Ecological Impact Assessment for the Proposed Upgrade to the Whirinaki Stopbank, Napier

Prepared for

Hawke's Bay Regional Council

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Limitations:

This report has been prepared by Pattle Delamore Partners Limited (PDP) on the basis of information provided by Hawke's Bay Regional Council. PDP has not independently verified the provided information and has relied upon it being accurate and sufficient for use by PDP in preparing the report. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.

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1.0 Introduction

Hawke's Bay Regional Council (HBRC) appointed Pattle Delamore Partners (PDP) to assist with the proposed upgrade and extension of the Whirinaki stopbank and associated scour protection works, north of Bayview, Napier.

The stopbank is proposed to provide flood protection to revised levels of service following Cyclone Gabrielle in February 2023. The scour protection work along the lower Whirinaki Stream true left bank (TLB) will secure the stopbank asset. As part of the larger project, an ecological investigation and assessment of potential ecological impacts of the design was required. This is reported in this document.

1.1 Site Description

The stopbanks to be upgraded and constructed lie on the eastern bank of an unnamed stream (hereafter referred to as "Whirinaki Stream") and traverse southern boundary of the Whirinaki Power Station. The Whirinaki Stream originates in the eastern hills above Whirinaki, north of Napier. The stream descends to the western boundary of the Pan Pac timber mill in Whirinaki and follows the boundary south to its confluence with Esk River at Eskdale Beach. The project corridor has been divided into southern, middle, northern, and upper reaches to reflect the different construction requirements along the proposed alignment (Figure 1). An area of hardfill and Ararata Urupā located near the southern end of the stream, east of the river mouth have been avoided.

1.2 Proposed Works

Flooding and storm related damage is a relatively regular occurrence in Hawke's Bay, and climate change is expected to intensify the effects of this. Widespread slipping, channel erosion, bank scour, and damage to roading and other infrastructure are consequential impacts of flood events in the catchment.

The stopbank project is at the preliminary design stage. Therefore, enabling works, construction methods, erosion and sediment control, and timescales are not yet finalised.

The general construction/upgrade scope includes four components (Figure 1):

- Section 1: A proposed extension (i.e., new construction) of the stopbank south of SH2 to Esk River mouth at the coast, which follows Whirinaki Stream and measures approximately 900 m in length.
- Section 2: Approximately 500 m runs northeast along the southbound SH2 before veering northwest along the southern boundary of the Whirinaki Power Station to Whirinaki Stream. This middle section will be newly constructed and will involve the raising of SH2 and North Shore Road to accommodate the proposed stopbank.

- Section 3: Upgrading the existing stopbank north of Whirinaki Power Station. This section measures approximately 600 m and follows the western boundary of Pan Pac. It follows an existing stopbank which terminates at the eastern corner of the pine plantations neighbouring Pan Pac to the west.
- Section 4: Constructing an additional stopbank along the northwestern extent of the Pan Pac plant adjacent to a lumber storage yard. The stopbank will measure approximately 450 m along the western boundary of Pan Pac and will be constructed alongside the existing stream.

The construction will include the following:

- Two stockpile areas to temporarily stockpile construction materials along the project corridor and/or to hold over burden material excavated from the tops of existing stopbanks.
- Potentially two temporary stream crossings to convey materials via haulage roads.

Preliminary design drawings and construction areas (i.e., stockpile areas) can be found in Appendix A.

1.3 Assessment Scope

The overall scope of this assessment is to:

- Undertake an ecological assessment of terrestrial, aquatic and coastal ecological features of the project corridor and zone of influence (ZOI);
- Determine the presence or absence of wetland habitat within 100 m of the project area utilising the standard wetland delineation protocols for Aotearoa/New Zealand;
- Assess the presence of indigenous vegetation, habitats, and fauna within the project area; and,
- Assess the potential effects of the proposed stopbank extension on the ecology of Whirinaki Stream including the downstream coastal environment and surrounding terrestrial ecosystems.

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SCALE : 1:7,500 (A3)

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B	FINAL	MAY 24	DK
A	ISSUED FOR REVIEW	APR 24	ME

SOURCE:
1. AERIAL IMAGERY (FLOWN .2023/4 SOURCED FROM THE EAGLE NZ IMAGERY BASEMAP.
2. HAIL BOUNDARY EXTRACTED FROM HAWKES BAY REGIONAL COUNCIL ON APR 2024.
3. CADASTRAL/TOPOGRAPHICAL INFORMATION AND INSET DERIVED FROM LINZ DATA.

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FIGURE

FIGURE 1: PROJECT CORRIDOR AND WORK SECTIONS, WHIRINAKI

PROJECT

WHIRINAKI STOPBANK ECOLOGY

2.0 Methodology

2.1 Desktop Assessments

PDP undertook an initial desktop review of publicly available information relating to the current ecological values of the project corridor, Whirinaki Stream, and surrounding area. This included the following information sources, which have been used in text throughout sections 4.0 and 5.0:

- HBRC maps;
- HBRC and LAWA surface water quality and flow data from nearby monitoring sites;
- Recent and historical aerial and satellite imagery (including Retrolens);
- HBRC biodiversity information and maps;
- The NZ Freshwater Fish Database (NZFFD) to identify recorded fish assemblages within the Esk River catchment and infer likely species presence at the site;
- Flora, herpetofauna, bat and avifauna databases to identify threatened species records in the vicinity of the project corridor; and,
- Wilderlab's discover eDNA database (2024) within the Esk River.

2.2 Field Assessments

Initial ecological investigations were undertaken on the 20th of February 2024 by PDP ecologists to ground-truth desktop information and obtain further data on ecological communities within the project corridor. This included wetland, terrestrial and aquatic habitat surveys, environmental DNA (eDNA), macroinvertebrate sampling, and water quality surveys. No flushing flows had occurred in the Esk River or Whirinaki Stream catchment within the three weeks prior to these assessments.

A second site investigation was undertaken on the 10th of July 2024, after Section 4 and the SH2 culvert upgrade were added to the stopbank design (the latter has since been removed). Surveys included wetland and aquatic habitat surveys in the Section 4 extent, a high-level lizard habitat survey within the potential Stockpile 7 area (a former quarry to the west of Pan Pac), and inspection of the double culverts under SH2. As of 30 May 2025, the upgrade of the SH2 culvert has been excluded from the design proposal. Stockpile 7 was excluded from the proposal as of 21 August 2025.

A third site investigation was conducted on the 25th of November 2024 to assess the lower portion of Whirinaki Stream and coastal environment. This included spot water quality measurements, terrestrial and aquatic habitat assessments, and broadscale coastal assessment at Whirinaki Stream and Esk River confluence. Low flows between 3.1 m^3/s and 3.7 m^3/s were evident on the day (LAWA, 2024).

These flows were below the mean flow of 5.30 m^3/s and mean annual flood flow of 240 m^3/s. No flush flows occurred within three weeks prior. The Esk Estuary mouth was closed at the time of the site survey as pers. comm. Stan Evans (November 2024) and based on electrical conductivity data.

A fourth site investigation was carried out on 21 May 2025 to assess a proposed realignment around a plantation located south of the Whirinaki Power Station (Section 2). No additional aquatic systems were observed along the realignment in this section. A terrestrial assessment of floral habitats and fauna was conducted, including visual screening for potential bat roosting sites in trees with a stem Diameter at Breast Height (DBH) of greater than 15 cm according to the DoC (2024) Bat Roost Protocols (version 4). The assessment took place during a period of fine weather.

The sampling locations are provided in Table 1 and Figure 2 below.

Table 1: Sampling Site Locations

Site Name	Samples/Assessments	Latitude	Longitude
WHIRI-01 to WHIRI-06	eDNA	-39.385827	176.884329
W-NRTH	RHA and water quality	-39.223732	176.537120
W-UPS	RHA, MCI, and water quality	-39.381390	176.885246
W-MID	RHA, MCI, and water quality	-39.385016	176.884082
W-DWN	RHA, MCI, and water quality	-39.390094	176.884959
W-STH	RHA and water quality	-39.390955	176.885047
W-COAST	Broadscale coastal assessment	-39.395534	176.885290

Notes:

1. *Co-ordinates for RHA and MCI mark the most upstream point of the assessment reach. Each reach is approximately 50 m in length.*

All vegetation across the project site (Figure 1) was assessed and mapped with its associated composition, structure, and integrity recorded. Avifauna was observed and recorded while on-site, and suitable fauna habitat availability was assessed. Opportunistic, non-destructive manual habitat searches were carried out for ground-dwelling lizard species and indigenous fish.

Areas suspected of containing wetlands were identified on aerial imagery and assessed in the field in accordance with standard Wetland Delineation Protocols for New Zealand (Ministry for the Environment (MfE), 2022).

Environmental DNA (eDNA)

eDNA sampling was completed using Wilderlab eDNA syringe mini kits, following the manufacturers recommended methodology (see https://www.wilderlab.co.nz/directions). Six replicate samples were taken from one site upstream from the SH2 culvert. One litre of water from each site was passed through a 5.0 µm microfibre filter using each syringe sampler. Biological material captured in the filter was preserved and samples were sent to Wilderlab NZ Limited for comprehensive analysis. This included an analysis for the presence of DNA from mammals, insects, crustaceans, fish, birds, lizards, and frogs.

Rapid Habitat Assessment

A habitat assessment of five reaches of Whirinaki Stream were carried out according to the Rapid Habitat Assessment Protocol (RHA) developed by Cawthron (Clapcott, 2015) (Table 1 and Figure 2). The RHA provides an indication of the condition of the physical habitat and its ability to support stream biota by scoring 10 habitat parameters between 1 ('poor') and 10 ('excellent'). The scores are then summed for an overall total habitat score.

The RHA for reaches W-DWN, W-MID, and W-UPS were undertaken during the February 2024 site visit, while W-NRTH was carried out in July 2024 and W-STH in November 2024.

Benthic Macroinvertebrates

Sampling was undertaken using a kick-net (500 µm mesh) following the semi-quantitative protocol for soft-bottomed streams outlined in the National Environmental Monitoring Standards for Macroinvertebrates (MfE, 2020). This method targets all suitable macroinvertebrate mesohabitats available, in proportions equal to their relative occurrence across the monitoring reach. The sampling method involved the disturbance of bank margins and in-stream macrophytes, sampling an area of approximately 1.0 m^2 in three reach sections (Table 1 and Figure 2).

Samples were preserved in 70% ethanol in the field and processed in the laboratory by Environmental Impact Assessments Ltd, under appropriate chain of custody. Analysis and identification followed Protocol P200 (200 fixed count with scan for rare taxa) (Stark *et al.*, 2001).

Biological indices used to assess the stream health included:

- **Macroinvertebrate Community Index (MCI) and Quantitative Macroinvertebrate Community Index (QMCI) for soft-bottomed streams (MCI-sb)** (Stark & Maxted, 2004) – a presence/absence-based measurement which describes the 'health of the stream' based on individual taxa scores between 1 and 10 (tolerant or sensitive to organic enrichment respectively).

- **EPT** – a measure of the relative abundance of Ephemeroptera, Plecoptera and Trichoptera taxa, the major pollution sensitive taxonomic groups within macroinvertebrate communities, providing insight into water and habitat quality conditions.
- **Taxonomic richness** – a measure of the number of different macroinvertebrate taxa present in each sample.

Quality thresholds for interpretation of MCI results were used to assess MCI scores (Stark and Maxted, 2007), along with national 'bottom-line' values as specified in the National Objectives Framework (NOF) of the National Policy Statement for Freshwater Management (NPS-FM) 2020, amended January 2024 (MfE, 2024). These guidelines and standards are outlined in Table 2 below.

Table 2: Interpretation of MCI Scores for Streams

Stark & Maxted (2007b)			
Quality Class	**Descriptions**	**MCI Score**	**QMCI Score**
Excellent	Clean water	>120	>6.00
Good	Doubtful quality/possibly mild pollution	100-120	5.00-5.99
Fair	Probable moderate pollution	80-100	4.00-4.99
Poor	Probable severe enrichment	<80	<4.00
National Policy Statement – Freshwater Management 2020			
Description		**MCI Score**	**QMCI Score**
Attribute Band A	Pristine conditions with almost no organic pollution or nutrient enrichment	≥130	≥6.5
Attribute Band B	Mild organic pollution or nutrient enrichment	≥110 - <130	≥5.5 - <6.5
Attribute Band C	Moderate organic pollution or nutrient enrichment	≥90 - <110	≥4.5 - <5.5
Attribute Band D[1]	Severe organic pollution or nutrient enrichment	<90	<4.5

Notes:
1. *Attribute Band D falls below the national bottom-line of the NPS-FM 2020.*

Water Quality

Field measurements of physico-chemical water quality parameters (temperature, pH, electrical conductivity (EC), and turbidity) were taken during the ecological survey. This was conducted using a calibrated handheld water quality probe (YSI Pro DSS) at four locations to characterise freshwater conditions during low tide. Conductivity measurements were taken during a site inspection in September 2024, and additional spot measurements were taken at W-STH to characterise the water quality at high tide in November 2024.

Water quality results were compared with the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018) Default Guideline Values (DGVs).

Broadscale Coastal Assessment

A survey of the lower Whirinaki Stream at its confluence with Esk River was conducted by a qualified marine ecologist on 25 November 2024. The assessment was limited to bank side visual observations including photography, spot water quality measurements, habitat assessment, and eDNA sampling. In later discussions with the client, it was decided to not include the eDNA and water quality results under closed mouth conditions as they were more reflective of a freshwater environment. A desktop review of literature pertaining to similar coastal environments in Napier and historic eDNA and NZFFD data for Esk River was used to supplement field data.

2.3 Impact Assessment

The Environment Institute of Australia and New Zealand (EIANZ's) Guidelines for undertaking Ecological Impact Assessments (Roper-Lindsay *et al.,* 2018) were used to assess the impacts of the proposed works. The guidelines provide criteria to assess ecological values using the factors 'representativeness', 'rarity/distinctiveness', 'diversity and pattern', and 'ecological context.' Based on the designated values for each factor, the ecological aspects of the site are then assessed using the attributes matrix in Appendix 10 of the EIANZ guidelines. Chapter 6 of the EIANZ guidelines provides criteria for determining the magnitude of effects.

The level of effect can then be determined by combining the value of the ecological feature/attribute with the score or rating for the magnitude of effect to create criteria for describing the level of effects. Cells with low or very low levels of effect represent a low risk to ecological values rather than low ecological values. A 'moderate' level of effect requires careful assessment and analysis of the individual case. These effects could be mitigated through avoidance, design, or appropriate mitigation actions.

The catchment level ecological context or scale is predominantly used within this report, after consideration of scale at the site, and the local, regional, and national scale matters for the relevant components.

The EIANZ assessment criteria tables are included as Appendix B for reference.

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FIGURE
FIGURE 2: ECOLOGICAL ASSESSMENT FEATURES, WHIRINAKI

PROJECT
WHIRINAKI STOPBANK ECOLOGY

3.0 Ecological Context

The project corridor is located within the Heretaunga Ecological District (ED) (McEwen, 1987). The ED is primarily low-altitude greywacke and argillite, with thick gravel slope deposits along the hills. The climate is characterised by cold winters and moderately warm summers. Original vegetation cover would have included short tussockland in basins and valleys, black beech forest and mixed scrub (mānuka and kānuka) on slopes and hillsides, and lakes and tarns throughout. Much of the indigenous vegetation has been cleared and wetlands drained for sheep and cattle farming, cropland, and orchards.

Whirinaki Stream forms its own small catchment which sits across a ridgeline from the Esk River catchment, joins with Esk River just before the mouth, and runs through a similar environment as the lower Esk Valley. The tributaries of the lower Esk catchment are of similar type (Warm Dry Low Elevation) and condition as Whirinaki Stream.

The Esk River catchment extends from the Maungaharuru Range in the northwest to Hawke's Bay in the south. In the lower catchment, Esk River is a fourth-order watercourse which supports a diverse range of indigenous fish. The river environment also supports foraging and roosting habitat for a range of freshwater and coastal wading birds.

The Esk River and Whirinaki Stream have several consented water takes for irrigation and the Pan Pac timber mill. There are indications of water quality issues related to surrounding land use, and the catchment has an overall water quality of 'average', regularly breaching nutrient guidelines (LAWA, 2024). Whirinaki Stream itself originates in hills planted in pines to the west of Whirinaki settlement before descending into a floodplain and wrapping around the base of the hill it originates from. It then cuts through cropping farmland to meet Esk River adjacent to its mouth.

The project site and wider Esk River catchment is classified as Category 1 under the Threatened Environments Classification (TEC), meaning that 10% indigenous vegetation cover remains and very little of the remaining vegetation is protected (Cieraad *et al.,* 2015). The Potential Vegetation of New Zealand layer shows that, pre-human settlement, the Whirinaki Stream would have originated in rimu/tawa-kamahi forest on the slopes above the current day Eskdale before travelling through kahikatea-pukatea-tawa swamp forest to the Esk River (Leathwick *et al.,* 2020).

It is likely that the lower reaches of Whirinaki Stream have been modified and redirected to its current alignment. The outlet, which is susceptible to deposition and has shifted multiple times in recent decades, was historically periodically excavated to maintain outflow into the ocean. During Cyclone Gabrielle a large scour hole/erosion gully formed upstream of the confluence between Whirinaki Stream and Esk River. The floodwaters altered the channel morphology and habitat within lower Whirinaki Stream based on satellite imagery (Google Earth, March 2023).

4.0 Terrestrial Assessment Results

4.1 Vegetation and Habitats

The project corridor consisted of five main vegetation types:

- Rank exotic grassland
- Exotic woody species treeland
- Juncus-exotic grass grassland
- Kukuraho sedgeland
- Mercer grass grassland
- Kukuraho/mercer grass grassland

These are discussed in more detail below.

The Section 3 addition to the project corridor was assessed for wetland habitat during the second site survey. It contained the same rank exotic grass habitat detailed below, with some hydrophytic vegetation interspersed in the lower areas. It was found that the areas with hydrophytic features passed the pasture exclusion test (≥ 50% pasture species within a 2x2 m plot) and do not qualify as natural inland wetland. However, they can be considered to meet the RMA wetland criteria for the purposes of future mitigations or offsetting.

4.1.1 Rank exotic grassland

This vegetation type was found on the tops and sides of the stopbanks in the northern portions (Sections 3 & 4) of the project corridor. The same vegetation type extended down the incised bank and in open pasture of the southern and middle corridors (Sections 1 and 2).

Dominant species consisted of common pasture grasses such as cocksfoot (*Dactylis glomerata*), sweet vernal grass (*Anthoxanthum odoratum*), barnyard grass (*Echinochloa crus-galli*), and meadow foxtail (*Alopecurus pratensis*), with occasional exotic herbs associated with pasture. Closer to the stream margins, tall fescue (*Lolium arundinaceum*) and creeping bent (*Agrostis stolonifera*) were common and stands of wīwī (*Juncus edgariae*) were occasional. Poplar (*Populus* species) and crack willow (*Salix fragilis*) saplings were rare throughout. A small stand of juvenile redwood (*Sequoia sempervirens*) and another of juvenile kahikatea (*Dacrycarpus dacrydioides*) were present along the Section 4 reach.

4.1.2 Exotic woody species treeland

A mixture of exotic woody species, with sparse native understory and exotics, was observed in the SH2 road reserve and along the Whirinaki Power Station southwestern boundary (Section 2).

This unit included windrows of Poplars and Lawson's cypress (Chamaecyparis lawsoniana), and sparse native saplings of toatoa (*Haloragis erecta subsp. erecta*), kohekohe (*Didymocheton spectabilis*), karaka (*Corynocarpus laevigatus*), and taupata (*Coprosma repens*). Groundcover was dominated by exotic species including blackberry, inkweed (*Phytolacca octandra*), black nightshade (*Solanum nigrum*), and yarrow (*Achillea millefolium*). A small patch of wandering jew (*Tradescantia fluminensis*) was identified and is an 'advisory' pest species in Hawkes Bay region. Eucalyptus species and well-maintained Norfolk Island Hibiscus (*Lagunaria patersonia*), and pōhutukawa (*Metrosideros excelsa*) were dominant along the southbound SH2.

4.1.3 Juncus-exotic grass grassland

This vegetation type occurred in the northern section of the project corridor where there was flat space between the stream margin and the base of the stopbank on the TLB.

Vegetation was a mix of facultative (FAC) and facultative wetland (FACW) *Juncus* and grass species including track rush (*Juncus tenuis* subsp. *tenuis*), jointed rush (*Juncus articulatus*), creeping bent, paspalum (*Paspalum dilatatum*), brown top (*Agrostis capillaris*), and sweet vernal. Umbrella sedge (*Cyperus eragrostis*) was occasional throughout.

This vegetation did not pass the rapid, dominance, or prevalence tests for wetland presence and is therefore not a wetland habitat.

4.1.4 Kukuraho sedgeland (wetland)

This vegetation type was located in the northern section along the side of the stopbank on the true right bank (TRB) (west) where the bank curves around Pan Pac.

A long stretch of kukuraho (*Bolboschoenus fluviatilis*) occurred away from the stream margin halfway up the bank underneath a belt of Lombardy poplars (*Populus nigra*) and is likely sustained by ground water infiltration to the surface at the face of the stopbank. Smaller patches of this vegetation type commonly occurred along the TRB but were absent from the TLB (east).

As kukuraho has a wetland indicator rating of OBL and was the dominant species (>95%), this area passed the rapid test for wetland presence.

4.1.5 Mercer grass grassland (wetland)

This vegetation type consisted of a swathe of mercer grass (*Paspalum distichum*) located between the stream margin and the existing stopbank near the W-UPS assessment site (Figure 2).

As mercer grass has a wetland indicator rating of FACW and was the only species, this area passed the rapid test for wetland presence.

4.1.6 Kukuraho/mercer grass sedgeland (wetland)

This vegetation type was found along both banks of Whirinaki Stream from SH2 to the Whirinaki mouth and comprises the majority of the length of the southern project corridor (Section 1).

The vegetation type was dominated by kukuraho and mercer grass with abundant giant rush (*Juncus pallidus*), purua grass (*Bolboschoenus medianus*), and kuawa (*Schoenoplectus tabernaemontani*) in patches throughout. Upokotangata (*Cyperus ustulatus*), umbrella sedge, and *Isolepis prolifera* were frequent, and small willow saplings were common.

As all dominant and abundant species had a wetland indicator ranking of either OBL (kukuraho, purua grass, kuawa) or FACW (mercer grass, giant rush), this area passed the rapid test for wetland presence.

4.2 Flora

No Threatened or At-Risk plant species were observed in the project corridor that was able to be accessed during site surveys.

Pampas grass (*Cortaderia selloana*) was observed in Section 3 during site surveys. It is registered as an 'Organism of Interest' in the Hawke's Bay Regional Pest Management Plan (RPMP) (HBRC, 2023). Crack willow saplings were beginning to establish along the corridor and are considered environmental weeds (Biosecurity New Zealand, 2020). Wandering Jew (*Tradescantia fluminensis*) was identified beneath the windrows in Section 2 and is an 'advisory' species in the RPMP and an 'unwanted organism' on the National Pest Plant Accord (NPPA). Blackberry (*Rubus fruticosus* agg.) was identified along the SH2 opposite the Whirinaki Power Station turnoff and is a 'sustained control' pest in the RPMP. It is also possible species from the RPMP or NPPA such as hornwort (*Ceratophyllum demersum*), or reed sweet grass (*Glyceria maxima*) may occur further into the catchment.

4.3 Birds

Whirinaki Stream and its surrounds provide foraging and roosting habitat for indigenous birds. However, suitable roosting habitat is limited in the project corridor itself. Pūkeko (*Porphyrio melanotus*) were seen nesting on the stream margins during the ecological surveys.

Table 3 below contains records from iNaturalist (research grade observations) and New Zealand Bird Atlas data of indigenous birds from a 5 km radius of the project corridor. Data has been restricted to birds likely to use the site for at least refuge and foraging opportunities.

Table 3: Bird Observations and Records Within 5km of the Project Corridor

Species	Name	NZTCS Status[1]	Regional Status[2]
Anthus novaeseelandiae	Pīhoihoi, New Zealand pipit	Naturally Uncommon	Not Threatened
Circus approximans	Kāhu, swamp harrier	Not Threatened	Not Threatened
Egretta novaehollandiae	Matuku moana, white faced heron	Not Threatened	Regionally Vulnerable
Haematopus unicolor	Tōrea pango, variable oystercatcher	Recovering	Regionally Critical
Himantopus himantopus	Poaka, pied stilt	Not Threatened	Regionally Vulnerable
Microcarbo melanoleucos	Kawaupaka, little pied shag	Relict	Regionally Endangered
Phalacrocorax carbo	Māpunga, black shag	Naturally Uncommon	Data Deficient
Phalacrocorax punctatus	Kawau tikitiki, spotted shag	Nationally Vulnerable	Migrant
Phalacrocorax sulcirostris	Kawau tūī, little black shag	Naturally Uncommon	Data Deficient
Porphyrio melanotus	Pūkeko	Not Threatened	Not Threatened
Rhipidura fuliginosa	Pīwakawaka, New Zealand fantail	Not Threatened	Not Threatened
Tadorna Variegata	Pūtangitangi, paradise shelduck	Not Threatened	Not Threatened

Table 3: Bird Observations and Records Within 5km of the Project Corridor

Species	Name	NZTCS Status[1]	Regional Status[2]
Todiramphus sanctus	Kōtare, sacred kingfisher	Not Threatened	Not Threatened
Vanellus miles	Spur-winged plover	Not Threatened	Not Threatened
Zosterops lateralis	Tauhou, silvereye	Not Threatened	Not Threatened

Notes:
NZTCS; New Zealand Threat Classification System, https://nztcs.org.nz/
HBRC, 2021b

Pīhoihoi (New Zealand pipit) prefer open country and grassland and may use the stopbanks in Section 3 and stockpile sites in Sections 1 & 2 for foraging. However, given the lack of vegetation for nesting due to intensive land use and flood wash, it is unlikely that pīhoihoi will be nesting within the project areas.

Pīwakawaka and tauhou were observed in high densities in the upper sections of the project corridor. These birds are likely to be using the small group of kahikatea in Section 4 for nesting.

4.4 Lizards

A search of research-grade iNaturalist observations of indigenous lizards from a 5 km radius of the project site showed one record of northern grass skink (*Oligosoma polychroma*). A search of the BioWeb Herpetofauna Database (Department of Conservation) returned no results for lizard surveys within 5 km or 10 km of the project corridor.

Northern spotted skink (*Oligosoma kokowai*) is known to have a Hawke's Bay population. However, a 2021 report from Wildland Consultants Ltd found no individuals north of Napier city (Marine Parade) and noted very little suitable habitat on the Whirinaki coastline (Wildlands, 2021). The report also notes that flood prone areas are unsuitable for indigenous lizard species.

4.4.1 Project Corridor including stockpiles and laydown area

No lizard species were sighted within the project corridor, laydown area or at stockpiles 1 and 2 during site investigations. The vegetation on site provides some habitat for indigenous skinks, specifically rank grass and areas of woody debris and shrubs in Section 2. The lack of forest within the project corridor reduced the likelihood of gecko presence, although the woody species in Section 2 may provide limited habitat. Habitat fragmentation through development and consistent disturbance from the SH2 traffic may deter species from inhabiting these areas.

The habitat quality has been further impacted by significant sedimentation from recent flooding, which also very likely represents a substantial mortality event for lizards locally. There is a low likelihood of either skinks or geckos being present within the project corridor, laydown area or proposed stockpiles 1 and 2.

4.5 Bats

The pine plantation to the west of Pan Pac, a small stand of kahikatea (Section 4, Figure 2), a small stand of redwood (Section 4, Figure 2), and several large Lombardy poplar and Eucalyptus trees (Section 2, Figure 2) may provide potential roosting areas for indigenous bats. Bats may also utilise the stream corridor for feeding habitat.

The kahikatea and redwoods are not fully grown and have limited to no bat roosting features. The Lombardy poplars, Lawson cypress and Eucalyptus species represent the most likely roost trees within the project footprint.

Two qualified environmental scientists conducted a visual inspection of tree species with a stem DBH of ≥15 cm in Section 2. No potential bat roosting sites (e.g., hollows, cavities, knot holes, cracks) or evidence of roosting (i.e., guano) were identified. The trees had an average height of between four and nine metres due to regularly maintenance of the farm windrows, local roadsides, and southbound SH2 road reserve (Photograph 1). Bats have very specific requirements when they are choosing roosts and show consistent fidelity to existing roosts (DoC, 2024). The presence of bats was assessed as low based on limited roosting sites, no visual evidence of bats, and constant disturbance from SH2 and surrounding farmland.

Photograph 1: Maintained tree species within the southbound SH2 road reserve.

5.0 Aquatic Assessment Results

5.1 Habitat Assessment

5.1.1 Site W-NRTH

This reach was located west of Pan Pac within Section 4 (upper Whirinaki Stream) near a lumber storage yard and flowed west to east (Photograph 2). The W-NRTH site scored 38 out of 100 in the RHA, falling into the 'Fair' habitat category.

The stream at this reach was highly modified, with steep banks either side of the watercourse along the reach. There was evidence of bank collapse in sections and extensive undercutting through much of the stream. The wetted width of the stream was approximately 1 m throughout the assessed reach. Water depth ranged from approximately 50 mm to 500 mm with limited hydraulic heterogeneity (i.e., only fast and slow runs were present along the assessed reach).

The streambed was highly sedimented, with large fine sediment deposits (comprising approximately 50% cover of the stream bed) and exposed stretches of heavy clay further upstream. Stoney substrates such as cobbles and gravels comprised approximately 30% of the total reach.

Invertebrate habitat diversity was low, with intermittent patches of cobbles, gravel and sand across extents of the wetted reach, with the occasional patch of emergent macrophytes. Dominant macrophyte species were bulbous buttercup and water celery (*Helosciadium nodiflorum*).

There were extensive swathes of rank grasses lining the banks, with a small plantation of pine trees along approximately 40 m of the TRB of the stream, providing most of the shade. Additionally, the banks were very steep over the whole reach creating a small amount of streambed shade.

Photograph 2: Site W-NRTH looking west.

5.1.2 Site W-UPS

This reach was located within Section 3, midway along the Pan Pac western boundary (Photograph 3) and near a culvert through the stopbank from the Pan Pac property into Whirinaki Stream. Site W-UPS scored 47 out of 100, falling into the 'Fair' habitat category.

The stream at this location was channelised and incised with defined bank sides within the stopbanks. Stopbanks to either side of the stream were close to the stream boundary (i.e., little terrestrial width between the stream and the base of the stopbank). Wetted width of the reach was approximately 1 m and was consistent for the length of the assessed reach. Depth ranged from approximately 300 mm to 600 mm and water was swift flowing and clear, with limited hydraulic variation.

The bed was highly sedimented with heavy clay deposits. Significant portions of stoney substrates (cobbles and gravels) were still exposed in the mid-channel and comprised approximately 30% of the total substrate of the reach (Photograph 4).

Macrophytes covered approximately 50% of the wetted width and were concentrated on the margins of the stream. Dominant macrophytes were water celery interspersed with common patches of floating sweetgrass (*Glyceria fluitans*) and water starwort (*Callitriche stagnalis*) and occasional *Isolepis prolifera*. Submerged species included abundant indigenous species such as horse' mane weed (*Ruppia polycarpa*) and water milfoil (*Myriophyllum propinquum*).

There was little to no overhang from rank grasses lining the banks and no woody vegetation inside the stopbanks to provide riparian shading - most shading was provided by the banks themselves. Some shading came from windbreak poplars and pines at the top of the TRB.

Photograph 3: Site W-UPS looking north.

Photograph 4: Substrates at Site W-UPS.

5.1.3 Site W-MID

This reach was located near the southern end of the Pan Pac boundary and just upstream (north) of SH2 (Photograph 5). Site W-UPS scored 38 out of 100, falling into the 'Fair' habitat category.

The stream at this location had less definition between bed and bank, with the wetted width ranging between 1.5 to 2.5 m, and approximately 4 to 8 m between the stream channel and the bottom of the stopbank on the TLB. The bank inclined from the stream margin to the top of the stopbank on the TRB. Depth was overall shallower than the upstream site (W-UPS), and ranged between 150 mm to 400 mm.

The bed was highly sedimented with heavy clay deposits, with very little (<15%) stony substrate exposed. Macrophytes covered more than 60% of the wetted width of the stream and consisted of mats of floating sweetgrass with common *Isolepis prolifera* and occasional stands of kukuraho (*Bolboschoenus fluviatilis*). Where the water surface was not obscured by emergent macrophytes, submerged macrophytes were visible and dominated by water milfoil. Very little of the bed substrate was visible.

As with the upstream site, there was little to no overhang from rank grasses lining the banks, no woody vegetation between the stopbanks, and shading was provided solely via the stopbanks themselves. There were no windbreak trees along the stopbanks at this reach.

Photograph 5: Site W-MID looking south (towards SH2).

Photograph 6: The streambed at Site W-MID.

5.1.4 Site W-DWN

This reach was located within Section 1, approximately 350 m south of SH2 (Photograph 7). Site W-UPS scored 45 out of 100, falling into the 'Fair' habitat category.

The stream at this location had less definition between bed and bank compared to W-UPS, but with no flat terrestrial width between the stream margin and the bottom of the stopbank slope. The wetted width ranged between 1.5 to 2.5 m and was overall shallower than both upstream sites (W-UPS & W-MID), being approximately 150 mm deep consistently across the whole reach.

The bed was highly sedimented with heavy clay deposits which were between 100 to 150 mm deep in places, with very little (<5%) stony substrate exposed.

Macrophytes were restricted primarily to the stream margins and covered approximately 40% of the wetted width of the stream. The dominant species consisted of mats of floating sweetgrass interspersed with *Isolepis* prolifera, with rare patches of water cress (*Nasturtium officinale*). Submerged macrophytes were not present in this reach.

As with the other sites, there was little to no overhang from rank grasses lining the banks, no woody vegetation between the stopbanks, and shading was provided solely via the stopbanks themselves. There were no windbreak trees along the stopbanks at this reach.

Photograph 7. Site W-DWN looking north (towards SH2).

5.1.5 Site W-STH

This reach was located within the lower (southern) portion of Section 1, extending approximately 100 m south of an informal bridge crossing (Photograph 8). Site W-STH scored 37 out of 100, falling into the 'Fair' habitat category.

The wetted width measured approximately 2 m comprising of soft-bottomed substrate with small patches of stones (<3%). A high coverage of deposited fine sediment (>75%) was observed throughout the reach. An incised channel with steep banks (>45°) dominated by exotic grasses, such a tall fescue, were evident. The channel was void of macrophytes, and overhanging marginal vegetation included mercer grass, one water celery, and sections of *Juncus* spp. A dense patch of crack willow saplings was recorded on the TRB of the lower portion in the reach. Other exotics included, amongst others, interspersed fennel (*Foeniculum vulgare*), fleabane (*Erigeron bonariensis*), and broad-leaved dock (*Rumex obtusifolius*).

Overhanging plant species and associated root mats and some woody debris provided some fish cover, while interspersed stones, leaf litter and plants provided moderate invertebrate habitat. Minimal bank erosion was observed with good groundcover evident throughout. Sources of shade were limited to overhanging grasses and the banks, with no mature woody tree species identified.

Photograph 8: Site W-STH facing south towards Esk River (25 November 2024).

5.1.6 Summary

Rapid Habitat Assessments were undertaken at each reach (Clapcott, 2015). All assessment sites aside from the lower reach scored high for fish cover abundance (provided by a dominance of macrophytes) and bank erosion. However, diversity of habitat types for both fish and macroinvertebrates were very low (Table 4). Whirinaki Stream has little in the way of woody debris, pools or riffles, and the high sediment cover of the stream bed is a limiting factor for invertebrates. While riparian width scored moderately, four of the stream reaches assessed had no shade or riparian vegetation to enhance biodiversity, with only a small pine tree stand providing shade for approximately 40 m of the W-NRTH reach. In general, the habitat scores are low to moderate across all sites.

Table 4: Rapid Habitat Assessment of Whirinaki Stream

Habitat Parameter	Condition Score				
	W-NRTH	W-UPS	W-MID	W-DWN	W-STH
Deposited sediment	3	4	2	1	1
Invertebrate habitat diversity	3	6	4	5	6
Invertebrate habitat abundance	4	2	1	2	1
Fish cover diversity	2	5	1	3	5
Fish cover abundance	5	6	8	7	4
Hydraulic heterogeneity	3	5	2	4	1
Bank Erosion	7	8	9	9	8
Bank vegetation	3	3	3	4	3
Riparian width	3	5	6	7	4
Riparian shade	5	3	2	3	4
Total	**38**	**47**	**38**	**45**	**37**

Notes:

All categories are scored out of 10, the total score is out of 100.

5.2 Fish Passage

5.2.1 Haulage road culverts

Whirinaki Stream flows through two culverts beneath access roading between Pan Pac and the pine forest to the west and north. The upper culvert is single barrel culvert that appears to be buried at least 25% into the streambed and does not feature any obvious drop or constriction of water flow. This culvert does not appear to represent any barrier to fish passage.

The lower culvert is double barrelled and features a flap gate (Photograph 9). Depending on how the flap gate functions, there is the potential for this structure to represent a barrier to fish passage.

Photograph 9: Flap gate on the downstream side of the lower Pan Pac culvert.

5.3 Fish Community

No NZFFD records exist for Whirinaki Stream. However, there are multiple NZFFD observations associated with Esk River, into which Whirinaki Stream flows before the waterbodies discharge to the ocean.

Eleven indigenous fish species have been recorded in the Esk River from 1984 to 1998 with no more recent observations close to the site (NIWA, accessed 6 December 2024). Details of these species and their conservation status are outlined in Table 5 below.

Table 5: NZFFD Records; Mouth to 10km Upstream of Esk River

Name	Common Name	NZTCS Status[1]
Anguilla australis	Tuna, shortfin eel	Not Threatened
Anguilla dieffenbachii	Ōrea, longfin eel	At Risk - Declining
Cheimarrichthys fosteri	Pānonoko, torrentfish	At Risk - Declining
Galaxias brevipinnis	Kōaro	At Risk - Declining
Galaxias fasciatus	Banded kōkopu	Not Threatened
Galaxias maculatus	Īnanga	At Risk - Declining
Gobiomorphus cotidianus	Toitoi, common bully	Not Threatened
Gobiomorphus gobioides	Giant bully	Naturally Uncommon
Gobiomorphus hubbsi	Bluegill bully	At Risk - Declining
Oncorhynchus mykiss	Rainbow trout	Introduced and Naturalised
Retropinna retropinna	Paraki, common smelt	Not Threatened
Rhombosolea retiaria	Pātiki-mohoao, black flounder	Not Threatened
Salmo trutta	Brown trout	Introduced and Naturalised

Notes:

1. *NZTCS; New Zealand Threat Classification System, https://nztcs.org.nz/*
2. *NZTCS Status is dependent on current conservation efforts being maintained.*

Fish data from Wilderlab's Explore eDNA tool was available from four sites located 6.8 km upstream from the mouth of the Esk River (Table 6). Fish species found in the eDNA results from Esk River are mostly the same as the NZFFD results from Esk River, with the exception of kanae (grey mullet), Cran's bully, redfin bully, and speckled longfin eel not recorded in the NZFFD. Similarly, banded kōkopu and giant bully were found in the NZFFD and not the eDNA records. This may be attributed to one or more factors such as absence from the system, lack of eDNA sequencing or timing of the sampling.

Table 6: Wilderlab Fish Results 6.8km Upstream of Esk River Mouth

Name	Common Name	NZTCS Status[1]
Anguilla australis	Tuna, shortfin eel	Not Threatened
Anguilla dieffenbachii	Ōrea, longfin eel	At Risk – Declining[2]
Anguilla reinhardtii	Australian/speckled longfin eel	Coloniser
Cheimarrichthys fosteri	Pānonoko, torrentfish	At Risk - Declining
Galaxias brevipinnis	Kōaro	At Risk - Declining
Galaxias maculatus	Īnanga	At Risk - Declining
Gobiomorphus basalis	Cran's bully	Not Threatened
Gobiomorphus cotidianus	Toitoi, common bully	Not Threatened
Gobiomorphus hubbsi	Bluegill bully	At Risk - Declining
Gobiomorphus huttoni	Redfin Bully	Not Threatened
Mugil cephalus	Kanae, grey mullet	Not Threatened
Oncorhynchus mykiss	Rainbow trout	Introduced and Naturalised
Retropinna retropinna	Paraki, common smelt	Not Threatened
Rhombosolea retiaria	Pātiki-mohoao, black flounder	Not Threatened
Salmo trutta	Brown trout	Introduced and Naturalised

Notes:

1. *NZTCS; New Zealand Threat Classification System, https://nztcs.org.nz/*
2. *NZTCS Status is dependent on current conservation efforts being maintained.*

Results from eDNA sampling in Whirinaki Stream at the site identify the presence of four indigenous fish species, all of which are migratory and require access to the coast. Two of these have a conservation status of 'At Risk – Declining'. A summary of eDNA fish results is presented in Table 7 below, and full results are available in Appendix C.

In addition to the eDNA results, several adult īnanga were observed at the time of the ecological survey during opportunistic searches for resident fish and mollusc and crustacea presence (e.g., kōura, kākahi, īnanga). Īnanga spawn in riparian vegetation on the banks of waterways between February and July at the upper limit of the saltwater wedge (Greer *et al.*, 2015).

Table 7: eDNA Fish Presence Results from Whirinaki Stream

Name	Common Name	NZTCS Status
Anguilla australis	Tuna, shortfin eel	Not Threatened
Anguilla dieffenbachii	Ōrea, longfin eel	At Risk - Declining
Galaxias maculatus	Īnanga	At Risk - Declining
Gobiomorphus cotidianus	Toitoi, common bully	Not Threatened

In summary, no previous freshwater fish data was found for Whirinaki Stream, however the eDNA results suggest it provides habitat for four indigenous freshwater fish species. Several fish species are likely to use the stream as a conduit during migration to and from the ocean or estuarine environments.

5.4 Benthic Macroinvertebrates

Benthic macroinvertebrate sampling was carried out along the three survey reaches, in conjunction with RHA data collection and water quality readings. A summary of macroinvertebrate results is provided in Table 8 below, and full macroinvertebrate results are included in Appendix D.

A total of 30 taxa were identified across the three sites, two of which were EPT taxa (the mayfly species *Deleatidum* and the caddisfly species *Triplectides*). EPT taxa were not identified at W-MID but were present in very low abundances (< 3 individuals) at the upstream and downstream sites. Molluscs (primarily freshwater snails) were the most common taxonomic group identified at each site, followed by damselflies (*Ischnura* and *Xanthocnemis*) at the middle and downstream sites. Crustacea (e.g., *Paracalliope* amphipods) were in high abundance upstream but not present at either downstream site, likely due to the increase in tidal influence. The axehead caddisfly (*Oxyethira spp.*) was common at the middle and downstream sites - its presence is typically reflective of degraded instream conditions.

With the exception of the MCI score for the upstream site, all scores were consistent with the 'poor' water quality class (Stark and Maxted, 2007) and the NPS-FM 2020 Attribute Band 'D' (i.e., failed to meet the national 'bottom-line' standard). Overall, benthic macroinvertebrate communities were dominated by pollution-tolerant taxa and indicate that all sites were impacted by severe organic pollution, nutrient enrichment, or modified physical habitat conditions.

MCI scores were highest at W-UPS, decreasing with distance downstream to W-DWN, which had the lowest MCI and QMCI scores.

Table 8: Summary of MCIs for Whirinaki Stream

Sample Site[1]	Taxa Richness	% EPT Taxa[2]	MCI[3]	Stark & Maxted Quality Class MCI	NPS-FM 2020 Attribute Band MCI	QMCI[3]	Stark & Maxted Quality Class QMCI	NPS-FM 2020 Attribute Band QMCI
W-UPS	11	2	94	Fair	Band C	4.16	Fair	Band D
W-MID	21	0	73	Poor	Band D	3.30	Poor	Band D
W-DWN	21	1	71	Poor	Band D	3.21	Poor	Band D

Notes:

1. *Where taxon MCI values are not available for soft-bottomed streams, the value of the higher taxon order is given as a proxy following Stark and Maxted (2017)*
2. *EPT indices exclude the pollution tolerant Oxythira and Paroxyethira sp.*
3. *Shaded values do not meet the NPS-FM 2020 national bottom-line.*

5.5 Surface Water Quality

Surface water quality spot measurement results have been compared to the ANZG DGVs (ANZG, 2018) and attribute bands for freshwater quality as specified in the NOF of the NPS-FM (2020) where applicable (e.g., dissolved oxygen mg/L). Results are presented in Table 9 below. It should be noted that a thorough assessment of both temperature and dissolved oxygen requires continuous measurement of these variable to ensure that relevant minima and maxima are recorded.

A relative water temperature increase is recorded at the W-MID and W-DWN sites relative to W-UPS. W-NRTH and W-STH could not be compared due to being collected on a different date. Temperatures were within the chronic and acute thermal tolerance of indigenous fish (Olsen *et al*., 2012) but approached the chronic criteria for brown trout (Todd *et al*., 2008). However, assessing the likely effects of chronic thermal stress on brown trout would require continuous measurement of temperature over a week.

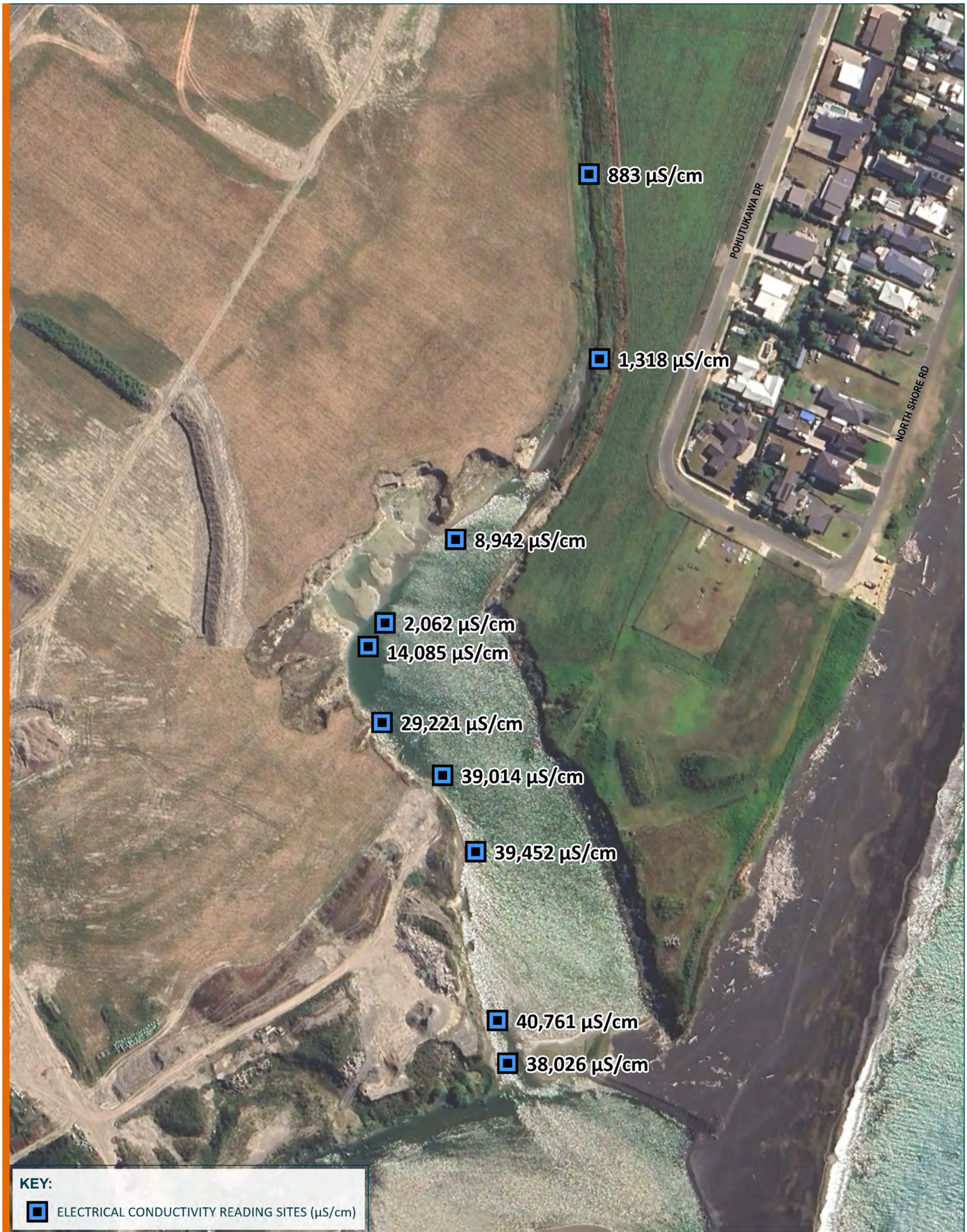
pH was within the DGV range at both upstream sites, while only slightly above the guideline value for the downstream location.

Dissolved oxygen (mg/L) was within Attribute Band A at the upstream and downstream sampling locations, and the upper end of Attribute Band B for the middle site (NPS-FM, 2020).

Electrical conductivity (EC) readings taken during the September 2024 site visit indicate that saline water was making its way into the lower Whirinaki Stream with EC levels between 40,761µs/cm and 39,041µs/cm within the lower 150 m (Figure 4). Saline waters typically have an EC above 50,000 µs/cm, with freshwater ranging between 0-1,500 µs/cm.

When the mouth was closed during the November 2024 site assessment, the EC readings observed in the lower Whirinaki Stream were consistent with those typical of freshwater, and those observed in the upper reaches of the stream (Table 9).

In summary, all of the water quality field parameters recorded show satisfactory water quality.



pdp

FIGURE 3: ELECTRICAL CONDUCTIVITY READINGS IN THE LOWER WHIRINAKI STREAM

WHIRINAKI STOPBANK ECOLOGY

SOURCE:
1. AERIAL IMAGERY: GOOGLE EARTH FLOWN 02/2025.
2 ROAD INFORMATION SOURCED FROM LINZ.

0 25 50
METRES
SCALE : 1:2,500 (A4)
N

REVISION: 01 | DATE: MAY 25| BY: MS
CLIENT: HAWKE'S BAY REGIONAL COUNCIL

HB010500006_.aprx - HB010500006GIS103

Table 9: Surface Water Quality Results

Field Parameter	W-NRTH[1]	W-UPS[2]	W-MID[2]	W-DWN[2]	W-STH[3]	ANZG DGVs[4,5]
Temperature (°C)	7.8	16.9	19.7	19.5	22.4	-
pH (pH units)	7.61	7.80	7.59	<u>7.89</u>	8.17	7.27 - 7.80
Dissolved Oxygen (% saturation)	96.7	89.4	84.5	<u>105.5</u>	<u>105.8</u>	82 - 100
Dissolved Oxygen (mg/L)	11.48	8.64	7.72	9.68	9.16	-
Electric Conductivity (µs/cm)	<u>751</u>	<u>751</u>	<u>734</u>	<u>695</u>	721	86
Turbidity (NTU)	1.34	1.70	0.70	0.96	<u>4.22</u>	4.2

Notes:

1. *Sampling occurred on 10th July 2024.*
2. *Sampling occurred on 20th February 2024.*
3. *Sampling occurred on 25th November 2024 at high tide, and under closed mouth conditions.*
4. *<u>Underlined</u>* denotes exceedance *of the ANZG Default Guideline Value (DGV), GWRC guidelines match the ANZG DGVs.*
5. *ANZG (2018) Default Guideline Values for warm dry low-elevation REC code. Values refer to the 80th percentile reference values. pH and dissolved oxygen (% saturation) values refer to the 20th and 80th percentile values - <u>https://www.waterquality.gov.au/anz-guidelines/your-location/new-zealand.</u>*

5.6 Broadscale Coastal Assessment

5.6.1 Overview

Significant flooding was experienced in Napier during Cyclone Garielle in February 2023 leading to the development of a scour hole at the mouth of Whirinaki Stream (Figure 4). The build-up of wood debris at Esk River mouth and subsequent flushing reported by locals may have increased flow velocities and led to the scour (PDP, 2024). The event increased the top of bank width by approximately 60 to 100 m and resulted in a scour depth of approximately 5 m from the 2021 channel base based on a bathymetric survey.

It is assumed that the greater width and depth of Whirinaki Stream mouth has increased the influx of coastal saline waters during open mouth conditions creating an extension of Esk River estuary. This necessitated the need to characterise the coastal environment at Whirinaki Stream mouth. The survey was conducted under closed mouth conditions based on conductivity readings and as per. comms. Stan Evans on 25 November 2024.

Figure 4: Pre (left- November 2021) and Post (right- April 2023) Cyclone Gabrielle comparison of lower Whirinaki Stream at confluence with Esk River (PDP, 2024)

5.6.2 Habitat Assessment

Photographs 10 and 11 overleaf show the condition of lower Whirinaki Stream and its confluence with Esk River, respectively. Sheer, greater than 5 m high banks were recorded with little vegetation cover aside from sparse exotic herbs and grasses, and patches of hydrophytes at the waterline. Marginal habitat was very limited by sheer banks and provide little spawning habitat for species such as īnanga. Little to no macrophytes were evident within the scour hole likely due to depth and the recent flood disturbance. Crack willow saplings were identified within the shallows against the beach barrier providing very limited shade/cover. Flood waters had scattered or unearthed concrete rubble and woody debris along the water's edge and at the confluence with Esk River which presumably provide cover for fish at high or spring tide.

Hydraulic components included a deep pool and slow run. The ponding and slow laminar flow within lower Whirinaki Stream was presumably exasperated by the closed mouth state of Esk River. Deposited fine sediment eroded from the upstream catchment dominated the assessed reach, and patches of sand, gravel and stones were recorded against the beach barrier. The lower estuarine environment at the confluence of Whirinaki Stream and Esk River is a relatively new feature in the landscape and is likely to continually develop. Its persistence as an estuary is dependent on the frequency of tidal inundation subject to unhindered flow through the mouth.

The channel floor in the assessed reach was primary void of vegetation, however, observations were slightly restricted by water depth and slightly murky waters at the time of assessment (November 2024).

5.6.3 Fish species

NZFFD and Wilderlab eDNA information presented under Section 5.3 indicates that several taonga fish species are known to use Esk River and lower Whirinaki Stream for coastal passage. These species include īnanga, pātiki-mohoao, tuna, ōrea, and kanae, all of which are migratory species that utilise the freshwater and estuarine environments in their catadromous[1] (tuna, ōrea, pātiki-mohoao) and amphidromous[2] (īnanga) lifecycles. It is likely that īnanga use the banks of Whirinaki Stream at the upper limit of the saltwater wedge to spawn (Greer *et al.*, 2015). Contrastingly, īnanga spawning is unlikely to occur in the lower reaches of Whirinaki Stream (i.e., the scour hole) due to the sheer banks and absence of suitable spawning habitat (e.g., grasses and sedge beds).

[1] Catadromous: Migrate down river to the sea to spawn.
[2] Amphidromous: Fish that reproduce in freshwater/estuaries and drift into the sea as larvae before juveniles migrate into freshwater to mature.

Photograph 10: Scour hole in lower Whirinaki Stream captured from the mouth facing upstream (25 November 2024).

Photograph 11: Lower Whirinaki Stream facing south toward the confluence with Esk River (25 November 2024 – Crack willow seedlings observable in the waterline to the right of the photo).

5.7 Summary

Whirinaki Stream was dominated by encroaching rank grass and instream macrophytes which provide some fish cover. However, there was low overall habitat diversity for both fish and macroinvertebrates. Moderately high sediment deposition along with limited riparian vegetation diversity generated low to moderate habitat scores across all sites.

Four indigenous freshwater fish species, two of which have a threat status of At Risk, were found to inhabit Whirinaki Stream. Fish passage to the ocean is an important consideration because all fish present were migratory and move between fresh and salt water to complete their life cycles. Enhancement of Whirinaki Stream riparian vegetation has the potential to improve spawning habitat for īnanga.

The confluence of Esk River and Whirinaki Stream was characterised by a large scour hole (slightly upstream) and consequent pool and slow run flow conditions. When tidal egress is possible, this area can be relatively estuarine in nature. Five taonga species are likely to use the lower estuarine environment during their diadromous lifecycle. However, very limited habitat was recorded in the lower coastal reach (W-COAST; Figure 2).

Benthic macroinvertebrate communities were dominated by pollution-tolerant taxa and indicate that all sites were impacted by severe organic pollution, nutrient enrichment, or modified physical habitat conditions.

The water quality field parameters recorded generally show satisfactory water quality with the exception of elevated temperatures at the lower sites. It is likely that the low diversity of habitat and high deposited fine sediment on the stream bed is causing poor macroinvertebrate health. Fish feed on macroinvertebrates and so fish populations are likely to be impacted by poor macroinvertebrate health.

An increase in riparian shading would protect the waterway from the negative effects of high-water temperatures and supress aquatic plant growth limiting the potential for deleterious over-night declines in dissolved oxygen.

6.0 Ecological Values

The current physical and ecological characteristics of the immediate reach of the watercourse, the surrounding terrestrial environment, and downstream environments were assessed against the matters and attributes outlined in the EIANZ EcIA guidelines (Roper-Lindsey, 2018).

6.1 Terrestrial Ecological Values

Three terrestrial and three wetland vegetation types were recorded along the project corridor. Table 10 below summarises the ecological values for the terrestrial habitats assessed on site and the justification for each rating.

Table 10: Ecological Valuation and Justification for Terrestrial Environments

Matter	Rating	Justification
Rank Exotic Grassland		
Representativeness	Very Low	While some indigenous species occasionally occur, the vegetation type is predominantly common exotic pasture grasses.
Rarity/Distinctiveness	Very Low	
Diversity and Pattern	Very Low	
Ecological Context	Low	Provides some cover and foraging habitat for indigenous fauna and invertebrates.
	Overall Value	**Negligible**
Exotic Woody Species Treeland		
Representativeness	Very Low	While some indigenous species occasionally occur, the vegetation type is dominated by exotic woody species.
Rarity/Distinctiveness	Very Low	
Diversity and Pattern	Very Low	
Ecological Context	Low	Provides some cover and foraging habitat for indigenous fauna and invertebrates.
	Overall Value	**Negligible**
Juncus and Exotic Grass Grassland		
Representativeness	Very Low	While some indigenous species occasionally occur, the vegetation type is predominantly common exotic pasture grasses.
Rarity/Distinctiveness	Very Low	
Diversity and Pattern	Very Low	
Ecological Context	Low	Provides some cover and foraging habitat for indigenous fauna and invertebrates.
	Overall Value	**Negligible**
Kukuraho Sedgeland		
Representativeness	Low	This vegetation type does constitute a wetland, which is a naturally uncommon ecosystem. However, this is constrained by it being a small area of predominately one species and not reflective of expected wetland vegetation assemblages in Hawke's Bay.

Table 10: Ecological Valuation and Justification for Terrestrial Environments

Matter	Rating	Justification
Rarity/Distinctiveness	Moderate	While kukuraho is not an At Risk or Threatened species, the habitat type is indigenous and occurs within a mosaic of Class 1 and Class 3 Threatened Environments.
Diversity and Pattern	Low	Vegetation type is small, dominated by kukuraho and very few other flora species occur.
Ecological Context	Moderate	Provides cover and foraging habitat for indigenous fauna and invertebrates. Kukuraho is resilient to environmental disturbance (i.e., high flow and flood events) and recovers quickly.
	Overall Value	**Moderate**
Mercer Grass Grassland		
Representativeness	Very Low	This vegetation type does constitute a wetland, which is a naturally uncommon ecosystem in Aotearoa. However, it is comprised entirely of a single exotic species and is not representative of wetland habitats in Aotearoa.
Rarity/Distinctiveness	Very Low	
Diversity and Pattern	Very Low	
Ecological Context	Low	Provides some cover and foraging habitat for indigenous fauna and invertebrates.
	Overall Value	**Negligible**
Kukuraho/Mercer Grass Grassland		
Representativeness	Moderate	This vegetation type does constitute a wetland, which is a naturally uncommon ecosystem in Aotearoa. The diversity of native plant species, including FACW and OBL hydrophytes, and ecosystem provision potential was assessed as moderate.
Rarity/Distinctiveness	Moderate	
Diversity and Pattern	Moderate	
Ecological Context	Moderate	Provides cover and foraging habitat for indigenous fauna and invertebrates.
	Overall Value	**Moderate**

Notes:
1. *The cultural significance of fauna species is not incorporated the ecological evaluation.*

6.2 Aquatic Ecological Values

The values and justification for each rating assigned to the aquatic environment of Whirinaki Stream are presented in Table 11 below.

Table 11: Ecological Valuation and Justification for Aquatic Environments

Matter	Rating	Justification
Representativeness	Low	Results from the aquatic assessments of the project corridor indicate habitats impacted by modification and are reflective of the use of the stream in flood management infrastructure. The stream has been channelised and restricted over time and is regularly cleared of vegetation and sediment, resulting in homogenous hydraulic features.
Rarity/Distinctiveness	Low	Whirinaki Stream is a very impacted waterway and likely to support a less diverse aquatic fauna community, though it is known to provide habitat to both īnanga and ōrea (At Risk – Declining). There may be further diversity of indigenous fauna in the upper catchment that was not captured in eDNA data, such as kōura or kākahi.
Diversity and Pattern	Low	
Ecological Context	Moderate	The project corridor is located in the lower reaches of a short catchment and is the main stem of Whirinaki Stream. Whirinaki Stream therefore represents the only conduit from the upper catchment to the coast. The scour hole in the lower Whirinaki Stream may provide temperature refuge and pool habitat that may be used by migratory fish species.
	Overall Value	**Low**

Notes:
1. *The cultural significance of fauna species is not incorporated the ecological evaluation.*

7.0 Ecological Impact Assessment

The current physical and ecological characteristics of the identified estuarine, aquatic and terrestrial habitats within the survey area were assessed against the matters and attributes outlined in the EIANZ EcIA guidelines (Roper-Lindsey, 2018. Appendix B).

The nature and level of actual or potential effects of activities for which consent is being sought are addressed. Positive and adverse effects, cumulative effects and residual effects are considered, and the assessment informs the nature and scale of impact management required.

7.1 Terrestrial Effects

Potential effects on the values of terrestrial habitats in and around the project corridor were identified and assessed as follows:

- Vegetation removal and material stockpiling resulting in loss of fauna habitat and disturbance to indigenous birds, lizards and bats;
- Noise and vibration from machinery;
- Spread of pest and weed plant species due to earthworks; and,
- Hydrological modification of natural inland wetlands.

It is not anticipated that any terrestrial effects will occur outside of the project site due to the localised nature of the proposed activities and the current land use of the terrestrial surroundings (i.e., highly modified farmland and industrial areas).

7.1.1 Vegetation removal and material stockpiling resulting in loss of fauna habitat

The vegetation likely to be affected by the construction of the stopbanks will include exotic grassland and windrows of exotic woody species, which are suitable habitats for indigenous lizards, bats and some birds. It is unlikely lizards, bats or birds are present at the site in high abundance (see below).

It is recommended that all removed vegetation be replaced with suitable indigenous plant species, whether within the corridor after completion or as part of an offsetting package. Appropriate planting and management after project completion represents an opportunity for a Net Gain to ecological values for Whirinaki Stream.

The overall magnitude of effects of vegetation removal is assessed as **low** provided vegetation loss is mitigated (e.g., through restoration planting). Effects concerning indigenous terrestrial fauna will be **short term** as there are large areas of suitable habitat available in the surrounding environment and regrowth of grasses on the banks will be rapid.

7.1.1.1 Harm or accidental mortality to indigenous birds

Pūkeko are likely to utilise areas of low-growing vegetation around Whirinaki Stream for nesting, and pīhoihoi may utilise the project areas for foraging but are less likely to use it for nesting. Pīwakawaka, tauhou, and other small indigenous birds (e.g., riroriro) are likely to be using the trees in Section 4 of the proposed development for nesting. Birds are highly mobile and will move to more favourable habitat during the construction phase but will be more vulnerable during the peak bird breeding season (September to December).

The likelihood of indigenous birds using the project corridor or stockpiling sites for permanent roosting during construction has been assessed as moderate for smaller songbirds in the upper catchment (Section 4), high for pūkeko, and very low for pīhoihoi.

If works are to occur in peak breeding season, a suitably qualified ornithologist should be consulted for potential bird management. Any trees to be felled as part of works should be inspected for nests 1-2 days prior to removal. It is anticipated that the magnitude of effect will be **low** to **moderate**, depending on whether bird nests are present or not, with the overall level of effect anticipated to be **low** post-mitigation.

7.1.1.2 Harm or accidental mortality to indigenous lizards

No indigenous lizards were identified during the field investigations and historic records are limited to one northern grass skink in 5 km of the project corridor. Although it is noted that may be potential lizard habitats on site (e.g., rank grass).

To minimise risk to lizards potentially in the proposed works footprint, it is recommended that any rank grasses at the construction site are mown to approximately 10 cm, 2 to 3 days prior to earthworks commencing, and cut grass is raked away from the earthworks zone, deterring lizards from using these areas a habitat. All woody species and wood debris (if any) should be inspected for lizards during the same period prior to works. Staged vegetation removal will further reduce the low likelihood of lizards being present within the project footprint.

The magnitude of effect was assessed as **low** with a **very low** level of effect over the construction phase (i.e., temporary).

7.1.1.3 Harm or accidental mortality to indigenous bats

The likelihood of indigenous bats utilising the project corridor or stockpiling sites has been assessed as low. This is based on initial visual inspections for potential roosting features (e.g., hollows, cavities, cracks), the relatively small average height of woody species in the area (< 7 m), regular tree maintenance, and the likelihood that traffic on SH2 deters species presence.

To avoid unnecessary removal of potential bat roosting sites, only tree species located directly within the construction footprint should be felled. Felling should occur outside of the breeding season (late November – February), when young are not dependent on the roost (DoC, 2024).

To minimise potential risk to bats, any trees that have potential bat roosting features and are to be felled must undergo a tree survey before removal. This should be in accordance with the Bat Roost Protocols[3] (DoC, 2024) and include visual inspection and deployment of acoustic monitors for two consecutive nights before felling. The inspection should be conducted by an experienced treeclimber (e.g., an arborist) working with an approved person accredited with Competency 3.3.

Trees confirmed to be free of bats should be removed on the same day to eliminate the risk of bats returning overnight. If bats are identified in roosts the felling will need to be postponed until they have moved offsite. An approved person accredited with Competency 2.1 and DoC must be consulted. Felling can only continue once permission has been granted from DoC. If evidence of a bat colony is found, such as guano at the base of hollows or nearby trees, and the trees cannot be preserved, compensatory measures will be necessary.

The magnitude of effect from tree removal will potentially be either **very low** in the absence of bats or **moderate** if bats are present or there is evidence they use these trees. Implementing the recommended mitigation steps will reduce the potential residual effect to **low**.

7.1.2 Noise and vibration from machinery

A temporary increase in noise and vibration is expected during earthworks. This has the potential to negatively impact lizards and nesting or migratory birds nearby.

However, the increase in noise associated with the earth and construction works will be temporary and it is unlikely that Threatened or At-Risk birds nest in or near the site. Birds and lizards likely to be impacted by the disturbance are largely mobile species capable of moving in response to disturbance or noise.

The magnitude of effect associated with the increased noise and disturbance on indigenous fauna is assessed as **low** with a **very low** level of effect. The disturbance will also be temporary in nature and the effects should not persist following the completion of works.

[3] https://www.doc.govt.nz/globalassets/documents/conservation/native-animals/bats/bat-recovery/protocols-minimising-risk-felling-occupied-bat-roosts.pdf

7.1.3 Spread of pest and weed plant species due to earthworks

Vegetation to be removed is primarily exotic species, some of which are identified as environmental weeds. The earthworks for the stopbank may result in moving pest plant and weed species to new environments. The vegetation removal prior to construction will also open areas of bare substrate that may be colonised by weeds from neighbouring areas, and potentially from pest plant species new to the project site.

All pest plant species are recommended for removal and ongoing control and should be removed in a way which does not promote their spread. Removal and control will prevent these species further contributing to local populations.

The overall magnitude of effect of potential pest plant spread is assessed as **low**, with **low** overall level of effect.

7.1.4 Hydrological modification of natural inland wetlands

Works to increase the height of existing and create new stopbanks have the potential to alter the hydrological context of wetlands associated with Whirinaki Stream. However, because the base of the stream and form of the channels will not be impacted adjacent wetlands are unlikely to experience any significant change in hydrology.

The overall magnitude of effect of potential hydrological alteration is assessed as **low**, with **low** overall level of effect.

7.2 Aquatic Effects (Freshwater and Estuarine)

Potential effects to the values of Whirinaki Stream related to the stopbank upgrades and construction, and culvert replacement were assessed as:

- Riparian vegetation removal resulting in reduced shade and bankside aquatic habitat;
- Noise and vibration from machinery and construction;
- Sediment release during works; and,
- Modification of existing instream habitat.

It is noted that the scoping of potential effects was limited to those effects anticipated under standard, good practice management. Accordingly, the assessment does not include any effect associated with the poor maintenance of construction equipment (e.g., oil spills) or poor operational practice (e.g., unnecessarily disturbing the environment outside the footprint of the proposed works).

7.2.1 Riparian vegetation removal resulting in reduced shade and bankside aquatic habitat

The current riparian vegetation provides limited shade and the instream vegetation is primarily fast growing indigenous and exotic macrophytes (e.g., *Isolepis prolifera*; watercress). Any vegetation removal from the banks and stream margins is expected to have a moderate but short-term impact on the ecological function of the stream as rank grasses will quickly recover. The overall effect will be low and commensurate with routine drainage maintenance activities undertaken along the stream.

Revegetating the riverbank with suitable indigenous species, either on site or elsewhere would constitute an enhancement to the stream. Nonetheless, replacement with commensurate vegetation would result in the long-term negative impacts of habitat loss being **low**.

It was determined that this activity will have an overall **low** magnitude and **very low** level of effect of the Whirinaki Stream within the project corridor provided rapid revegetation plans are carried out.

7.2.2 Noise and vibration from machinery

A temporary increase in noise and vibration is expected when excavators and other heavy machinery are used onsite (e.g., clearing vegetation, shaping the bank, and placing fill). This has a potential to negatively impact fish species nearby through temporary stress and behavioural change. As with birds, the fish that are likely to be impacted by the disturbance are largely mobile species capable of moving in response to disturbance or noise.

The magnitude and level of effect associated with the temporary increased noise and disturbance on indigenous aquatic fauna is therefore assessed as **low**. Any effects should not persist following the completion of works.

7.2.3 Sediment release during works

Earthworks along the stopbank may result in the mobilisation of sediment into the waterway and has the potential to negatively impact fish migration, spawning, cover and habitat. High turbidity (low water clarity due to suspended sediment) prevents the growth of aquatic plants and decreases the ability of fish to find food or to detect predators. This in turn can affect the growth and morphology of some species and/or smother stream invertebrates.

Based on fish records for the Esk River it is likely that species other than those identified in Whirinaki Stream are utilising the upper Whirinaki catchment as habitat and would be migrating past the project site at certain times of year. All of the recorded 'At Risk – Declining' species that were detected in lower Esk River are relatively insensitive to elevated suspended sediment and turbidity (NIWA, 2014; Rowe *et al*., 2000). Among the species identified in Whirinaki Stream, īnanga are likely to be the species most sensitive to elevated turbidity.

While īnanga are common in turbid rivers, juvenile feeding rates are significantly reduced by increases in turbidity, while adults are less affected (Boubee *et al*., 1997). Temporary loss or smothering of spawning habitat in Whirinaki Stream has the potential to impact on īnanga in the system. This is however unlikely in the lower reach near the scour hole due to absence of suitable spawning habitat and the saltwater wedge likely located further upstream. Effects of increased sediment input from the proposed works can be managed by the implementation of appropriate erosion and sediment control, avoidance of removal of spawning vegetation and rapid replacement of removed vegetation.

The magnitude and level of effect associated with the vegetation clearance and disturbance on indigenous aquatic fauna is therefore assessed as **low**.

The project corridor likely provides habitat for adult eel as opposed to juveniles that prefer riffle habitat. Adult eels are generally insensitive to elevated suspended sediment, common in turbid rivers, and are adapted to cope with increased sediment loads (NIWA, 2014). The temporary potential effects of the increased suspended sediment are likely to have **low** effect on the eel.

Elevated suspended sediment has the potential to disrupt fish migration. The coastal location of Whirinaki Stream and surrounding land use means it is likely to have relatively high existing turbidity during elevated flows, but during low flows on the occasion of our site visits the water was very clear. While the construction activities may temporarily disturb a small section of the TLB adequate sediment and erosion control will prevent sediment reaching the stream. Assuming adequate sediment and erosion control it is considered unlikely that fish migration will be impacted by the proposed works.

It is likely that the tidal nature of the southern section and elevated flows will eventually flush any deposited fine sediment to the coast. Adequate sediment and erosion control will be required to avoid the export of sediment through the Whirinaki Stream and into the Esk and Hawke's Bay.

7.2.4 Modification of existing instream habitat

Limited modification of instream habitat is expected due to the works avoiding the stream bed except at existing crossing points. The benthic habitat at the crossing points consisted primarily of fine sediment with interspersed stones.

Robust sediment and erosion control will be required at crossing points to prevent sediment entering the stream and smothering habitat. This is to be guided by a robust ESCP to be drafted by a suitably qualified professional.

The overall magnitude of effect associated with the modification of instream habitat from the instream works is assessed as **low**. The effect is anticipated to be **temporary** and limited to the construction phase.

8.0 Summary of Effects

below summarises the overall level of effects using EIANZ's (2018) guidelines (Appendix B).

Table 12: Level and Magnitude of Effects Associated with the Proposed Works on Ecological Features

Ecological Feature	Ecological Value	Activity	Magnitude of Effect	Level of Effect	Timescale of Effect	Recommended Mitigation Measures	Residual Level of Effect
Terrestrial	Low to Moderate	Reduced faunal habitat due to vegetation clearance and material stockpiling	Low	Low	Short to long-term (depending on vegetation type and length of time to reestablish)	Replacement of removed vegetation with suitable indigenous species where it will not interfere, or will add to, flood mitigation measures. Pest plant management and ongoing control after project completion.	Low. Opportunities for net-gain in the future.
		Disturbance of indigenous birds	Low to Moderate	Low	Temporary (construction phase)	Consultation with a suitably qualified ornithologist to minimise potential impacts to birds if works are planned in peak bird breeding season. Nesting surveys completed prior to felling any trees within the project footprint.	Low
		Disturbance of indigenous lizards	Low	Very Low	Temporary (construction phase)	Staged vegetation removal 1-2 days prior to earthworks commencing.	Very Low
		Disturbance of indigenous bats	Very Low to Moderate	Low	Temporary (construction phase)	A pre-felling tree survey to assess for bat presence if any trees over 15 cm (DBH) with potential bat roost features (e.g., crevasses, cracks, dead wood, flaking bark) are to be felled as part of works. Compensation of trees felled if they are found to be potential roosting sites during pre-felling surveys.	Low
		Noise and vibration from machinery	Low	Very Low	Temporary (construction phase)	None recommended.	Very Low
		Spread of pest plant and weed species	Low	Low	Permanent	Appropriate removal and control of pest plants within the project corridor.	Low
		Modification of natural inland wetland	Low	Low	Permanent (or long-term if vegetation loss is compensated)	Restoration planting of the disturbed project corridor with indigenous species post-construction.	Low

8.0 Summary of Effects

Table 12 below summarises the overall level of effects using EIANZ's (2018) guidelines (Appendix B).

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		Disturbance of indigenous birds	Low to Moderate	Low	Temporary (construction phase)	Consultation with a suitably qualified ornithologist to minimise potential impacts to birds if works are planned in peak bird breeding season. Nesting surveys completed prior to felling any trees within the project footprint.	Low
		Disturbance of indigenous lizards	Low	Very Low	Temporary (construction phase)	Staged vegetation removal 1-2 days prior to earthworks commencing.	Very Low
		Disturbance of indigenous bats	Very Low to Moderate	Low	Temporary (construction phase)	A pre-felling tree survey to assess for bat presence if any trees over 15 cm (DBH) with potential bat roost features (e.g., crevasses, cracks, dead wood, flaking bark) are to be felled as part of works. Compensation of trees felled if they are found to be potential roosting sites during pre-felling surveys.	Low
		Noise and vibration from machinery	Low	Very Low	Temporary (construction phase)	None recommended.	Very Low
		Spread of pest plant and weed species	Low	Low	Permanent	Appropriate removal and control of pest plants within the project corridor.	Low
		Modification of natural inland wetland	Low	Low	Permanent (or long-term if vegetation loss is compensated)	Restoration planting of the disturbed project corridor with indigenous species post-construction.	Low

9.0 Conclusion

Terrestrial vegetation assessments along the project corridor identified two terrestrial vegetation types and three wetland habitats. The project site sits within a wider agricultural environment, and both terrestrial and wetland habitats were assessed as **negligible** to **moderate** ecological value in context.

Overall, the level of effects to terrestrial vegetation and habitats are assessed primarily as **low** to **very low** after implementation of the effects management hierarchy. Recommended mitigations to reduce impacts to terrestrial environments have been assessed as:

- The planting of indigenous species following the completion of the upgrades to mitigate the effects of vegetation clearance.
- Removal and control of pest plant species within the project corridor.
- Management of risk to indigenous birds by nest inspection of trees scheduled to be removed prior to felling.
- Management of risk to indigenous lizards by a staged vegetation removal and inspection of woody species and debris (if any) prior to works.
- Management of risk to indigenous bats by roost inspections of any trees scheduled to be removed with bat roost features prior to felling. Compensation may be required if roosting sites may be lost.

If these recommended mitigation measures are implemented, the residual level of effect on terrestrial vegetation and habitats has been assessed as **very low** to **low**.

The freshwater assessment identified the presence of four indigenous freshwater fish species, two with an 'At Risk – Declining' conservation status. MCI scores at the project site were consistent with the 'poor' water quality class, indicative of severe organic pollution or enrichment, and dominated by pollution tolerant species. Habitat assessments within the project site scored as 'fair' in rapid habitat assessments at four locations.

A broadscale coastal assessment showed estuarine conditions in the lower Whirinaki Stream, although these were observed to fluctuate dependant on the mouth conditions. During the November site assessment freshwater conditions in the lower Whirinaki Stream were attributed to the closed mouth of Esk River. Limited aquatic habitat was available in this reach and aquatic fauna are likely to move to more suitable habitat. No īnanga spawning habitat was recorded. However, several migratory fish species including īnanga and other taonga species are known to use Esk River and lower Whirinaki Stream for coastal passage.

The overall aquatic ecological value of the project site was **low**. Construction phase effects can be kept **low** through erosion and sediment control, and restoration planting with pest control.

Overall, level of effects to the aquatic communities are assessed as **low** to **moderate** and of **temporary** duration. Recommended mitigations to reduce impacts to aquatic environments have been assessed as:

- Timing construction works within the summer earthworks period (October to April) when the groundwater level is expected to be lower and rainfall events less likely.
- A robust ESCP will be implemented under the Environmental Management Plan. Routine inspection and maintenance for onsite sediment controls will be outlined in the ESCP, and as such, we consider that the effects will be managed as effectively as possible.

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Appendix A: Preliminary Design Drawings

KEY:

EXISTING
- PRIMARY PARCEL
- NON PRIMARY PARCEL
- 220kV OVERHEAD POWER LINES
- EXISTING STOPBANK

PROPOSED
- EARTH STOP BANK CENTERLINE AND FOOTPRINT
- RETAINING WALL CENTERLINE AND FOOTPRINT
- HBRC OWNED SERVICE ROADS
- STOCKPILE AREA
- ROADWORKS & CONSTRUCTION AREA
- WHIRINAKI OIC

PRELIMINARY ISSUE

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WORKING PLOT 22/08/2025

NO.	REVISION	DATE	APP.
A	PRELIMINARY ISSUE	AUG 25	

HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

PATTLE DELAMORE PARTNERS

ACE MEMBER

CLIENT: HAWKES BAY REGIONAL COUNCIL

PROJECT: WHIRINAKI STOPBANK

OVERALL PROJECT LAYOUT PLAN

DESIGNED	DESIGN REVIEW	DATE	APPROVED	DATE
TC	P.C	JULY 25		
DRAWN	DRAWING CHECK	DATE		
D.F.P	----	JULY 25	THIS DRAWING IS NOT FOR CONSTRUCTION UNLESS SIGNED AS APPROVED	

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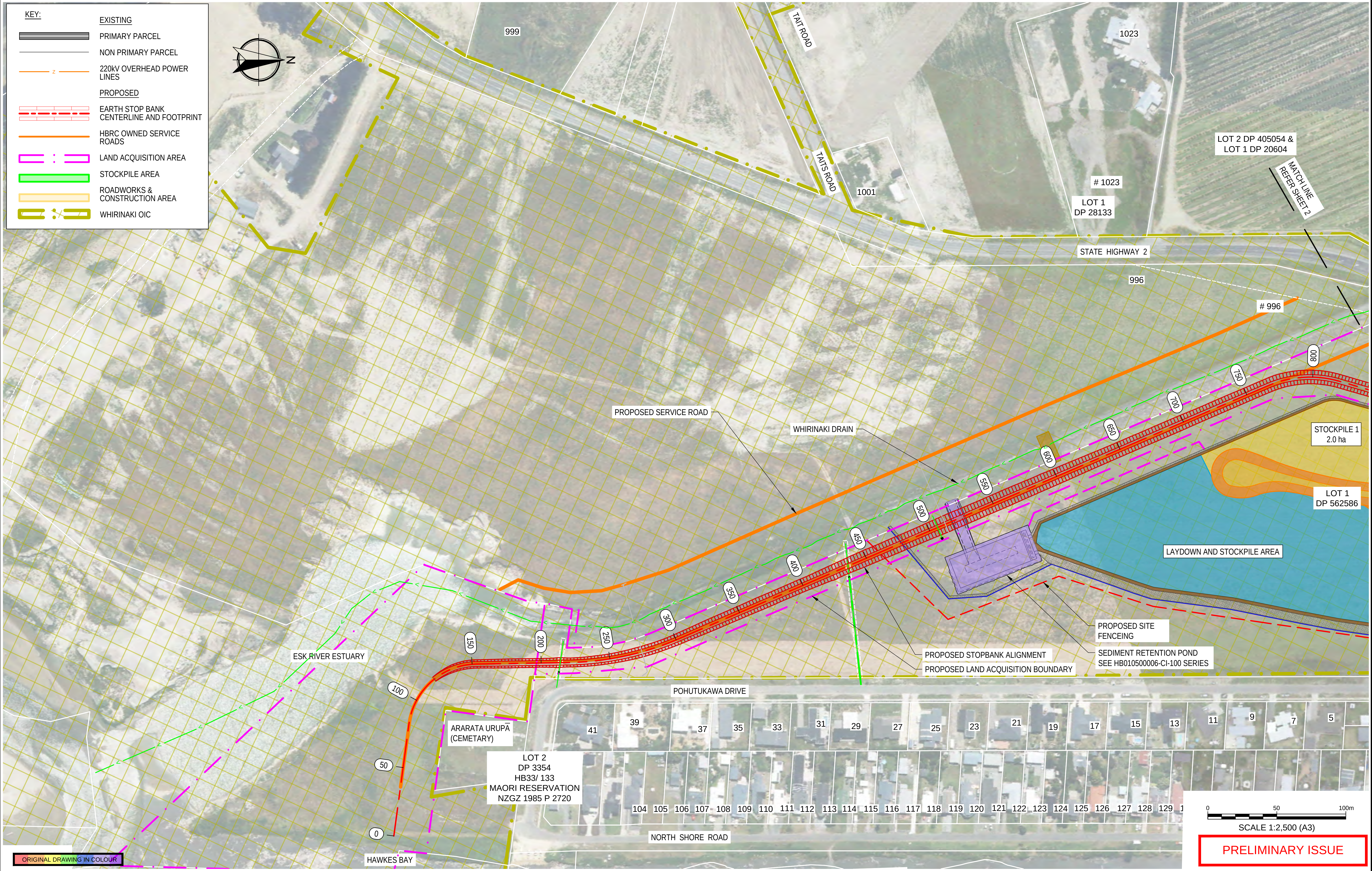

PRELIMINARY ISSUE

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22/08/2025

NO.	REVISION	DATE	APP.
A	PRELIMINARY ISSUE	AUG 25	

HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

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PATTLE DELAMORE PARTNERS

ACE MEMBER

CLIENT:
HAWKES BAY REGIONAL COUNCIL

PROJECT:
WHIRINAKI STOPBANK

PROJECT PLAN (SHEET 1 OF 3)

DESIGNED	DESIGN REVIEW	DATE	APPROVED	DATE
I.Z.B	P.C	JULY 25		
DRAWN	DRAWING CHECK	DATE		
D.F.P	----	JULY 25	THIS DRAWING IS NOT FOR CONSTRUCTION UNLESS SIGNED AS APPROVED	

SCALE :	DRAWING NO. :	REV :
AS SHOWN (A3)	HB010500006-CI-011	A

DO NOT SCALE DRAWING

Plot: 22/08/2025 3:45:25 pm

FILED: HB010500006-CI-012.dwg

KEY:

EXISTING
- PRIMARY PARCEL
- NON PRIMARY PARCEL
- 220kV OVERHEAD POWER LINES
- EXISTING STOPBANK

PROPOSED
- EARTH STOP BANK CENTERLINE AND FOOTPRINT
- HBRC OWNED SERVICE ROADS
- LAND ACQUISITION AREA
- STOCKPILE AREA
- ROADWORKS & CONSTRUCTION AREA
- WHIRINAKI OIC

0 50 100m

SCALE 1:2,500 (A3)

PRELIMINARY ISSUE

WORKING PLOT
22/08/2025

NO.	REVISION	DATE	APP.
A	PRELIMINARY ISSUE	AUG 25	

HAWKE'S BAY REGIONAL COUNCIL
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PROJECT: WHIRINAKI STOPBANK

PROJECT PLAN (SHEET 2 OF 3)

DESIGNED	DESIGN REVIEW	DATE	APPROVED	DATE
I.Z.B	P.C	JULY 25		
DRAWN	DRAWING CHECK	DATE		
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SCALE :	DRAWING NO. :	REV :
AS SHOWN (A3)	HB010500006-CI-012	A

KEY:

EXISTING
- PRIMARY PARCEL
- NON PRIMARY PARCEL
- 220kV OVERHEAD POWER LINES
- EXISTING STOPBANK

PROPOSED
- EARTH STOP BANK CENTERLINE AND FOOTPRINT
- RETAINING WALL CENTERLINE AND FOOTPRINT
- HBRC OWNED SERVICE ROADS
- LAND ACQUISITION AREA
- ROADWORKS & CONSTRUCTION AREA
- WHIRINAKI OIC

0 50 100m

SCALE 1:2,500 (A3)

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PROJECT: WHIRINAKI STOPBANK

PROJECT PLAN (SHEET 3 OF 3)

DESIGNED	DESIGN REVIEW	DATE	APPROVED	DATE
I.Z.B	P.C	JULY 25		
DRAWN	DRAWING CHECK	DATE	THIS DRAWING IS NOT FOR CONSTRUCTION UNLESS SIGNED AS APPROVED	
D.F.P	----	JULY 25		

SCALE :	DRAWING NO. :	REV :
AS SHOWN (A3)	HB010500006-CI-013	A

Appendix B: EIANZ Tables

Table B-1: Attributes to be considered when assigning ecological value or importance to a site or area of vegetation/habitat/community. Adapted from EIANZ (2018)

Matters	Attributes to be considered
Representativeness	Criteria for representative vegetation and aquatic habitats: • Typical structure and composition; • Indigenous species dominate; • Expected species and tiers are present; and, • Thresholds may need to be lowered where all examples of a type are strongly modified. Criteria for representative species and species assemblages: • Species assemblages that are typical of the habitat; and, • Indigenous species that occur in most of the guilds expected for the habitat type.
Rarity/distinctiveness	Criteria for rare/distinctive vegetation and habitats: • Naturally uncommon, or induced scarcity; • Amount of habitat or vegetation remaining; • Distinctive ecological features; and, • National priority for protection. Criteria for rare/distinctive species or species assemblages: • Habitat supporting nationally Threatened or At Risk species, or locally uncommon species; • Regional or national distribution limits of species or communities; • Unusual species or assemblages; and, • Endemism.

Table B-1: Attributes to be considered when assigning ecological value or importance to a site or area of vegetation/habitat/community. Adapted from EIANZ (2018)

Matters	Attributes to be considered
Diversity and pattern	• Level of natural diversity, abundance, and distribution; • Biodiversity reflecting underlying diversity; • Biogeographical considerations – pattern, complexity; and, • Temporal considerations, considerations of lifecycles, daily or seasonal cycles of habitat availability and utilisation.
Ecological context	• Site history, and local environmental conditions which have influenced the development of habitats and communities; • The essential characteristics that determine an ecosystem's integrity, form, functioning, and resilience (from "intrinsic value" as defined in RMA); • Size, shape, and buffering; • Condition and sensitivity to change; • Contribution of the site to ecological networks, linkages, pathways and the protection and exchange of genetic material; and, • Species role in ecosystem functioning – high level, key species identification, habitat as proxy.

Table B-2: Attributes to be considered when assigning ecological value to a freshwater site or area. Adapted from EIANZ (2018)

Matters	Attributes to be assessed
Representativeness	• Extent to which site/catchment is typical or characteristic; • Stream order; • Permanent, intermittent or ephemeral waterway; • Catchment size; and, • Standing water characteristics.
Rarity/distinctiveness	• Supporting nationally or locally Threatened, At Risk or uncommon species; • National distribution limits; • Endemism; • Distinctive ecological features; and, • Type of lake/pond/wetland/spring.
Diversity and pattern	• Level of natural diversity; • Diversity metrics; • Complexity of community; and, • Biogeographical considerations – pattern, complexity, size, shape.
Ecological context	• Stream order; • Instream habitat; • Riparian habitat; • Local environmental conditions and influences, site history and development; • Intactness, health and resilience of populations and communities; • Contribution to ecological networks, linkages, pathways; and, • Role in ecosystem functioning – high level, proxies.

Table B-3: Factors considered in assigning value to terrestrial species. Adapted from EIANZ (2018)

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

Table B-4: Scoring sites combining values for four matters in Tables B-1 or B-2. Adapted from EIANZ (2018)

Value	Description
Very high	Area rates High for three or all of the four assessment matters listed in Tables B-1 or B-2. Likely to be nationally important and recognised as such
High	Area rates High for two of the assessment matters, Moderate and Low for the remainder, or Area rates High for one of the assessment matters, Moderate for the remainder. Likely to be regionally important and recognised as such
Moderate	Area rates High for one matter. Moderate and Low for the remainder, or Area rates moderate for two or more assessment matters and Low or Very low for the remainder Likely to be important at the level of the Ecological District
Low	Area rates Low or Very Low for the majority of assessment matters and Moderate for one. Limited ecological value other than as local habitat for tolerant native species
Very low	Area rates Very Low for three or all matters and Moderate or Low for the remainder.

Table B-5: Criteria for describing magnitude of effect. Adapted from EIANZ (2018)

Magnitude of effect	Description
Very high	Total loss of, or major alteration to, baseline condition.
High	Major loss or alteration to baseline conditions.
Moderate	Loss or alteration to one or more key elements/features of the original baseline condition; and, Loss of a moderate proportion of the known population or range of the element/feature.
Low	Minor shift away from existing baseline condition; and/or, Having a minor effect on the known population or range of the element/feature.
Negligible	Very slight change from existing baseline condition; and/or, Having negligible effect on the known population or range of the element/feature.

Table B-6: Criteria for describing level of effects. Adapted from EIANZ (2018)

Magnitude of effect	Ecological Value				
	Very High	**High**	**Moderate**	**Low**	**Negligible**
Very High	Very High	Very High	High	Moderate	Low
High	Very High	Very High	Moderate	Low	Very Low
Moderate	High	High	Moderate	Low	Very Low
Low	Moderate	Low	Low	Very Low	Very Low
Negligible	Low	Very Low	Very Low	Very Low	Very Low

Appendix C: eDNA Results

Table C-1: Full eDNA Results for Whirinaki Stream

Scientific Name	Rank	Taxon ID	Common Name	Group	WHIRI-01	WHIRI-02	WHIRI-03	WHIRI-04	WHIRI-05	WHIRI-06
Cochliopodium kieliense	species	1512276	Amoeba	Amoebae	9	9	8	17	32	17
Vannella simplex	species	197532	Amoeba	Amoebae	0	0	0	14	9	0
Vexillifera bacillipedes	species	1105345	Amoeba	Amoebae	8	0	5	0	0	0
Cochliopodium	genus	313557	Amoeba	Amoebae	109	104	55	122	86	186
Vannella	genus	95228	Amoeba	Amoebae	23	30	19	28	14	32
Arcellinida	order	318493		Amoebae	0	0	0	0	16	0
Eumycetozoa	class	142796		Amoebae	0	0	0	0	5	0
unclassified Saccamoeba	no rank	2622403		Amoebae	262	455	206	318	320	170
Acinetobacter	genus	469		Bacteria	44	57	0	32	47	18
Actinoplanes	genus	1865		Bacteria	30	20	23	0	31	9
Aeromonas	genus	642		Bacteria	774	633	506	655	624	524
Afipia	genus	1033		Bacteria	0	0	0	6	0	0
Alistipes	genus	239759		Bacteria	0	5	0	0	0	0
Arcicella	genus	217140		Bacteria	14	17	71	42	10	27
Arcobacter	genus	28196		Bacteria	0	0	0	6	6	0
Arenimonas	genus	490567		Bacteria	10	0	25	29	19	18
Armatimonas	genus	1042315		Bacteria	21	8	18	15	23	26
Asticcacaulis	genus	76890		Bacteria	0	26	0	23	0	9
Azospirillum	genus	191		Bacteria	22	0	11	0	0	14
Bacteriovorax	genus	146784		Bacteria	0	0	8	0	0	0
Bdellovibrio	genus	958		Bacteria	0	0	52	0	0	0
Blastopirellula	genus	265487		Bacteria	0	0	0	0	0	11
Brevundimonas	genus	41275		Bacteria	29	35	15	44	24	61
Candidatus Rhabdochlamydia	genus	292833		Bacteria	69	116	71	60	77	56
Cellulosilyticum	genus	698776		Bacteria	0	13	0	0	0	0
Cellvibrio	genus	10		Bacteria	152	142	180	185	168	168
Cetobacterium	genus	180162		Bacteria	37	89	56	33	38	34
Chryseobacterium	genus	59732		Bacteria	32	0	0	0	0	42
Chryseolinea	genus	1433993		Bacteria	34	40	17	24	21	36
Chthoniobacter	genus	295577		Bacteria	8	0	0	0	0	0
Clostridium	genus	1485		Bacteria	0	0	0	5	0	10
Curtobacterium	genus	2034		Bacteria	0	0	0	8	0	0
Cutibacterium	genus	1912216		Bacteria	0	0	22	6	6	0
Cyanospira	genus	165798		Bacteria	0	0	0	0	5	15
Cytophaga	genus	978		Bacteria	31	53	35	21	24	43
Desulfovibrio	genus	872		Bacteria	0	7	7	0	9	0
Devosia	genus	46913		Bacteria	17	23	0	9	39	0
Dyadobacter	genus	120831		Bacteria	0	23	7	0	14	15
Emticicia	genus	312278		Bacteria	27	0	16	45	36	0
Exiguobacterium	genus	33986		Bacteria	0	31	0	5	0	14
Ferribacterium	genus	88875		Bacteria	0	0	0	0	13	0

Flavisolibacter	genus	398041		Bacteria	81	121	84	80	97	70
Flavobacterium	genus	237		Bacteria	226	305	267	311	346	186
Flavonifractor	genus	946234		Bacteria	14	0	0	0	0	0
Flectobacillus	genus	101		Bacteria	13	0	0	0	0	0
Fluviicola	genus	332102		Bacteria	0	10	0	23	0	0
Fusobacterium	genus	848		Bacteria	0	0	0	12	0	0
Gemmata	genus	113		Bacteria	0	0	10	0	0	5
Gilliamella	genus	1193503		Bacteria	0	6	0	0	0	0
Haliscomenobacter	genus	2349		Bacteria	9	11	0	0	11	0
Herpetosiphon	genus	64		Bacteria	18	48	16	25	15	22
Hydrogenophaga	genus	47420		Bacteria	107	165	135	205	166	80
Hymenobacter	genus	89966		Bacteria	0	8	5	0	0	10
Hyphomicrobium	genus	81		Bacteria	0	14	0	23	26	19
Jannaschia	genus	188905		Bacteria	0	6	0	0	0	9
Labilithrix	genus	1524217		Bacteria	25	0	19	67	0	0
Labrys	genus	204476		Bacteria	0	57	0	22	24	0
Lacihabitans	genus	1649462		Bacteria	125	157	146	78	105	97
Lacrimispora	genus	2719231		Bacteria	11	0	0	0	0	0
Legionella	genus	445		Bacteria	159	144	69	106	137	165
Leptonema	genus	32205		Bacteria	0	6	0	0	0	0
Mesorhizobium	genus	68287		Bacteria	0	0	25	0	0	0
Methylobacterium	genus	407		Bacteria	50	32	28	36	24	0
Methylovorus	genus	81682		Bacteria	0	31	32	45	0	0
Microbacterium	genus	33882		Bacteria	12	28	13	31	19	14
Mucilaginibacter	genus	423349		Bacteria	94	87	121	209	131	145
Nevskia	genus	64001		Bacteria	8	42	13	18	11	16
Niveispirillum	genus	1543704		Bacteria	0	16	49	36	23	38
Nocardioides	genus	1839		Bacteria	0	67	20	0	0	0
Novosphingobium	genus	165696		Bacteria	0	21	0	0	79	0
Ohtaekwangia	genus	1210119		Bacteria	0	68	15	0	0	0
Oligoflexus	genus	1553903		Bacteria	14	6	5	16	14	20
Paenibacillus	genus	44249		Bacteria	0	0	0	8	0	0
Paludibacter	genus	346096		Bacteria	13	18	13	19	21	0
Pedobacter	genus	84567		Bacteria	48	47	66	67	15	74
Pedomicrobium	genus	47494		Bacteria	20	9	0	0	11	22
Phocaeicola	genus	909656		Bacteria	16	0	0	0	0	0
Pirellula	genus	123		Bacteria	0	0	16	0	0	0
Polaromonas	genus	52972		Bacteria	0	0	0	0	18	0
Polynucleobacter	genus	44013		Bacteria	50	24	18	38	13	32
Prevotella	genus	838		Bacteria	19	19	0	10	0	0
Prosthecobacter	genus	48463		Bacteria	9	0	7	28	31	8
Pseudarcicella	genus	1664383		Bacteria	0	0	0	0	7	0
Pseudomonas	genus	286		Bacteria	165	130	73	135	142	161

Pseudoxanthomonas	genus	83618		Bacteria	0	18	0	0	0	0
Reyranella	genus	445219		Bacteria	40	42	59	60	82	64
Rheinheimera	genus	67575		Bacteria	30	0	26	17	8	40
Rhodobacter	genus	1060		Bacteria	81	104	67	112	114	91
Rhodococcus	genus	1827		Bacteria	0	21	0	37	0	0
Rickettsia	genus	780		Bacteria	33	0	0	0	0	0
Romboutsia	genus	1501226		Bacteria	0	17	44	7	8	6
Roseomonas	genus	125216		Bacteria	13	0	0	0	13	8
Ruminiclostridium	genus	1508657		Bacteria	0	15	0	0	0	0
Sediminibacterium	genus	504481		Bacteria	0	0	0	33	0	0
Shinella	genus	323620		Bacteria	0	27	13	7	14	7
Siccationidurans	genus	1968878		Bacteria	0	13	11	13	11	0
Sideroxydans	genus	314343		Bacteria	12	0	0	10	0	0
Silanimonas	genus	292713		Bacteria	19	0	0	14	0	0
Solirubrobacter	genus	207599		Bacteria	0	0	20	0	0	0
Sphingobacterium	genus	28453		Bacteria	8	0	0	0	0	0
Sphingobium	genus	165695		Bacteria	15	0	0	0	0	0
Sphingomonas	genus	13687		Bacteria	94	65	78	0	91	142
Sphingopyxis	genus	165697		Bacteria	118	119	145	133	134	106
Sphingorhabdus	genus	1434046		Bacteria	0	22	28	0	18	26
Spirochaeta	genus	146		Bacteria	93	122	80	59	109	25
Spirosoma	genus	107		Bacteria	0	5	0	0	0	0
Sulfuricurvum	genus	286130		Bacteria	0	0	15	6	0	0
Sulfurospirillum	genus	57665		Bacteria	0	0	17	0	0	0
Taibaiella	genus	1434702		Bacteria	6	0	10	0	0	0
Thermomonas	genus	141948		Bacteria	18	0	0	21	18	31
Treponema	genus	157		Bacteria	0	6	0	0	0	0
Uliginosibacterium	genus	392735		Bacteria	0	0	0	21	0	0
Verrucomicrobium	genus	2735		Bacteria	0	16	17	0	0	0
Vogesella	genus	57739		Bacteria	44	25	38	56	34	53
Acetobacteraceae	family	433		Bacteria	13	15	15	18	0	0
Alcaligenaceae	family	506		Bacteria	0	6	21	0	20	8
Atopobiaceae	family	1643824		Bacteria	0	6	0	0	0	0
Azospirillaceae	family	2829815		Bacteria	0	0	0	0	10	10
Bacillaceae	family	186817		Bacteria	0	0	0	0	10	0
Bacteroidaceae	family	815		Bacteria	0	24	0	20	6	0
Breznakiellaceae	family	2951104		Bacteria	0	0	0	5	0	0
Burkholderiaceae	family	119060		Bacteria	18	16	23	27	35	12
Campylobacteraceae	family	72294		Bacteria	0	9	0	0	0	0
Caulobacteraceae	family	76892		Bacteria	111	94	145	33	128	97
Cellvibrionaceae	family	1706371		Bacteria	0	0	33	39	0	0
Chitinophagaceae	family	563835		Bacteria	227	242	189	386	211	208
Chromatiaceae	family	1046	Purple sulfur bacteria	Bacteria	62	115	122	98	91	89

Clostridiaceae	family	31979		Bacteria	0	0	0	13	0	5
Comamonadaceae	family	80864		Bacteria	455	417	503	466	423	402
Coxiellaceae	family	118968		Bacteria	64	65	56	65	56	72
Crocinitomicaceae	family	1853230		Bacteria	198	201	186	234	156	150
Cytophagaceae	family	89373		Bacteria	84	75	83	78	48	108
Desulfobulbaceae	family	213121		Bacteria	0	0	23	0	10	0
Devosiaceae	family	2831106		Bacteria	0	35	39	0	0	35
Elusimicrobiaceae	family	641876		Bacteria	10	8	0	0	9	0
Endomicrobiaceae	family	1783343		Bacteria	0	0	0	8	0	0
Enterobacteriaceae	family	543		Bacteria	0	0	0	0	52	17
Eubacteriales Family XIII. Incertae Sedis	family	543314		Bacteria	0	0	0	0	0	5
Flavobacteriaceae	family	49546		Bacteria	281	328	343	288	203	312
Fulvivirgaceae	family	2762286		Bacteria	54	11	66	30	98	77
Gemmataceae	family	1914233		Bacteria	43	22	69	13	54	73
Geobacteraceae	family	213422		Bacteria	0	0	0	18	0	0
Hyphomicrobiaceae	family	45401		Bacteria	0	10	24	0	35	0
Ilumatobacteraceae	family	2448023		Bacteria	0	0	0	22	0	0
Lachnospiraceae	family	186803		Bacteria	0	0	0	6	0	16
Lactobacillaceae	family	33958		Bacteria	0	0	14	6	0	0
Legionellaceae	family	444		Bacteria	104	64	66	71	77	60
Lewinellaceae	family	1937960		Bacteria	15	34	25	46	19	21
Microbacteriaceae	family	85023		Bacteria	110	92	79	86	122	81
Micromonosporaceae	family	28056		Bacteria	27	57	46	55	18	34
Moraxellaceae	family	468		Bacteria	9	38	17	27	0	6
Nannocystaceae	family	224463		Bacteria	0	16	8	0	0	0
Nitrobacteraceae	family	41294		Bacteria	73	74	96	170	61	43
Oscillospiraceae	family	216572		Bacteria	15	12	47	0	28	39
Oxalobacteraceae	family	75682		Bacteria	0	0	0	37	8	45
Paludibacteraceae	family	2005523		Bacteria	0	0	11	23	0	0
Paracoccaceae	family	31989		Bacteria	119	142	126	88	84	123
Phyllobacteriaceae	family	69277		Bacteria	9	38	0	48	23	15
Pirellulaceae	family	2691357		Bacteria	19	45	115	36	81	92
Pleomorphomonadaceae	family	2843308		Bacteria	0	0	0	13	0	0
Prevotellaceae	family	171552		Bacteria	0	0	7	0	0	0
Prolixibacteraceae	family	1471398		Bacteria	11	32	25	21	16	33
Pseudobdellovibrionaceae	family	213483		Bacteria	0	31	0	35	0	0
Pseudonocardiaceae	family	2070		Bacteria	0	0	16	0	0	0
Rhizobiaceae	family	82115		Bacteria	48	86	29	31	63	72
Rhodanobacteraceae	family	1775411		Bacteria	6	0	0	0	0	0
Rikenellaceae	family	171550		Bacteria	5	0	5	9	11	5
Roseobacteraceae	family	2854170		Bacteria	0	0	0	0	12	0
Sandaracinaceae	family	1055686		Bacteria	0	0	0	0	12	0
Saprospiraceae	family	89374		Bacteria	16	50	19	18	37	23

Sinobacteraceae	family	568386		Bacteria	0	0	0	7	0	0
Sphingobacteriaceae	family	84566		Bacteria	34	51	27	27	41	25
Sphingomonadaceae	family	41297		Bacteria	21	38	0	29	0	0
Sporomusaceae	family	1843490		Bacteria	0	0	9	0	0	0
Tannerellaceae	family	2005525		Bacteria	0	0	11	0	0	0
Tepidisphaeraceae	family	1771355		Bacteria	0	0	10	0	8	0
Treponemataceae	family	2845253		Bacteria	0	0	5	0	0	0
Verrucomicrobiaceae	family	203557		Bacteria	7	0	0	0	10	0
Xanthomonadaceae	family	32033		Bacteria	55	22	30	12	44	39
Cystobacterineae	suborder	80811		Bacteria	42	148	42	73	57	43
Alteromonadales	order	135622		Bacteria	13	6	0	0	5	0
Bacillales	order	1385		Bacteria	0	0	13	10	0	0
Bacteroidales	order	171549		Bacteria	0	14	0	0	0	0
Burkholderiales	order	80840		Bacteria	1193	1097	1321	1663	986	1017
Cytophagales	order	768507		Bacteria	21	21	17	25	16	0
Desulfuromonadales	order	69541		Bacteria	41	22	18	0	20	26
Enterobacterales	order	91347		Bacteria	123	101	147	147	62	94
Eubacteriales	order	186802		Bacteria	7	0	6	11	0	0
Flavobacteriales	order	200644		Bacteria	123	108	67	106	127	61
Hyphomicrobiales	order	356		Bacteria	232	173	170	212	244	77
Legionellales	order	118969		Bacteria	0	10	7	0	0	10
Micrococcales	order	85006		Bacteria	0	0	9	0	0	0
Myxococcales	order	29	Fruiting gliding bacteria	Bacteria	21	9	37	8	24	19
Parachlamydiales	order	1963360		Bacteria	0	0	0	12	0	0
Pirellulales	order	2691354		Bacteria	0	6	0	0	0	0
Pseudonocardiales	order	85010		Bacteria	0	8	0	0	0	0
Rhodobacterales	order	204455		Bacteria	51	48	62	64	30	41
Rhodocyclales	order	206389		Bacteria	8	20	21	56	16	0
Rhodospirillales	order	204441		Bacteria	0	0	37	39	0	27
Sphingomonadales	order	204457		Bacteria	20	36	12	43	7	13
Verrucomicrobiales	order	48461		Bacteria	0	0	0	0	0	14
Xanthomonadales	order	135614		Bacteria	0	0	36	0	0	17
Actinomycetes	class	1760	High G+C Gram-positive bacteria	Bacteria	95	41	53	53	87	42
Alphaproteobacteria	class	28211		Bacteria	268	247	265	362	140	260
Bacteroidia	class	200643		Bacteria	0	11	0	19	0	0
Betaproteobacteria	class	28216		Bacteria	393	396	414	446	346	451
Cytophagia	class	768503		Bacteria	15	16	0	17	16	17
Deltaproteobacteria	class	28221		Bacteria	0	0	0	77	0	0
Flavobacteriia	class	117743		Bacteria	0	11	0	0	0	0
Gammaproteobacteria	class	1236		Bacteria	947	1225	1131	1093	982	930
Oligoflexia	class	1553900		Bacteria	18	0	0	0	43	25
Planctomycetia	class	203683		Bacteria	99	14	72	24	8	50
Saprospiria	class	1937959		Bacteria	12	8	9	40	27	23

Spirochaetia	class	203692		Bacteria	0	0	0	0	0	28
Acidobacteriota	phylum	57723		Bacteria	0	0	0	16	0	0
Actinomycetota	phylum	201174		Bacteria	134	119	107	72	111	119
Armatimonadota	phylum	67819		Bacteria	0	9	0	0	0	0
Bacillota	phylum	1239	Low GC Gram+	Bacteria	30	5	0	44	0	0
Bacteroidota	phylum	976	Bacteroides-Cytophaga-Flexibacter group	Bacteria	760	953	723	729	726	701
Myxococcota	phylum	2818505		Bacteria	0	0	0	6	0	0
Planctomycetota	phylum	203682		Bacteria	0	13	18	26	0	32
Pseudomonadota	phylum	1224	Purple bacteria and relatives	Bacteria	1177	983	995	1174	1168	961
Thermodesulfobacteriota	phylum	200940		Bacteria	0	10	0	0	0	0
Verrucomicrobiota	phylum	74201		Bacteria	10	15	77	20	31	41
Chryseobacterium group	no rank	2782232		Bacteria	27	50	52	48	58	0
Rhizobium/Agrobacterium group	no rank	227290		Bacteria	44	0	0	8	0	0
Anas platyrhynchos	species	8839	Rakiraki; mallard duck	Birds	0	47	204	133	323	96
Fringilla coelebs	species	37598	Pahirini; common chaffinch	Birds	0	0	0	112	0	0
Frontoniidae sp. bLPN3	species	1683238		Ciliates	14	22	16	15	16	15
Stentor roeselii	species	1703786	Ciliate	Ciliates	0	15	0	0	0	0
Blepharisma	genus	5959		Ciliates	0	0	0	0	0	5
Chaenea	genus	5991		Ciliates	0	7	0	0	0	0
Chilodonella	genus	151076		Ciliates	17	103	17	17	16	51
Cinetochilum	genus	693930		Ciliates	28	11	8	0	0	0
Cyclidium	genus	35099		Ciliates	61	22	77	92	76	127
Euplotes	genus	5935		Ciliates	0	60	32	0	0	10
Frontonia	genus	60002		Ciliates	104	104	104	171	137	192
Halteria	genus	5973		Ciliates	159	190	179	180	139	133
Hemiurosomoida	genus	1646343		Ciliates	88	95	0	95	19	111
Histriculus	genus	47667		Ciliates	69	87	93	15	56	88
Litonotus	genus	346246		Ciliates	21	0	0	34	11	0
Loxophyllum	genus	39458		Ciliates	29	31	0	0	0	0
Oxytricha	genus	5943		Ciliates	426	715	323	520	584	345
Paramecium	genus	5884		Ciliates	102	160	40	191	159	128
Paraurostyla	genus	6013		Ciliates	0	307	0	0	337	0
Phialina	genus	497728	Ciliate	Ciliates	12	0	0	0	0	0
Spirostomum	genus	37867	Ciliate	Ciliates	0	0	0	15	0	0
Stentor	genus	5962		Ciliates	12	9	0	0	26	0
Sterkiella	genus	94288		Ciliates	0	0	0	103	0	0
Stylonychia	genus	5948		Ciliates	37	216	80	99	90	29
Tachysoma	genus	693951		Ciliates	59	0	0	0	0	0
Tetrahymena	genus	5890		Ciliates	9	27	21	72	6	11
Urocentrum	genus	122941		Ciliates	23	34	0	0	0	0
Urosomoida	genus	1537161		Ciliates	0	0	76	93	77	92
Vorticella	genus	60849		Ciliates	68	134	86	78	67	89
Stylonychinae	subfamily	1001748		Ciliates	63	0	0	0	0	0

Amphileptidae	family	197895		Ciliates	0	134	0	168	0	0
Chilodonellidae	family	1170554		Ciliates	0	0	22	0	0	0
Frontoniidae	family	340079		Ciliates	220	298	329	225	302	300
Lacrymariidae	family	375590		Ciliates	0	19	0	69	94	0
Litonotidae	family	197908	Ciliates	Ciliates	35	45	42	136	51	39
Oxytrichidae	family	57506		Ciliates	0	58	0	20	55	0
Spathidiidae	family	375581		Ciliates	768	948	1175	725	1014	159
Stentoridae	family	219169		Ciliates	7	0	0	0	0	0
Tokophryidae	family	168137		Ciliates	19	13	19	34	27	27
Vorticellidae	family	85904		Ciliates	0	0	11	91	0	17
Tetrahymenina	suborder	37093	Ciliates	Ciliates	98	159	245	175	69	89
Astomatida	order	278828		Ciliates	0	0	0	16	0	0
Chlamydodontida	order	238897		Ciliates	0	0	37	0	0	0
Choreotrichida	order	200605		Ciliates	1474	2391	1648	1367	1396	3151
Haptorida	order	5989		Ciliates	7	58	37	146	14	8
Heterotrichida	order	5957		Ciliates	8	0	0	0	0	0
Pleurostomatida	order	197906		Ciliates	0	6	42	7	0	11
Sessilida	order	1974272		Ciliates	1556	2434	1080	2689	1844	1691
Sporadotrichida	order	693921		Ciliates	54	72	24	0	68	82
Urostylida	order	486728		Ciliates	0	0	68	14	28	40
Choreotrichia	subclass	141411		Ciliates	1656	2733	1750	1532	1468	2433
Scuticociliatia	subclass	35094		Ciliates	91	0	47	77	0	45
Stichotrichia	subclass	194286		Ciliates	1136	914	1124	1490	891	1267
Armophorea	class	658449		Ciliates	0	0	0	0	6	0
Litostomatea	class	5988		Ciliates	46	28	11	5	47	10
Oligohymenophorea	class	6020		Ciliates	0	0	0	15	0	32
Spirotrichea	class	33829		Ciliates	299	458	214	399	424	387
Intramacronucleata	subphylum	431838		Ciliates	0	10	0	0	0	0
unclassified Vorticella	no rank	2615168		Ciliates	0	0	0	0	0	6
Hydra vulgaris	species	6087	Hydra	Cnidarians	0	35	0	0	9	0
Hydra	genus	6083	Hydra	Cnidarians	29	27	33	37	39	27
Acanthocyclops robustus	species	415614	Copepod	Crustaceans	51	1099	22	35	73	23
Acanthocyclops viridis	species	298422		Crustaceans	0	20	0	0	0	0
Chydorus brevilabris	species	362310	Water flea	Crustaceans	1384	1208	0	63	0	1089
Chydorus sphaericus	species	77745		Crustaceans	0	0	0	37	45	0
Chydorus sphaericus complex sp. A1	species	1939838		Crustaceans	7	0	16	934	1650	0
Paracyclops fimbriatus	species	1606834	Copepod	Crustaceans	16	15	0	0	0	0
Porcellio scaber	species	64697	Pāpapa; woodlouse; slater	Crustaceans	0	11	0	0	0	0
Chydorus	genus	77744		Crustaceans	0	0	0	514	635	0
Eucyclops	genus	84316	Copepod	Crustaceans	0	0	0	0	6	37
Ilyocypris	genus	182491		Crustaceans	0	13	0	0	0	0
Candonidae	family	288905		Crustaceans	0	0	6	0	0	0
Chydoridae	family	77713		Crustaceans	59	59	0	0	73	36

Cyclopidae	family	84315		Crustaceans	0	176	0	0	0	0
Ilyocyprididae	family	182490		Crustaceans	0	226	0	0	0	0
Diplostraca	order	84337		Crustaceans	21	35	0	0	0	7
Cryptomonas curvata	species	233186		Cryptomonads	0	0	8	0	14	15
Cryptomonas lucens	species	483047		Cryptomonads	12	13	0	14	0	0
Cryptomonas	genus	3030		Cryptomonads	159	126	116	222	206	177
Cryptomonadaceae	family	2896		Cryptomonads	32	0	9	22	48	12
Pyrenomonadaceae	family	589344		Cryptomonads	23	19	23	33	12	28
Cryptomonadales	order	589350		Cryptomonads	16	0	7	0	39	0
unclassified Goniomonas	no rank	2645401		Cryptomonads	13	0	0	0	6	0
unclassified Rhodomonas	no rank	2685842		Cryptomonads	5	0	0	0	0	0
Cyclotella cryptica	species	29204	Brackish-water diatom	Diatoms	97	107	62	9	77	68
Nitzschia acidoclinata	species	1302829	Diatom	Diatoms	0	0	0	0	6	0
Nitzschia palea	species	303400	Diatom	Diatoms	0	6	0	0	0	0
Cocconeis	genus	216715	Diatom	Diatoms	23	17	15	35	99	0
Cyclotella	genus	29203	Brackish-water diatom	Diatoms	68	30	66	40	20	47
Eolimna	genus	137465	Diatom	Diatoms	20	0	0	0	0	0
Gomphonema	genus	97226	Diatom	Diatoms	24	0	0	0	0	0
Sellaphora	genus	216740	Diatom	Diatoms	0	0	0	0	11	7
Thalassiosiraceae	family	29202		Diatoms	43	98	62	59	38	64
Naviculales	order	38748		Diatoms	0	0	0	9	0	0
Thalassiosirales	order	33847		Diatoms	95	127	131	91	66	152
Fragilariophycidae	subclass	33854		Diatoms	49	0	39	22	0	33
Bacillariophyceae	class	33849	Raphid; pennate diatoms	Diatoms	0	0	0	9	32	13
Anguilla australis	species	7940	Tuna; short-fin eel	Fish	2366	1199	646	152	620	1884
Anguilla dieffenbachii	species	61127	Ōrea; tuna; long-fin eel	Fish	268	92	193	100	7	122
Galaxias maculatus	species	61620	Īnanga	Fish	986	138	182	8	715	496
Gobiomorphus cotidianus	species	226931	Tīpokopoko; toitoi; common bully	Fish	55	0	0	0	0	0
Galaxias	genus	51242	Galaxiids	Fish	0	0	0	0	106	0
Gobiomorphus	genus	86236	Bullies	Fish	123	196	235	0	217	0
Galaxiiformes	order	51241	Galaxiids	Fish	0	0	0	0	86	0
Microdalyellia	genus	84088		Flatworms	0	0	0	0	0	5
Stenostomum	genus	39238	Freshwater catenulid flatworm	Flatworms	19	32	444	36	31	13
Stenostomidae	family	39237		Flatworms	0	0	0	0	0	122
Rhabdocoela	order	27901		Flatworms	0	0	27	0	0	10
unclassified Stenostomum (in: flatworms	no rank	2688962		Flatworms	194	0	0	0	0	0
Endochytrium sp.	species	2107736		Fungi	23	33	44	26	78	29
Cladochytrium	genus	109935		Fungi	0	0	0	13	30	18
Melampsora	genus	5260		Fungi	0	0	0	5	0	0
Cladochytriaceae	family	109915		Fungi	241	152	140	182	264	165
Blastocladiales	order	4805		Fungi	14	0	5	0	0	0
Dothideales	order	5014		Fungi	0	0	0	9	0	0
Pleosporales	order	92860		Fungi	0	0	0	26	0	0

Chytridiomycetes	class	451435		Fungi	0	0	0	0	6	0
Ascomycota	phylum	4890	Ascomycetes	Fungi	0	11	30	0	0	0
Chytridiomycota	phylum	4761		Fungi	570	250	247	410	684	300
Cryptomycota	phylum	1031332		Fungi	0	0	0	0	11	0
Cryptomycota incertae sedis	no rank	2683658		Fungi	0	0	0	5	0	0
Aphanochaete	genus	104530	Green alga	Green algae	22	0	22	0	39	6
Chlamydomonas	genus	3052	Green alga	Green algae	20	13	0	29	6	8
Cladophora	genus	34125	Green alga	Green algae	0	0	5	0	0	0
Oedogonium	genus	55993	Filamentous green alga	Green algae	52	58	6	37	85	0
Oocystis	genus	120746	Green alga	Green algae	0	0	0	0	23	0
Oedogoniaceae	family	2682485		Green algae	15	10	17	0	17	6
Protosiphonaceae	family	2491658		Green algae	0	0	0	0	6	0
Chlamydomonadales	order	3042		Green algae	0	0	0	7	8	11
Chlorophyceae	class	3166		Green algae	44	46	188	10	64	20
unclassified Chlamydomonas	no rank	2034146		Green algae	18	16	0	5	17	7
Poterioochromonas	genus	88166	Mixotrophic flagellate	Heterokont algae	14	5	0	0	17	0
Sorodiplophrys	genus	1804150		Heterokont algae	0	0	0	0	0	8
Spumella	genus	89043	Golden-brown alga	Heterokont algae	0	7	0	0	0	0
Tribonema	genus	2980		Heterokont algae	0	0	0	0	7	0
Ochrophyta	clade	2696291		Heterokont algae	0	6	0	40	10	0
Amphifilida	order	2699529		Heterokont algae	10	8	11	10	7	6
Chromulinales	order	96792		Heterokont algae	93	133	88	140	164	114
Bigyra	class	2683628		Heterokont algae	0	0	0	0	0	6
Chrysophyceae	class	2825	Chrysomonads	Heterokont algae	21	0	17	7	0	0
Bacillariophyta	phylum	2836	Diatoms	Heterokont algae	43	25	19	10	35	21
Oomycota	phylum	4762		Heterokont algae	328	198	200	420	303	282
unclassified Paraphysomonas	no rank	2617784		Heterokont algae	0	0	7	0	0	0
Ablabesmyia sp. NZ08.Motel	species	1981520		Insects	0	0	0	17	5	0
Austroclima sepia	species	1968917	Mayfly	Insects	0	0	0	6	0	0
Carpelimus zealandicus	species	1587141		Insects	0	7	0	0	0	11
Cecidomyiidae sp. BIOUG21496-E01	species	2352237		Insects	0	0	0	14	0	0
Chironomus cloacalis	species	113493	Grey midge	Insects	8	8	9	6	11	0
Corynoneura scutellata	species	611450	Non-biting midge	Insects	825	886	2680	615	2000	517
Cryptochironomus sp. 1 MEC-2014	species	1566685		Insects	0	0	5	0	0	0
Ectopsocus briggsi	species	322492	Psocopteran fly	Insects	0	0	12	0	0	0
Hydroptilidae sp. 12KH6B	species	1877717	Purse-case caddisfly	Insects	31	0	0	0	0	0
Hygraula nitens	species	1374232	Australian water moth	Insects	0	5	0	0	0	0
Ischnura aurora	species	218366		Insects	14	22	11	0	26	16
Lonchoptera bifurcata	species	385268		Insects	0	7	0	0	0	0
Mycodiplosis sp.	species	2995188		Insects	0	0	0	0	6	0
Paratanytarsus grimmii	species	288873	Chironomid	Insects	991	377	121	262	345	212
Pseudolycoriella cavatica	species	2664622		Insects	0	5	0	0	0	0
Rhopalosiphum nymphaeae	species	253253	Waterlily aphid	Insects	0	7	8	19	0	19

Scaptomyza flava	species	928822	Turnip leafminer	Insects	5	0	0	54	0	0
Trioxys sunnysidensis	species	2340088	Parasitoid wasp	Insects	0	0	0	0	0	7
Triplectides cephalotes	species	144281	Caddisfly	Insects	0	5	0	8	0	0
Zephlebia pirongia	species	1969013	Mayfly	Insects	10	0	0	0	0	0
Ablabesmyia	genus	46216		Insects	0	0	26	0	0	0
Ctenopseustis	genus	65023	Brownheaded leafroller moth	Insects	0	8	0	0	0	0
Limnophyes	genus	190098	Non-biting midge	Insects	8	0	0	0	200	9
Pieris	genus	7115		Insects	0	0	0	0	0	5
Smittia	genus	315559	Flies	Insects	5	0	0	0	0	0
Triplectides	genus	144280	Caddisfly	Insects	0	0	0	16	0	0
Orthocladiinae	subfamily	43808		Insects	13	13	259	22	96	0
Aphididae	family	27482	Aphids	Insects	0	0	0	0	7	0
Cecidomyiidae	family	33406	Gall midges	Insects	16	0	0	0	0	20
Chironomidae	family	7149	Nonbiting midges	Insects	11	0	7	0	0	0
Thripidae	family	45053	True thrips	Insects	0	0	5	0	0	0
Diptera	order	7147	Flies	Insects	0	10	0	0	0	0
Trichoptera	order	30263	Caddisflies	Insects	20	15	40	35	27	0
unclassified Orthocladiinae	no rank	559852		Insects	6	0	0	0	0	0
Canis lupus familiaris	subspecies	9615	Dog; pero	Mammals	0	0	8	0	0	0
Mus musculus	species	10090	House mouse	Mammals	422	288	215	139	292	174
Rattus norvegicus	species	10116	Pouhawaiki; kaingarua; Norway rat	Mammals	10	8	38	0	19	88
Canis	genus	9611	Kurī; dog	Mammals	0	0	0	11	0	0
Mus	genus	10088	Mouse	Mammals	0	23	0	0	0	0
Boreoeutheria	clade	1437010	Placental mammals	Mammals	0	23	27	0	25	11
Dermatophagoides pteronyssinus	species	6956	House dust mite; dust mite	Mites and ticks	0	0	0	0	0	14
Tyrophagus curvipenis	species	2138292	Mite	Mites and ticks	0	146	0	0	0	0
Tyrophagus	genus	41443	Bulb mites	Mites and ticks	0	93	0	0	0	0
Aplexa hypnorum	species	271031		Molluscs	0	6	0	0	0	6
Physella acuta	species	109671	Left handed sinistral snail	Molluscs	548	429	358	523	532	452
Potamopyrgus antipodarum	species	145637	Mud Snail	Molluscs	12	12	14	18	22	41
Potamopyrgus	genus	145636	Mud snails	Molluscs	14	29	10	0	46	0
Caenogastropoda	subclass	69555		Molluscs	100	93	113	152	172	59
Gastropoda	class	6448	Gastropods	Molluscs	0	63	27	6	9	0
uncultured Pythium	species	205931		Oomycetes	8	0	10	19	27	14
Achlya	genus	4765		Oomycetes	0	0	8	0	5	0
Pythium	genus	4797	Parasitic oomycete	Oomycetes	0	0	9	0	79	30
Saprolegnia	genus	4769	Cotton mould; water mould	Oomycetes	29	7	14	26	31	12
Peronosporaceae	family	4777		Oomycetes	78	70	72	88	102	126
Peronosporales	order	4776		Oomycetes	0	0	0	0	0	6
Oomycota incertae sedis	no rank	2038152		Oomycetes	0	0	0	0	0	6
Chara australis	species	31298	Stonewort	Other	239	239	167	160	189	170
Closterium baillyanum	species	1416941	Charophyte green algae	Other	0	114	0	0	0	0
uncultured eukaryote	species	100272		Other	0	0	19	0	0	0

Cercomonas	genus	45109		Other	5	0	5	8	0	0
Chaetonotus	genus	68038	Gastrotrich	Other	139	0	484	5	253	373
Chara	genus	13778		Other	12447	5581	6025	8248	9318	7600
Neobodo	genus	312470		Other	0	0	19	0	0	0
Nuclearia	genus	154967	Amoeba	Other	0	0	0	6	0	6
Peranema	genus	56465		Other	0	5	0	0	0	0
Procryptobia	genus	266822		Other	8	0	18	0	14	0
Raphidocystis	genus	2126174		Other	0	5	0	0	0	0
Spirogyra	genus	3179		Other	0	0	28	0	0	0
Embryophyta	clade	3193	Higher plants	Other	0	13	9	0	0	0
Leishmaniinae	subfamily	1286322		Other	0	0	0	0	21	0
Chaetonotidae	family	41372		Other	1877	1291	1480	594	1599	1524
Characeae	family	3146	Charophytes	Other	4912	2410	1564	2372	1910	2538
Diplonemidae	family	2603949		Other	30	36	38	68	42	36
Leptophryidae	family	1920164		Other	22	5	5	19	31	21
Nucleariidae	family	154966		Other	26	24	14	26	8	30
Phalangiidae	family	101160		Other	0	0	7	0	0	0
Araneae	order	6893	Spiders	Other	0	0	0	0	0	18
Dermocystida	order	198624		Other	9	0	7	0	10	0
Neobodonida	order	2704648		Other	15	0	0	0	0	0
Metakinetoplastina	subclass	2704647		Other	9	11	0	41	27	27
Zygnematophycidae	subclass	2684882		Other	360	228	512	813	67	35
Aves	class	8782	Birds	Other	147	0	0	0	0	0
Insecta	class	50557	Insects	Other	188	166	110	161	170	163
Kinetoplastea	class	5653	Kinetoplastids	Other	14	24	33	9	22	6
Arthropoda	phylum	6656	Arthropods	Other	42	17	13	26	27	13
Cercozoa	phylum	136419		Other	29	26	31	42	40	42
Chlorophyta	phylum	3041	Green algae	Other	155	80	60	130	164	161
Chordata	phylum	7711	Chordates	Other	0	0	0	16	0	6
Ciliophora	phylum	5878	Ciliates	Other	312	466	365	659	362	317
Nematoda	phylum	6231	Nematode	Other	0	17	45	0	0	0
Streptophyta	phylum	35493		Other	20	0	35	59	59	0
Fungi	kingdom	4751		Other	1032	383	593	765	1058	775
Metazoa	kingdom	33208	Metazoans	Other	626	1554	382	408	663	742
Viridiplantae	kingdom	33090	Green plants	Other	6	0	0	0	0	0
Bacteria	superkingdor	2	Eubacteria	Other	59	57	128	68	95	133
Eukaryota	superkingdor	2759	Eucaryotes	Other	72	187	216	116	65	83
root	no rank	1	Unidentified	Other	11232	9429	6812	9541	11229	10312
Veronica subgen. Beccabunga	subgenus	1461652		Plants	2598	1268	1286	1152	1663	1266
Prunus persica f. compressa	forma	323853		Plants	0	0	78	68	11	125
Aristotelia serrata	species	140574	Makomako; wineberry	Plants	42	0	0	0	0	0
Bolboschoenus medianus	species	10000153	Purua grass	Plants	5	9	0	54	0	0
Carpodetus serratus	species	54173	Putaputawētā	Plants	0	75	0	81	0	0

Dactylis glomerata	species	4509	Cocksfoot	Plants	5	0	0	0	0	0
Festuca rothmaleri	species	200268		Plants	0	0	5	0	0	0
Glyceria notata	species	388682		Plants	862	320	453	540	524	1003
Holcus lanatus	species	29679	Yorkshire fog	Plants	0	0	6	0	0	0
Juncus articulatus	species	223654	Jointleaf rush	Plants	123	66	0	52	114	65
Juncus bulbosus	species	223657	Bulbous rush	Plants	232	72	155	335	138	289
Juncus parryi	species	223675	Rush	Plants	0	6	0	0	0	0
Kunzea ericoides	species	106044	Burgan	Plants	8	0	0	0	0	0
Nasturtium officinale	species	65948	Wātakirihi; kōwhitiwhiti; watercress	Plants	1561	7573	2234	851	6936	5323
Paspalum dilatatum	species	313893	Dallisgrass	Plants	0	10	0	0	0	0
Paspalum distichum	species	547423	Knotgrass	Plants	32	0	5	0	26	81
Prunus persica	species	3760	Peach	Plants	0	0	27	0	0	0
Ranunculus sceleratus	species	147635		Plants	43	6	0	0	0	5
Schoenoplectus triqueter	species	316510		Plants	0	61	38	0	0	0
Trifolium subterraneum	species	3900	Subterranean clover	Plants	0	0	0	0	24	0
Veronica anagallis-aquatica	species	74693	Water speedwell	Plants	0	0	0	0	29	0
Atriplex	genus	3550		Plants	0	0	6	0	0	0
Bolboschoenus	genus	76416		Plants	15	11	0	22	0	0
Callitriche	genus	13380	Water chickweed	Plants	0	0	0	10	0	0
Dactylis	genus	4508	Bluegrass	Plants	8	0	0	0	0	5
Echinochloa	genus	45618		Plants	255	105	147	95	383	277
Festuca	genus	4605	Grass	Plants	49	0	357	0	0	41
Glyceria	genus	37871	Mannagrasses; sweet-grasses	Plants	2273	1959	2062	1798	1488	1553
Holcus	genus	15560	Soft-grasses; velvet grasses	Plants	0	0	89	0	0	0
Juncus	genus	13578	Rushes	Plants	911	785	634	928	843	773
Lotus	genus	3867		Plants	0	221	76	0	0	0
Orychophragmus	genus	71233		Plants	22	168	46	0	36	12
Paspalum	genus	147271	Paspalums; dallis grasses	Plants	519	188	518	502	412	394
Persicaria	genus	61508	Knotweeds	Plants	0	0	136	0	0	0
Polygonum	genus	46786		Plants	0	0	121	0	0	0
Populus	genus	3689	Poplars; aspens; cottonwoods	Plants	0	39	141	70	68	67
Ranunculus	genus	3445	Buttercups; spearworts; water crowfoots	Plants	0	119	0	0	56	41
Salix	genus	40685	Willows	Plants	0	5	0	0	0	0
Sorghum	genus	4557		Plants	0	0	355	0	0	0
Stuckenia	genus	246706		Plants	77	85	27	39	34	42
Veronica	genus	4173	Brooklimes	Plants	4094	3492	3183	1781	2368	3087
Zea	genus	4575		Plants	0	7	0	0	0	0
Mesangiospermae	clade	1437183		Plants	44	0	447	0	42	6
Pentapetalae	clade	1437201		Plants	66	76	227	393	321	306
Agrostidinae	subtribe	640621		Plants	0	25	169	140	0	6
Andropogoneae	tribe	147429		Plants	0	0	69	0	0	0
Poeae	tribe	147387		Plants	81	96	455	463	154	142
Potentilleae	tribe	721789		Plants	0	0	0	0	0	122

Saliceae	tribe	238069		Plants	0	0	0	0	0	61
Chenopodioideae	subfamily	1307796		Plants	0	0	0	0	0	47
Chloridoideae	subfamily	147371		Plants	0	0	0	0	23	0
Cyperoideae	subfamily	986140		Plants	0	21	0	0	0	15
Panicoideae	subfamily	147369		Plants	575	132	271	33	173	202
Pooideae	subfamily	147368		Plants	299	522	222	109	65	0
Rosoideae	subfamily	171638		Plants	0	0	26	0	0	17
Araliaceae	family	4050	Ginseng family	Plants	0	0	94	0	0	0
Asparagaceae	family	40552	Asparagus family	Plants	0	0	0	0	16	0
Asteraceae	family	4210	Daisy family	Plants	0	0	73	0	0	40
Brassicaceae	family	3700	Mustard family	Plants	1229	2631	947	728	2111	1513
Chenopodiaceae	family	1804623		Plants	40	0	0	0	0	0
Cucurbitaceae	family	3650	Cucumber family	Plants	0	0	114	118	77	0
Cyperaceae	family	4609	Sedge family	Plants	0	55	0	0	0	0
Fagaceae	family	3503	Beech family	Plants	0	0	0	113	0	0
Lamiaceae	family	4136	Mint family	Plants	38	0	0	0	0	45
Malvaceae	family	3629	Mallow family	Plants	0	0	21	0	0	0
Moraceae	family	3487	Mulberry family	Plants	0	0	0	62	0	0
Poaceae	family	4479	Grass family	Plants	667	381	767	577	418	661
Potamogetonaceae	family	16362	Horned pondweed family	Plants	472	456	205	497	434	323
Primulaceae	family	4335	Primrose family	Plants	0	0	0	0	0	29
Brassicales	order	3699		Plants	715	4340	848	1039	4616	3804
Myrtales	order	41944		Plants	31	74	0	0	0	0
Poales	order	38820		Plants	86	148	239	0	275	229
Petrosaviidae	subclass	1437197		Plants	0	0	0	0	16	0
Magnoliopsida	class	3398	Angiosperms	Plants	94	12	121	293	62	68
Echinochloa crus-galli var. crus-galli	varietas	338575		Plants	22	41	0	30	50	0
Prostoma graecense	species	324887	Freshwater nemertean	Ribbon worms	0	5	37	0	0	0
Prostoma	genus	35727		Ribbon worms	0	0	32	0	32	0
Proales fallaciosa	species	1087462		Rotifers	5	0	0	0	8	8
Rotaria rotatoria	species	231624	Rotifer	Rotifers	6	0	0	46	0	0
Lecane	genus	96445	Rotifer	Rotifers	0	0	0	5	0	0
Ploima	order	84394		Rotifers	0	96	26	42	0	7
Eurotatoria	class	2816136		Rotifers	13	168	38	16	42	32
unclassified Philodina	no rank	2625787		Rotifers	11	14	14	8	7	17
Monhysteridae	family	120165		Roundworms	48	5	54	59	0	0
Tobrilidae	family	1337729		Roundworms	0	0	6	0	0	0
Chromadorea	class	119089		Roundworms	0	0	0	9	5	5
environmental samples	no rank	213072		Roundworms	0	0	11	0	0	0
Isotomidae	family	36141	Smooth springtails	Springtails	6	0	0	0	0	0
Aulodrilus pluriseta	species	76585	Aquatic oligochaete worm	Worms	814	219	293	17	443	52
Bothrioneurum vejdovskyanum	species	188204	Worm	Worms	12	9	0	0	48	101
Branchiura sowerbyi	species	195543	Oligochaete worm	Worms	514	195	291	13	336	30

Chaetogaster diaphanus	species	212246	Oligochaete worm	Worms	20	0	25	5	73	17
Chaetogaster diastrophus	species	74727	Oligochaete worm	Worms	577	231	121	585	899	3069
Eiseniella tetraedra	species	1302610	Squaretail worm	Worms	162	0	19	61	34	41
Henlea ventriculosa	species	913666	Worm	Worms	0	0	21	0	0	14
Ilyodrilus templetoni	species	170993	Aquatic worm	Worms	8	0	0	0	0	0
Limnodrilus hoffmeisteri	species	76587	Redworm	Worms	0	0	39	0	45	0
Limnodrilus udekemianus	species	146604	Worm	Worms	5	0	0	0	0	0
Lumbricus rubellus	species	35632	Red earthworm	Worms	0	0	0	0	81	0
Nais christinae	species	1138466	Sludgeworm	Worms	76	54	41	35	145	0
Tubifex tubifex	species	6386	Sludge worm	Worms	0	7	0	0	0	0
Aeolosoma	genus	55816	Minute freshwater worm	Worms	0	0	5	0	12	0
Fridericia	genus	77730	Worm	Worms	19	0	0	0	0	0
Limnodrilus	genus	76586	Worm	Worms	376	0	5	0	47	80
Nais	genus	74730	Sludgeworm	Worms	297	52	58	107	308	23
Pristina	genus	150439	Worm	Worms	0	0	0	0	14	0
Lumbricinae	subfamily	1046325		Worms	0	14	0	6	0	0
Naidinae	subfamily	1780200	Sludgeworms	Worms	34	41	0	15	127	329
Tubificinae	subfamily	1780203		Worms	0	47	0	0	272	0
Aeolosomatidae	family	55815		Worms	0	7	0	0	0	0
Enchytraeidae	family	6388		Worms	0	0	0	0	0	16
Lumbricidae	family	6392		Worms	0	0	0	0	0	7
Naididae	family	2109251	Sludgeworms	Worms	34	0	76	46	0	854
Clitellata	class	42113		Worms	47	42	28	17	80	44

Appendix D: Benthic Macroinvertebrate Results

Table D-1: Aquatic Results for Whirinaki Stream

Taxa	MCI score	MCI-sb score	W_UPS	W_MID	W_DWN	Count
		Sample Name				
Mayfly *Deleatidium*	8	5.6	1			1
Caddisfly *Oxyethira*	2	1.2		9	11	20
Caddisfly *Paroxyethira*	2	3.7		3	4	7
Caddisfly *Triplectides*	5	5.7	2		1	3
Damselfly *Ischnura*	6	3.1	3	32	39	74
Damselfly *Xanthocnemis*	5	1.2	2	10	8	20
Bug *Mesovelia*	5	5.0			1	1
Bug *Microvelia*	5	4.6		3	8	11
Bug *Sigara*	5	2.4		2	2	4
Beetle *Antiporus*	5	3.5		1	1	2
Beetle Hydrophilidae	5	8.0		3		3
Beetle Staphylinidae	5	6.2			1	1
True Fly Ceratopogonidae	3	6.2		1		1
True Fly *Chironomus*	1	3.4		1	8	9
True Fly *Corynoneura*	2	1.7		39	7	46
True Fly Muscidae	3	1.6			2	2
True Fly Orthocladiinae	2	3.2		5	22	27
True Fly *Paradixa*	4	8.5	1	1		2
True Fly Stratiomyidae	5	4.2	1			1
True Fly Tanytarsini	3	4.5		2	19	21
Moth *Hygraula*	4	1.3			1	1
Collembola	6	5.3		1	1	2
Crustacea Ostracoda	3	1.9	3	1		4
Crustacea *Paracalliope*	5	0.0	58	2		60
SPIDERS *Dolomedes*	5	6.2	1	2		3
Mollusc Lymnaeidae	3	1.2		1		1
Mollusc *Physella* (Physa)	3	0.1	2	34	16	52
Mollusc *Potamopyrgus*	4	2.1	324	64	49	437
OLIGOCHAETES	1	3.8			1	1
PLATYHELMINTHES (Flatworms)	3	0.9			1	1
Number of Taxa			11	21	21	
EPT Value			2	0	1	
Number of Individuals			398	217	203	
% EPT			0.75	0.00	0.49	
% EPT Taxa			18.18	0.00	4.76	
Sum of recorded scores			47	73	71	
Count of recorded scores			10	20	20	
Sum of individuals with scores			395	185	164	
MCI Value			**94.00**	**73.00**	**71.00**	
Sum of abundance load			1643	611	527	
QMCI Value			**4.16**	**3.30**	**3.21**	
Sum of recorded scores			38.6	72	64.5	
Count of recorded scores			10	20	21	
Sum of individuals with scores			340	215	203	
MCI-sb Value			**77.20**	**72.00**	**61.43**	
Sum of abundance load			733.9	447.2	534.5	
QMCI-sb Value			**2.16**	**2.08**	**2.63**	
Fraction examined for VA taxa			1/16	2/16	2.25/16	