and grasses) and in-stream macrophytes. Samples were analysed by Environment Impact Assessments Ltd in Auckland, and macroinvertebrate community scores were calculated for each sample.

The results of the macroinvertebrate samples were used to calculate the soft bottomed Macroinvertebrate Community Index (sbMCI) and Quantitative Macroinvertebrate Community Index (sbQMCI) scores for each site. An interpretation of sbMCI and sbQMCI scores is presented in Table 2.1. Macroinvertebrate samples were also analysed for the proportion of all Ephemeroptera, Plecoptera and Trichoptera (EPT-a) taxa and solely the pollution sensitive taxa which indicate good water and habitat quality taxa within these orders, i.e., EPT-b[2]; and number of taxa present.

[2] EPT-b excludes the pollution and low habitat quality tolerant *Hydroptilidae* species.

Table 2.1: Interpretation of macroinvertebrate community index values (Stark & Maxted, 2007)

Quality class	sbMCI score	sbQMCI score
Excellent	> 119	> 5.99
Good	100 -119	5.00 – 5.99
Fair	80 – 99	4.00 – 4.99
Poor	< 80	< 4.00

2.5 Terrestrial fauna surveys

Targeted terrestrial fauna surveys for long-tailed bats and native lizards were conducted during November/December 2024. Bats and lizards are more active and easier to detect during the period October to April inclusive.

2.5.1 Long-tailed bat surveys

Potential bat commuting, foraging and roosting habitat was classified as either exotic treeland habitat consisting of hedgerows and shelterbelts or groups of trees. Individual trees with potential bat roosting features were classified as exotic trees (see maps in Appendix A).

Sixteen acoustic bat monitors (ABMs) were deployed on 12 and 13 November 2024 and were collected on 18 December 2024. ABMs were deployed in trees where they could detect any bats flying nearby. Long-tailed bats use linear features in the landscape as flyways and ABMs were spread across the proposed stopbank and borrow pit areas to target features such as shelterbelts, large specimen trees and the edges of groups of trees.

ABMs record and store bat echolocation calls (bat passes) as image files with a date and time. Image files were first analysed with T+T's AutoBat[3] AI software which identifies long-tailed bat calls. Potential long-tailed bat calls were then manually checked using the Department of Conservation DOC) BatSearch 3.23 software and reclassified as necessary.

ABM surveys require suitable weather for the results to be valid (NZ Department of Conservation Bat Recovery Group, 2024). Suitable weather is considered as:

- Temperature 8°C or greater for the first four hours after official sunset time.
- Ideally no to very little precipitation within the first four hours after official sunset.
- No to light wind within the first four hours after official sunset. To provide specific measurable criteria for wind previous DOC Bat Recovery Group guidance was used, with average wind to be no more than 20 km/h within the first four hours after official sunset.

Temperature, rainfall and wind records for the survey period were obtained from HBRC for the Bridge Pa environmental monitoring site (https://www.hbrc.govt.nz/environment/environmental-data/rainfall/).

[3] AutoBat (Version 0.3), 2022. Unpublished. Tonkin + Taylor Ltd., New Zealand.

2.5.2 Native lizard surveys

Lizard habitat was classified as either high value or low value lizard habitat or not providing habitat for lizards (see maps in Appendix A):

- High value lizard habitat contained anthropogenic debris features like sunny piles of horticultural prunings, timber, flood debris, bricks or other cover with small holes for lizards to use or dense vegetation such as flax/harakeke.
- Low value lizard habitat was dominated by long grass or herbaceous weed cover.
- Areas not considered suitable for lizards included short grass.

Native lizards were surveyed using a combination of tracking tunnels[4] and manual searching targeting high value lizard habitat.

A total of 183 tracking tunnels were deployed on 12 and 13 November 2024 and collected on 18 December 2024. In addition, a total of 8.5 hours of manual searching was undertaken during suitably fine weather conditions. Manual searching targeted three areas of high value lizard habitat totalling approximately 0.2 ha and involved:

- Turning over or pulling apart cover objects such as piles of logs, horticultural prunings or fenceposts.
- Raking leaf litter or ground cover.
- Habitat searches of dense low-growing vegetation such as flax/harakeke and vines.

[4] Tunnels used were Black Trakka™ tracking tunnels with Black Trakka pre-inked cards.

3 Ecological context, site characteristics and values

Pakowhai is within the Heretaunga Ecological District of the Hawkes Bay Ecological Region (McEwen, 1987). This area is characterised by highly modified vegetation, with a mix of pastoral and horticultural land uses. The total site area, including the borrow areas, is approximately 370 hectares. Located about halfway between Napier and Hastings cities, the site lies between the Tūtaekurī and Ngaruroro Rivers and is intersected by the Hawkes Bay Expressway (Figure 1.1).

Under the Hastings District Council (HDC) District Plan the site is classified as a combination of 'Rural' and 'Plains Production' zones. The Tūtaekurī-Waimate Stream is identified as 'Riparian Land Management TAG List 2'. There are no 'Notable Trees', no 'Recommended Areas for Protection' and no 'Nature Preservation Zones' within or near the site.

Under the HBRC Hawke's Bay Maps the site's Schedule II Land Cover is identified as 'Primarily Pastoral' with small areas of 'Primarily Horticultural' land. There are no 'Priority Wetlands' or 'Schedule VIII Riparian Protection Rivers' within or near the site.

Manaaki Whenua Landcare Research's 'Our Environment' maps identify the Vegetation Cover within the site as a mix of 'Short Rotation Cropland', 'High Producing Exotic Grassland' and 'Deciduous Hardwoods'. The Threatened Environment Classification is '<10 % Indigenous Cover Left' and the Potential Natural Vegetation (i.e. historical vegetation extent) is recorded as 'Podocarp (Native Conifers)'. The Pre-Human Wetland Class is 'Marsh' however there is no data on current wetlands. There are no identified 'Protected Areas Network' within or near the site.

The Tūtaekurī-Waimate Stream flows into the Ngaruroro River to the south of the site (Figure 1.1, Appendix A). The Waitangi Regional Park and Waitangi Estuary are approximately 4 km east of the site at the confluence of the Ngaruroro, Tūtaekurī and Te Awa o Mokotūāraro (formerly Clive) Rivers. The Waitangi Estuary is listed as a 'Priority Wetland' under the Hawke's Bay Regional Plan. Immediately north of the site is the Napier Golf Club.

A description of the ecological features observed on site and identified from the desktop assessment is provided below and presented on maps in Appendix A.

3.1 Freshwater – Streams

The Tūtaekurī-Waimate Stream is a permanent stream and the Waiohiki drain is an intermittent stream, and both are located adjacent to the proposed stopbank footprints (Figure 1.1, Appendix A Map A). Both watercourses are described below along with the eDNA and macroinvertebrate results.

3.1.1 Waiohiki Drain

The Waiohiki Drain at the assessed reach had a uniform channel shape, which appears to have been historically straightened and deepened throughout (Photograph 3.1). Hydrological heterogeneity and instream habitat diversity was low, with the stream being mainly a long slow run with grassed channel banks. A culvert was present near the confluence of the Tūtaekurī-Waimate Stream. The culvert was not perched but flow is controlled by a flood gate on the downstream end, which was partially closed at the time of assessment (Photograph 3.2). Being close to the coast and based on our observations and survey results the Waiohiki Drain could provide habitat for diadromous[5] species such as adult īnanga. The presence of a flood gate will restrict fish passage intermittently.

[5] Fish species that move between freshwater and marine environments as part of their life cycle.

Photograph 3.1: Representative photo of Waiohiki Drain channel within the proposed impact reach. Showing uniform channel, presence of periphyton and lack of shading, taken 20 August 2024.

Photograph 3.2: Waiohiki Drain looking upstream at culvert crossing and flood gate. Culvert is embedded (not perched), taken 20 August 2024.

3.1.2 Tūtaekurī-Waimate Stream

The Tūtaekurī-Waimate Stream in the assessed reach is a low-grade channel, with a varying wetted width (approximately 6 - 15 m). The stream exhibited some meandering and appeared largely unaltered (Photograph 3.3). Instream habitat was primarily a mixture of fast and slow runs, and pools (Photograph 3.4). Small areas of riffle habitat were present.

Most of the channel banks were grassed. Bottom substrate was predominantly silt. There was a limited amount of in-stream habitat present for freshwater fauna, including bankside vegetation, macrophytes, fine gravels, 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. Some sediment bubbling was evident where sediment had accumulated in areas of slow water flow, suggesting presence of anaerobic processes.

Photograph 3.3: Representative photo of Tūtaekurī Waimate Stream channel within the proposed impact reach at the SEV Site 1 location. Showing meandering channel and a lack of shading, taken 21 August 2024.

Photograph 3.4: Representative photo of Tūtaekurī-Waimate Stream channel within the proposed impact reach at the SEV Site 2 location, taken 21 August 2024.

3.1.3 Stream Ecological Valuations

The overall SEV scores for the surveyed reaches on the Tūtaekurī-Waimate Stream was **0.53** at Site 1 on the upper reach and **0.51** at Site 2 on the lower reach. This corresponds with a "fair" score (scores between 0.41 - 0.60 are considered fair). The fair scores are primarily due to the lack of riparian shading along the Tūtaekurī-Waimate Stream.

3.1.4 Freshwater fish

Results of eDNA sampling at the two sites on the Tūtaekurī-Waimate Stream identified eight species of native freshwater fish, three of which are classified as At Risk, and one as Threatened (Table 3.1). An additional two native freshwater invertebrate species, three Introduced and Naturalised species, and one marine fish were also detected at the sites.

Common bullies (*Gobiomorphus cotidianus*), mosquitofish (*Gambusia affinis*), shortfin eel (*Anguilla australis*), and longfin eel (*Anguilla dieffenbachii*) had the highest number of eDNA readings (refer to Table Appendix B.1 and Table Appendix B.2). However, high number of readings cannot be used as a proxy for fish abundance.

Torrentfish (*Cheimarrichthys fosteri "northern";* At Risk – Declining[6]) were detected in the Ngaruroro River, based on records in the NZFFD. They were not detected in the eDNA survey on site; however, this isn't out of the ordinary as the Tutaekuri-Waimate Stream doesn't provide their preferred habitat.

Common bully, longfin eel, shortfin eel, Īnanga, redfin bully, giant bully and lamprey species were identified within the catchment and are diadromous, meaning that they must migrate to the sea as

[6] https://niwa.co.nz/freshwater/nz-freshwater-fish-database

part of their lifecycle. Therefore, access to habitats throughout the catchment is important so that these species can complete their lifecycles and aid in maintaining regional populations.

The culvert on the Waiohiki Drain, near the confluence of the Tūtaekurī Waimate Stream features a flap gate to protect upstream areas from flooding. While the drain is considered ephemeral, this creates a partial barrier to fish migration (Photograph 3.2). Additionally, a weir on the Tūtaekurī-Waimate Stream, located approximately 500 m downstream of the Franklin Road Bridge (Site 1), was identified on the NIWA Fish Passage Assessment Tool as another barrier to migration within the catchment. This weir was assessed on site and determined to be only a partial barrier to fish migration.

Table 3.1: Summary of fish and large invertebrate species detected using eDNA

Common name	Scientific name	Threat status	Locality	Diadromous
Lamprey	*Geotria australis*	Threated - Nationally Vulnerable	Site 1 only	Yes
Giant bully	*Gobiomorphus gobioides*	At Risk –Naturally Uncommon	Site 1 and Site 2	Yes
Longfin eel	*Anguilla dieffenbachii*	At Risk - Declining	Site 1 and Site 2	Yes
īnanga	*Galaxias maculatus*	At Risk - Declining	Site 2 only	Yes
Shortfin eel	*Anguilla australis*	Not Threatened	Site 1 and Site 2	Yes
Common bully	*Gobiomorphus cotidianus*	Not Threatened	Site 1 and Site 2	Yes
Redfin bully	*Gobiomorphus huttoni*	Not Threatened	Site 1 and Site 2	Yes
Black flounder	*Rhombosolea retiaria*	Not Threatened	Site 1 and Site 2	No
Common smelt	*Retropinna retropinna*	Not Threatened	Site 1 and Site 2	No
Rainbow trout	*Oncorhynchus mykiss*	Introduced and Naturalised	Site 1 and Site 2	No
Gambusia	*Gambusia affinis*	Introduced and Naturalised	Site 1 and Site 2	No
Goldfish	*Carassius auratus*	Introduced and Naturalised	Site 1 and Site 2	No
Freshwater shrimp	*Paratya curvirostris*	Not Threatened	Site 1 and Site 2	No
Kōura	*Paranephrops planifrons*	Not Threatened	Site 1 and Site 2	No
Silver trevally	*Pseudocaranx georgianus*	Marine species	Site 2 only	No

Notes: Threat status for fish and invertebrate species, via Dunn et al. (2018) and Grainger et al. (2018), respectively.

3.1.5 Macroinvertebrate results

Macroinvertebrate results indicated soft-bottomed macroinvertebrate community index (sb-MCI) scores ranging from 65.1 to 94.8, with an average of 74.5, for the five replicates collected at the upstream Site 1 on 20 August 2024 (Table Appendix B.3). These scores suggest reduced in-stream ecological health. Similarly, MCI scores at the downstream Site 2, collected on 21 August 2024, ranged from 41.6 to 94.8, averaging 68.5, also reflecting reduced in-stream ecological health (Table 2.1). Summary macroinvertebrate indices are provided in Table 3.2 below.

Table 3.2: Summary macroinvertebrate indices

	Sb-MCI	Quality class[1]	Sb-QMCI	Quality class[1]	EPT % abundance	EPT % taxa	taxa count
Site 1 range	65.1 - 94.8	Poor - fair	2.11 - 3.19	Poor	0.47 - 7.98	8.33 - 33.33	6 - 12
Site 1 average	74.50	Poor	2.50	Poor	2.63	19.47	9.00
Site 2 range	41.6 - 94.8	Poor - fair	2.07 - 3.15	Poor	0 - 1.7	0 - 28.57	7 - 14
Site 2 average	68.50	Poor	2.59	Poor	0.43	7.53	10.80

Note: 1 = Quality Class per Stark and Maxted (2007) in Table 2.1

3.2 Terrestrial and wetland habitat characteristics

3.2.1 Vegetation

Terrestrial vegetation within and around the site is dominated by exotic species, with large areas of grass and annual weeds along the stream. Large exotic trees are present in places along the stream, or as shelterbelts or specimen trees. The proposed stopbank is bordered by horticultural species and pasture. Residential dwellings and gardens were also present. There are no Significant Natural Areas (SNA) mapped within or near the site, no notable trees, and no areas recommended for protection or nature preservation within the site or its vicinity. Occasional native tree and shrub species were present in residential gardens but were otherwise largely absent from the site. All native vegetation recorded is classified as nationally Not Threatened (de Lange et al. 2024).

The desktop assessment did not reveal any records of privet (*Ligustrum* spp.), Chilean needle grass (*Nassella neesiana*) or yellow bristle grass (*Setaria pumila*) on site. HBRC have confirmed Chilean needle grass in neighbouring areas (Maraekakaho, Bayview, Puketapu, Tuku tuki valley, Omakere, Poukawa, Porangahau, Waipawa and Waipukurau). Any removal of vegetation should follow the biosecurity measures in the Hawke's Bay Regional Pest Management Plan 2018-2038 (RPMP).

3.2.2 Wetlands

During the initial site visit in August 2024, potential wetlands were classified, and approximate extents mapped according to the dominant features of the area (Appendix A Map A). Wetlands were recorded as exotic dominated, juncus dominated or standing water. Exotic dominated areas featured exotic species such as willows, herbaceous weeds and grasses (Photograph 3.5). Juncus dominated areas were low-lying or riverside areas with reeds among pasture or exotic herbaceous weeds (Photograph 3.6 and Photograph 3.7). Areas of standing water featured ponded water which may dry out seasonally (Photograph 3.8).

Photograph 3.5: Exotic dominated potential wetland featuring willows, arum, and blackberries with patches of standing water, taken 22 August 2024.

Photograph 3.6: Potential wetland dominated by juncus in the foreground but dominated by exotic willows in the distance, taken 21 August 2024.

Photograph 3.7: Juncus dominated potential wetland along the stream margin, taken 21 August 2024.

Photograph 3.8: Potential wetland featuring standing water which may dry out seasonally, taken 20 August 2024.

Detailed assessments in November 2024 aimed to refine wetland extents based on vegetation, topography and visible hydrological features. During detailed assessment of all potential wetlands downstream of the Hawkes Bay Expressway, it was evident that the vast majority of these areas had visually similar ecological and hydrological features. Many were in a transitional state, with evidence of soils drying out and terrestrial vegetation apparently beginning to take the place of wetland vegetation.

All but one of the potential wetlands was topographically within the wider channel of the Tutaekuri-Waimate Stream. This prompted further investigation of historic aerial imagery, which confirmed that these potential wetlands are subject to intermittent and complete inundation by the stream (Figure 3.1). As a result, they are expected to be influenced by fluvial processes such as sediment deposition and erosion. Therefore, while they would pass the vegetation tests under the WDPs, they are considered to be part of the stream channel, and therefore in our view not wetlands. It is noted that there is no clear guidance in freshwater legislation or protocols to distinguish streams from wetlands, and as such, classification in these situations requires professional judgement. Notwithstanding this, consideration of impacts from the project on all these areas following the effects management hierarchy will result in appropriate management.

Figure 3.1: Snip from Hawkes Bay Regional Plan maps, NZ Imagery Hybrid basemap, of the Tutaekuri-Waimate Stream within 76 Chesterhope Rd, showing the stream at high flows. Multiple potential wetland areas identified in the initial high-level ecological assessment are fully inundated in this imagery and are under a visible layer of deposited sediment. Imagery from September 2023.

One small wetland area (Wetland 23) was confirmed at the western end of 1986 Pakowhai Rd (Appendix A). Due to the presence of a low bank between the stream and the wetland, as well as the distinct concave topography of the wetland, it was considered hydrologically different to the other potential wetland areas described above. This area met the 'rapid test' for wetland vegetation and meets the definition of a wetland under the RMA and a natural inland wetland under the NPS-FM. While there was historic evidence of modification of this area through vegetation clearance and land cultivation, there was no clear evidence of this wetland being constructed. Therefore, it does not meet any of the exclusion criteria in the NPS-FM under the definition of a natural inland wetland.

Wetlands are a nationally threatened ecosystem type due to wetland drainage and clearance. Wetlands also have a high level of protection under the NPS-FM. Impacts on Wetland 23 due to the project will need to be managed and recommendations are provided in Section 4.2.2.

3.2.3 Bats

Long-tailed bats (*Chalinolobus tuberculatus*) have the threat classification of Threatened – Nationally Critical (O'Donnell et al., 2023) and are fully protected under the Wildlife Act.

The National Bat Database (updated 23 August 2024) contains records of five bat surveys within 25 km of the site. Two surveys in forestry in the Esk area detected long-tailed bats 20 km from site in 2007 and 25 km from site in 2000. One survey point on the Main Outfall Channel of the Napier Estuary detected no bats but was surveyed for one night only in each of 2013 and 2018. Closer to the site, T+T conducted two bat surveys for HBRC for other flood recovery projects in April 2024 at Waiohiki one kilometre north of site, and in April/May 2024 at Ohiti eight kilometres west of the site. Neither survey detected bats.

Potential habitat exists within the site for bats to utilise for commuting, foraging and roosting. Potential bat roost habitat within the site includes exotic trees and shelterbelts featuring holes, cracks, crevices, flaking bark and dead wood (Photograph 3.9 and Photograph 3.10). These include willow species, a variety of deciduous trees and shelterbelts of casuarina, macrocarpa and cypress. Potential bat roosting habitat was identified as either individual exotic trees or exotic treeland areas containing multiple trees such as a shelterbelt or group of trees (Appendix A Map A).

The acoustic bat survey detected no bat activity. Six ABMs recorded for 36 nights, eight ABMs recorded for 35 nights, one ABM recorded for eight nights before failing early and one ABM disappeared and was unable to be retrieved. The weather conditions on three nights were invalid due to dropping below 8°C and invalid on one night due to average wind being over 20 km/h but no nights were invalidated due to rainfall. ABM locations are shown in the maps in Appendix A and ABM and weather data are presented in Appendix D.

Given no bats were detected during the survey in November/December 2024, and no bats were detected at nearby Waiohiki and Ohiti in April/May 2024, it is considered unlikely that long-tailed bats utilise this area. As a result, further bat management is not required.

Photograph 3.9: A group of trees with features bats could potentially use for roosting including dead wood, flaky bark and holes, taken 21 August 2024.

Photograph 3.10: Topped hedgerow featuring dead wood with numerous holes potentially suitable for bats to roost in, taken 20 August 2024.

3.2.4 Birds

Due to the size of the site and the variety of habitat available, a wide range of native terrestrial and shorebird species may utilise the site. A total of 26 species of native birds have been recorded in eBird or iNaturalist in the Pakowhai area between Napier and Hastings or seen or heard during site investigations on 20 to 22 August 2024. These are presented in Table Appendix C.3, along with their threat status and potential for breeding within the site. As the site is inland rather than coastal, some species are likely to visit the site only to feed or roost while others are likely to breed within the site.

Suitable breeding habitat is available for a variety of native terrestrial and shorebird species which nest on or in trees and shrubs, long grass or short grass (Photograph 3.11 and Photograph 3.12). Most species likely to breed within the site are classified as Not Threatened, however, banded dotterel (*Charadrius bicinctus bicinctus*) and pipit (*Anthus novaeseelandiae*) are classified as 'At Risk – Declining', little pied shag (*Phalacrocorax melanoleucos brevirostris*) and black shag (*Phalacrocorax carbo novaehollandiae*) are 'At Risk – Relict' and black-fronted dotterel (*Elseyornis melanops*) is 'Naturally Uncommon' (Robertson et al., 2021). Banded dotterel and black-fronted dotterel can breed within lightly grassed pasture habitat, pipit nest in rank grass and little pied shag and black

shag nest in trees, often overhanging water or wetlands. A range of other native birds nest within trees and shrubby vegetation.

Potential wetland habitat within the site is highly degraded. It is considered unlikely that cryptic wetland birds are present, and the available wetland habitat is unlikely to be suitable for wetland birds to breed.

Most native birds are protected under the Wildlife Act. While birds are generally mobile and can disperse during disturbance, they are vulnerable when nesting. Habitat clearance during nesting season should be avoided where achievable. Table 3.3 shows the peak breeding season for the bird species and groups which potentially breed on site, along with the months outside of peak breeding season when nesting habitat can be safely cleared.

Table 3.3: Bird breeding seasons and habitat clearance timing

Bird group	Nesting habitat	Peak nesting season	Habitat clearance season
Terrestrial birds	Trees/shrubs/shelterbelts	September - January	February - August
Shorebirds	Short grass	July - January	February – June
Pipit	Rank grass	August - March	April - July
Little pied shag	Trees overhanging water	August - March	April - July
Black shag	Trees overhanging water	All year round	All year round with nest check

To avoid clearance during peak bird nesting season, trees, shrubs and shelterbelts should be felled between February and August inclusive while grass habitats should be cleared between April and July inclusive. Black shags can nest all year round and an ecologist should check trees overhanging water before felling all year round.

Photograph 3.11: Trees provide nesting habitat for native forest birds while short grass can provide suitable nesting habitat for banded dotterel, taken 21 August 2024.

Photograph 3.12: Rank grass can provide suitable nesting habitat for pipit as well as common native species like pūkeko while shrubs provide suitable nesting habitat for native terrestrial birds, taken 20 August 2024.

3.2.5 Lizards

Six species of native lizard have been recorded within 15 km of site in the Herpetofauna Atlas (updated 5 December 2023) and iNaturalist (accessed 5 August 2024). These are presented in Table Appendix C.4, along with four species not recorded within 15 km of site but whose distribution or

potential distribution includes this area of the Hawke's Bay (New Zealand Herpetological Society, 2021). No native lizards have been recorded within 5 km of the site.

Tracking tunnel surveys were undertaken by T+T at Waiohiki, about one kilometre north of the site in April 2024 and at Ohiti, Twyford about 8 km from the site in late April/early May 2024. Neither survey detected lizards and both sites were inundated during Cyclone Gabrielle. Both surveys detected high levels of rat and mouse activity, reducing the likelihood of lizard presence (due to lizard predation).

Potential lizard habitat in the stopbank footprint contained small discrete areas of high value anthropogenic debris lizard habitat totalling 8 ha (Photographs 3.13 and 3.14) but was primarily dominated by low value rank grass dominated lizard habitat totalling 24.3 ha (Photographs 3.15 and 3.16). Neither tracking tunnels nor manual searching techniques detected native lizards. Of the 177 tracking cards analysed 58 contained rat prints and 86 contained mice prints. Tracking tunnel survey results are presented in Appendix D.3 and survey areas are shown on the maps in Appendix A.

It is considered that lizards are not likely to be present, based on the following:

- Most of the site flooded during the Cyclone Gabrielle in 2023.
- There are no database records within 5 km of site.
- Tracking tunnel surveys across nearby sites resulted in no lizard detections.
- Onsite tracking tunnel and manual surveys in high value lizard habitat resulted in no lizard detections.
- High pest mammal tracking card detections.

Photograph 3.13: High value lizard habitat where a pile of logs, timber and horticultural prunings provides basking and hiding spaces for lizards, taken 20 August 2024.

Photograph 3.14: High value lizard habitat where a pile of concrete fence posts and bricks provides basking and hiding spaces for lizards, taken 21 August 2024.

Photograph 3.15: Low value lizard habitat consisting of a strip of ungrazed grass between the stream and cultivated fields, taken 21 August 2024.

Photograph 3.16: Low value lizard habitat consisting of a strip of dead long grass between bare ground and cultivated areas, taken 20 August 2024.

3.3 Summary of ecological characteristics and values

A summary of ecological characteristics and values identified within this ecological scoping assessment is provided in Table 3.4.

Table 3.4: Summary of ecological characteristics and values

Ecological feature		Summary of characteristics and values
Streams	Waiohiki Drain	• Modified intermittent stream. • Low quality habitat heterogeneity and diversity. • Culvert and flood gate likely present restrictions to fish passage. • Potential to provide habitat for some native fish species.
	Tūtaekurī-Waimate Stream	• Permanent stream. • Moderate quality habitat heterogeneity and diversity. • SEV scores ranged from 0.51 – 0.53, corresponds to a “fair” score. • Provides habitat for several native fish species, including some with a ‘Threatened’ or ‘At-Risk’ conservation status. • Riparian wetland habitats are strongly linked with the stream and located throughout the extent of the stream. These habitats have wetland characteristics and are dominated with hydrophytic plants.
	Freshwater fish	• Eight native freshwater fish identified • Three of which are classified as At Risk, and one as Threatened. • Several native fish are diadromous and must migrate to the sea as part of their lifecycle.
	Macroinvertebrates	• Macroinvertebrate quality class ranged from poor – fair and was on average poor. • Macroinvertebrate community suggest reduced in-stream ecological health

Ecological feature		Summary of characteristics and values
Wetlands	Natural Inland wetland	• Wetland 23 located at the western end of 1986 Pakowhai Rd. • Wetland vegetation meets the definition of a wetland under the RMA and a natural inland wetland under the NPS-FM. • Wetland habitat within the site is degraded and modified.
Terrestrial	Terrestrial vegetation	• Dominated by exotic species • Large areas of grass and annual weeds along the stream • Large exotic trees are present in places along the stream, or as shelterbelts or specimen trees • Occasional native tree and shrub species were present • All native vegetation recorded is classified as nationally Not Threatened
	Bats	• No bats were detected at site, and no bats were detected at nearby Waiohiki and Ohiti • It is considered unlikely that long-tailed bats utilise this area.
	Birds	• A total of 26 species of native birds have been recorded in the Pakowhai area between Napier and Hastings. • Suitable breeding habitat is available for a variety of native terrestrial and shorebird species. • Wetland and riparian habitat is degraded and unlikely that cryptic wetland birds are present.
	Lizards	• No lizards were detected at site and no lizards were detected at nearby Waiohiki. • It is considered unlikely that native lizards utilise this area.

4 Opportunities, constraints and recommendations

4.1 Streams

The major freshwater stream constraint for the proposed stopbank realignment is the required instream works (inclusive of any stream realignments) within the Tūtaekurī-Waimate Stream. Stream realignments are preferable compared to stream culverting or reclamation due to being able to maintain or enhance ecological function and value.

Where instream works are necessary, then designs and construction should aim to avoid and minimise the extent of instream works, and where practical remediate the instream works areas to maintain ecological function and value. If confirmed stream realignments within the Tūtaekurī-Waimate Stream, are shown to have residual loss effects to stream function and value, then offsetting actions will be required so that there is a net positive outcome for ecological values (per the OiC; clause 26 (2) d)).

Recommended actions to avoid, minimise, remedy and/or offset ecological loss are included in Table 4.1.

Stopbank realignment designs currently show that c. 545 m of stream is requiring realignment. After measures to avoid, minimise, and remedy; any residual effects will be managed via the implementation of offsetting to achieve a net positive ecological outcome. Offset actions should include native riparian plantings alongside the Tūtaekurī-Waimate Stream. Approximately, 2.2 km of stream bed length has been identified as being available for any offset. Available planting areas have been provided by HBRC and are shown in Appendix A Map B and a proposed native riparian plant species list is available in Appendix E. With the extent of area available to implement the native riparian plantings, it is likely that these offset actions will achieve the net positive ecological outcome outlined in OiC Clause 26 (2) d). However, it is recommended that offset success monitoring (restoration planting success and/ or stream habitat assessments) is completed following the implementation of offset actions, a suitable and practical methodology should be included in the CEMP to show that this OiC clause is met.

Table 4.1: Measures to avoid, minimise, remediate, or offset the loss of stream value and extent due to instream works and stream realignments

Measure	Instream works and stream realignment actions
Avoid	Instream works and stream realignments should be avoided to the extent practical within the Tūtaekurī-Waimate Stream during the design process.
Minimise	Confirmed areas of instream works and stream realignment shall be designed to allow the shortest impact reach possible. Any stream realignment designs should maintain (at a minimum) the current Tūtaekurī-Waimate Stream ecological functional value throughout the impact reach.
Remediate	Where practical, any confirmed instream works or stream realignment designs should include stream habitat features which are collaboratively developed by iwi, landscape designers, ecologists, and river engineers. Examples of high-level design principles that can be included in any CEMP include: • Realignments will be designed to consider the existing stream geometry (plan form and section) and natural geomorphology of the stream where practicable. • Scour protection, such as rock rip rap, may be considered where hydraulic conditions could result in significant, non-desirable scour that could impact the stopbank or other infrastructure. • Natural bank scour will be allowed where possible.

Measure	Instream works and stream realignment actions
	• A low flow channel to maintain water depth during low flows. • Maintain natural fish passage throughout the realigned reach. • Creation of pool, riffle and run sequences where achievable (i.e. enough length of stream diversion and sufficient gradient to tie into existing stream channel). • Utilising existing natural materials such as rocks, woody debris from the existing stream where present. Incorporating a flood plain terrace.
Offset	In the first instance, offset actions due to stream realignments will include native riparian plantings within areas located adjacent to the Tūtaekurī-Waimate Stream. Several areas have been initially identified by HBRC as being suitable for native plantings within the riparian area. Offset areas have been selected due to: • Their proximity to the realignment sites and allows offset actions to be completed in one stream catchment. • The offset site is on HBRC owned land, which allows any offset outcomes to be secured for as long as the impacts occur. • The offset areas available within the HBRC land, adjacent to the Tūtaekurī-Waimate Stream, achieves as far as practicable, a net positive ecological outcome (per OiC Clause 26 (2) d)). • The net positive ecological outcomes are gains beyond those that would have occurred in the absence of the offset actions. • Offset actions will be completed on a single highly modified and degraded stream catchment. This results in greater ecological outcome as opposed to spreading offset actions over several fragmented catchments throughout the region. • Any offset of the Tūtaekurī-Waimate Stream should achieve, as far as practicable, a net positive ecological outcome (per OiC Clause 26 (2) d)) and monitoring following the implementation of offset actions will be necessary to show that this OiC clause is met. A methodology to assess post implementation of offset actions shall be included in the CEMP.

Parts of the riparian margin next to 1972 Pakowhai Rd have previously been subject to some restoration effort by the property owner who has also utilised the riparian area for recreation.[7] An opportunity therefore exists to liaise with the property owner regarding the stopbank footprint in this area and, if practical, to support restoration and enhancement efforts such as continuation of the riparian planting upstream and downstream of this area.

Native freshwater fish including several 'At Risk Declining' species have been identified within Tūtaekurī-Waimate Stream. As a result, if instream works are required, a Fish Relocation Plan (FRP) shall be included in the CEMP and implemented prior to any in stream works being conducted. This plan should align with the Ecological Principles outlined in Clause 26 of the OiC, ensuring that impacts on at-risk, threatened species, and taonga species are minimised and appropriately managed prior to any instream activities.

The proposed design could result in an increase of sediment runoff during construction and a likely change in the volume of and rate at which sediment enters the receiving environment. Excess sediment in waterways can result in adverse ecological effects on native flora and fauna. In addition, any changes to the flow path of the watercourses could result in an increase in stream erosion and scour during storm events, which subsequently contributes to a further increase in sediment deposition and bank instability.

[7] Pers comms with property owner on site during site assessments August 2024.

An Erosion and Sediment Control Plan (ESCP), as outlined in Clauses 10 and 14 of the OiC, will be required to manage sedimentation impacts and reduce the risk of erosion during construction. Stream enhancement works, such as riparian planting and fencing streambanks to exclude grazing stock, can help stabilise streambanks and reduce erosion potential. In addition, specific provisions for works in adjoining watercourses, including the requirement for works on structures in and around the beds of watercourses (Clauses 18 and 19 of the OiC), should be followed to ensure these activities are conducted in a manner that protects watercourse integrity and minimises environmental impacts.

4.2 Terrestrial and wetland opportunities, constraints and recommendations

Overall, the site is highly modified with limited habitat for native fauna. There are abundant opportunities to enhance the site if required, in compliance with OiC Clause 28 (Managing ecological loss).

4.2.1 Vegetation

There is limited native vegetation within the site and no nationally 'Threatened' or 'At Risk' species. As a result, terrestrial vegetation is generally of low ecological value and is unlikely to pose a constraint to the project. Vegetation removal will however be subject to the constraints and management actions outlined in Sections 4.2.2 to 4.2.5 below.

Any additional native vegetation planting that may be associated with the project will provide ecological value to this project as per OiC Clause 26 (2) c) and d).

4.2.2 Wetlands

Refinement of the stopbank design should avoid or minimise encroachment to Wetland 23 as much as practicable, as required by OiC Clause 26 (2) a). Any permanent loss of wetland extent and value will require offset in accordance with OiC Clause 26 (2) d). Offset measures typically involve wetland restoration. Sites suitable for offset include potential wetlands in the surrounding area which are visible on aerial imagery, although this will depend on the final works footprint and borrow pit extents. However, because the vegetated areas within the Tutaekuri-Waimate Stream channel are similar ecologically to Wetland 23, restoration and enhancement of these areas is also considered a valid alternative restoration site.

Restoration and enhancement would likely take the form of measures such as stock exclusion and fencing, weed control, infill and/or buffer native plantings. Any offset of wetlands should achieve, as far as practicable, a net positive ecological outcome (per OiC Clause 26 (2) d)) and monitoring following the implementation of offset measures may be necessary to show that this is met.

Indirect effects to Wetland 23 from construction activities, such as sediment runoff, or alteration of hydrological inputs, will require management through preparation of and adherence to relevant management plans (such as the ESCP required by OiC Clause 13).

4.2.3 Bats

It is unlikely long-tailed bats utilise the site. Although large exotic trees and shelterbelts provide potential bat commuting, foraging and roosting habitat across the site, these are isolated within the wider ecological context of agricultural and horticultural land uses and urban areas, and no forest areas in the nearby vicinity. Existing records of bats are sparse, distant and over 10 years old while recent nearby bat surveys have not detected any bats. Therefore, further bat management is not necessary. However accidental discovery protocols should be included within the CEMP to provide guidance if any unexpected species are discovered on site.

4.2.4 Birds

A range of vegetation across the site offers suitable nesting habitat for a variety of native terrestrial and shorebird species. Most native birds are fully protected by the Wildlife Act and vegetation clearance will need to be managed in accordance with OiC Clause 26 (2). It is recommended:

- Vegetation clearance should be minimised and avoided if practical.
- Vegetation which provides suitable nesting habitat for native birds should be cleared outside of peak bird breeding season:
  - Trees, shrubs and shelterbelts should be felled between February and August inclusive.
  - Grass habitats should be cleared between April and July inclusive.
  - Trees overhanging water should be checked by an ecologist before felling all year round.
- If suitable nesting habitat needs to be cleared during peak bird breeding season (i.e., due to critical pathway), then pre-clearance bird nest checks by an ecologist will be required to ensure there are no native bird nests with eggs or chicks present when clearance is undertaken:
  - Between September to January for trees, shrubs and shelterbelts.
  - Between August and March for grass habitats.
  - All year round for trees overhanging water.
- Where active native bird nests are found, nests will require avoidance until the nest has fledged or been naturally abandoned. This may result in disruptions to the construction programme.
- An Avifauna Management Plan (AMP) or similar could be prepared as part of the CEMP or EMP to guide bird management measures during vegetation clearance as required by OiC Clause 28 (1) b.
- Opportunities to enhance available habitat for native birds in line with OiC Clause 26 (2) b), c) and d) include:
  - Fencing riparian and wetland areas and planting with suitable native species.
  - Undertaking pest control to reduce predation pressure on native bird populations.

4.2.5 Lizards

Extreme flooding caused by Cyclone Gabrielle impacted most potential lizard habitat in the project footprint. In addition, no lizards were detected during targeted surveys at the site. It is recommended that further lizard management is not necessary. However, accidental discovery protocols should be included within the CEMP or EMP to provide guidance if lizard species are unexpectedly discovered on site.

To ensure skinks do not colonise the site in the 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 Summary

This site contains a variety of ecological characteristics which could be adversely affected by construction of the proposed Pakowhai Secondary Stopbank. Table 5.1 provides a summary of ecological constraints and options for managing the ecological effects from stopbank construction.

Table 5.1: Summary of recommended effects management options for ecological constraints

Ecological constraint	Summary of effects management options
Freshwater	• Streamworks should aim to maintain or enhance the stream's ecological value, with stream realignments favoured over culverting or reclamation. • Ecological loss (e.g., via stream reclamation or realignment) should be avoided, minimised, remediated, or offset to meet the net positive outcome required by the OiC. Where stream realignments result in a residual loss effect on stream value and extent, offset actions including stream enhancement via native riparian plantings should be implemented. Potential planting areas have been identified by HBRC. Any areas where offset actions have occurred shall be monitored to show that the net positive ecological outcome of the OIC achieved. • Native fish species require a FRP before any instream works to be in line with Clause 26 of the OiC. • Increased runoff and sediment from construction could harm the ecosystem, so an Erosion and Sediment Control Plan (ESCP) as outlined in Clauses 10 and 14 of the OiC should be considered. • Rehabilitation of the Waiohiki Drain by diversifying hydraulic conditions and improving fish passage could further support ecological goals.
Wetlands	• Avoid potential wetland habitat where possible (OiC Clause 26 (2) a). Any loss of wetland extent or value will require offset involving wetland restoration as outlined in OiC Clause 26. • Potential areas for enhancement are present within the vicinity of the site and along the Tutaekuri-Waimate stream channel.
Bats	• Bat management is not recommended as bats are unlikely to be present. • An accidental discovery protocol should be included in the CEMP or EMP to provide guidance if unexpected species are discovered on site.
Birds	• Avoid suitable bird breeding habitat where possible (OiC Clause 26 (2) a). • An Avifauna Management Plan or similar could be included in the CEMP or EMP detailing bird management requirements to protect birds during vegetation removal (OiC Clause 28 (1) b). • Bird nest checks should be undertaken by an ecologist within 3 days prior to clearance of any vegetation during bird breeding season. Bird breeding season is: – Between September to January for trees, shrubs and shelterbelts. – Between August to March for grass habitats. – All year round for trees overhanging water.
Lizards	• Lizard management is not recommended as targeted lizard surveys did not detect lizards within the site and most habitat was impacted by Cyclone Gabrielle. • An accidental discovery protocol should be included in the CEMP to provide guidance if unexpected species are discovered on site.

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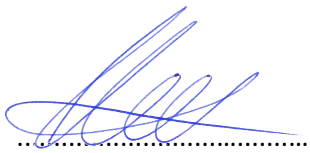
7 Applicability

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:



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Tim Morris

Project Director

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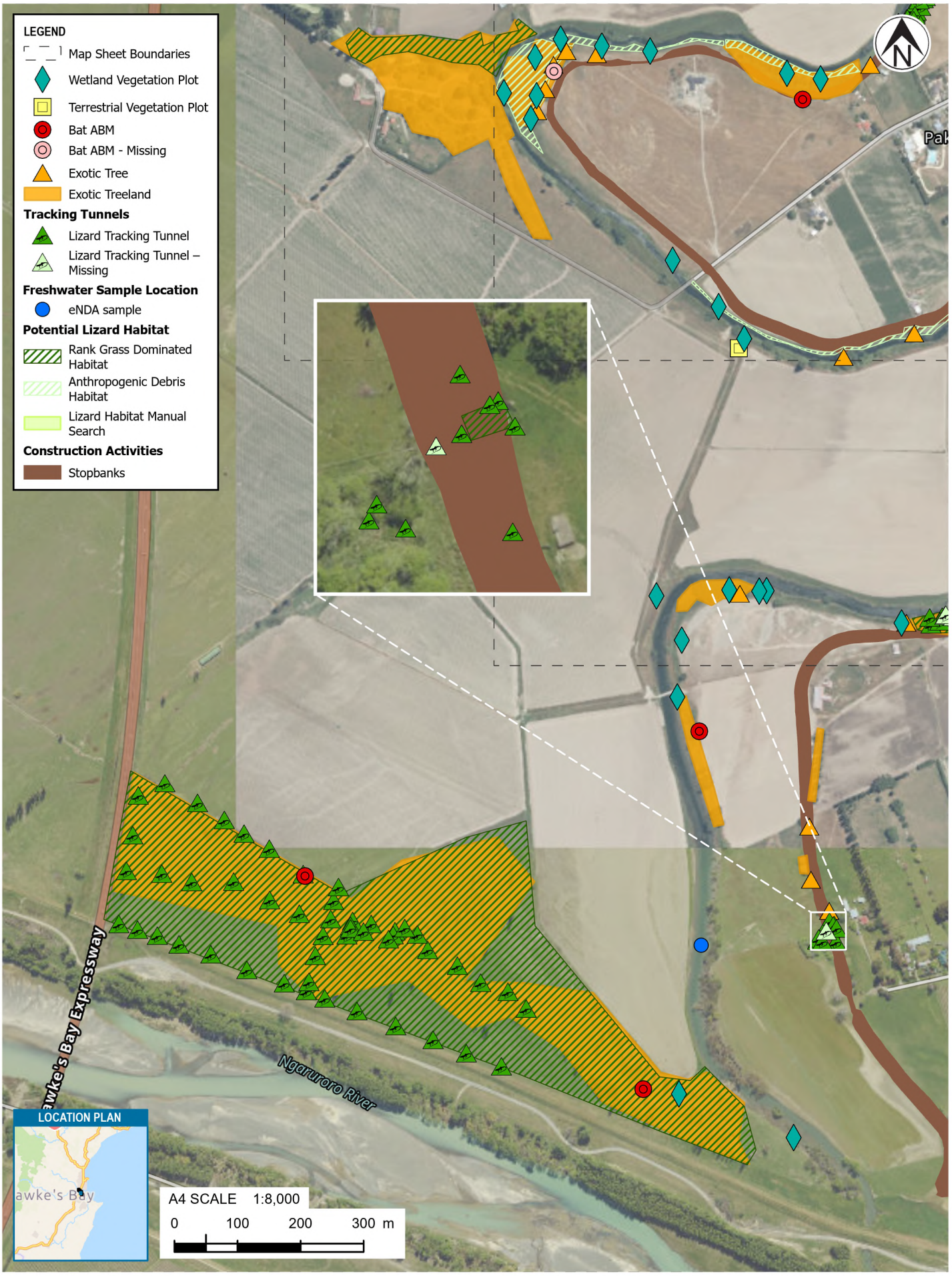
Appendix A Site Figures



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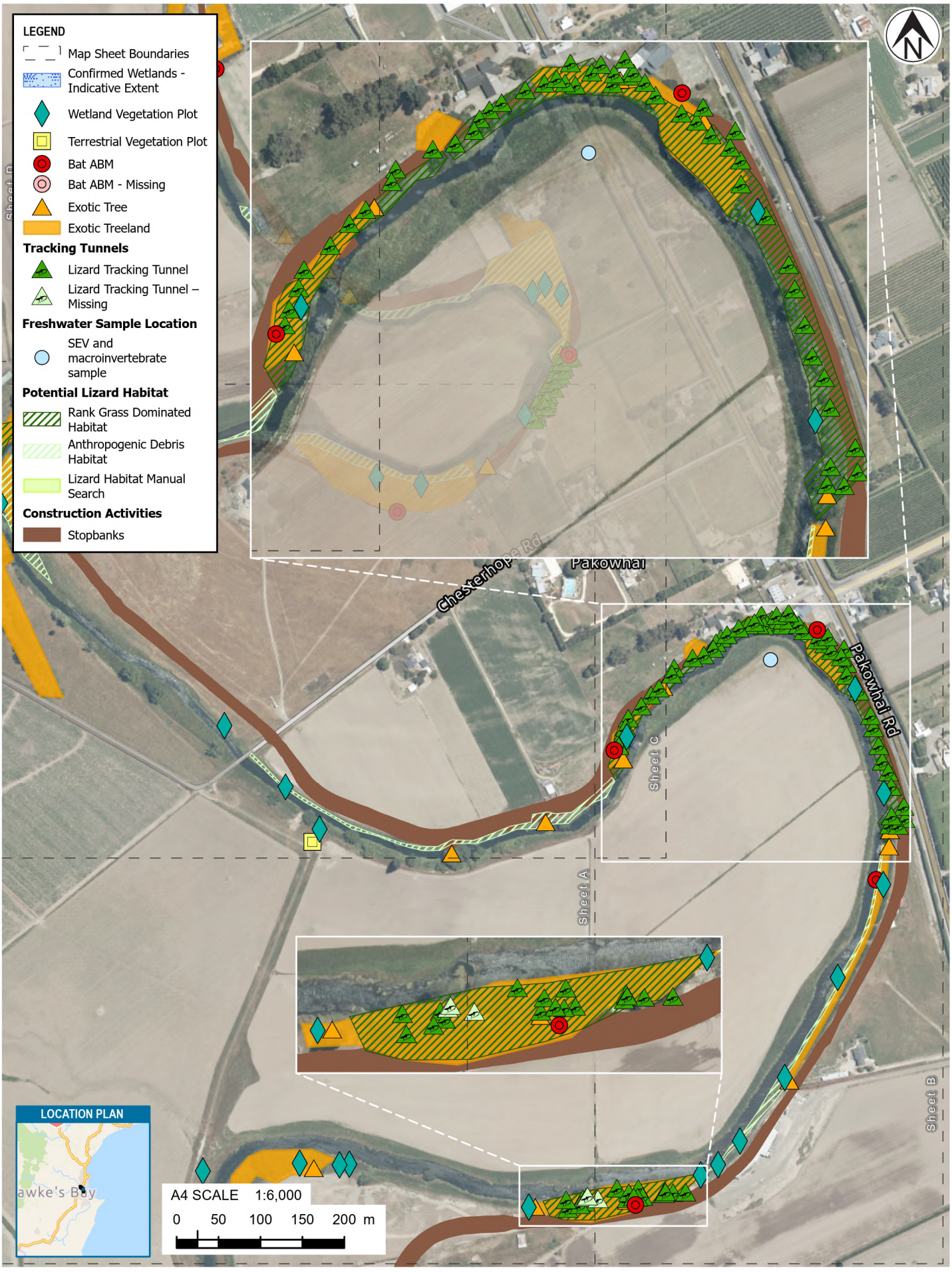
TITLE ECOLOGICAL OPPORTUNITIES AND CONSTRAINTS MAP

SCALE (A4) 1:8,000 FIG No. FIGURE 1A REV 0



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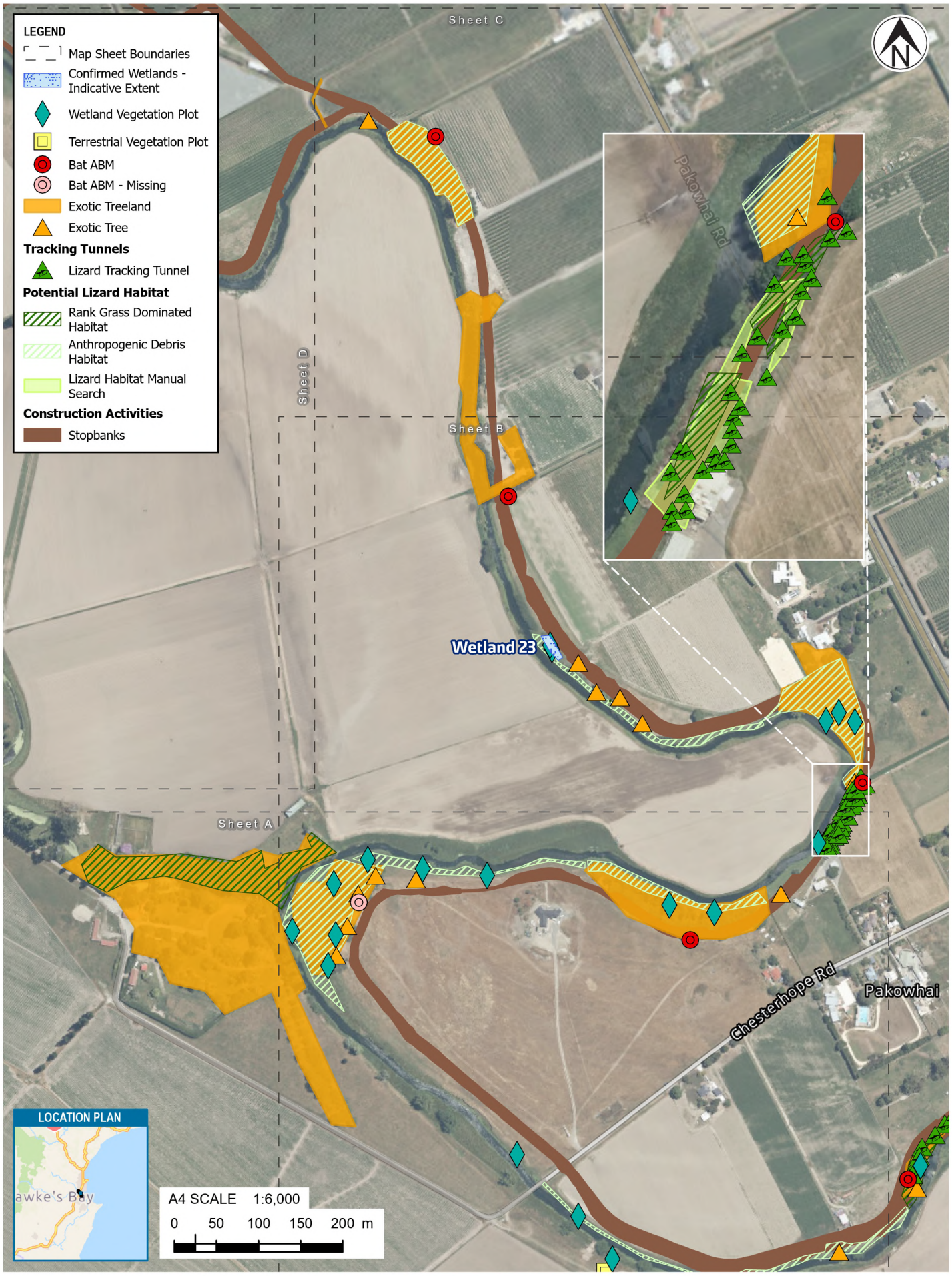
SCALE (A4) 1:6,000 FIG No. FIGURE 1B REV 0



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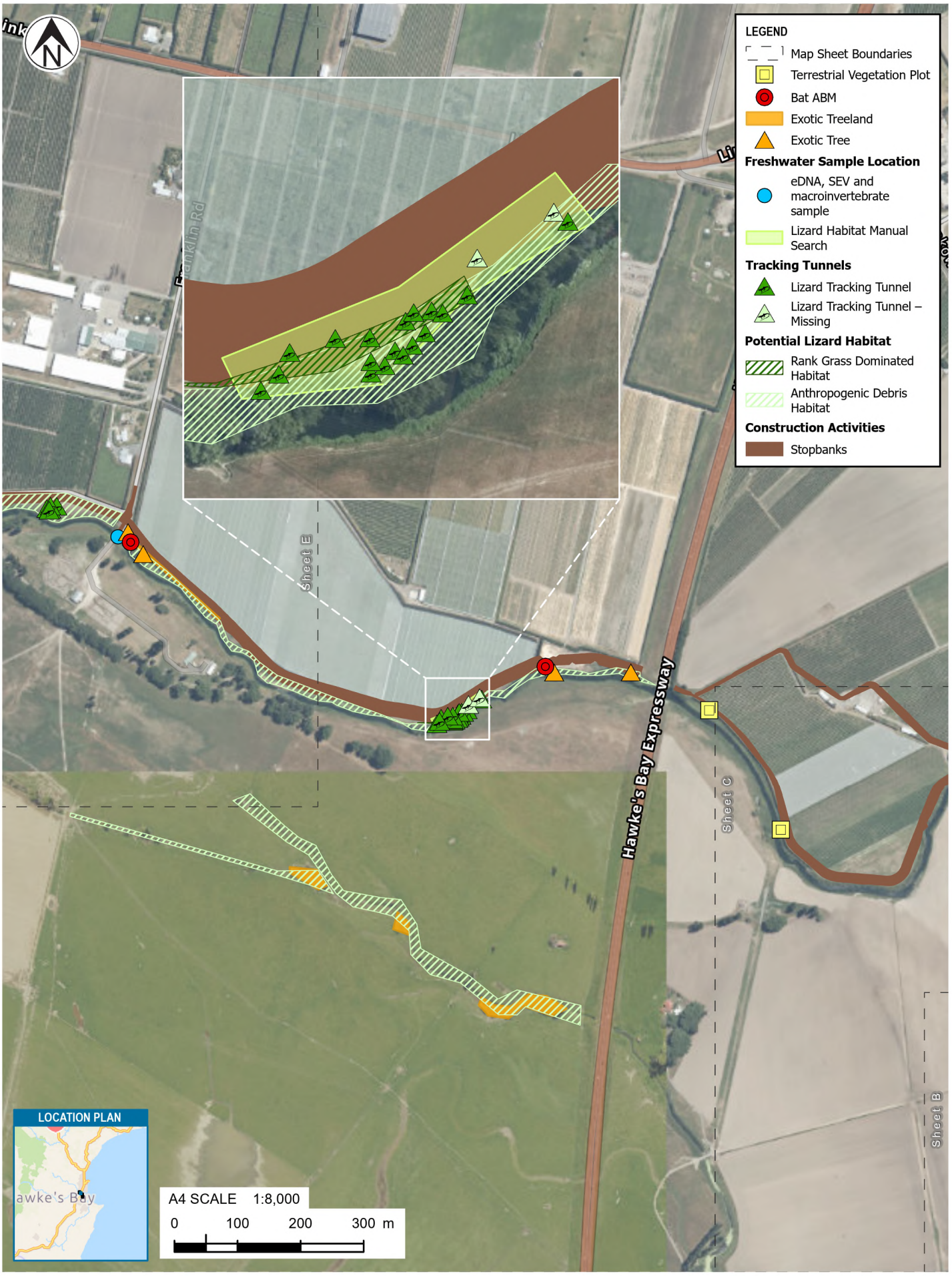
SCALE (A4) 1:6,000 FIG No. FIGURE 1C. REV 0



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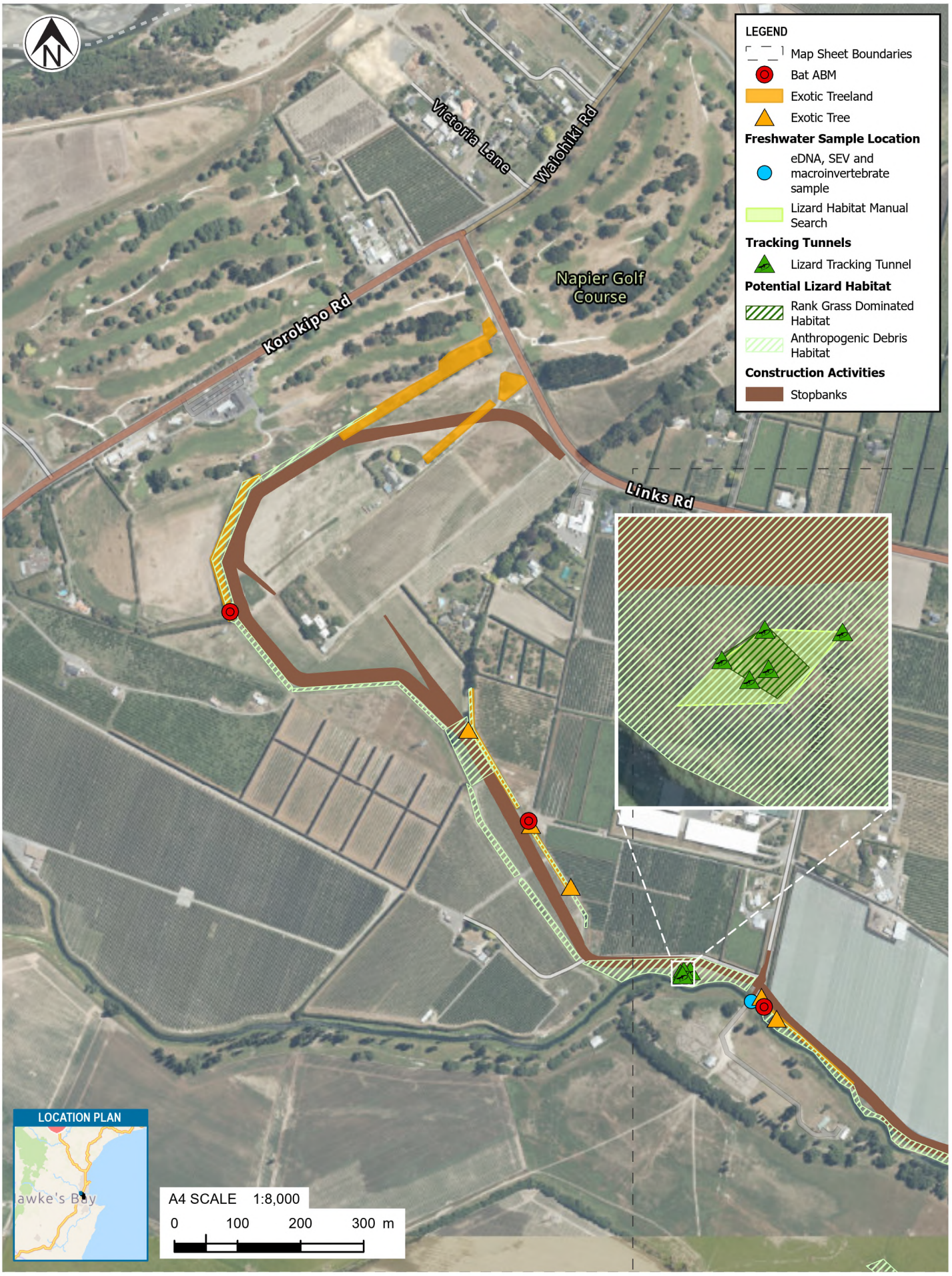
SCALE (A4) 1:8,000 FIG No. FIGURE 1D. REV 0



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TITLE ECOLOGICAL OPPORTUNITIES AND CONSTRAINTS MAP

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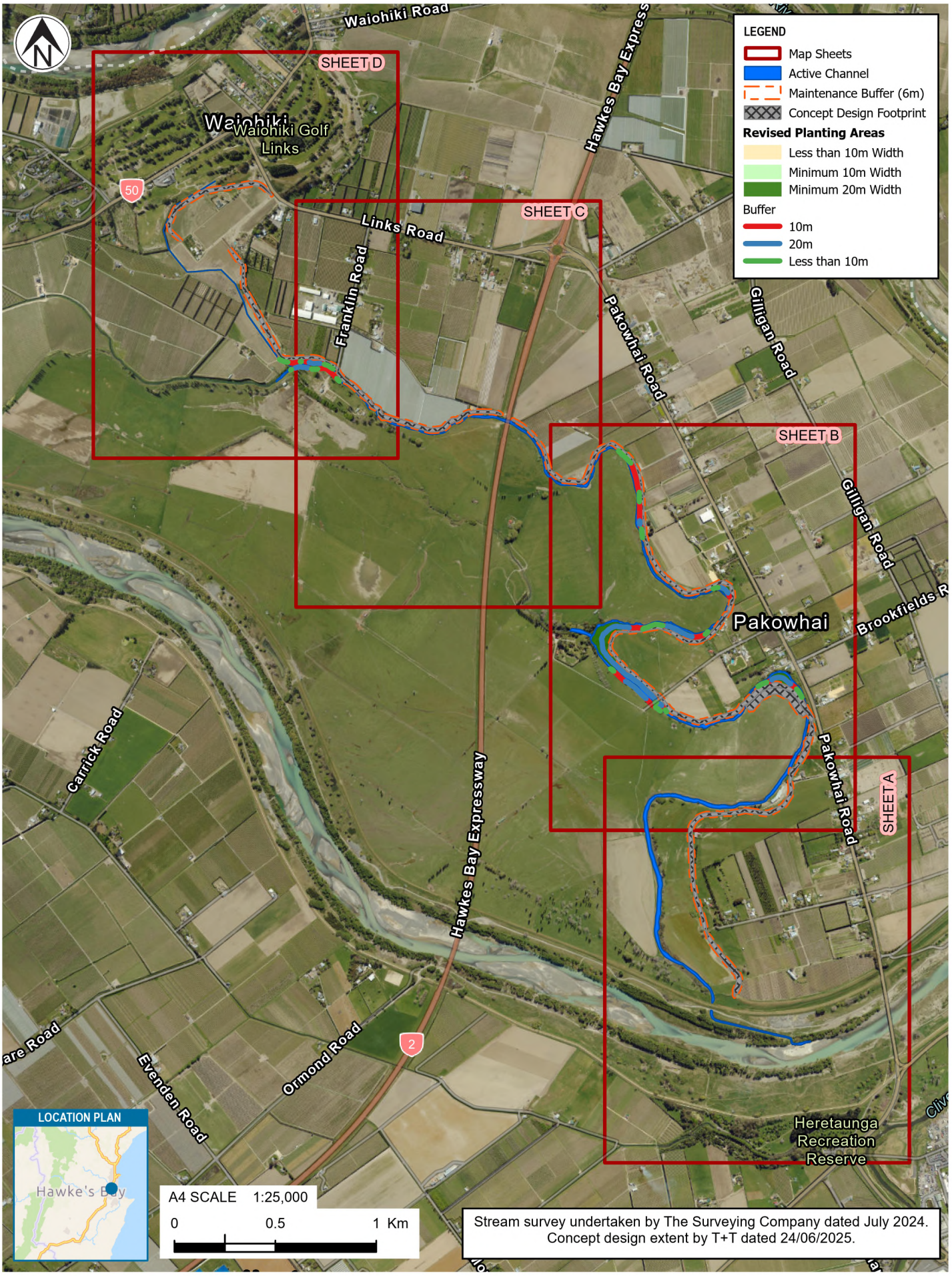

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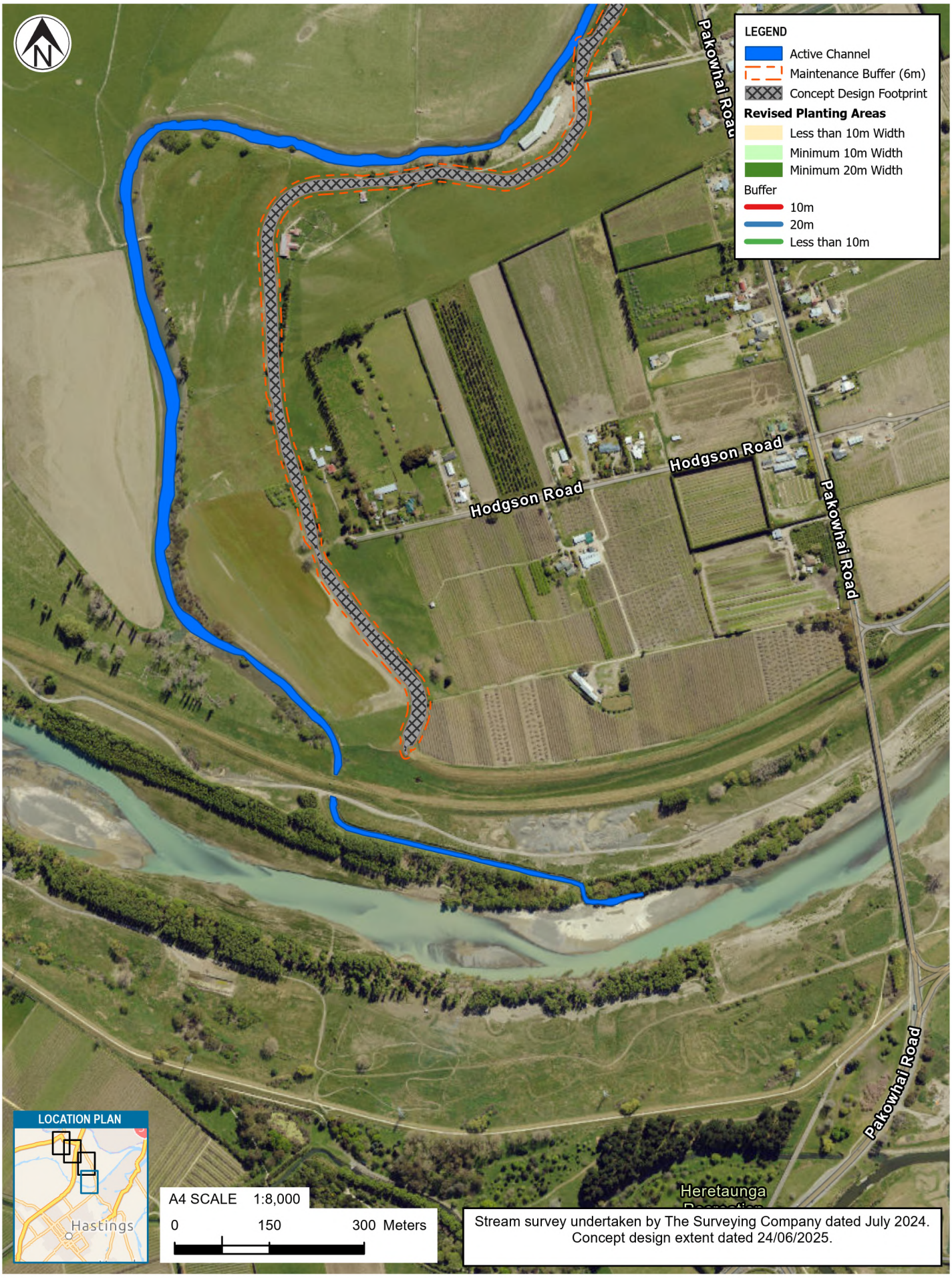
PROJECT **PAKOWHAI SECONDARY STOPBANKS**

TITLE TUTAEKURI-WAIMATE STREAM PLANTING - INDEX MAP

SCALE (A4) 1:25,000 FIG No. FIGURE 1. REV 0



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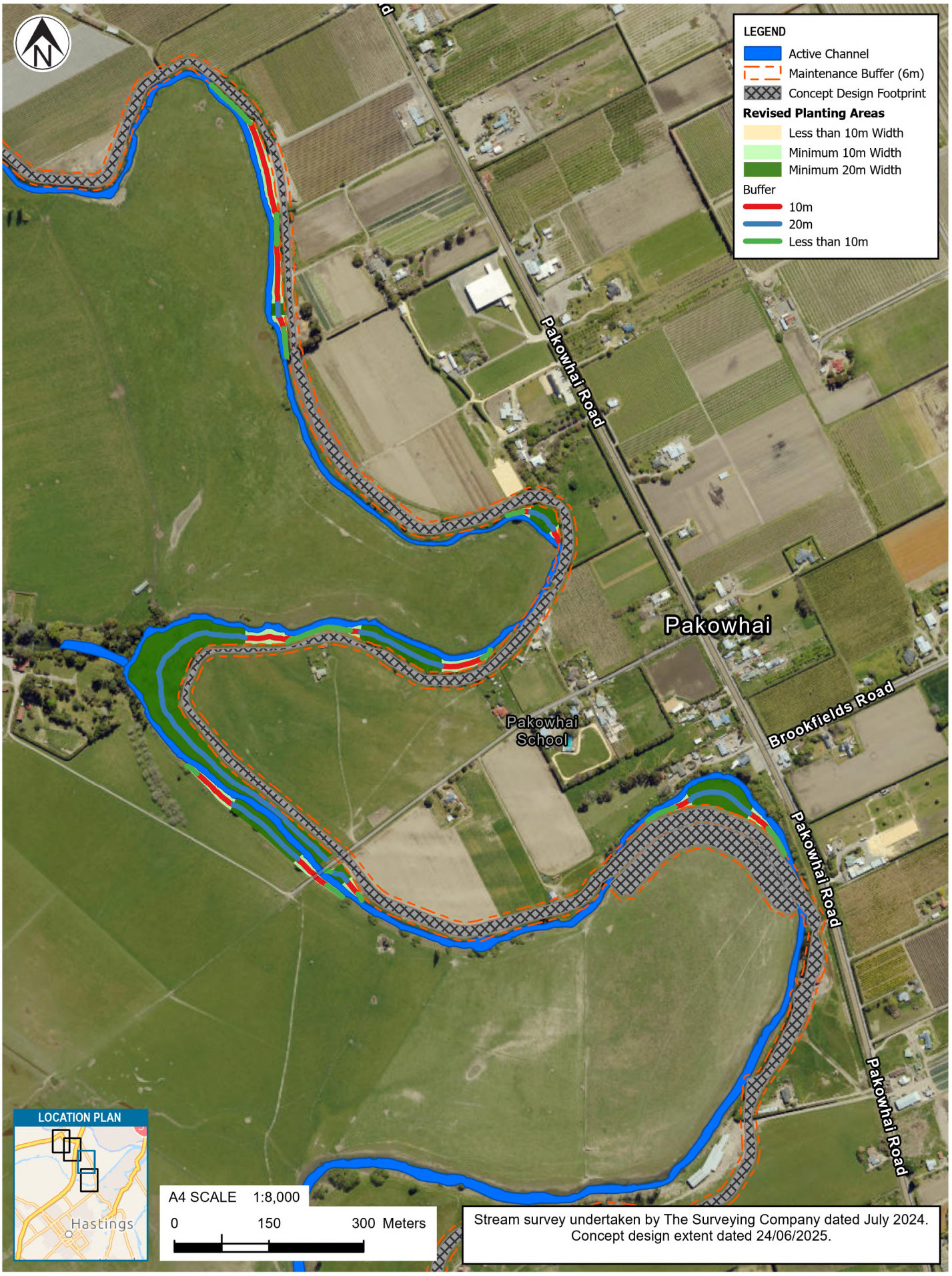
TITLE TUTAEKURI-WAIMATE STREAM PLANTING - SHEET A

SCALE (A4) 1:8,000 FIG No. FIGURE 1 - SHEET A REV 0



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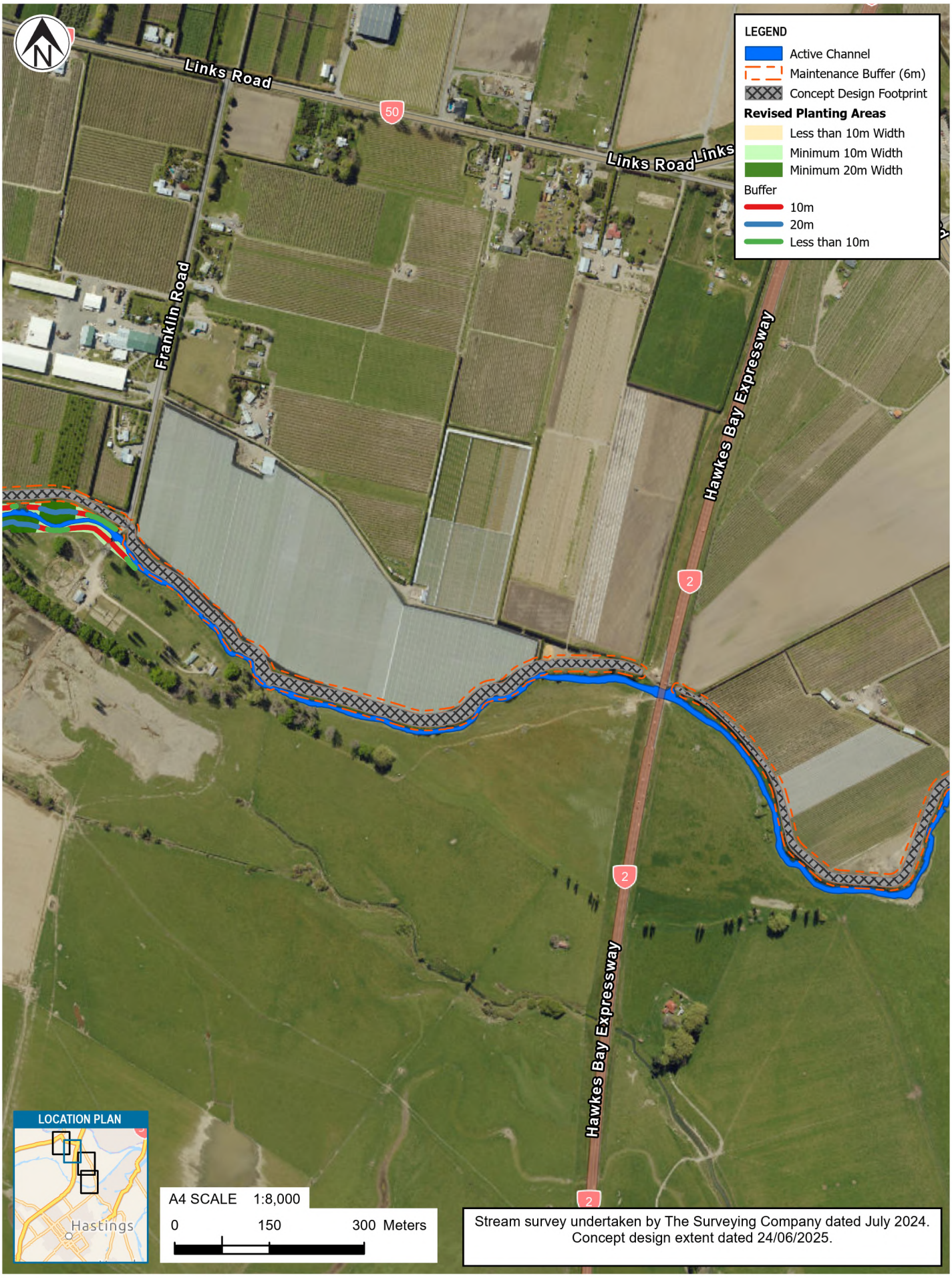
TITLE TUTAEKURI-WAIMATE STREAM PLANTING - SHEET B

SCALE (A4) 1:8,000 FIG No. FIGURE 1 - SHEET B REV 0



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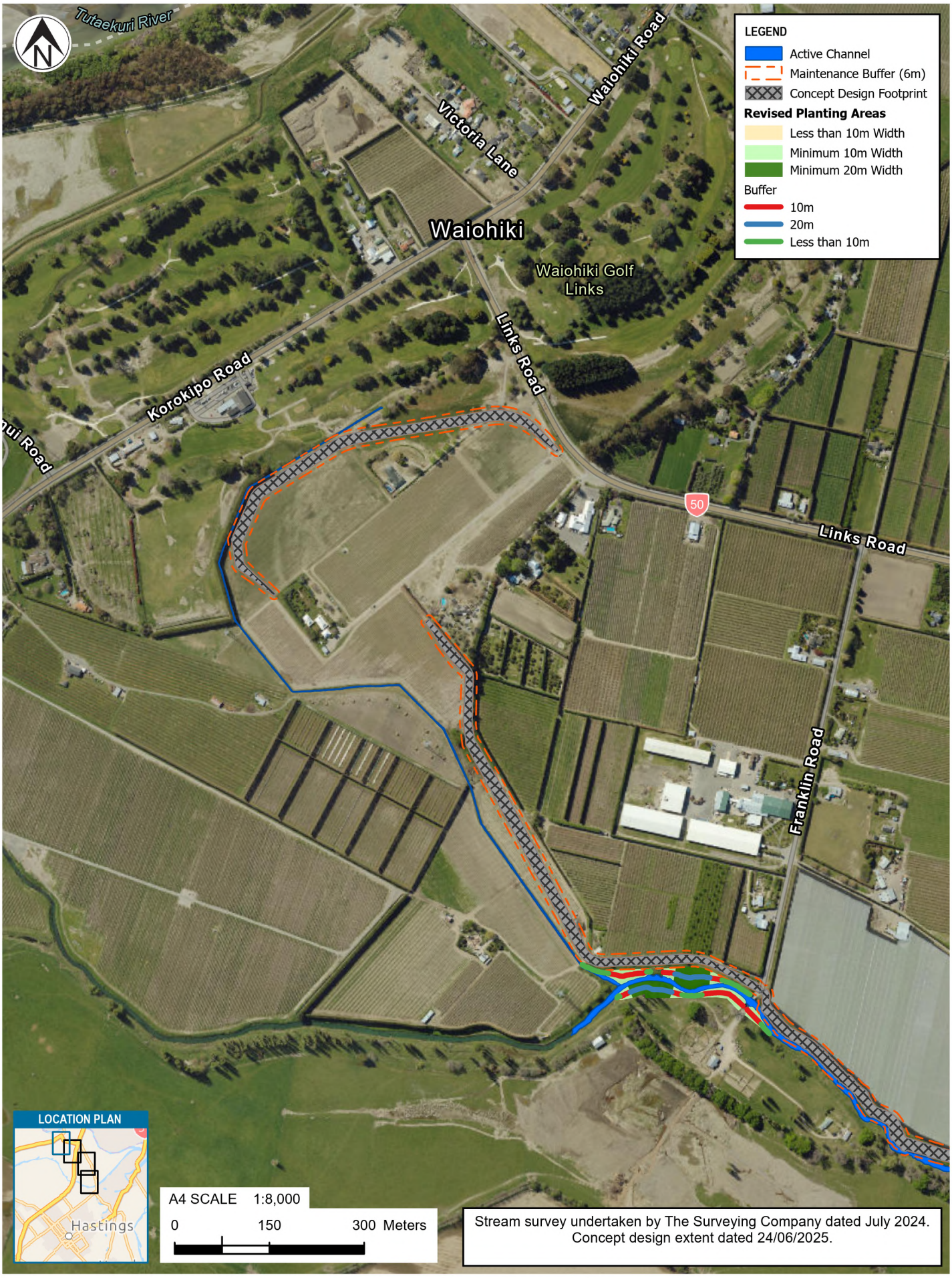
TITLE TUTAEKURI-WAIMATE STREAM PLANTING - SHEET C

SCALE (A4) 1:8,000 FIG No. FIGURE 1 - SHEET C REV 0



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TITLE TUTAEKURI-WAIMATE STREAM PLANTING - SHEET D

SCALE (A4) 1:8,000 FIG No. FIGURE 1 - SHEET D REV 0

Appendix B eDNA and macroinvertebrate results

Table Appendix B.1 : Summary eDNA results for fish species and koura at Site 1 (Franklin Road) Tūtaekurī-Waimate Stream

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	16144	11081	17842	11242	21651	6926
Gambusia affinis	Mosquitofish	470	1291	2408	443	2159	9
Anguilla australis	Shortfin eel; tuna; hao; aopori; hikumutu	2262	3907	6103	4726	6728	5239
Anguilla dieffenbachii	Longfin eel; tuna; kūwharuwharu; reherehe; kirirua	1311	571	695	956	2567	4445
Gobiomorphus huttoni	Redfin bully	0	470	2377	3366	454	3218
Oncorhynchus mykiss	Rainbow trout; taraute;tarauta; hāmana; tāmana	410	795	371	0	0	2451
Retropinna retropinna	Common smelt; ngaore; paraki; pōrohe	981	7	227	1000	0	7
Gobiomorphus gobioides	Giant bully; tītarakura; tīpokopoko	84	0	0	0	0	0
Paranephrops planifrons	Koura; freshwater crayfish; kēwai; kōura; koeke; kēkēwai; karawai	15057	6467	19663	13735	20028	4752
Carassius auratus	Goldfish; morihana	387	0	0	403	802	968
Rhombosolea retiaria	Black Flounder; freshwater flounder	172	0	0	0	0	0
Geotria australis	Pouched lamprey; piharau; kanakana	0	0	42	0	0	0
Gobiomorphus	Bullies	2436	3651	3129	3688	7652	3889
Gobiomorphus cotidianus/basalis/dinae	Common/Cran/Dinahs bully; titikura	294	289	585	892	2375	65
Oncorhynchus	Salmon/Trout; taraute;tarauta; hāmana; tāmana	979	249	0	849	458	342
Anguilla	Eels	0	0	271	0	0	31
Eleotridae	Bullies	0	0	35	0	0	0
Otophysi	Otophysi	0	0	0	0	134	0
Gobiiformes	Gobies and sleepers	102	0	0	0	0	0

Table Appendix B.2: Summary eDNA results for fish species and koura at Site 2 (lower Tūtaekurī-Waimate Stream reach)

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	16758	11554	1784	6279	13031	6794
Gambusia affinis	Mosquitofish	14976	11919	20160	15184	24403	18300
Anguilla australis	Shortfin eel; tuna; hao; aopori; hikumutu	3365	4156	1483	3510	3631	4079
Anguilla dieffenbachii	Longfin eel; tuna; kūwharuwharu; reherehe; kirirua	1252	1170	0	456	1369	394
Gobiomorphus huttoni	Redfin bully	0	211	0	0	221	0
Oncorhynchus mykiss	Rainbow trout; taraute;tarauta; hāmana; tāmana	310	433	0	149	1967	228
Galaxias maculatus	īnanga	796	3614	0	681	381	328
Retropinna retropinna	Common smelt; ngaore; paraki; pōrohe	0	251	0	179	750	156
Gobiomorphus gobioides	Giant bully; tītarakura; tīpokopoko	0	114	0	2427	625	0
Paranephrops planifrons	Koura; freshwater crayfish; kēwai; kōura; koeke; kēkēwai; karawai	159	7091	0	5394	10248	1749
Carassius auratus	Goldfish; morihana	0	341	0	0	9	0
Rhombosolea retiaria	Black Flounder; freshwater flounder	26	63	0	0	318	152
Pseudocaranx georgianus	Silver trevally; araara	0	94	0	0	0	0
Gobiomorphus	Bullies	1647	2032	1548	948	2702	360
Gobiomorphus cotidianus/basalis/dinae	Common/Cran/Dinahs bully; titikura	369	79	0	577	1235	941
Oncorhynchus	Salmon/Trout; taraute;tarauta; hāmana; tāmana	306	935	0	430	2007	1046
Anguilla	Eels	61	0	0	11	0	0
Salmoninae	Salmon and trout	251	0	0	0	0	0
Salmonidae	Salmonids	0	0	0	0	42	0
Galaxiiformes	Galaxiids	0	0	414	0	366	0

Table Appendix B.3: Macroinvertebrate results for the Tūtaekurī-Waimate Stream samples

Bottle No.			Site1 Franklin Road A	Site1 Franklin Road B	Site1 Franklin Ro	Site1 Franklin Road D	Site1 Franklin Road E	Site 2 A	Site 2 B	Site 2 C	Site 2 D	Site 2 E
			20.08.2024	20.08.2024	20.08.2024	20.08.2024	20.08.2024	21.08.2024	21.08.2024	21.08.2024	21.08.2024	21.08.2024
Sample No.												
Site Name												
Taxa	MCI	MCI-sb										
	score	score										
Mayfly Zephlebia	7	8.8	1	6	16	1					1	
Caddisfly Plectrocnemia	8	6.6									1	
Caddisfly Polyplectropus	8	8.1						1			1	
Caddisfly Triplectides	5	5.7	1		1	1	1				1	
Damselfly Xanthocnemis	5	1.2				2	1	2	1	1	2	1
Bug Anisops	5	2.2				1	1					
Bug Microvelia	5	4.6						4		4	4	4
Beetle Antiporus	5	3.5	2	1			1				1	1
Beetle Elmidae	6	7.2										1
Beetle Hydrophilidae	5	8										1
True Fly Empididae	3	5.4						1				
True Fly Nothodixa	4	9.3				1						
True Fly Paradixa	4	8.5									1	
True Fly Polypedilum	3	8						1	1			
Moth Hygraula	4	1.3		1								
Collembola	6	5.3						2			2	1
Crustacea Ostracoda	3	1.9						2		1		
Crustacea Paracalliope	5	0	173	56	109	176	21	170	154	211	194	190
Crustacea Paratya	5	3.6		1		1	1	1				1
SPIDERS Dolomedes	5	6.2		1	1	1	1				1	
Mollusc Glyptophysa	5	0.3		1								
Mollusc Gyraulus	3	1.7	1									
Mollusc Lymnaeidae	3	1.2								1		
Mollusc Physella (Physa)	3	0.1	1			3	5		3	1	1	1
Mollusc Potamopyrgus	4	2.1	33	145	85	22	180	35	58	14	23	30
Mollusc Sphaeriidae	3	2.9					1		2	1		
OLIGOCHAETES	1	3.8					1			1		1
PLATYHELMINTHES (Flatw	3	0.9	1		1	2	1	2	2	1	2	1
Number of Taxa			8	8	6	11	12	11	7	10	14	12
EPT Value			2	1	2	2	1	1	0	0	4	0
Number of Individuals			213	212	213	211	215	221	221	236	235	233
% EPT			0.94	2.83	7.98	0.95	0.47	0.45	0	0	1.70	0
% EPT Taxa			25	12.5	33.33	18.18	8.33	9.09	0	0	28.57	0
Sum of recorded scores			35	40	29	51	49	50	26	35	73	53
Count of recorded scores			8	8	6	11	12	11	7	10	14	12
Sum of individuals with scores			213	212	213	211	215	221	221	236	235	233
MCI Value			87.5	100	96.67	92.73	81.67	90.91	74.29	70	104.29	88.33
Sum of abundance load			1028	926	1010	1024	877	1063	1031	1152	1155	1129
QMCI Value			4.83	4.37	4.74	4.85	4.08	4.81	4.67	4.88	4.91	4.85
Sum of recorded scores			22.8	25.8	23.7	40.1	32.2	41.1	15.2	18.7	61.6	40.3
Count of recorded scores			7	7	5	10	11	10	6	9	13	11
Sum of individuals with scores			40	156	104	35	194	51	67	25	41	43
SBMCI Value			65.14	73.71	94.8	80.2	58.55	82.2	50.67	41.56	94.77	73.27
Sum of abundance load			93.5	372.2	332.1	86.5	408.5	135.6	138.9	59.8	129	115
QMCI-sb Value			2.34	2.39	3.19	2.47	2.11	2.66	2.07	2.39	3.15	2.67
			11/16 sample examined	11/16 sample examined	15/16 sample exa	01/16 sample examined	12/16 sample examined	01/16 sample examined	02/16 sample examined	01/16 sample examined	02/16 sample e	01/16 sample examined

Appendix C Freshwater and terrestrial fauna records

Table Appendix C.1 : Freshwater fish species for Tūtaekurī-Waimate Stream and Ngaruroro River (New Zealand Freshwater Fish database accessed 1 August 2024, site investigations 20-22 August 2024)

Stream name	Location of record	Scientific name	Common name	Threat status*
Tūtaekurī-Waimate Stream	West of 74 Hodgson Rd	Gobiomorphus gobioides	Giant Bully	At risk – three naturally uncommon
		Anguilla dieffenbachii	Longfin eel	At Risk Declining
		Anguilla australis	Shortfin eel	Not threatened
		Paranephrops	Kaura	Not threatened
		Echyridella menziesi	Freshwater mussel	At Risk Declining
	47 Chesterhope Road (Bridge)	*Gambusia affinis*	Mosquitofish	Introduced and naturalised
	West of 1475 Korokipo Road (drain)	*Retropinna retropinna*	Common smelt	Not threatened
		Gobiomorphus cotidianus	Common bully	Not threatened
		Anguilla dieffenbachii	Longfin eel	At Risk Declining
	East of 1491-1575 Korokipo Road	*Anguilla dieffenbachii*	Longfin eel	At Risk Declining
		Gobiomorphus cotidianus	Common bully	Not threatened
		Oncorhynchus mykiss	Rainbow trout	Introduced and naturalised
		Anguilla australis	Shortfin eel	Not threatened
Ngaruroro River	74 Gilbertson Road	*Gambusia affinis*	Mosquitofish	Introduced and naturalised
	79 Carrick Road	*Gobiomorphus cotidianus*	Common bully	Not threatened
		Retropinna retropinna	Common smelt	Not threatened
		Galaxias maculatus	Inanga	At Risk Declining
		Anguilla dieffenbachii	Longfin eel	At Risk Declining
		Cheimarrichthys fosteri	Torrentfish	At Risk Declining

Stream name	Location of record	Scientific name	Common name	Threat status*
	North of 469-470 Twyford Road	*Cheimarrichthys fosteri*	Torrentfish	At Risk Declining

Table Appendix C.2 : Macroinvertebrate scores for Tūtaekurī-Waimate Stream and Ngaruroro River (Land Air Water Aotearoa (LAWA) accessed 1 August 2024, site investigations 20-22 August 2024)

Stream name	Location of record	MCI	QMCI	Taxonomic Richness	Percent EPT richness
Tūtaekurī-Waimate Stream	Upstream of Ngaruroro at Chesterhope	56.2 (D attribute band – Very likely degrading)	1.6 (D attribute band – Very likely degrading)	21	19
Ngaruroro River	Chesterhope	93.3 (C attribute band – Very likely degrading)	4.4 (B attribute band – Intermediate trend)	16	44

Table Appendix C.3 : Native birds recorded in the Pakowhai area (eBird and iNaturalist databases accessed 6 August 2024, site investigations 20-22 August 2024)

Common name	Māori name	Scientific name	Threat status[8]	Potentially breed on site	Recorded online	Detected on site
Pūkeko	Pūkeko	*Porphyrio melanotus melanotus*	Not Threatened	√	√	√
Spur-winged plover	-	*Vanellus miles novaehollandiae*	Not Threatened	√	√	√
Black swan	Kakīānau	*Cygnus atratus*	Not Threatened			√
Australasian shoveler	Kuruwhengi	*Spatula rhynchotis*	Not Threatened	√		√
Banded dotterel	Pohowera	*Charadrius bicinctus bicinctus*	At Risk - Declining	If present	√	
Black-fronted dotterel	-	*Elseyornis melanops*	Naturally Uncommon	√		√
Eastern bar-tailed godwit	Kuaka	*Limosa lapponica baueri*	At Risk - Declining		√	
Pied stilt	Poaka	*Himantopus himantopus leucocephalus*	Not Threatened	√	√	√

[8] Robertson et al., 2021.

Common name	Māori name	Scientific name	Threat status[8]	Potentially breed on site	Recorded online	Detected on site
Little pied shag	Kawaupaka	*Phalacrocorax melanoleucos brevirostris*	At Risk - Relict	√	√	√
Black shag	Kawau	*Phalacrocorax carbo novaehollandiae*	At Risk - Relict	√	√	√
Royal spoonbill	Kōtuku ngutupapa	*Platalea regia*	At Risk - Naturally Uncommon		√	
White heron	Kōtuku	*Ardea alba modesta*	Threatened - Nationally Critical		√	
White-faced heron	Matuku moana	*Egretta novaehollandiae*	Not Threatened		√	√
Caspian tern	Taranui	*Hydroprogne caspia*	Threatened - Nationally Vulnerable		√	
Black-billed gull	Tarāpuka	*Larus bulleri*	At Risk - Declining		√	
Red-billed gull	Tarāpunga	*Larus novaehollandiae scopulinus*	At Risk - Declining		√	
Australasian harrier	Kāhu	*Circus approximans*	Not Threatened	√	√	√
Kererū	Kererū	*Hemiphaga novaeseelandiae*	Not Threatened	If present	√	
Kingfisher	Kōtare	*Todiramphus sanctus vagans*	Not Threatened	√	√	√
New Zealand Pipit	Pīhoihoi	*Anthus novaeseelandiae*	At Risk - Declining	If present	√	
Tūī	Tūī	*Prosthemadera novaseelandiae novaseelandiae*	Not Threatened	√	√	√
Bellbird	Korimako	*Anthornis melanura*	Not Threatened	√		√
Welcome swallow	Warou	*Hirundo neoxena neoxena*	Not Threatened	√	√	√
Grey warbler	Riroriro	*Gerygone igata*	Not Threatened	√	√	√
North Island Fantail	Pīwakawaka	*Rhipidura fuliginosa placabilis*	Not Threatened	√	√	√
Silvereye	Tauhou	*Zosterops lateralis lateralis*	Not Threatened	√	√	√

Table Appendix C.4 : Native lizards recorded within 15 km of site in the Herpetofauna Atlas (updated 5 December 2023) and iNaturalist (accessed 5 August 2024) or whose distribution includes the site (New Zealand Herpetological Society, 2021)

Common name	Scientific name	Threat status[9]	Location	Distance from site	Year	Source
Northern grass skink	*Oligosoma polychroma*	Not Threatened	Napier	5 km 7 km	2019 2006	iNaturalist Herpetological Atlas
Northern spotted skink	*Oligosoma kokowai*	At Risk - Relict	Napier	7 km	2009	Herpetological Atlas
Hawke's Bay skink	*Oligosoma auroraense*	Threatened – Nationally Endangered	Te Mata Peak	12 km	2019	Herpetological Atlas
Glossy brown skink	*Oligosoma zelandicum*	At Risk - Declining	Within distribution	-	-	NZ Herpetological Society
Copper skink	*Oligosoma aeneum*	At Risk - Declining	Within potential distribution	-	-	NZ Herpetological Society
Ornate skink	*Oligosoma ornatum*	At Risk - Declining	Within potential distribution	-	-	NZ Herpetological Society
Forest gecko	*Mokopirirakau granulatus*	At Risk - Declining	Hastings	7 km	1929	Herpetological Atlas
Barking gecko	*Naultinus punctatus*	At Risk - Declining	Clifton	14 km	1970	Herpetological Atlas
Tuatara	*Sphenodon punctatus*	At Risk - Relict	Cape Sanctuary	15 km	2012	Herpetological Atlas
Raukawa gecko	*Woodworthia maculata*	Not Threatened	Within distribution	-	-	NZ Herpetological Society

[9] Hitchmough et al., 2021.

Appendix D Terrestrial fauna survey results

Table Appendix D.1 : Bat survey ABM results

ABM	Date deployed	Date retrieved	Number of nights recording	Number of bat passes	Notes
1	13/11/2024	18/12/2024	35	0	
2	13/11/2024	18/12/2024	35	0	
3	13/11/2024	18/12/2024	35	0	
4	13/11/2024	18/12/2024	35	0	
5	13/11/2024	18/12/2024	35	0	
6	13/11/2024	18/12/2024	35	0	
7	13/11/2024	18/12/2024	35	0	
8	12/11/2024	18/12/2024	36	0	
9	12/11/2024	-	-	-	Missing
10	12/11/2024	18/12/2024	36	0	
11	12/11/2024	18/12/2024	36	0	
12	12/11/2024	18/12/2024	36	0	
13	12/11/2024	18/12/2024	36	0	
14	12/11/2024	18/12/2024	36	0	
15	13/11/2024	18/12/2024	35	0	
16	13/11/2024	18/12/2024	8	0	Stopped recording early

Table Appendix D.2 : Bat survey weather conditions. Nights with invalid weather conditions are highlighted in blue

Date	Minimum temperature in the first four hours after sunset (°C)	Total rainfall in the first four hours after sunset (mm)	Average wind in the first four hours after sunset (km/h)	Valid weather night
12/11/2024	11	0	8.0	Yes
13/11/2024	11	0	6.7	Yes
14/11/2024	14	0.6	16.0	Yes
15/11/2024	14	0	4.4	Yes
16/11/2024	7.8	0	6.5	No
17/11/2024	7.8	0	2.9	No
18/11/2024	9	0	3.5	Yes
19/11/2024	11	0	3.6	Yes
20/11/2024	13	0	23.3	No
21/11/2024	6.6	0	6.4	No
22/11/2024	9	0	3.0	Yes

Date	Minimum temperature in the first four hours after sunset (°C)	Total rainfall in the first four hours after sunset (mm)	Average wind in the first four hours after sunset (km/h)	Valid weather night
23/11/2024	11	1.6	7.5	Yes
24/11/2024	12	0	2.7	Yes
25/11/2024	15	0	2.9	Yes
26/11/2024	16	0	4.5	Yes
27/11/2024	14	0	5.8	Yes
28/11/2024	19	0	5.6	Yes
29/11/2024	12	0	5.8	Yes
30/11/2024	10	0	4.1	Yes
1/12/2024	17	0	3.3	Yes
2/12/2024	17	0	1.7	Yes
3/12/2024	18	0	16.8	Yes
4/12/2024	19	0	4.2	Yes
5/12/2024	18	0	8.1	Yes
6/12/2024	11	0	3.0	Yes
7/12/2024	15	0	2.7	Yes
8/12/2024	16	0	15.8	Yes
9/12/2024	17	0	6.6	Yes
10/12/2024	15	0	4.0	Yes
11/12/2024	17	0	4.0	Yes
12/12/2024	17	0	3.8	Yes
13/12/2024	17	0	4.9	Yes
14/12/2024	18	0	5.3	Yes
15/12/2024	18	0	2.4	Yes
16/12/2024	14	0	4.6	Yes
17/12/2024	9	0	15.2	Yes

Table Appendix D.3 : Lizard survey tracking tunnel results (see next page)

Tracking Tunnel Number	Date Deployed	Date Retrieved	Lizard	Rat	Mouse	Insect	Hedgehog	Unsure	Nothing	Notes
1	12/11/2024	18/12/2024				1				
2	12/11/2024	18/12/2024				1				
3	12/11/2024	18/12/2024				1				
4	12/11/2024	18/12/2024								
5	12/11/2024	18/12/2024				1		1		
6	12/11/2024	18/12/2024				1				
7	12/11/2024									Destroyed by cattle
8	12/11/2024	18/12/2024				1		1		
9	12/11/2024	18/12/2024			1					
10	12/11/2024	18/12/2024		1						
11	12/11/2024	18/12/2024				1				
12	12/11/2024	18/12/2024				1				
13	12/11/2024	18/12/2024				1				
14	12/11/2024	18/12/2024				1				
15	12/11/2024	18/12/2024								
16	12/11/2024	18/12/2024							1	
17	12/11/2024	18/12/2024			1	1		1		
18	12/11/2024									Destroyed
19	12/11/2024									Destroyed
20	12/11/2024									Destroyed
21	12/11/2024	18/12/2024						1		
22	12/11/2024	18/12/2024				1				
23	12/11/2024	18/12/2024			1	1		1		
24	12/11/2024	18/12/2024				1				
25	12/11/2024	18/12/2024			1	1				
26	12/11/2024	18/12/2024				1				
27	12/11/2024	18/12/2024			1	1				
28	12/11/2024	18/12/2024							1	
29	12/11/2024	18/12/2024		1	1					
30	12/11/2024	18/12/2024				1				
31	12/11/2024	18/12/2024		1	1	1				
32	12/11/2024	18/12/2024		1	1	1				
33	12/11/2024	18/12/2024		1	1					
34	12/11/2024	18/12/2024		1	1	1				
35	12/11/2024	18/12/2024			1	1				

Tracking Tunnel Number	Date Deployed	Date Retrieved	Lizard	Rat	Mouse	Insect	Hedgehog	Unsure	Nothing	Notes
36	12/11/2024	18/12/2024			1	1				
37	12/11/2024	18/12/2024			1	1				
38	12/11/2024	18/12/2024				1				
39	12/11/2024	18/12/2024				1				
40	12/11/2024	18/12/2024			1					
41	12/11/2024	18/12/2024				1				
42	12/11/2024	18/12/2024							1	
43	12/11/2024	18/12/2024				1				
44	12/11/2024	18/12/2024			1					
45	12/11/2024	18/12/2024				1				
46	12/11/2024	18/12/2024							1	
47	12/11/2024	18/12/2024			1					
48	12/11/2024	18/12/2024		1	1	1				
49	12/11/2024	18/12/2024			1					
50	12/11/2024	18/12/2024		1	1	1				
51	13/11/2024	18/12/2024			1	1				
52	13/11/2024	18/12/2024			1					
53	13/11/2024	18/12/2024			1			1		
54	13/11/2024	18/12/2024			1	1		1		
55	13/11/2024	18/12/2024			1					
56	13/11/2024	18/12/2024		1	1	1				
57	13/11/2024	18/12/2024			1	1				
58	13/11/2024	18/12/2024		1	1	1				
59	13/11/2024	18/12/2024			1	1				
60	13/11/2024	18/12/2024		1	1					
61	13/11/2024	18/12/2024			1	1				
62	13/11/2024	18/12/2024		1	1					
63	13/11/2024	18/12/2024			1					
64	13/11/2024	18/12/2024		1	1					
65	13/11/2024	18/12/2024		1	1	1				
66	13/11/2024	18/12/2024		1	1	1				
67	13/11/2024	18/12/2024			1	1				
68	13/11/2024	18/12/2024		1	1	1				
69	13/11/2024	18/12/2024		1	1					
70	13/11/2024	18/12/2024		1	1	1				

Tracking Tunnel Number	Date Deployed	Date Retrieved	Lizard	Rat	Mouse	Insect	Hedgehog	Unsure	Nothing	Notes
71	13/11/2024	18/12/2024		1	1	1				
72	13/11/2024	18/12/2024		1	1					
73	13/11/2024	18/12/2024		1	1					
74	13/11/2024	18/12/2024		1	1					
75	13/11/2024	18/12/2024			1					
76	13/11/2024	18/12/2024			1					
77	13/11/2024	18/12/2024			1	1				
78	13/11/2024	18/12/2024		1	1					
79	13/11/2024	18/12/2024			1					
80	13/11/2024	18/12/2024				1				
81	13/11/2024	18/12/2024		1		1				
82	13/11/2024	18/12/2024		1		1				
83	13/11/2024	18/12/2024		1						
84	13/11/2024	18/12/2024		1	1					
85	13/11/2024	18/12/2024		1	1					
86	13/11/2024	18/12/2024		1	1	1				
87	13/11/2024	18/12/2024				1				
88	13/11/2024	18/12/2024				1				
89	13/11/2024	18/12/2024		1		1				
90	13/11/2024	18/12/2024		1		1				
91	13/11/2024	18/12/2024		1						
92	13/11/2024	18/12/2024		1		1				
93	13/11/2024	18/12/2024		1	1	1				
94	13/11/2024	18/12/2024				1				
95	13/11/2024	18/12/2024		1						
96	13/11/2024	18/12/2024		1						
97	13/11/2024	18/12/2024		1						
98	13/11/2024	18/12/2024		1						
99	13/11/2024	18/12/2024		1		1				
100	13/11/2024	18/12/2024			1	1				
101	13/11/2024	18/12/2024		1						
102	13/11/2024	18/12/2024				1				
103	13/11/2024	18/12/2024		1		1				
104	13/11/2024	18/12/2024		1	1	1				
105	13/11/2024	18/12/2024						1		

Tracking Tunnel Number	Date Deployed	Date Retrieved	Lizard	Rat	Mouse	Insect	Hedgehog	Unsure	Nothing	Notes
106	13/11/2024	18/12/2024				1				
107	13/11/2024	18/12/2024		1	1	1				
108	13/11/2024	18/12/2024		1	1	1				
109	13/11/2024	18/12/2024		1		1				
110	13/11/2024	18/12/2024		1	1	1				
111	13/11/2024	18/12/2024				1				
112	13/11/2024	18/12/2024				1				
113	13/11/2024	18/12/2024			1			1		
114	13/11/2024	18/12/2024							1	
115	13/11/2024	18/12/2024							1	
116	13/11/2024	18/12/2024				1				
117	13/11/2024	18/12/2024				1				
118	13/11/2024	18/12/2024				1				
119	13/11/2024	18/12/2024							1	
120	13/11/2024	18/12/2024				1				
121	13/11/2024	18/12/2024						1		
122	13/11/2024	18/12/2024							1	
123	13/11/2024	18/12/2024						1		
124	13/11/2024	18/12/2024			1					
125	13/11/2024	18/12/2024							1	
126	13/11/2024	18/12/2024				1		1		
127	13/11/2024	18/12/2024						1		
128	13/11/2024	18/12/2024						1		
129	13/11/2024	18/12/2024				1				
130	13/11/2024	18/12/2024							1	
131	13/11/2024	18/12/2024			1	1				
132	13/11/2024	18/12/2024								
133	13/11/2024	18/12/2024				1		1		
134	13/11/2024	18/12/2024			1	1				
135	13/11/2024	18/12/2024			1					
136	13/11/2024	18/12/2024			1					
137	13/11/2024	18/12/2024						1	1	
138	13/11/2024	18/12/2024			1			1		
139	13/11/2024	18/12/2024						1		
140	13/11/2024	18/12/2024							1	

Tracking Tunnel Number	Date Deployed	Date Retrieved	Lizard	Rat	Mouse	Insect	Hedgehog	Unsure	Nothing	Notes
141	13/11/2024	18/12/2024			1					
142	13/11/2024	18/12/2024			1					
143	13/11/2024	18/12/2024			1	1				
144	13/11/2024	18/12/2024							1	
145	13/11/2024	18/12/2024				1				
146	13/11/2024	18/12/2024				1				
147	13/11/2024	18/12/2024							1	
148	13/11/2024	18/12/2024						1		
149	13/11/2024	18/12/2024							1	
150	13/11/2024	18/12/2024			1	1				
151	13/11/2024	18/12/2024							1	
152	13/11/2024	18/12/2024				1				
153	13/11/2024	18/12/2024			1					
154	13/11/2024	18/12/2024				1				
155	13/11/2024	18/12/2024							1	
156	13/11/2024	18/12/2024				1				
157	13/11/2024	18/12/2024				1				
158	13/11/2024	18/12/2024			?	1		1		
159	13/11/2024	18/12/2024				1		1		
160	13/11/2024	18/12/2024							1	
161	14/11/2024	18/12/2024			1					
162	14/11/2024	18/12/2024		1		1				
163	14/11/2024	18/12/2024			1					
164	14/11/2024	18/12/2024			1	1				
165	14/11/2024	18/12/2024				1				
166	14/11/2024	18/12/2024			1					
167	14/11/2024	18/12/2024			1					
168	14/11/2024	18/12/2024		1	1					
169	14/11/2024	18/12/2024		1	1	1	likley			
170	14/11/2024	18/12/2024		1	1					
171	14/11/2024	18/12/2024		1			likley			
172	14/11/2024	18/12/2024		1	1					
173	14/11/2024	18/12/2024		1	1					
174	14/11/2024	18/12/2024			1					
175	14/11/2024	18/12/2024			1	1				

Tracking Tunnel Number	Date Deployed	Date Retrieved	Lizard	Rat	Mouse	Insect	Hedgehog	Unsure	Nothing	Notes
176	14/11/2024	18/12/2024		1	1		likley			
177	14/11/2024	18/12/2024								
178	14/11/2024	18/12/2024			1					
179	14/11/2024									Destroyed by mower
180	14/11/2024									Destroyed by mower
181	14/11/2024	18/12/2024		1	1	1				
182	14/11/2024	18/12/2024		1			possible			
183	14/11/2024	18/12/2024							1	
184	14/11/2024	18/12/2024		1	1	1				
185	14/11/2024	18/12/2024		1		1				

Appendix E Native riparian planting species list

Table Appendix E.1: Potential riparian planting species list

Common name	Species name	Example of where to plant
Rautahi; cutty grass	*Carex geminata*	Lower bench and slope
Māori sedge	*Carex maorica*	Lower bench and slope
Mānatu, ribbonwood	*Plagianthus regius subsp. regius*	Upper slope and bank
Tī kōuka; cabbage tree	*Cordyline australis*	Upper slope and bank
Koromiko	*Veronica stricta var. stricta*	Upper slope and bank
Mānuka	*Leptospermum scoparium var. scoparium*	Upper slope and bank
Kōwhai	*Sophora microphylla*	Upper slope and bank
Tarata, lemonwood	*Pittosporum eugenioides*	Upper slope and bank
Karamū	*Coprosma robusta*	Upper slope and bank
Tītoki	*Alectryon excelsus*	Upper slope and bank
Fivefinger	*Pseudopanax arboreus*	Throughout zone
Karamū	*Coprosma robusta*	Throughout zone
Harakeke; flax	*Phormium tenax*	Throughout zone (away from flood zone)
Toetoe	*Austroderia toetoe*	Throughout zone
Purei	*Carex secta*	Throughout zone
Kahikatea	*Dacrycarpus dacrydioides*	Outer edge of zone
karo	*Pittosporum Ralphii*	Outer edge of zone
kohukohu	*Pittosporum Tenuifolium*	Outer edge of zone
Tōtara	*Podocarpus totara var. totara*	Outer edge of zone
Pūriri	*Vitex lucens*	Outer edge of zone
Akeake	*Dodonaea viscosa*	Outer edge of zone
Ngaio	*Myoporum laetum*	Outer edge of zone

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