Ecological Impact Assessment

Tokanui Hospital Remediation

Land Information New Zealand

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Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
1.0	26 July 2024	Kendall Leitch	Hamish Dean	Hamish Dean

Basis of Report

This report has been prepared by SLR Consulting New Zealand (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Land Information New Zealand (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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1.0 Introduction

1.1 Background

The former Tokanui Hospital is located approximately 14 kilometres south of Te Awamutu in the Waikato Region (Figure 1). The 80 hectares of land in which the hospital resides became Crown land under the Public Works Act in 1910, against the objections from the local iwi and hapu. The hospital functioned as a psychiatric facility from 1912 until its closure in 1998. The land was then transferred to the Treaty Settlement Landbank in 1999 to settle historic claims.

The hospital has been decommissioned, but the infrastructure and buildings remain. This includes 74 hazardous, dilapidated buildings across the site. Additionally, roading, stormwater and wastewater piping, ducting, above and below ground utility lines, and closed landfills remain on site. For the most part, the property is currently unused, although cattle grazing occurs in areas.

Toitū Te Whenua - Land Information New Zealand (LINZ) is responsible for the former Tokanui Hospital site on the Crown's behalf and are seeking to remediate it to an agreed state. It has been determined that this will be undertaken through demolishing the site's buildings and remediating the land prior to offering it to Te Nehenehenui, the Ngāti Maniapoto post Settlement Governance Entity, for purchase.

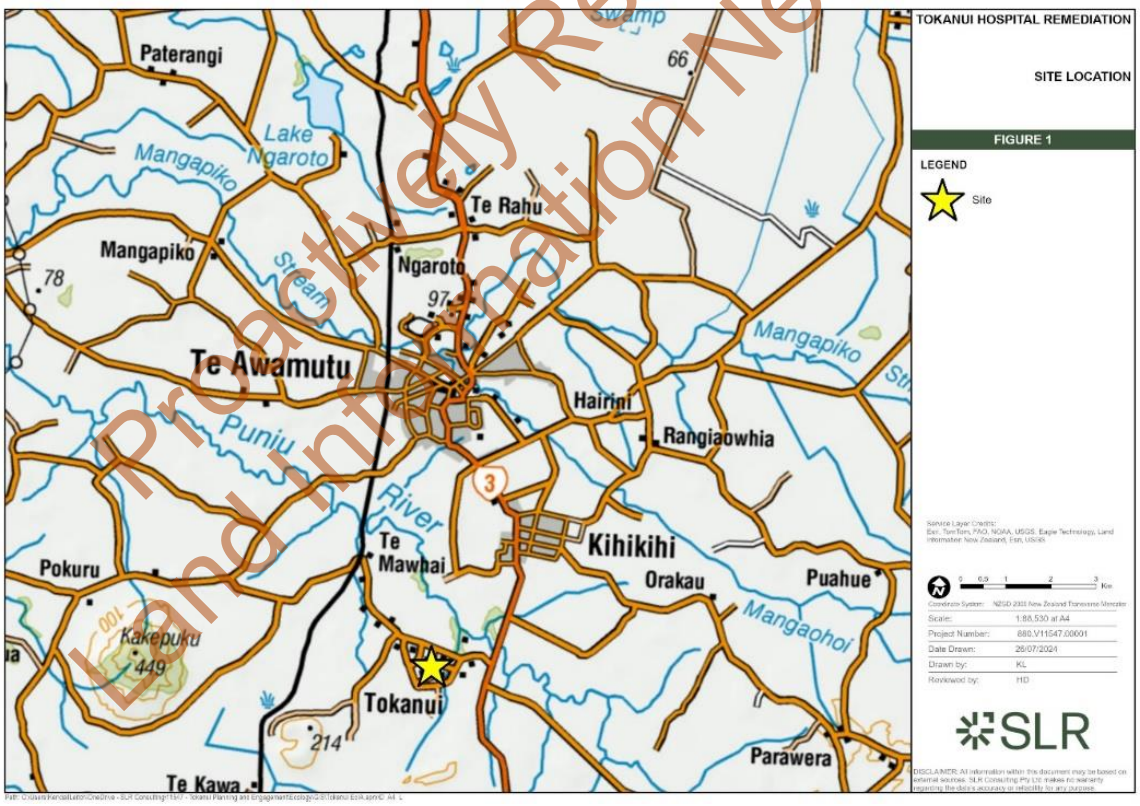


Figure 1: Location of site.

1.2 Report Purpose

The purpose of this report is to provide an assessment of the ecological effects of the proposed demolition and remediation of Tokanui Hospital and its associated infrastructure,

to support a resource consent application. This report details the findings of ecological assessments of the habitats and fauna within the site, their values, and any associated impacts from proposed works. An initial ecological constraints and opportunities assessment (4Sight, 2021) was undertaken during the planning of the project which informed the works plan.

2.0 Methodologies

2.1 Desktop Assessment

Prior to undertaking a site visit, a desktop assessment of the site and surrounds was undertaken. The review of relevant literature and databases was conducted to inform ecological values of the site. Databases and literature reviewed included:

- Aerial imagery
- *Significant natural areas of the Waipa District: terrestrial and wetland ecosystems* report (Kessels & Associates Ltd, 2012)
- Historical imagery, sourced from Retrolens[1]
- The New Zealand Herpetological Society[2]
- New Zealand Bird Atlas[3]
- The National Institute of Water and Atmospheric Research (NIWA) New Zealand Freshwater Fish Database (NZFFD)[4]
- Department of Conservation (DOC) bioweb database[5]
- iNaturalist (research grade observations only)[6]
- Landcare Research OurEnvironment – NZ Land Atlas maps[7]
- Waikato Regional Council Maps (Biodiversity & Environment and Waikato Long-tailed Bat Distribution)[8]
- Waipa District Plan Environment Map[9]

Any species identified through the desktop review were recorded and their threat status checked against the relevant national threatened species classification lists (de Lange et al., 2018; Dunn et al., 2018; Hitchmough et al., 2021; Robertson et al., 2021 and, O'Donnell et al., 2023).

[1] https://retrolens.co.nz/
[2] https://www.reptiles.org.nz/
[3] https://ebird.org/atlasnz/home
[4] https://nzffdms.niwa.co.nz/
[5] https://www.doc.govt.nz/our-work/monitoring-reporting/request-monitoring-data/
[6] https://www.inaturalist.org/
[7] https://ourenvironment.scinfo.org.nz/maps-and-tools/app
[8] https://waikatomaps.waikatoregion.govt.nz/Gallery/
[9] https://www.waipadc.govt.nz/our-services/mapsonline

2.1.1 GIS Mapping

The project area and habitats identified were mapped using ArcGIS Pro. Vegetation, wetland and freshwater habitats were mapped onto aerial imagery to allow for identification and quantification of features that will be impacted by proposed works.

2.2 Site survey

Following a preliminary desktop assessment, site visits and field data collection were conducted on 13 – 14 December 2022 to identify ecological features, potential fauna habitat, and species using the site and surrounds.

2.2.1 Terrestrial Habitat

Vegetation communities within the project footprint were recorded and a qualitative assessment of vegetation and habitats was conducted. The assessment focused on vegetative community composition and the ecological value of the plant community.

2.2.2 Wetlands

Potential wetland features on site were assessed using the wetland delineation protocols developed by the Ministry for the Environment (MfE, 2020 (2)) to support the National Policy Statement for Freshwater Management (NPS FM, MfE, 2020 (1)). The site assessment was undertaken under 'normal circumstances' and within the standard growing season for the Waikato Region.

Where possible, the rapid test was applied. The rapid test is used for assessing areas that are obviously dominated by wetland vegetation across all strata. However, a conservative approach was used to ensure that only wetlands meeting the definition were identified.

Where the rapid test wasn't able to be used, representative vegetation plots were established within or adjacent to potential wetland habitat in order to ascertain whether an area would meet the definition of a natural inland wetland under the Resource Management (National Environmental Standards for Freshwater) Regulations 2020 (NES FM). In total, seven plots were assessed across the site. In accordance with the MfE protocols, for each plot vegetation species and proportional cover in each stratum were recorded. This data can be used to calculate the wetland indicator status for the plot (using the Dominance Test and Prevalence Test). Where these tests produced marginal results, an examination of the soil and hydrological indicators was undertaken as additional measure. Locations of the surveyed wetland plots are shown in Figure 2 and summarised in Appendix B.

Amendments to the NPS FM were released in January 2024 and wetlands identified on site were reassessed against these updates.

2.2.3 Freshwater

Assessment of stream habitat values was carried out along an 80 m survey reach of the Wharekōrino Stream. Conditions during the assessment on 13 December at 09:50 were overcast, with minimal wind and no rainfall was recorded within the preceding 24 hours. A total of 1.0 mm of rain was recorded seven days prior to the assessment being undertaken[10].

A qualitative habitat assessment for wadable soft-bottom streams was undertaken following the Waikato Regional Council's guidelines (Collier and Kelly, 2005). The assessment guides

[10] Waikato Regional Council Environment maps and data. Station: Pūnui River – Bartons Corner Road Br.

field staff to score several habitat parameters on a scale of 0 (poor) to 20 (optimal). The results of the assessment were subsequently used to characterise the conditions of the surveyed reach. The location of the survey reach is shown on Figure 2.

Artificial watercourses on site were also identified, however no formal habitat assessment was undertaken for these.

2.2.3.1 Macroinvertebrates

Two macroinvertebrate samples were collected within the 80 m reach of stream assessed. Sample 1 was collected within the 40 m at the most upstream extent of the assessed reach, and Sample 2 was collected within 40 m at the most downstream extent of the assessed reach (Figure 2). A variety of habitats were sampled including leaf litter, woody debris, macrophytes, root mats, and edges within both pool and flowing areas. Samples were collected using a 500-micron net following Protocol C2 (Stark et al. 2001), preserved in ethanol and analysed according to Protocol P2: 200 Individual Fixed Count with Scan for Rare Taxa. Soft bottom macroinvertebrate indices (Macroinvertebrate Community Index – soft bottom, MCI-sb; and Semi-Quantitative Macroinvertebrate Community Index – soft bottom, SQMCI-sb) were calculated for the samples, as well as total macroinvertebrate taxonomic richness and number of Ephemeroptera-Plecoptera-Trichoptera (EPT) taxa[11]. Interpretation of the macroinvertebrate indices was undertaken as per Stark and Maxted (2007), to describe water quality conditions (Table 1).

Table 1: Interpretation of macroinvertebrate indices, adapted from Stark and Maxted (2007)

Quality Class	Descriptions	MCI-sb	SQMCI-sb
Excellent	Clean water	> 199	> 5.99
Good	Doubtful quality or possible mild pollution	100 – 199	5.00 – 5.90
Fair	Probable moderate pollution	80 – 99	4.00 – 4.99
Poor	Probable severe pollution	< 80	< 4.00

2.2.4 Significance of Indigenous Biodiversity Assessment

The Operative Waikato Regional Policy Statement (WRPS) sets out criteria for identifying areas of significant indigenous biodiversity based on their characteristics as they exist at the time the criteria are being applied. Criteria may be specific to a habitat type (i.e., water, land or airspace) or be more inclusive and address connectivity, or movement of species across habitat types. The WRPS states that "*To be identified as significant an area needs to meet*

[11] These insect groups are dominated by invertebrates that are indicative of higher quality conditions.

one or more of the criteria identified". The ecological habitats within the site were assessed against the criteria in Appendix 5 of the WRPS.

2.3 Fauna Surveys

2.3.1 Bats

Determining the presence/absence of long-tailed bats (*Chalinolobus tuberculatus*) was undertaken by a desktop review of relevant databases, a qualitative assessment of habitat values during the site walk over, and acoustic surveys.

The site was assessed for old, large trees with small cavities, loose bark, hollow limbs, and epiphyte growth, as long-tailed bats utilise these for roosting, with a preference for roosting >15 m above ground (Sedgeley et al., 2012). Long-tailed bats are also known to use linear habitat features (e.g., shelterbelts) to commute and forage (Borkin & Parsons, 2009).

Bioacoustic bat monitoring was undertaken using AR4 automatic acoustic bat monitors (ABMs) manufactured by the DOC. A total of four bat recorders were deployed across the site, targeting habitat features. The date and time settings were synchronised across the ABMs and they were programmed to monitor from one hour before sunset to one hour after sunrise over a five-week survey period (14/12/2022 - 19/01/2023). All ABM recordings were downloaded, and acoustic data was analysed using the programme AviaNZ Bioacoustic Software. The location of the deployed ABMs is shown on Figure 2.

2.3.2 Avifauna

Incidental sightings and vocalisations of bird species identified during the site visits were recorded. Additionally, a desktop review provided data on other species that may utilise the site.

2.3.3 Herpetofauna

In conjunction with a desktop review of databases to identify potential herpetofauna species using the site, habitat suitable for herpetofauna was identified and targeted searches were carried out in these areas. Suitable habitats and refugia investigated on site included debris, wood stockpiles, and leaflitter. A total of fifteen artificial cover objects (ACOs) were also deployed throughout the site and left for five weeks (14/12/2022 - 19/01/2023) to allow lizards to inhabit them. The locations of the deployed ACOs are shown on Figure 2.

2.3.4 Fish

Four un-baited Gee's minnow traps and two un-baited fyke nets were deployed throughout the 80 m assessment reach overnight (Figure 2). Fish survey methods followed the recommended guidelines outlined in Joy *et al.* (2013). All native fish captured were identified, measured, and released at the capture site. A desktop review of relevant information also provided species data on connected freshwater habitats.

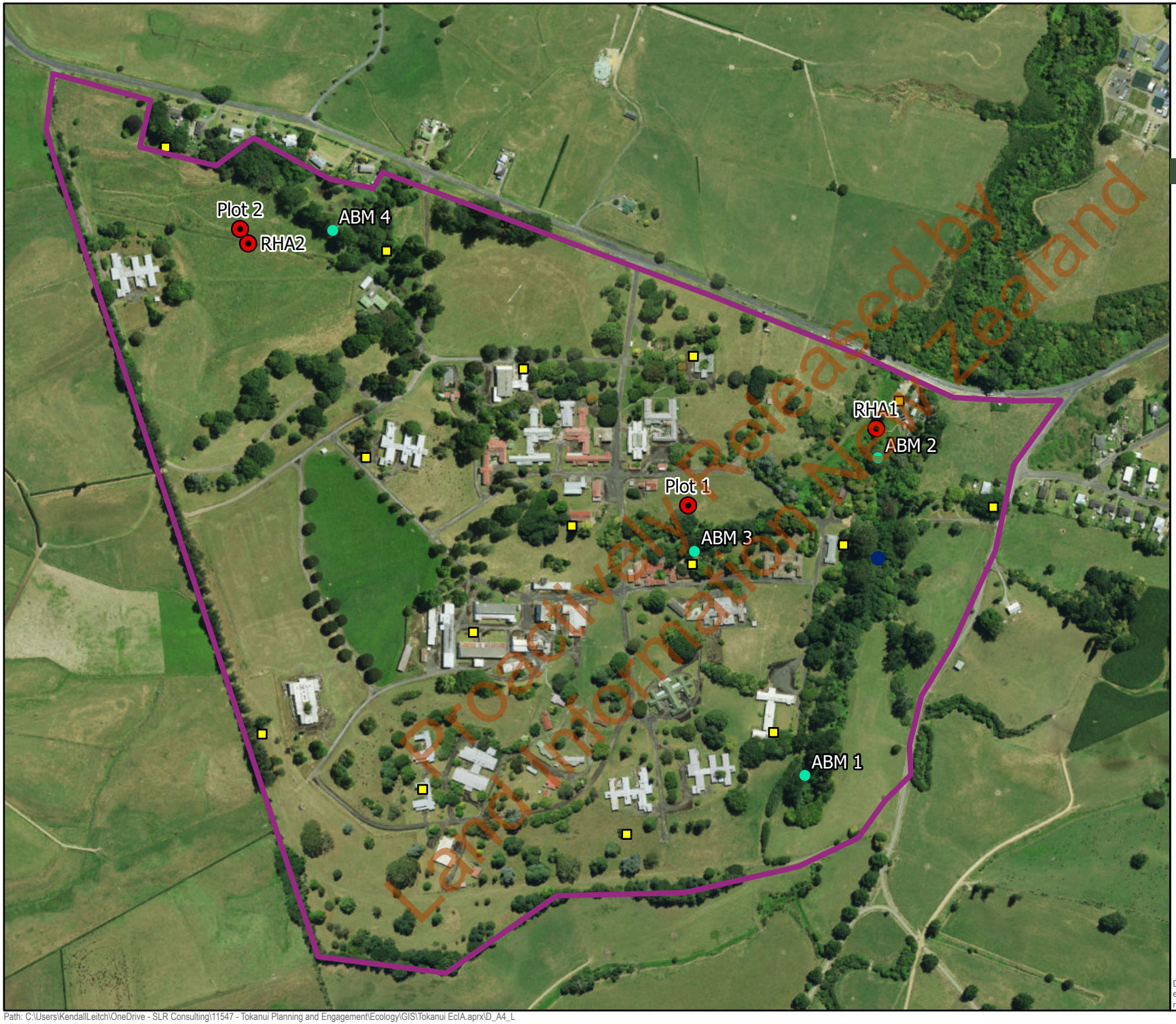
2.4 Assessment of Ecological Effects

The assessment of ecological effects was informed by the Ecological Impact Assessment (EcIA) guidelines of the Environment Institute of Australia and New Zealand (Roper-Lindsay et al. 2018).

The following steps were used for this assessment:

- Ecological values were assigned a level on a scale of Low, Moderate, High or Very High. This was based on an assessment of the values of identified species, communities and habitats according to the criteria set out in the EcIA guidelines.
- The magnitude of effect of the site works on ecological values was evaluated as either No Effect, Negligible, Low, Moderate, High, or Very High. The 'Magnitude of Effect' is based on:
    - The scale of the unmitigated effect per se (i.e. the proposed works, impacts on hydrology, impacts on wetland vegetation);
    - The proportion of habitat loss versus local availability;
    - The expected duration of the effect (e.g. permanent versus temporary); and
    - The intensity of the effect (i.e. the extent to which habitat loss within the site is complete or partial).
- The overall level of effect in the absence of mitigation was determined using a matrix that is based on the ecological values and the magnitude of effects on these values in the absence of any efforts to avoid, remedy or mitigate for potential effects.

The overall level of effect was used to determine if mitigation is required. Effects assessed as 'Moderate' or greater warrant efforts to avoid, remedy and/or mitigate them.



TOKANUI HOSPITAL REMEDIATION

SITE ASSESSMENT AND SURVEY AREA

FIGURE 2

LEGEND

- Site Boundary
- Stream assessment
- Wetland plot
- ACOs
- ABMs

Service Layer Credits:
Esri, TomTom, FAO, NOAA, USGS, Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributors, Esri, USGS

0 50 100 150 200 Meters

Coordinate System:	NZGD 2000 New Zealand Transverse Mercator
Scale:	1:6,245 at A4
Project Number:	880.V11547.00001
Date Drawn:	19/11/2024
Drawn by:	KL
Reviewed by:	HD

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3.0 Ecological Context

Tokanui is located within the Waipa Ecological District (ED), a lowland ED that has historical peat bog wetlands. Clearing of native vegetation for farmed pasture and residential properties resulted in only 1 – 2 % remaining by 1995. This includes <1% of original scrub, 1% of indigenous forest, and <0.5% of wetlands remaining.

Natural vegetation cover across the site would predominantly have been mixed podocarp-broadleaved forest with dominant species comprising rimu (*Dacrydium cupressinum*) and tawa (*Beilschmiedia tawa*). Wetlands throughout the area would have been a combination of swamp, marsh, bog, and fen and kahikatea (*Dacrycarpus dacrydioides*) forest would have been common. A large swamp wetland that connected to the Pūniu River and associated catchments was part of a larger network of connected wetland habitat. This wetland extended over the Tokanui Hospital site (Figure 3).

Threatened flora and fauna have been identified within the largest protected area in the ED, the Kakepuku Reserve, which is approximately five kilometres from the site. In addition, long-tailed bats have been recorded near Pirongia and Kohikihi.

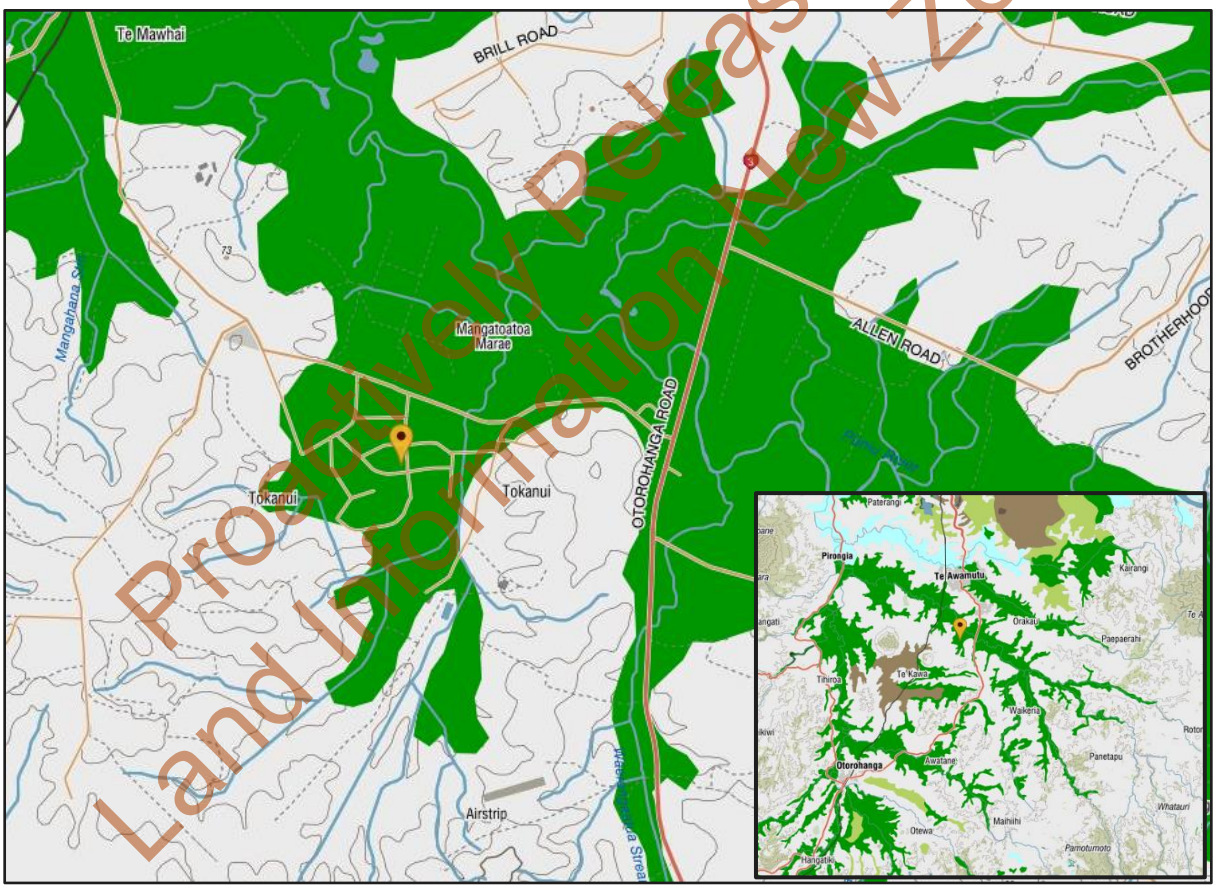


Figure 3: Historic wetland extent in and surrounding the site. Centre of site shown as an orange marker.

4.0 Results

4.1 Terrestrial

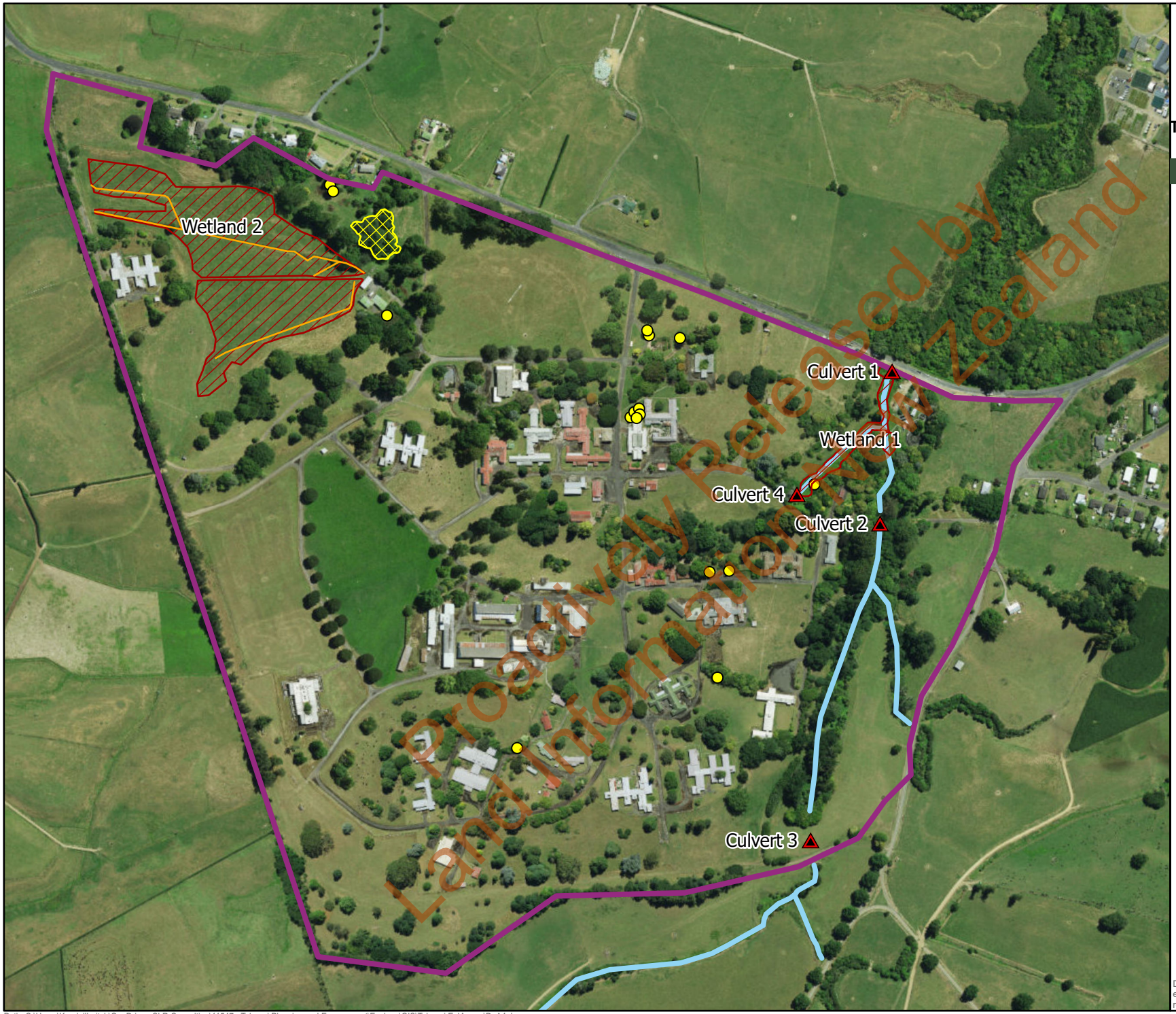
4.1.1 Vegetation

Terrestrial vegetation was predominantly exotic, with a number of pest plant species observed. Pest plants identified include Japanese honeysuckle (*Lonicera japonica*), blackberry (*Rubus fruticosus agg.*), pampas (*Cortaderia selloana*), woolly nightshade (*Solanum mauritianum*), black nightshade (*Solanum nigrum*), *Agapanthus* (*Agapanthus praecox* subsp. *orientalis*), Chinese privet (*Ligustrum sinense*), English ivy (*Hedera helix*), crack willow (*Salix fragilis*), *Tradescantia* (*Tradescantia fluminensis*), and tree privet (*Ligustrum lucidum*).

Large planted native trees (>4 m height) were sporadically located across the site and present in low numbers. These species included tōtara (*Podocarpus totara var. totara*), rimu, miro (*Pectinopitys ferruginea*), one kahikatea (*Dacrycarpus dacrydioides*) and five kauri (*Agathis australis*); the only Threatened – Nationally Vulnerable species (de Lange et al., 2018) (Photo 1). Large native trees were often in a stand amongst other native or exotic trees with grassed or no understorey. The largest stand of native trees was located in the northeastern part of the site and included tōtara with occasional rimu and miro (Photo 2). Native tree locations are shown on Figure 4.

Photo 1: Large kauri and rimu trees next to a building on site, with grass understory.

Photo 2: Native tree stand with no understory.



TOKANUI HOSPITAL REMEDIATION

ECOLOGICAL FEATURES

VEGETATION SITE-WIDE IS CLASSIFIED AS LARGE EXOTIC TREES OR EXOTIC / NATIVE SCRUB

FIGURE 4

LEGEND

- Culvert
- Large native tree
- Wharekōrino Stream
- Artifical watercourses
- Native tree stand
- Wetlands
- Site Boundary

Service Layer Credits:
Esri, TomTom, FAO, NOAA, USGS, Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributors, Esri, USGS

0 50 100 150 200 Meters

Coordinate System:	NZGD 2000 New Zealand Transverse Mercator
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Reviewed by:	HD

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There are also large, mature exotic trees across the site, with some existing as standalone trees and others forming tree lines, shelterbelts, riparian vegetation, or growing amongst scrub habitat. The species identified was a mix of exotic, ornamental, and pest plants. The main species identified included pine (*Pinus* sp.), blue gum (*Eucalyptus globulus subsp. globulus*), European oak (*Quercus robur*), red oak (*Quercus rubra*), tree privet, poplar (*Populus nigra*), *Casuarina* species, silver dollar gum (*Eucalyptus cinerea*), satinwood (*Nematolepis squamea)*, Japanese walnut (*Juglans ailantifolia*), red maple (*Acer rubrum*), European beech (*Fagus sylvatica*), magnolia (*Magnolia grandiflora*), silver birch (*Betula pendula*), and cherry (*Prunus* species*)*.

Photo 3: Exotic shelterbelt along the western boundary.

Photo 4: Large exotic trees adjacent to the stream bordering the site.

The remaining vegetation was classified as native and exotic scrub, being predominantly exotic with occasional native plants present. Species identified included lemonwood (*Pittosporum eugenioides*), tōtara, miro, tree privet, Chinese privet, Japanese honeysuckle, rank grass, Italian evergreen buckthorn (*Rhamnus alaternus*), Agapanthus, Chinese elm (*Ulmus parvifolia*), horse chestnut (*Aesculus hippocastanum*), English ivy, karamu (*Coprosma robusta*), red ceder (*Thuja plocata*) blackberry and bracken fern (*Pteridium esculentum*). Riparian vegetation along the stream also included Tradescantia, cabbage tree (*Cordyline australis*), and crack willow.

All terrestrial vegetation has been assessed as having **low** ecological value (Table 4).

4.1.2 Long-tailed Bats

Waikato Regional Council have determined that the site is within the range of long-tailed bat habitat, with the nearest confirmed bat detection 3.5 km from the site, in Kihikihi (Figure 5). The species typically favours native forest but has also adapted to utilising exotic vegetation in farmland for foraging, roosting, and commuting in the absence of native species (O'Donnell, 2000). A large threat to the remaining populations of long-tailed bats is habitat fragmentation. With any large vegetation now crucial in deforested areas, exotic vegetation is important habitat for the species. Therefore, the many large native and exotic trees as well as the scrub habitat and riparian vegetation on site may provide roosting, commuting and foraging habitat for long-tailed bats. In addition, although it is thought to be rare, long-tailed

bats have been known to occupy human structures as habitat as substitutes for natural roosts (Daniel and Williams, 1981). Therefore, the abandoned buildings on site have the potential to provide roosting habitat. It is considered that the site provides a variety of suitable habitats for long-tailed bats within an ED that has experienced a significant reduction in native habitat, as only 1% of indigenous forest and <1% of scrub habitat remains (Kessels and Associates, 2012).

Initial bioacoustic monitoring detected four long-tail bat vocalisations at the southern-most monitor (ABM 1). This confirms the presence of long-tailed bats within the site. Additional monitoring undertaken for the Tokanui Bat Management Plan (BMP) detected vocalisations across the site as well as numerous areas with appropriate roosting, commuting, and foraging habitat.

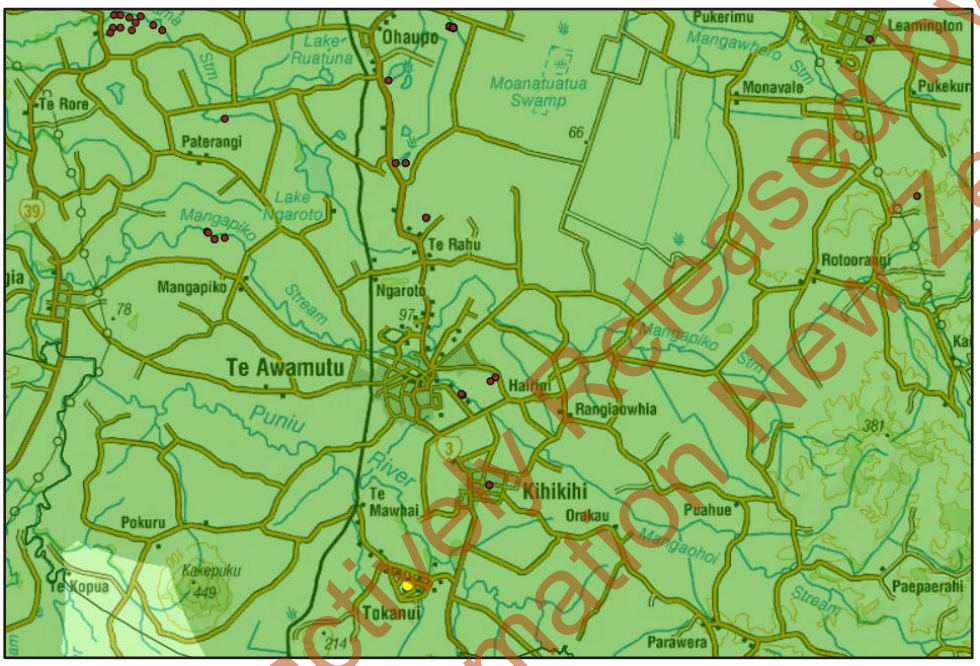

Figure 5: Long-tailed bat detections (red points) and bat habitat (dark green) surrounding the site (yellow point).

4.1.3 Avifauna

Avifauna recorded on the site included a number of native and exotic species (Table 2), all typical of highly modified environments. Rock pigeons (*Columba livia*) were commonly seen throughout the site and were observed nesting in buildings. No At-Risk or Threatened avifauna species were observed and although North Island kaka (*Nestor meridionalis septentrionalis*) have been observed three kilometres away in Kihikihi it is unlikely that they utilise this site as it is highly modified and lacks forested habitat. Native avifauna observed may utilise the large trees on site for nesting.

Table 2: Avifauna species identified on or near the site. Dark green indicates primary habitat and light green secondary habitat. * Indicates recorded on site.

Species	Scientific name	Conservation status	Native forest	Exotic Forest	Scrub / shrubland	Farmland / open country	Freshwater / wetlands	Urban/ Residential
Tui*	*Prosthemadera n. novaeseelandiae*	Not Threatened						
Kereru	*Hemiphaga novaeseelandiae*	Not Threatened						
Pukeko*	*Porphyrio m. melanotus*	Not Threatened						
Bellbird*	*Anthornis m. melanura*	Not Threatened						
Morepork*	*Ninox n. novaeseelandiae*	Not Threatened						
Grey warbler*	*Gerygone igata*	Not Threatened						
North Island fantail*	*Rhipidura fuliginosa placabilis*	Not Threatened						
Kingfisher*	*Todiramphus sanctus vagans*	Not Threatened						
Shining cuckoo*	*Chrysococcyx l. lucidus*	Not Threatened						
Welcome swallow*	*Hirundo n. neoxena*	Not Threatened						
Swamp harrier*	*Circus approximans*	Not Threatened						
North Island Kaka	*Nestor meridionalis septentrionalis*	At Risk – Recovering						
Song thrush	*Turdus philomelos*	Introduced						
Magpie*	*Gymnorhina tibicen*	Introduced						
Pheasant*	*Phasianus colchicus*	Introduced						
Eastern rosella*	*Platycercus eximius*	Introduced						
House sparrow*	*Passer domesticus*	Introduced						
Yellowhammer*	*Emberiza citrinella*	Introduced						
Rock pigeon*	*Columba livia*	Introduced						
Myna*	*Acridotheres tristis*	Introduced						
Chaffinch*	*Fringilla coelebs*	Introduced						
Goldfinch*	*Carduelis carduelis*	Introduced						
Greenfinch*	*Carduelis chloris*	Introduced						
Blackbird*	*Turdus merula*	Introduced						
Spotted dove*	*Streptopelia chinensis tigrina*	Introduced						

4.1.4 Herpetofauna

Lizard species that may be present, based on habitat preferences and known distribution, have been included in Table 3, however no species were observed during site surveys of preferred habitat. As a result of the high level of modification of the site and likely high numbers of mammalian pest species in and surrounding the site, it is considered highly unlikely that native skinks are present. The exotic plague skink is likely to be the only species inhabiting the site, as this species is better adapted to mammalian predator avoidance. No native gecko or frog species are likely to be present as the site does not have appropriate habitat to support them.

Table 3: Lizard species that may utilise the site.

Species	Threat Status	Habitat
Crenulate skink (*Oligosoma robinsoni*)	At-Risk - Declining	Open forest, scrub or pasture at inland sites. When not actively foraging or basking, crenulate skinks take refuge on the ground under rocks, logs, driftwood, or in dense vegetation.
Copper Skink (*Oligosoma aeneum*)	At-Risk - Declining	Found in urban areas. Most commonly found in thick, rank grass, compost heaps, or under rocks, logs and other debris.
Plague skink (*Lampropholis delicata*)	Introduced and Naturalised	This species occurs in a wide range of habitats, including gardens, industrial sites, road and railway clearings, rough pasture, open coastal habitats, as well as clearings around forests and shrublands.

4.2 Terrestrial Ecological Values

4.2.1 Vegetation

Vegetation across the site was predominantly exotic with limited understorey present. Native and exotic scrub areas did have tiered vegetation, however, native species were relatively scarce and pest plant species were prolific. No vegetation assemblages on site are considered to be representative of natural vegetation in the ED.

Kauri was the only plant species that is considered Threatened. Although considered Nationally Vulnerable due to impacts of kauri dieback disease, the few trees present are planted and have no native canopy or understorey and are not a self-sustaining population. All vegetation on site does provide potential habitat for long-tailed bats. Large exotic and native trees provide potential roosting, foraging, and commuting habitat for this Threatened species (O'Donnell et al., 2023). Shrubs within the exotic and native scrub also provide foraging habitat for the species.

All terrestrial vegetation has been assessed to have **Low** ecological value (Table 4), with the habitat it provides for long-tailed bats contributing to the overall value of the exotic vegetation.

4.2.2 Fauna

As long-tailed bats are classified as Threatened – Nationally Critical (O'Donnell et al., 2023) and they are present on site they are assessed as having **Very High** ecological value.

Ecological value of herpetofauna on site has been assessed as **Negligible** due to the lack of appropriate habitat for most native species as well as no observations of native species, making it highly unlikely that native herpetofauna inhabit the site.

As it is highly likely that Not Threatened avifauna species are the only species to utilise habitat within the proposed works area, the ecological value of avifauna has been assessed to be **Low**.

Table 4: Ecological value of terrestrial vegetation.

Matter	Native trees	Exotic trees	Native and exotic scrub
Representativeness	**Very Low** Although native species are present, they are all mature with no native mid-tier or understory or are growing amongst exotic vegetation. Therefore, the native species assemblage is not considered representative of the ecological district.	**Very Low** Comprises exotic species assemblages within a heavily modified environment.	**Very Low** Although some areas support tiered vegetation, it is predominantly exotic in composition, with native species only occasionally observed.
Rarity/distinctiveness	**Moderate** Kauri is classified as a Threatened - Nationally Vulnerable species due to the impact of kauri dieback disease. Native vegetation is largely absent within the region, however native vegetation on site is planted and not regenerating, therefore not self-sustaining. Mature trees do have the potential to provide roosting and corridor habitat for long-tail bats, which is also a Threatened species, but these species are highly mobile and also utilise farmland and urban environments.	**Low** Comprised of exotic species commonly found within the region. There is the potential that they provide roosting and corridor habitat for long-tail bats, but these species are highly mobile and also utilise farmland and urban environments.	**Low** Comprised predominantly of exotic species and native species commonly found within the region. There is the potential that they provide foraging, roosting and corridor habitat for long-tail bats (Threatened species) but these species are highly mobile and also utilise farmland and urban environments.

Diversity and Pattern	**Very Low** As the native vegetation is limited to small, discrete areas and/or located amongst exotic species, natural species diversity is lacking, and the community does not display the structure of natural forest.	**Very Low** Non-natural diversity and pattern as entirely exotic in composition.	**Very Low** Non-natural diversity and pattern as majority of community is exotic, with occasional common natives and an abundance of pest plant species.
Ecological Context	**Very Low** The site is highly modified and sporadic native trees are not resilient to anthropogenic impacts. Native trees do not provide connectivity or buffering to habitats in the wider ED.	**Very Low** No habitat connectivity or buffering is provided by large exotic trees on site.	**Low** Highly modified environment that provides habitat within the stream; however without a regenerating understory. The vegetation does provide some buffering to the Wharekōrino Stream and connectivity stream habitat upstream and downstream of the site bounds.
Overall Ecological Value	**Low**	**Low**	**Low**

4.3 Freshwater

4.3.1 Wharekōrino Stream

A portion of the Wharekōrino Stream, a tributary of the Pūniu River, flows along the eastern boundary of the site. Its headwaters are to the south of the site and consist of modified watercourses surrounded by pastural land (Figure 6). Three culverts intersect the stream within the site's boundaries. "Culvert 1" is located at the northernmost extent of the site, beneath Te Mawhai Road, connecting the stream to densely vegetated native and exotic habitat beyond the site bounds but similar habitat to what was observed on site (Photo 5 and photo 6). The culvert was unable to be observed, however, the pooling of water and surface scum directly upstream of the culvert location indicates the culvert was at capacity during the time of the assessment. "Culvert 2" is beneath an embankment constructed for an access to Tokanui Hospital. Pooling of water and debris upstream of this culvert and the lack of flow downstream indicates this culvert may be blocked (Photo 7 and Photo 8). The farm crossing at the most upstream extent on site is the location of "Culvert 3". Upstream of this culvert the stream is channelised and has a recently planted riparian zone. (Photo 9 and Photo 10). A piped reticulation system under the hospital site discharges hospital runoff and upgradient rural runoff into a tributary of the Wharekōrino Stream as does another culvert (Culvert 4) draining a detention basin within the hospital site. All culvert locations are shown on Figure 4.

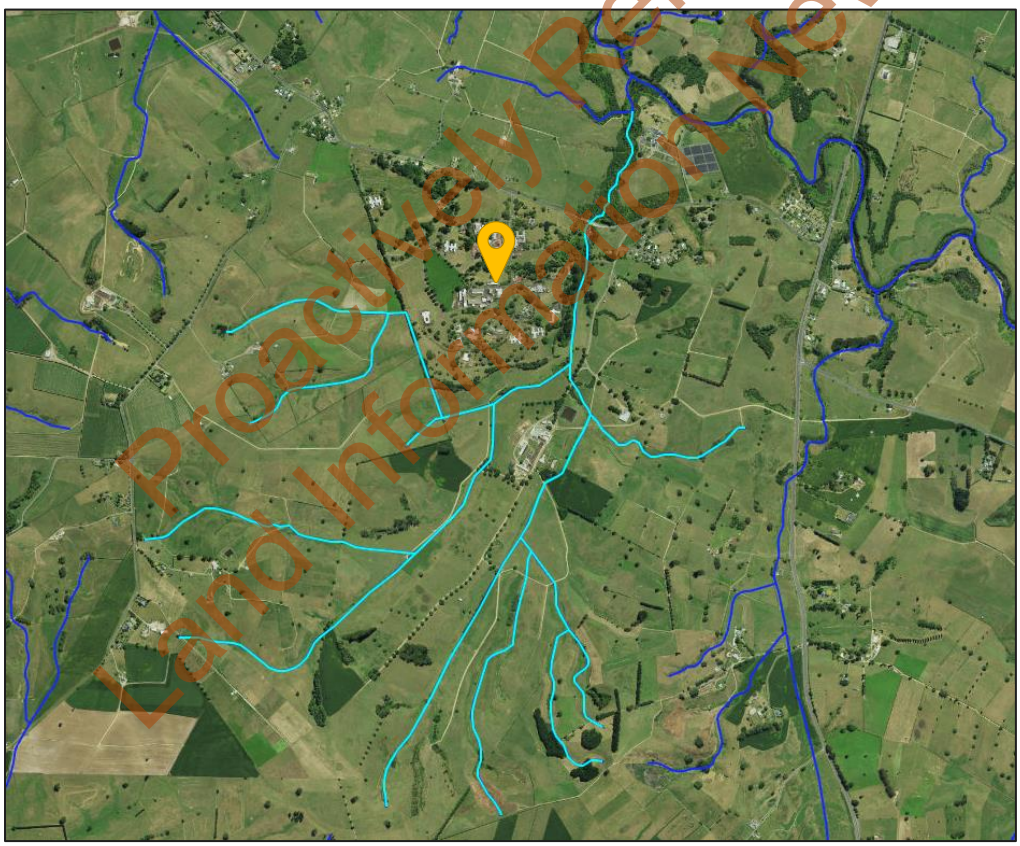

Figure 6: Wharekōrino Stream and the wider catchment (light blue) surrounding the site (orange point centre of site).

Photo 5: Upstream of Culvert 1.

Photo 6: Pooling above Culvert 1.

Photo 7: Downstream Culvert 2. Pooled water and debris visible.

Photo 8: Upstream of Culvert 2, no flow evident.

Photo 9: Downstream of Culvert 3.

Photo 10: Upstream of Culvert 3.

4.3.2 Stream Habitat Assessment

The assessed reach of the Wharekōrino Stream is located upstream of the old hospital access road. Vegetation was predominantly exotic in composition, with gum trees, Japanese honeysuckle, crack willow, and Tradescantia dominating the riparian zone on both banks (Photo 11). Both banks had little evidence of active erosion and were fenced off from stock access. The soft bottomed watercourse meandered along a natural flow path with a gently sloping gradient and wide, deep channel. The stream substrate was primarily made up of sand and fine sediments which were loosely packed, resulting in bars and many large, deep pools. Water was clear, cold, and fast flowing, however, due to the naturally low gradient, velocity slows with distance downstream. Submerged macrophytes were prolific with native blunt pondweed (*Potamogeton ochreatus*) being the most abundant. Exotic macrophytes, including water purslane (*Ludwigia palustris*), Primrose willow (*Ludwigia peploides sub. monteridensis*) and water pepper (*Persicaria hydropiper*) were also present, and no periphyton was observed. The abundance of macrophytes, deep pools, and overhanging Tradescantia provides a large amount of habitat for freshwater fish. In addition, some woody debris and root mats provide habitat diversity for macroinvertebrates.

Table 5: Habitat assessment for Wharekōrino Stream.

Habitat Parameter	Condition	Justification
Riparian Vegetative Zone width	Optimal	Continuous and dense with a width of <10 m for both banks.
Vegetative Protection	Suboptimal	Vegetation was exotic, however bank disruption was rare and was >10 m on both sides.
Bank Stability	Optimal	Both banks had minimal active erosion occurring.
Channel Sinuosity	Suboptimal	Bends throughout the reach, although straight areas are also present.
Channel Alteration	Optimal	Channel path appears to follow a natural pattern.
Sediment Deposition	Marginal	Large amounts of sand and fine sediments forming old and new bars throughout the reach.
Pool variability	Suboptimal	Majority of pools were large and deep.
Abundance and Diversity of Habitat	Optimal	Woody debris, overhanding vegetation, root mats, macrophytes abundant throughout reach.
Periphyton	Marginal	Largely absent from the softbottom reach due to lack of stable substrates.

Photo 11: Looking upstream of the assessment reach.

4.3.3 Macroinvertebrates

Both macroinvertebrate samples from the stream contained a high number of taxa but were dominated by pollutant tolerant species. A small number of sensitive species were also present, with six EPT taxa identified overall. MCI scores indicate poor water quality with probable severe pollution for sample 1 and fair water quality with probable moderate pollution for sample 2 (Stark and Maxted, 2007). The SQMCI indicates poor water quality with probable severe pollution for both sample locations. The disparity between the MCI and SQMCI score for Sample 2 is due to the difference between how the two metrics are calculated: MCI is a presence/absence measure, while SQMCI considers the relative abundance of each scoring taxon. Therefore, the low SQMCI score for Sample 2 is indicative of sensitive taxa being present but the numbers of tolerant species being more abundant. Abundant tolerant species include true flies (*Dipteria* sp.) and freshwater snails (*Potamopyrgus antipodarum*).

Observations in Section 4.3.2 indicate habitat parameters are predominantly optimal to suboptimal. Therefore, although it cannot be determined conclusively, poor water quality is possibly the main contributor to higher abundances of tolerant macroinvertebrate species. Surrounding and upstream land use of grazing cattle and potential leaching from the landfill at the southern end of the site, have likely degraded water quality within the stream.

Table 6: Macroinvertebrate counts and biotic indices.

	Sample 1	Interpretation	Sample 2	Interpretation
Number of taxa	20		28	
Number of EPT taxa	2		6	
% EPT taxa	10		21	
% EPT abundance	2		1	
MCI-sb score	73.0	Poor	82.1	Fair
SQMCI-sb score	1.8	Poor	2.2	Poor

4.3.4 Fish

Two native fish species were captured during the fish survey, including shortfin eels (Not Threatened, Dunn et al., 2017) at various life cycle stages, and a longfin eel, an At-Risk species (Table 7). These species have also been recorded in the NZFFD at locations upstream and downstream of the survey site. Gambusia (*Gambusia affinis*), a pest fish common throughout the region, were observed downstream of the blocked Culvert 2 during the site visit. *Gambusia* were not observed upstream of the culvert, suggesting it is acting as a fish passage barrier to this species.

Native species known to inhabit the wider catchment include banded kōkopu (*Galaxias fasciatus*, Not Threatened) and giant kōkopu (*Galaxias argenteus*, At-Risk – Declining). These climbing species may be present within the reach and not detected by survey efforts; however, they may also be unable to navigate the blocked culvert barrier (Culvert 2).

Culvert 3 has been observed with high flow, preventing inspection of its condition (Fraser Thomas, 2024). Fast, uniform flows through a culvert can also likely act as a barrier to fish passage for some native fish species.

Table 7: Fish species identified within the Wharekōrino Stream catchment.

Species	Threat Status	Observed	Captured	NZFFD
Longfin eel (*Anguilla dieffenbachia)*	At- Risk - Declining		✓	✓
Shortfin eel (*Anguilla australis)*	Not Threatened		✓	✓
Elver (*Anguilla* sp.)			✓	
Gambusia (*Gambusia affinis)*	Introduced	✓		✓

Photo 12: Longfin eel captured within the survey reach.

4.3.5 Artificial watercourses

Approximately 721 m of artificial watercourse is present within pasture in the northwest portion of the site. All watercourses supported an exotic macrophyte community dominated by creeping bent (*Agrostis stolonifera*) and Yorkshire fog (*Holcus lanatus*) (Photo 13 and Photo 14). The watercourses were shallow and had wetted substrate with very shallow pools observed in some areas. Riparian vegetation was predominantly exotic grass, as the watercourses are within grazed pasture, do not connect to any natural aquatic habitat, and were likely created to drain the wetland areas for grazing purposes. It is unlikely native fish species reside within these watercourses due to an absence of a connection to other aquatic habitat and the lack of suitable instream habitat.

Photo 13: Artificial watercourse dominated by creeping bent.

Photo 14: Artificial watercourse dominated by Yorkshire fog.

4.4 Freshwater Ecological Values

4.4.1 Aquatic habitat

The permanent reach of the Wharekōrino Stream within the site has natural characteristics and a reasonably sized catchment that forms part of the Pūniu River catchment. The riparian vegetation is highly modified, being predominantly exotic with pest plant species throughout. Additionally, it is likely water quality within the reach has been impacted by land use surrounding the many tributaries upstream, including grazing and landfill leaching. The stream connects to wetland habitat downstream, including a willow wetland that borders the Pūniu River and which has been identified as a Significant Natural Area (SNA WP330), where native fish species have been observed. Although currently its connection to upstream waterbodies is impeded by culverts that intersect at multiple locations.

Although impacted by modifications to the surrounding environment, the stream provides an abundance of habitat to support aquatic fauna. This is evident by the abundance of macroinvertebrates within the reach, including six EPT taxa species, and two native fish species identified within a wide range of size classes, including the At-Risk longfin eel. The stream has the potential to support the At Risk – Declining giant kokopu, which have been recorded nearby and are known to use Tradescantia as a spawning substrate (Franklin et al, 2015). The Wharekōrino Stream has been assessed to have **High** ecological value (Table 8).

In contrast to the Wharekōrino Stream, the linear artificial watercourses do not provide natural habitat as they are predominantly shallow muddy channels, dominated by exotic species and highly impacted by grazing. They are also not connected to other natural areas of aquatic habitat and lack instream habitat for fauna. The artificial watercourses on site have been determined to have **Negligible** ecological value (Table 8).

4.4.2 Fauna

As longfin eel were present in the fish survey within the Wharekōrino Stream, the ecological value of fish species has been assessed as **High** as it is classified as At-Risk – Declining.

Table 8: Ecological values of freshwater habitat on site.

Matter	Wharekōrino Stream	Artificial Watercourses
Representativeness	**Moderate** Permanent stream with highly modified riparian vegetation. However, stream characteristics are only slightly impacted. Supports a reasonable catchment size, however water quality is likely impacted by landfill water seepage and pasture grazing upstream.	**Very low** Artificially created, intermittent watercourses, dominated by exotic vegetation.

Rarity/distinctiveness	**High** Longfin eel (*Anguilla dieffenbachii*) inhabits the watercourse and the area has potential to support giant kōkopu, which have been recorded nearby meaning there is potential they inhabit this stream and use the *Tradescantia* as a spawning substrate.	**Very Low** Unlikely to support native species and no distinctive features.
Diversity and Pattern	**Moderate** Two eel species were recorded in the stream and the community supports a range of size classes. The stream supports high number of macroinvertebrate taxa but EPT diversity is low to moderate. The stream follows a natural path with suboptimal sinuosity but there is a diversity of pool habitat and invertebrate habitat present.	**Very Low** Small linear channels with no natural diversity or complex community.
Ecological Context	**High** Low stream order with abundant and diverse instream habitat. Riparian vegetation is exotic however all tiers present to provide habitat and stream shading. Connects downstream to wetland habitat (SNA WP330 – willow wetland) and the Pūniu River. The stream connects to a small area of aquatic habitat (the headwaters) upstream. Habitat connection and flora/ fauna communities are impacted by anthropogenic pressures. The stream reach also has the potential to provide spawning habitat for the At – Risk species, giant kōkopu.	**Very Low** Exotic instream habitat with grassed riparian vegetation. Highly modified environment that does not connect to any other aquatic habitat.
Overall Ecological Value	**High**	**Negligible**

4.5 Wetland Habitat

Two natural inland wetlands were identified on site (Figure 4). Wetland 1 is a riverine wetland encompassing the northern extent of the Wharekōrino Stream within the site bounds and its adjacent floodplains (Photo 15 and Photo 16). It is a small swamp wetland that is likely to have been induced by stormwater inputs and the downstream culvert, which is undersized, impeding flows. The main channel is also modified, being incised and dominated by exotic macrophytes. Vegetation was predominantly gypsywort (*Lycopus europaeus*), with buttercup (*Ranunculus repens*), Yorkshire fog, water pepper, rautahi (*Carex geminata*), watercress (*Nasturtium officinale*), and creeping bent also present. The only native species observed was rautahi, present along a portion of the true left bank. The wetland passed the Rapid Habitat Assessment. Native freshwater fish, including At-Risk species, likely reside within the wetland (Section 4.8). The wetland provides important habitat in an ED where wetlands are sparse and provides a connection to habitat upstream and downstream.

Photo 15: Wetland 1, facing downstream.

Photo 16: Wetland 1, from the true left bank, looking upstream.

Wetland 2 is a modified natural wetland with drainage channels constructed to allow for grazing of the area. At the time of the site visit, the area was wet underfoot and dominated by creeping bent, with the occasional buttercup and soft rush (*Juncus effusus)* (Photo 17). Although pasture species were present in patches (mainly sweet vernal, *Anthoxanthhum odoratum*), the area passed the Prevalence and Dominance tests. The drainage channels intersecting Wetland 2 meet the updated NPS FM exclusion criteria as they are artificial constructed water bodies and are therefore excluded from the identified wetland area (Appendix B).

Photo 17: Looking across Wetland 2.

4.6 Wetland Ecological Values

Prior to land development, the entire area of Tokanui Hospital was part of a larger swamp wetland that connected across the Pūniu River. Both wetland 1 and wetland 2 are highly modified remnants of the swamp wetland, in an ED that has <0.5% of wetlands remaining (Kessels & Associates Ltd, 2012).

Although both remnants of a historic wetland, wetland 1 provides habitat for native fauna, with shortfin eels recorded within the wetland, and the At-Risk – Declining longfin eel present upstream. Gambusia were also observed within the wetland. Although vegetation is low stature and exotic, it is likely habitat to native fauna species at varying life stages. It also provides a connection to stream habitat upstream, as well as willow wetland downstream (through a culvert), which forms one of the pathways that connects to the wider Pūniu River catchment.

In contrast, wetland 2 is isolated from aquatic habitat, and it has been drained for grazing, resulting in the entire extent being dominated by exotic herbaceous species. Historical imagery shows both wetland areas were already highly modified by 1944 (Photo 18).

The overall ecological value of wetland 1 has been assessed as **Moderate**, and wetland 2 **Negligible**, as summarised in Table 9.

Photo 18: Wetland 1 (right box) and wetland 2 (left box) in 1944.

Table 9: Ecological value assessment of wetlands on site.

Matter	Wetland 1	Wetland 2
Representativeness	**Low** Remnant swamp wetland that has been highly modified by the clearing of high stratum vegetation, installation of a culvert that inhibits flows, and stormwater inputs. Exotic species dominate.	**Very Low** A highly modified natural wetland that is restricted to exotic herbaceous stratum vegetation. Hydrology has been modified significantly through drainage and topsoil added to aid in farming of cattle.
Rarity/distinctiveness	**High** Natural inland wetland extent has declined regionally and nationally, and the ecosystem is a national priority for protection. Wetland 1 represents habitat that was once part of a larger wetland area. At-Risk fish species may inhabit the wetland, as they are found within the wider catchment.	**Low** Natural inland wetland extents have declined regionally and nationally, and the ecosystem is a national priority for protection. However, drained wetlands creating wetted pasture dominated by exotic species are common regionally and nationally.

Diversity and Pattern	**Moderate** Restricted to limited native vegetation and dominated by exotic herbaceous species. However, provides shallow, deep, flowing, and stagnant habitat. Submerged and emergent macrophytes also provide an abundance of habitat. Likely habitat for a diverse range of freshwater fauna at differing life stages.	**Very Low** Restricted to exotic herbaceous species, the wetland lacks pattern, complexity, and biodiversity.
Ecological Context	**Low** Highly modified wetland with anthropogenic influence apparent, including exotic herbaceous vegetation, pest fish and stormwater input. Provides linkage to stream habitat.	**Very Low** Documentation shows the wetland was modified and used as pasture prior to 1944. As a result, it has lost its natural form and function and is not resilient to anthropogenic impacts. It does not provide linkages, buffering or pathways to other habitat.
Overall Ecological Value	**Moderate**	**Negligible**

4.7 Ecological Values Summary

Table 10 summarises the ecological values of features and fauna identified associated with the site.

Table 10: Summary of ecological values.

Feature	Ecological Value
Native trees	Low
Exotic trees	Low
Native and exotic scrub	Low
Wharekōrino Stream	High
Wetland 1	Moderate
Wetland 2	Negligible

Fauna	Ecological Value
Long-tailed bats	Very High
Avifauna	Low
Herpetofauna	Negligible
Fish	High

5.0 Significance Assessment

The **Wharekōrino Stream** and **Wetland 1** on site meet multiple WRC criteria for significant indigenous biodiversity (Appendix C). The criteria met include:

3 *It is vegetation or habitat that is currently habitat for indigenous species or associations of indigenous species that are classified as threatened or at risk.*

The At-Risk species, longfin eel, was identified within Wharekōrino Stream and is also likely to be present in the connected habitat, Wetland 1, as the species has been recorded upstream of the site. Therefore, both the **Wharekōrino Stream** and **Wetland 1** provide habitat for At-Risk species.

4 *It is vegetation, habitat, or ecosystem type that is under-represented (20% or less of its known or likely original extent remaining). In an Ecological Region, or Ecological District, or nationally.*

Wetland 1 is a habitat type that is under-represented in the Ecological District, as <0.5% of wetland extents remain. Wetland 2 is excluded from this as it is an area of pastural wetland, which is common in the ED.

6 *It is wetland habitat for indigenous plant communities and/or indigenous fauna communities (excluding exotic rush/pasture communities).*

Wetland 1 is natural wetland habitat that likely supports indigenous freshwater fauna communities. Wetland 2 is unlikely to support indigenous fauna and is classified as an exotic pasture community, therefore, it is excluded.

Although the vegetation on site likely forms part of wider commuting and foraging habitat for long-tailed bats, there has not been confirmation that the species roost within the trees on site. Additionally, the large trees on site are common within the ED and this highly mobile species may not use the vegetation on site consistently. It is therefore not considered appropriate to define the vegetation as significant.

The Wharekōrino Stream may support giant kōkopu spawning habitat as they are known to lay eggs on Tradescantia (Franklin et al, 2015), which dominated the understory of the streams riparian edge. However, the species was not identified within the fish survey and therefore cannot be included within the significance assessment.

6.0 Proposed works

The proposed works to remediate the land to an agreed state will include the following:

- Removal and upgrade of horizontal infrastructure;
- Removal of former wastewater treatment plant (WWTP) infrastructure;
- Remediation of contaminated land;
- Removal of buildings and foundations;
- Repair and upgrading of existing landfill sites;
- Culvert removal and upgrades, and;
- Removal and disturbance of vegetation (native trees will be protected where possible).

Summary descriptions of the above works are provided below. For further details see the Demolition, Deconstruction, and Remediation Management Plan (DDRMP) and the AEE report.

6.1 Horizontal infrastructure removal and upgrading

'Horizontal infrastructure' refers to roading, paving, waters reticulation, underground heating, power, and telecommunications. In total, horizontal infrastructure removal will include roading material and infrastructure services. Non-contaminated materials will be recycled where possible, with remaining material to be disposed of at an approved facility. Trenches resulting from removal of underground infrastructure will be backfilled with topsoil to previous ground levels and grassed for stabilisation.

Within wetland 2 above ground wastewater lines and supports, below ground electricity cables, and a building and waterpipe adjacent to the wetland are all being removed (Figure 7 and Figure 8). All works will be conducted during an extended dry period with a small excavator travelling along swamp mats with works being done in sections. Backfilled trenches and damaged vegetation will be reseeded/replanted with appropriate vegetation.

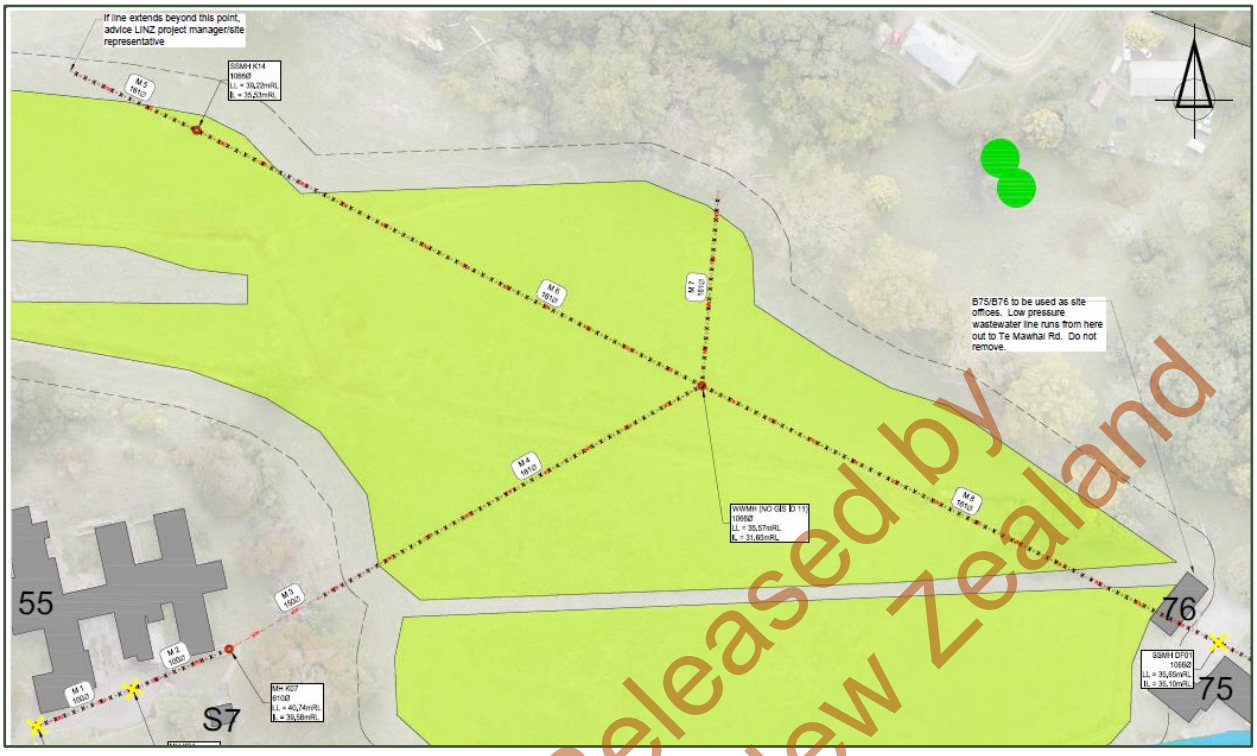

Figure 7: Wastewater lines to be removed within wetland 2 (green area).

Figure 8: Power line to be removed across wetland 2 (green area).

The trunk stormwater pipe system receives runoff from areas off-site and drains some flood detention areas within the site. It discharges to a tributary of the Wharekōrino Stream. During site investigations, it was found that the trunk stormwater pipes were in moderate to poor condition with major cracking at certain locations. To ensure that stormwater flow from upgradient properties could continue across the site, upgrades are required (Figure 9). This will involve lining the trunk stormwater system with an internal sleeve to extend its life by at least 50 years. During the upgrading works, sand bagging or similar will be installed at the outlet to the Wharekōrino Stream. This dam would remain in place for the duration of works. An “outlet pump” will be installed upstream to divert flows around works. Once works are completed all dams and pumps will be removed.

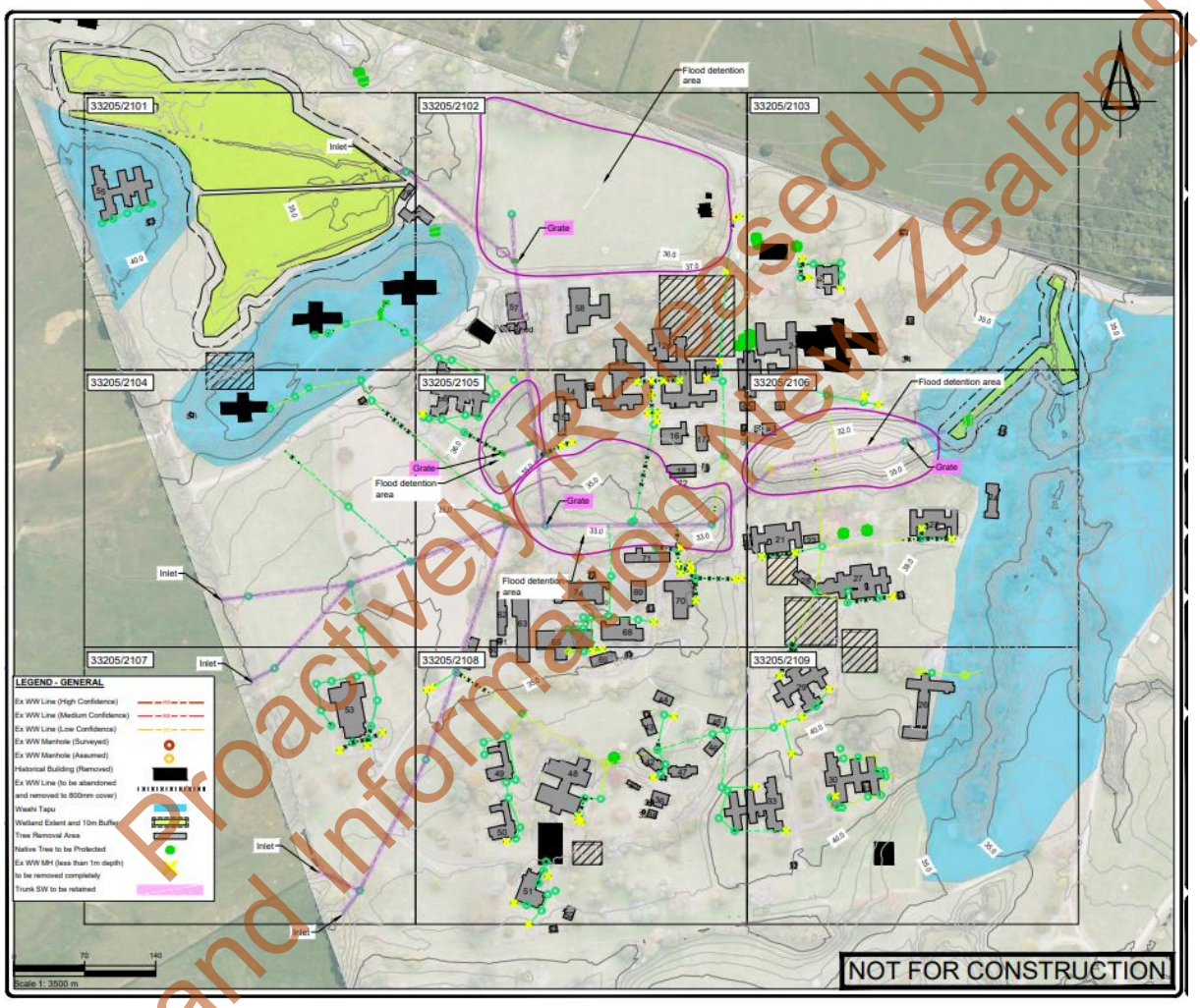

Figure 9: Stormwater infrastructure proposed to be upgraded (purple)

6.2 Removal of former wastewater treatment plant infrastructure

The remaining infrastructure from the decommissioned WWTP that is adjacent to wetland 1 are proposed to be removed. Of these works, the following removal works will be within or within 10 m of the wetland boundary.

- Outfall pipe;
- Edging around humus tank;
- Trickling filter and media;
- Grit chamber;
- Wastewater inlet pipe;
- Three wastewater pipes, associated manholes and one stormwater pipe
- Removal of fence;
- Ancillary cabling, and;
- Footbridge including timer supports;
- Three wastewater pipes and associated manholes and one stormwater pipe will be removed down to 800mm depth.

These works will be done during an extended summer dry period. Where required, a small excavator will travel along swamp mats to minimise the potential for damage to the wetland area. Where possible, works will be done manually from the foot bridge or with a large excavator located outside the wetland area. Earthworks during pipe removal is estimated to require a maximum of 20 m long x 300m wide x 0.8 m depth trench. The trench would be topped up with topsoil and be replanted with appropriate grass/plants to match the current vegetation in the wetland area. Any damaged areas of vegetation would also be replanted. Appropriate sediment controls will be implemented during works.

Photo 19: Area within wetland 1 that will be impacted by the WWTP works.

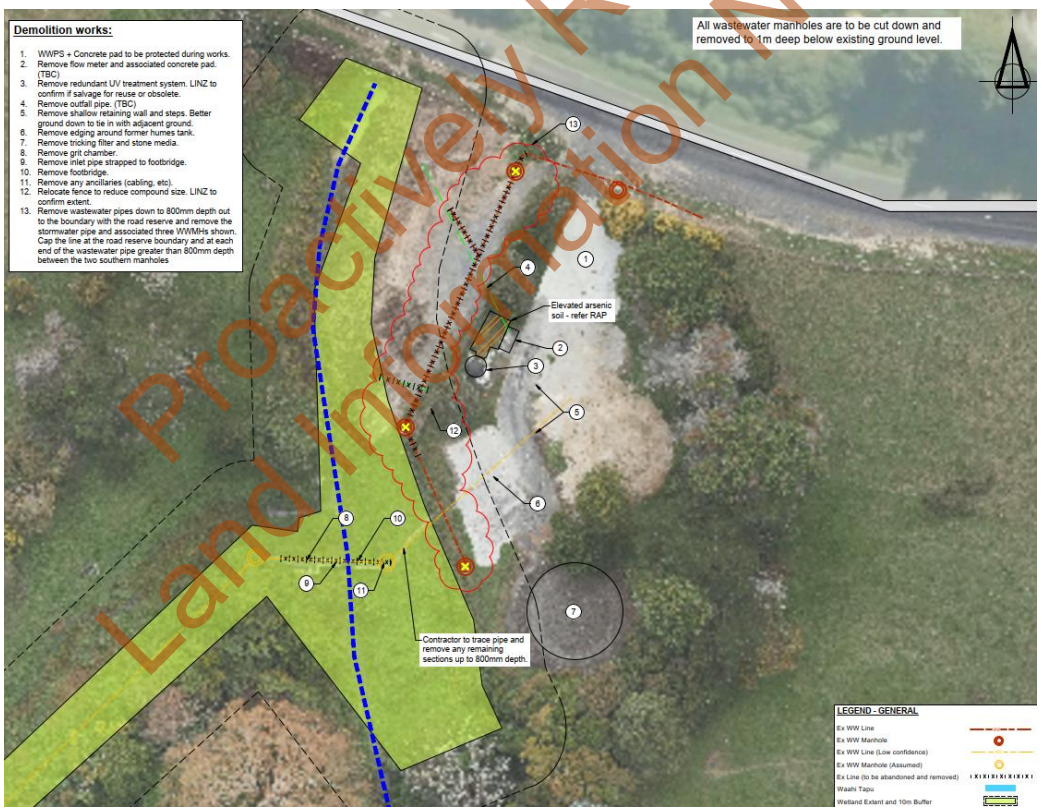

Figure 10: Aerial view of works within wetland 1 and within 10 m of wetland 1.

6.3 Remediation of Contaminated Land

To ensure soils within the site meet agreed standards, areas identified as having moderate and low level soil contamination will be excavated to a depth of up to 300-400 mm and approximately 2-3 m distance surrounding the buildings before halo scrapes are also undertaken. Soils around asbestos pipe watermains will also be removed. In total approximately 7,800 m^3 of contaminated soil will be removed and backfilled using soils from other works on site or imported soils.

6.4 Removal of Buildings and Foundations

The scope of the works involves removing all existing buildings and foundations on site, excluding the security portacom and a building for the site office. This covers 45,000 m^2 of the site. Building materials will be recycled where practicable, and any contaminated materials will be disposed of appropriately.

6.5 Upgrading of landfill sites

The 1.8 ha area of landfill sites adjacent to the Wharekōrino Stream have been identified as requiring repair (Figure 11). Additionally, contaminated soils on sites are proposed to be disposed of in these areas. Upgrading works will involve a number of tasks including (but not limited to):

- Establishment of erosion and sediment controls.
- Stripping the grass and topsoil cover
- Construction of a groundwater cut off drain upgradient of the landfill to suitable discharge points for gravity discharge to the stream. This will go along the eastern edge of landfill areas A1, B, C and then discharge to a gully connected to the Wharekōrino Stream.
- Placement of soils from remediation works.
- Recapping the landfill with appropriate materials before covering with topsoil and re-grassing for stabilisation.
- Removal of erosion and sediment controls once sufficient ground stabilisation is established.

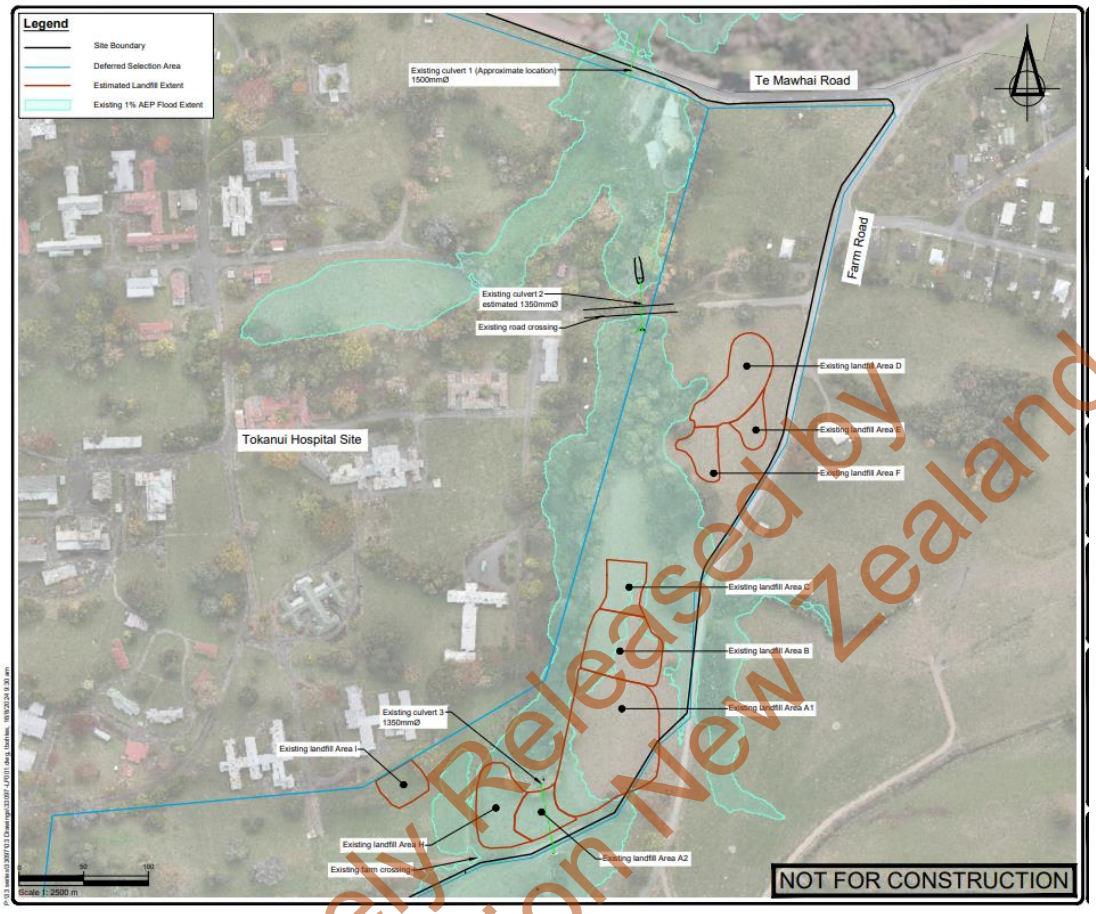

Figure 11: Historic landfill (red) area adjacent to the Wharekōrino Stream.

6.6 Culvert Replacement and Removal

The removal of the road and submerged culvert (approximately 35 m) that intersect the Wharekōrino Stream for historic site access is has been proposed (Figure 12). The road embankment currently acts as a dam, fragmenting habitat and impacting natural stream flow. The works will involve the following and cover an area of approximately 3,000 m^2:

- Establishment of erosion and sediment controls; including temporary damming of the stream and a diversion of stream by pumping of water.
- Undertake fish relocation as per the Fish Management Plan (FMP; Appendix F).
- Removal of vegetation, infrastructure and soil. This is to be disposed of or reused where appropriate.
- Trim stream banks to tie in with existing stream profile.
- Place clean topsoil along stream batters (100 – 150 mm thick) and cover with biodegradable matting.
- Undertake planting as per the Planting and Management Plan (PMP, Appendix E).
- Remove temporary dams and erosion/sediment controls.

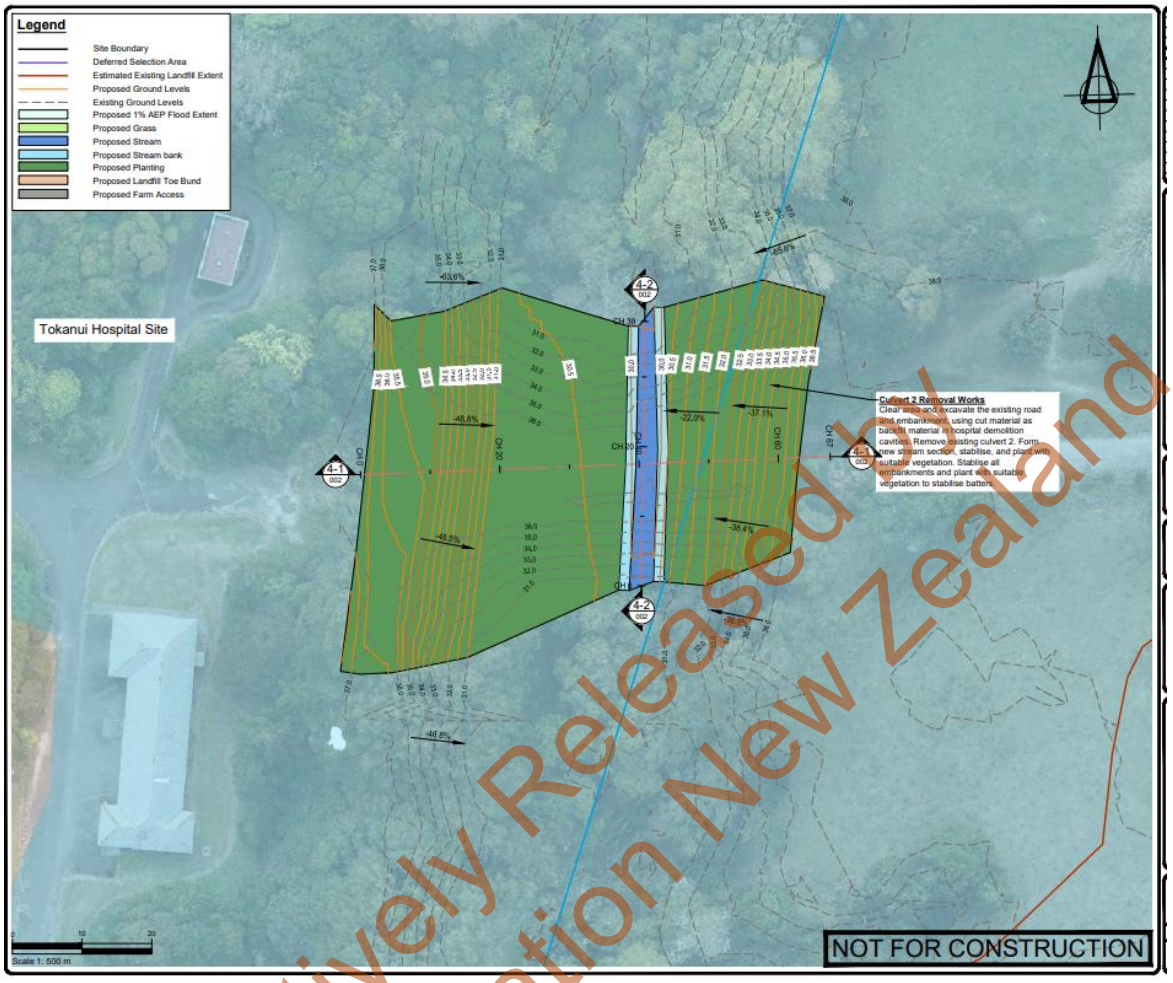

Figure 12: Proposed removal of road embankment and Culvert 2 intersecting the Wharekōrino Stream.

The 60 m Culvert 3 at the southern extent of the Wharekōrino Stream within the site bounds runs through the historic landfill. This culvert is estimated to be 44-65 years old and could be subject to differential settlement from landfill activity, leading to leaking joints and ultimately possible pipe failure, which would likely lead to refuse washout down the stream. Therefore, it is proposed that the culvert be replaced. The culvert will be replaced with a shorter structure (approximately 44 m) and realigned at an approximate northwest-southeast alignment, running beneath the existing farm track. The culvert will discharge to a new 75 m section of stream, which will be constructed in conjunction with the culvert replacement works. The existing culvert will be filled in and the stream diverted through the new culvert. The culvert replacement will result in a section of the natural stream (28 m) being lost, as the new section of stream will reconnect to the existing channel approximately 28 m downstream of the existing culvert outlet. However, this 28-m section of channel will still receive stormwater from overland flows and, therefore, will likely continue to function as an ephemeral flowpath. (Figure 13). Works will be similar to Culvert 2 removal and include implementing management plans where appropriate.

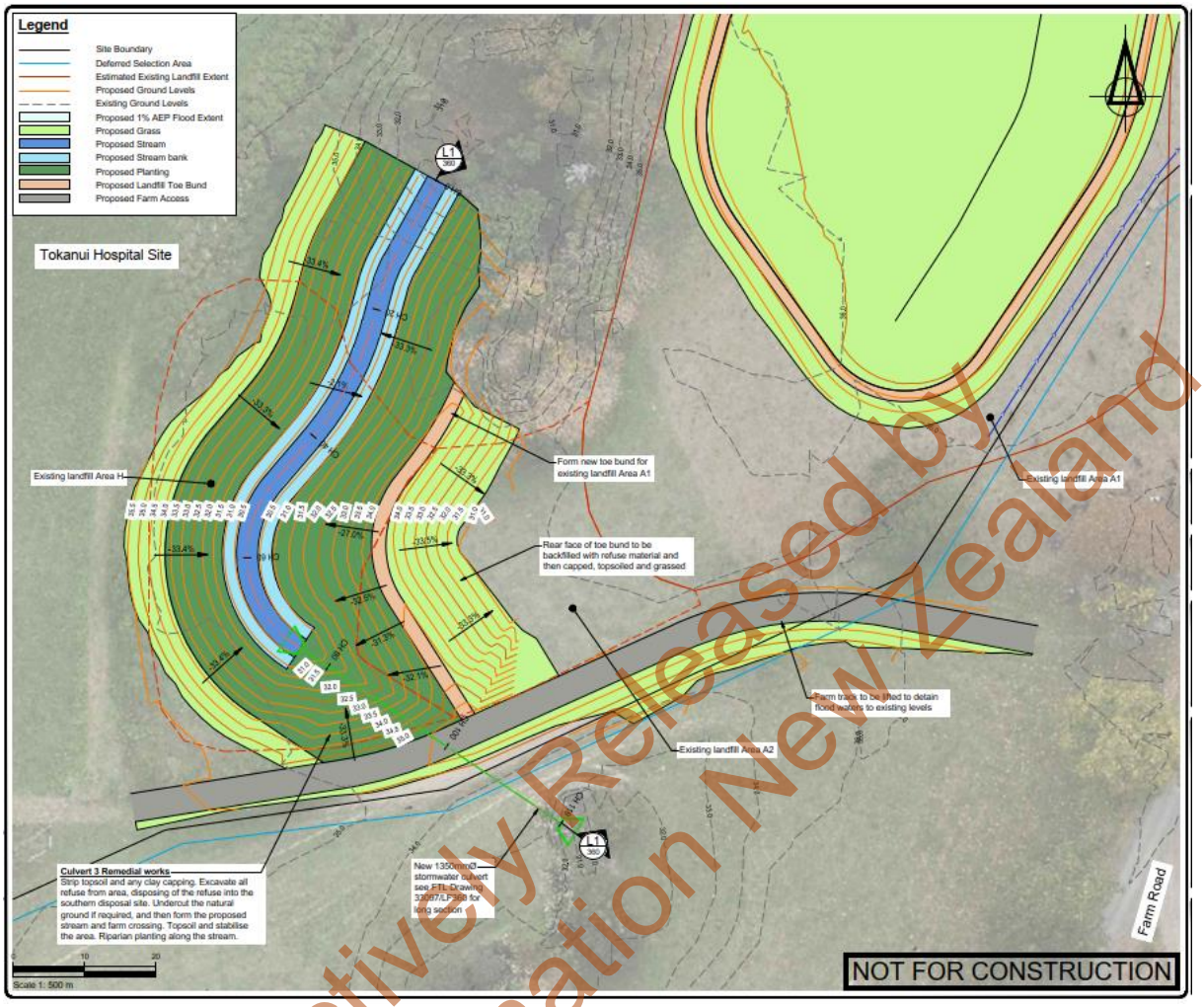

Figure 13: Proposed Culvert 3 replacement.

Hydrological modelling has shown proposed works for the removal and upgrade of all culverts are not anticipated to have an impact on water flow or levels throughout the stream or wetland 1 during normal conditions and normal rainfall events. This is due to the gradient of the stream being flat within the site bounds (0.11% from north to south of site boundary). This is a result of the reach being historically wetland (Tokanui Hydrology Assessment, Appendix D; email comms, Fraser Thomas, July 2024).

6.7 Removal and disturbance of vegetation

The proposed works will result in multiple small areas of vegetation being removed or disturbed during works. Exact areas that will be affected for each works area are depicted in the DDRMP. Disturbance refers to works that intersect with a dripline of trees and any roots that will likely be cut. If there is a trunk within that area, the whole tree will be removed. Areas that will have the largest vegetation removal surround the proposed culvert works. Culvert 2 works will include approximately 2,020 m^2 and Culvert 3 will include approximately 2200 m^2 of vegetation removal (Figure 14).

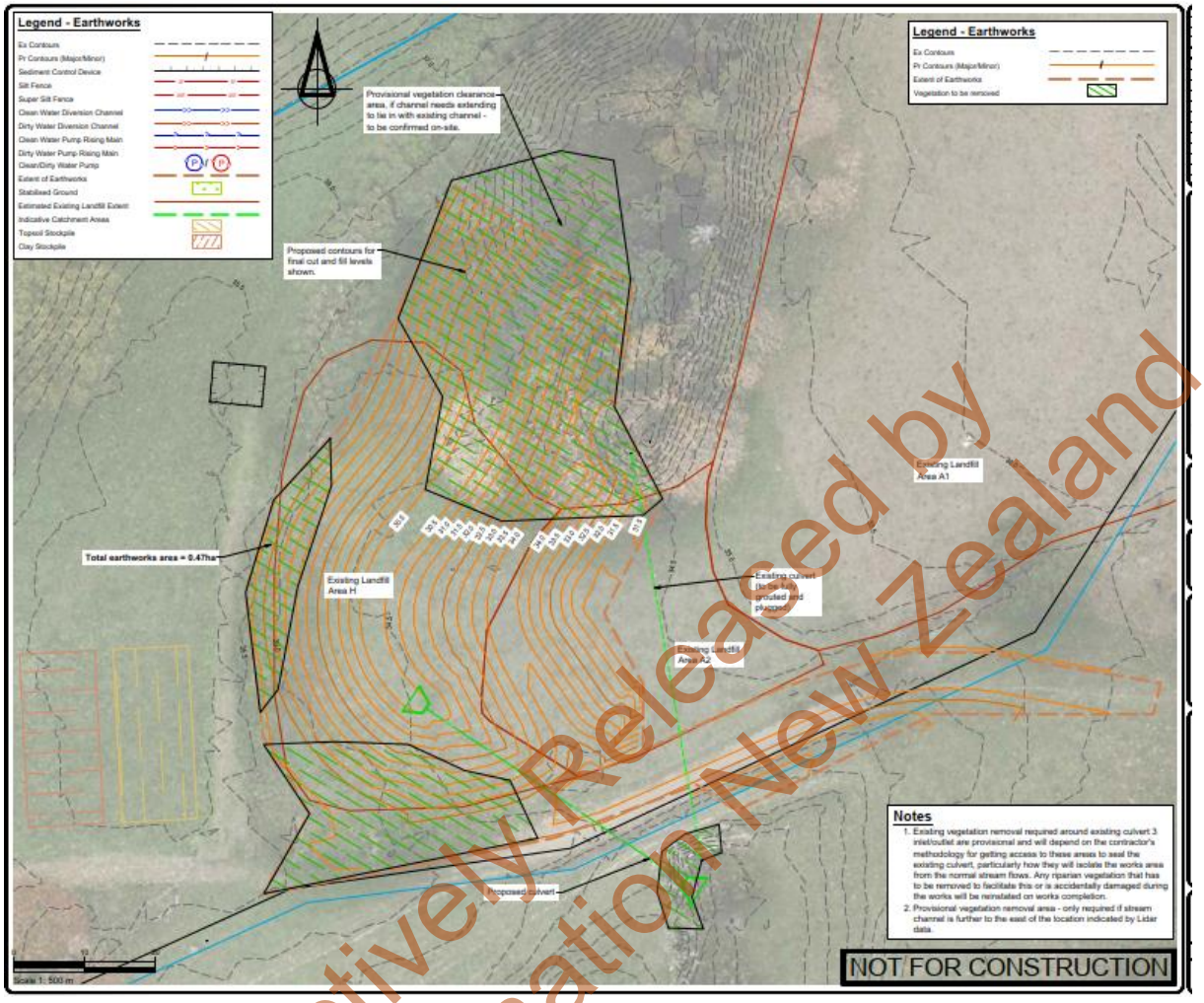

Figure 14: Culvert 3 works vegetation removal area.

7.0 Works Management Actions

The draft DDRMP outlines all methodologies and management actions. Key management measures relevant to the mitigation of ecological impacts are:

- Works are expected to be completed within 18 - 24 months, with hours of operation 7:30am to 7pm, Monday to Saturday.
- Erosion and sediment control measures will be installed in accordance with WRC 'Erosion & Sediment Control Guidelines for Soil Disturbing Activities TR2009/02' and are outlined in more detail in Section 19 of the DDRMP and in the separate Erosion and Sediment Control Plans for the demolition works and landfill repair and upgrade works. Regular inspections of control measures will be undertaken, and any required stabilisation or remediation will be undertaken as soon as possible.
- Refuelling of vehicles will occur away from streams.
- Recycling of materials will be undertaken where appropriate and contaminated materials will be disposed of appropriately.
- None of the earthworks aim to significantly alter the existing contours of the land near identified wetland or stream habitat. Where minor changes are required (due to

reinstatement of stream banks after culvert removal and reinstatement of landfill cap with additional material enclosed) these will align with existing ground levels.

- Excavated cavities and trenches will be backfilled with compacted cleanfill, followed by topsoiling and grassing (except at road crossings which are to remain post-works and will be backfilled with approved, compacted hardfill).
- Large trees over 15 m in height (which provide potential bat habitat) will be avoided where practicable. Some tree removal will be required if trees are in close proximity to infrastructure designated for removal.
- A BMP will be prepared and implemented during construction to ensure appropriate effects management for this Threatened – Nationally Vulnerable species.
- A PMP (Appendix E) has been developed and will be implemented in the riparian areas and wetland impacted by vegetation removal.
- A FMP (Appendix F) has been prepared as a management measure for the instream works and will be implemented to mitigate effects on native freshwater fish species.

8.0 Assessment of Ecological Effects

The proposed remediation works will require earthworks, vegetation removal, stream diversions, works in and near wetlands and the removal or upgrade of infrastructure. Construction-related effects are considered temporary, with works occurring from 7:30am to 7pm Monday – Saturday within an expected timeframe of 18 - 24 months (likely to be staged in sections across the site). However, the works will have permanent impacts on some ecological features. The actual and potential effects of the proposed works described above are detailed below.

8.1 Terrestrial vegetation

The earthworks will result in several areas of exotic vegetation being removed. All large native trees identified on site will be protected from damage if possible. The two largest areas of vegetation removal will be replanted with native vegetation as per the PMP. As the vegetation removal proposed is minimal and an area will be revegetated, there will be a minor deviation from baseline conditions. Therefore, the magnitude of effect on all terrestrial vegetation is low, with a corresponding **Very Low** level of effect for all.

8.2 Wetland habitat

In assessing the effects on wetlands, the following potential effects were considered:

- Impacts on wetland hydrology;
- Loss or alteration of wetland extent due to sediment run off and earthworks;
- Loss of vegetation
- Disturbance.

Works that may impact the wetlands include the removal of Culvert 2, upgrading Culvert 3, removal of the infrastructure associated with the decommissioned WWTP, and upgrading the trunk stormwater pipe system. Potential impacts associated with these activities include loss and damage to vegetation, increased sedimentation and increased flows. Appropriate erosion and sediment control measures (in accordance with WRC ‘Erosion & Sediment Control Guidelines for Soil Disturbing Activities TR2009/02) will be implemented for these works. Additionally, hydrological changes are not anticipated within Wetland 1 as a result of

the culvert works due to the low gradient of the Wharekōrino Stream (Tokanui Hydrology Assessment, Appendix D). Vegetation within the area of Wetland 1 that will be impacted by proposed works is exotic and herbaceous in composition. In addition to appropriate erosion and sediment controls being implemented, excavators will be used outside the wetland extent where practicable and a small excavator will travel on swamp mats where required. Any areas with vegetation impacted by the works will be planted with native species identified as appropriate. Therefore, the magnitude of effect is assessed as low, with the corresponding level of effect being **Low**.

Works proposed within wetland habitat include the removal of horizontal infrastructure within Wetland 2 to a depth of 800 mm. Any areas with disturbed soil will be filled with topsoil once the infrastructure has been removed and any disturbed areas will be grassed with appropriate species. These short term, temporary works will return the wetland to its current state, which is wetted exotic grass. The magnitude of effect is assessed as Negligible. The corresponding level of effect is therefore **Very Low**.

8.3 Freshwater habitat

The following potential effects on freshwater habitat have been assessed:

- Impacts on stream hydrology;
- Loss and alteration of habitat;
- Water quality impacts from sedimentation run off and landfill works;
- Habitat fragmentation;
- Pest animal and plant impacts.

Impacts on Stream Hydrology

Stream hydrology will be impacted by the removal of the old access road and associated infrastructure. This will result in less pooling directly upstream of the currently blocked Culvert 2. The low gradient of the stream will result in no change in stream hydrology or flow across the subject reach, although flow will be restored in the immediate vicinity of Culvert 2. These works will also reconnect habitat upstream (wetland and stream habitat) and downstream (i.e., connection to the Pūniu River catchment) of the old access road.

The removal of Culvert 2 and replacement of Culvert 3 will be achieved without changing streambed levels. This combined with the low gradient of the stream means that no changes to stream flows are expected (Tokanui Landfill Works, refer to AEE). Additionally, the replacement culvert will be the same size as the current culvert. The purpose of this is to detain water upstream of Culvert 3 and ensure flooding at Te Mawhai Road (Culvert 1) does not occur. Stream flows will therefore not change with the replacement of Culvert 3.

Loss of Stream Habitat

Proposed works to replace Culvert 3 will also impact stream hydrology within the 28 m of stream that will be replaced with the constructed channel. Flows will reduce through this section, being limited to overland flow. This will change the hydrology, although it is uncertain exactly how this will impact the habitat there. Currently this section of stream supports run habitat. It is possible that, once flows reduce, water may pool, potentially becoming stagnant when rainfall is minimal. The construction of a new channel represents an opportunity to create new stream habitat with features (i.e., varied substrates and flow regimes) that will support a diversity of instream fauna.

The proposed works will result in the removal of riparian vegetation directly upstream and downstream of Culvert 2, however, the vegetation is predominantly exotic and planting of native vegetation for instream habitat and riparian shading will be undertaken after works are completed (as per the PMP). Planting will also be undertaken on the riparian margins of the constructed stream reach proposed as part of Culvert 3 works. The area of vegetation removal is small and with post-works native planting it is expected that a contiguous native canopy will fully form after 3-5 years.

Water Quality Effects

Appropriate erosion and sediment control measures (in accordance with WRC 'Erosion & Sediment Control Guidelines for Soil Disturbing Activities TR2009/02) will be implemented for all instream works. It is therefore unlikely sedimentation will impact the habitat or water quality of the Wharekōrino Stream.

The construction of a groundwater cut off drain along the edge of a portion of the historic landfill adjacent to the Wharekōrino Stream will result in storm and ground water flowing over and around the historic landfill sites, rather than through. This will likely result in less contaminants from the historic landfill areas entering the stream, improving water quality. This is not able to be quantified however, current water quality monitoring shows elevated boron levels as a result of the landfill.

Pest Animals and Plants

Reconnecting the stream habitat will result in the pest fish, Gambusia gaining access to upstream habitat. This species is distributed widely across the Waikato Region and native species of fish will also gain access to the upstream reach once the fish barrier has been removed. Reconnecting habitat for native species is considered more ecologically beneficial than not removing the infrastructure to restrict movement of a common pest fish that native species can also predate on and that already inhabits the wider catchment.

Removal of Culvert 2 also increases the risk of the weed Tradescantia establishing downstream of the culvert, where it is currently absent. However, the riparian margins downstream of the culvert are currently dominated by exotic vegetation that does not provide optimal habitat for native fish species. In contrast, Tradescantia provides fish cover (overhanging vegetation) and some species (i.e., kōkopu) are known to utilise the pest plant as a spawning substrate.

The magnitude of effects on freshwater values is positive, with an overall level of effect being the achievement of a **Net gain**.

8.4 Avifauna

The following potential effects on birds were considered during the assessment:

- Loss of roosting and foraging habitat;
- Light and noise disturbance.

Vegetation removal is restricted to as few areas as possible, with the majority of the vegetation on site being retained. There is potential for some disturbance of avifauna during works, however, this will be temporary. The surrounding landscape provides similar habitat for avifauna to utilise if temporary displacement occurs due to disturbance from works. Proposed works have been assessed to have a low magnitude of effect on avifauna and a corresponding **Very low** level of effect.

8.5 Herpetofauna

The lack of detection of any native lizards in preferred habitats during the site assessment mean it is highly unlikely that they are present within the site. The works will, therefore, not impact native lizard species. As such, the magnitude of effect has been assessed as negligible, with the corresponding level of effect **Very low.**

8.6 Bats

Potential effects on long-tailed bats include:

- Injury and/or mortality;
- Loss of roosting, commuting and/or foraging habitat;
- Temporary displacement from noise, vibration and artificial light at night.

The removal of large exotic trees on site has the potential to impact long-tailed bats as the species may be roosting in them. Therefore, there is increased risk of injury and/or mortality. Additionally, the removal of these trees represents a loss of habitat in an ED with already highly fragmented habitat for the Threatened species.

A suitably qualified ecologist will prepare a BMP for the site. Protocols and appropriate effects management measures will be implemented to ensure adverse effects on bats are minimised as much as possible. These include:

- Mapping of habitat values and retention of vegetation that is identified as critical for bats;
- If a roost is detected, measures to reduce effects of noise and artificial lighting impacts will be determined by an appropriately qualified ecologist and implemented on site;
- Protocols for tree felling;
- Measures for building demolition;
- Pest animal control to improve habitat;
- Restoration planting where roosting, commuting, and/or foraging habitat is lost;
- The installation of artificial bat roosts if roosting habitat is lost.

The effects management to be included within the BMP is considered appropriate and best practice for long-tailed bat effects. Implementing the BMP will result in an overall **Low** level of effect on long-tailed bats.

8.7 Fish

The following potential effects on fish were considered:

- Injury and/or mortality during works;
- Fish passage effects.

All proposed instream works have the potential to harm native fish species that reside in the Wharekōrino Stream. An FMP has been prepared by a suitably qualified ecologist to stipulate appropriate capture and relocation efforts that will mitigate adverse effects of instream works on native fish. The capture and relocation of native fish prior to undertaking instream works will result in a low magnitude of effect on fish, with a corresponding **Low** level of effect.

The removal of Culvert 2 and installation of a shorter culvert that will replace Culvert 3 will improve fish passage for swimming and climbing fish species. In addition, flow velocity through these culverts will not increase in comparison current flow velocities through the existing structures (Tokanui Landfill Works, see AEE). Therefore, these works result in a positive magnitude of effect for native fish, achieving an overall **Net gain** level of effect for ecological values Although a Net gain is achieved through the proposed works the Fish Passage Guidelines (NIWA, 2024) have not been applied to the replacement culvert. This is due to needing to retain water upstream to avoid flooding. We recommend consultation with an appropriately qualified ecologist during further design of the culvert to determine appropriate measures for fish passage.

9.0 Effects management

The proposed works include appropriate effects management measures to avoid, remedy, and mitigate potential adverse effects on identified ecological features and fauna identified. In many assistances, the works will result in positive outcomes for ecological values. The appropriate effects management as per the effects management hierarchy and positive ecological outcomes are outlined below.

9.1 Avoid

- Avoiding vegetation removal including large exotic and native trees where practicable. This will avoid impacts on potential bat habitat and nesting habitat for native birds.
- Avoid damage to roots of large exotic and native trees where practicable.
- The footprint for instream works will be minimised to avoid impacts on instream and riparian habitat.
- Undertaking works within/near wetland areas during an extended dry period to minimise the potential for damage to the wetland and stream.
- Use of excavators will be outside of waterways/wetlands where possible. Where required within wetlands they will be small and travel along swamp mats to avoid and minimise impacts to vegetation.

9.2 Remedy

- Implementation of a PMP to restore vegetation impacted during instream culvert works and wetland works.
- Backfilling and planting appropriate grass/vegetation on trenched and damaged areas within Wetlands. This will return the area to its current state.
- The Culvert 3 works will result in the loss of river extent and are subject to Section 3.24 the NPF-FM. Therefore, the Effects Management Hierarchy must be applied. The works are unable to be avoided due to the risks of washout of of landfill contaminants into the Wharekōrino Stream. The creation of 75 m of river habitat will replace the extent lost and add an additional 47 m of freshwater habitat. This qualifies as remediation for effects management.
- The 28 m of watercourse that will be disconnected from the main channel will be planted with natives to manage the habitat changes that result from the works. Native

planting that is appropriate will likely be small stature sedges that will overhang to provide fish habitat and is outlined in the PMP.

9.3 Mitigate

- Implementation of a BMP that outlines management measures included in Section 8.6 to mitigate adverse effects to long-tailed bats during vegetation removal and site works.
- Undertake fish recovery efforts (see FMP) to avoid injury to and/or mortality of native fish species for any instream works.
- Erosion and sediment controls will be implemented for instream works, near stream works, and works within the main stormwater trunk line and wetlands. This will ensure minimal sedimentation effects on the Wharekōrino Stream and minimal downstream effects on stream habitat, wetland habitat, and associated native fauna.
- Planting of native species (as per the appended PMP) within the riparian zones of the Wharekōrino Stream where vegetation clearance is required for instream works.

9.4 Positive outcomes

- Improvement of water quality within the Wharekōrino Stream as a result of rubbish removal, restoration of flows, and construction of a groundwater cut off drain to reduce ground water flows discharging through the landfill directly to the stream.
- The proposed culvert works will result in the daylighting of one culvert pipe, construction of a channel, and replacement of one culvert with a shorter structure. As a consequence, fish passage will be improved, connection of stream and wetland habitat will be restored, and approximately 85 m of stream habitat will be created.
- Planting of native species within works areas (as outlined in the PMP) will result in new native riparian areas in a community that is predominantly exotic in composition.

9.5 Recommendations

The following effects management actions are recommended to ensure adverse effects are appropriately managed.

- A BMP specific to this site and proposed works must be prepared by a suitably qualified ecologist and include appropriate effects management measures for potential adverse effects on bats.
- To ensure the 75 m constructed stream reach and the reinstated stream reach provide positive outcomes for freshwater values, it is recommended an appropriately qualified ecologist is consulted about the channel designs. The designs should include meanders, the installation of a variety of hard substrates (i.e., logs, rocks) to provide habitat heterogeneity, and the creation of varied flow regimes, such as pooled areas, which are favoured by tuna and kōkopu. In addition, consideration should be given to contouring the banks and planting with suitable plant species to provide spawning sites for kōkopu.
- As it has been identified that high flows can be present within the current Culvert 3, it is recommended that the replacement culvert design is undertaken in consultation with an appropriately qualified ecologist to further improve fish passage. This is because high flows will still occur through the shorter culvert, due to it being the

same diameter as the existing culvert, and, therefore, it may still prevent some fish reaching habitat upstream.

10.0 Ecological Effects Summary

Table 11 provides a summary of the actual and potential effects of the proposed works on ecological features and fauna on site. The magnitude and level of effect with and without mitigation measures has been included.

Table 11: Overall level of effect on ecological features and native fauna.

Feature	Ecological value	Magnitude of effect without effects management	Level of effect without effects management	Magnitude of effect with effects management	Residual level of effect
Native trees	Low	Moderate	Low	Negligible	**Very low**
Exotic trees	Low	Low	Very low	Low	**Very low**
Native and exotic scrub	Low	Low	Very low	Low	**Very low**
Wharekōrino Stream	High	High	Very high	Positive	**Net gain**
Wetland 1	Moderate	High	Moderate	Low	**Low**
Wetland 2	Negligible	Negligible	Very low	Low	**Very low**
Fauna					
Long-tailed bats	Very High	High	Very high	Low	**Low**
Birds	Low	Low	Very low	Low	**Very low**
Herpetofauna	Negligible	Negligible	Very low	Low	**Very low**
Fish	High	High	Very high	Positive	**Net gain**

11.0 Conclusion

Terrestrial, wetland, and freshwater ecological features have been identified and evaluated within the Tokanui Hospital site. Assessed ecological values for ecological features range from Negligible to Moderate. Some of these features were identified as habitat for native At-Risk and Threatened fauna, therefore the site has been assessed as supporting fauna with Very high and High ecological value.

The proposed remediation works for Tokanui Hospital have included a range of effects management measures to minimise potential adverse effects on ecological values. Additionally, positive ecological outcomes will result, with improved water quality, fish passage, connectivity, and native habitats anticipated to be outcomes of the remediation efforts.

The effects management measures included within the proposed works provide a high level of certainty that impacts on the most sensitive ecological values on site will be avoided and impacts that cannot be avoided will be remediated. Additional recommendations have been provided to ensure ecological values are not adversely impacted from proposed works. These include:

- A BMP specific to this site and proposed works must be prepared by a suitably qualified ecologist and include appropriate effects management measures for potential adverse effects on bats;
- Avoid removal of large native and exotic trees which may provide roosting habitat for bats where practicable;
- The constructed stream reaches should be designed in consultation with an appropriately qualified ecologist to create appropriate fish habitat;
- The replacement culvert for Culvert 3 should be designed in consultation with an appropriately qualified ecologist to further improve fish passage.

We consider that the effects management measures included within the proposed works and recommendations will manage adverse ecological effects to the extent that there will be Very low to Low levels of effect for most ecological values, and the remaining will have a net gain residual level of effect.

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Sincerely,

SLR Consulting New Zealand

Kendall Leitch
Senior Ecologist

Hamish Dean
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13.0 Feedback

At SLR, we are committed to delivering professional quality service to our clients. We are constantly looking for ways to improve the quality of our deliverables and our service to our clients. Client feedback is a valuable tool in helping us prioritise services and resources according to our client needs.

To achieve this, your feedback on the team's performance, deliverables and service are valuable and SLR welcome all feedback via https://www.slrconsulting.com/en/feedback. We recognise the value of your time and we will make a $10 donation to our Charity Partner - Lifeline, for every completed form.

Appendix A Macroinvertebrate Raw Data

Ecological Impact Assessment

Tokanui Hospital Remediation

Land Information New Zealand

SLR Project No.: 880.V11547.00001

19 November 2024

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ORDER	TAXON	MCI-sb tolerance value	Sample 1	Sample 2
ACARINA	ACARINA	5.2	20	100
COLEOPTERA	Scirtidae	6.4		40
COLLEMBOLA	COLLEMBOLA	5.3	20	
CRUSTACEA	Copepoda	2.4		140
	Ostracoda	1.9	240	2640
	Paracalliope	-	2020	14780
	Paraleptamphopus	-		20
DIPTERA	*Austrosimulium*	3.9		40
	Chironomus	3.4	1	100
	Corynoneura	1.7	20	
	Harrisius	4.7		1
	Orthocladiinae	3.2	100	80
	Paradixa	8.5		1
	Polypedilum	8.0	40	20
	Psychodidae	6.1	1	
	Tanypodinae	6.5		1
	Tanytarsini	4.5	20	20
EPHEMEROPTERA	*Mauiulus*	4.1		20
	Zephlebia	8.8	80	80
HEMIPTERA	*Microvelia*	4.6	40	180
HIRUDINEA	HIRUDINEA	1.2		20
MOLLUSCA	Lymnaeidae	1.2	40	20
	Physa = Physella	0.1	100	660
	Potamopyrgus	2.1	1040	6760
	Sphaeriidae	2.9	60	540
ODONATA	*Xanthocnemis*	1.2	80	240
OLIGOCHAETA	OLIGOCHAETA	3.8	480	960
PLATYHELMINTHES	PLATYHELMINTHES	0.9	20	
TRICHOPTERA	*Hydrobiosis*	6.7		20
	Paroxyethira	3.7		20
	Polyplectropus	8.1	1	60
	Psilochorema	7.8		1

Appendix B Wetland Plot Data and Summary

Ecological Impact Assessment

Tokanui Hospital Remediation

Land Information New Zealand

SLR Project No.: 880.V11547.00001

19 November 2024

SLR

Table 12: Results for areas assessed for natural inland wetlands on site.

Identifier	Hydrosystem	Class	Form	Primary vegetation structure	Vegetation composition (Atkinson, 1985)	Area within site (ha)	Plot ID	Rapid test	Dominance test	Prevalence test	Wetland?	Natural (as defined in the NPS-FM)?
Wetland 1	Riverine	Swamp	Floodplain	Herbfield	*Lycopus europaeus - Persicaria hydropiper – (Carex geminata)*	3.62	RHA1	Pass	N/A	N/A	Yes	Yes
Wetland 2	Palustrine	Fen	Flat	Grassland	Agrostis stolonifera – (Juncus effusus)	0.27	2	Fail	Pass	Pass	Yes	Yes
Stormwater retention area	Palustrine	Fen	Depression	Grassland	Juncus articulates *– Holcus lanatus – Lotus pedunculatus*	0.02	1	Fail	Pass	Pass	Yes	No – Constructed waterbody
Artificial watercourses	Palustrine	Fen	Swale	Grassland	Agrostis stolonifera *- Holcus lanatus*	0.18	RHA2	Pass	N/A	N/A	Yes	No – Constructed waterbody

Appendix C Criteria for determining significance of indigenous biodiversiy (Appendix 5 of the Waikato Regional Policy Statement)

Ecological Impact Assessment

Tokanui Hospital Remediation

Land Information New Zealand

SLR Project No.: 880.V11547.00001

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Table 28 – Criteria for determining significance of indigenous biodiversity

Previously assessed site	
1.	It is indigenous vegetation or habitat for indigenous fauna that is currently, or is recommended to be, set aside by statute or covenant or by the Nature Heritage Fund, or Ngā Whenua Rāhui committees, or the Queen Elizabeth the Second National Trust Board of Directors, specifically for the protection of biodiversity, and meets at least one of criteria 3-11.
Ecological values	
2	In the Coastal Marine Area, it is indigenous vegetation or habitat for indigenous fauna that has reduced in extent or degraded due to historic or present anthropogenic activity to a level where the ecological sustainability of the ecosystem is threatened.
3.	It is vegetation or habitat that is currently habitat for indigenous species or associations of indigenous species that are: • classed as threatened or at risk, or • endemic to the Waikato region, or • at the limit of their natural range.
4.	It is indigenous vegetation, habitat or ecosystem type that is under-represented (20% or less of its known or likely original extent remaining) in an Ecological District, or Ecological Region, or nationally.
5.	It is indigenous vegetation or habitat that is, and prior to human settlement was, nationally uncommon such as geothermal, chenier plain, or karst ecosystems, hydrothermal vents or cold seeps.
6.	It is wetland habitat for indigenous plant communities and/or indigenous fauna communities (excluding exotic rush/pasture communities) that has not been created and subsequently maintained for or in connection with: • waste treatment; • wastewater renovation; • hydro electric power lakes (excluding Lake Taupō); • water storage for irrigation; or • water supply storage; unless in those instances they meet the criteria in Whaley et al. (1995).
7.	It is an area of indigenous vegetation or naturally occurring habitat that is large relative to other examples in the Waikato region of similar habitat types, and which contains all or almost all indigenous species typical of that habitat type. Note this criterion is not intended to select the largest example only in the Waikato region of any habitat type.
8.	It is aquatic habitat (excluding artificial water bodies, except for those created for the maintenance and enhancement of biodiversity or as mitigation as part of a consented activity) that is within a stream, river, lake, groundwater system, wetland, intertidal mudflat or estuary, or any other part of the coastal marine area and their margins, that is critical to the self sustainability of an indigenous species within a catchment of the Waikato region, or within the coastal marine area. In this context "critical" means essential for a specific component of the life cycle and includes breeding and spawning grounds, juvenile nursery areas, important feeding areas and migratory and dispersal pathways of an indigenous species. This includes areas that maintain connectivity between habitats.
9.	It is an area of indigenous vegetation or habitat that is a healthy and representative example of its type because: • its structure, composition, and ecological processes are largely intact; and, • if protected from the adverse effects of plant and animal pests and of adjacent land and water use (e.g. stock, discharges, erosion, sediment disturbance), can maintain its ecological sustainability over time.
10.	It is an area of indigenous vegetation or habitat that forms part of an ecological sequence, that is either not common in the Waikato region or an ecological district, or is an exceptional, representative example of its type.
Role in protecting ecologically significant area	
11.	It is an area of indigenous vegetation or habitat for indigenous species (which habitat is either naturally occurring or has been established as a mitigation measure) that forms, either on its own or in combination with other similar areas, an ecological buffer, linkage or corridor and which is necessary to protect any site identified as significant under criteria 1-10 from external adverse effects.

Appendix D Tokanui Hydrology Assessment

Technical Memorandum

To:	Bryan Daly	**From:**	Charlotte Lockyer
Company:	Toitū Te Whenua Land Information New Zealand		**SLR Consulting New Zealand**
cc:		**Date:**	13 November 2024
		Project No.	880.V11547.00001

RE: Potential effects on natural inland wetlands

1.0 Purpose

As part of the resource consent application to remediate the former Tokanui Hospital site, SLR Consulting Ltd have summarised the actual and potential environmental effects in the Remediation Application. This technical memorandum was used to inform the Assessment of Effects specifically considering the hydrological effects to the wetlands from removal of redundant infrastructure.

This focus of this assessment was to addresses clause 53 and 54 of the National Environmental Standards for Freshwater (NES-F), with specific reference to the following:

- Whether the earthworks are likely to result in the complete or partial drainage of all or part of a natural inland wetland;
- Vegetation clearance and earthworks within, or within a 10m setback from, a natural inland wetland; and
- The diversion of water within, or within a 100m setback from, a natural inland wetland.

2.0 Project Overview

Two resource consent applications are being made to Waipā District Council and Waikato Regional Council. This memorandum focuses on hydrological effects to wetlands related to the Remediation Application.

Two natural inland wetlands (as defined under the National Policy Statement for Freshwater Management (NPS-FM)) have been identified on Site (Figure 1). Wetland 1 is a riverine wetland encompassing the northern extent of the Wharekōrino Stream in the site and its floodplains. Vegetation present is predominantly exotic. Native freshwater fish, including At-Risk species, likely reside within the wetland. The wetland provides important habitat in a region lacking wetland habitat and provides connection to stream habitat upstream. Its ecological value is assessed as Moderate. Wetland 2 is a modified natural wetland with drainage channels created to allow for grazing of the area. The area was dominated by creeping bent wet underfoot. Its ecological value is assessed as Negligible.

Wetland 1 and the Wharekōrino Stream meet criteria for indigenous biodiversity significance under the WRPS.

Figure 1 Location of wetlands

3.0 Works within and in proximity to wetlands

The following sections detail works within and in proximity to wetlands. These works are largely as described in the Remediation Application. Photos of the infrastructure within Wetland 2 are included in Appendix A.

3.1 Wetland 1

This wetland is located toward the northeast of the site, adjacent to the decommissioned WWTP and the Wharekōrino Stream.

Demolition works that are to occur within the WWTP, as described in full in section 4.6 of the Remediation Application, are partially located within 10m of Wetland 1. In addition, a grit chamber, footbridge and ancillary cabling are located within the wetland and stream area and will be removed either in full or part.

Details and methodology for works within or within 10m of Wetland 1 are set out as follows, with reference to their location on Figure 2 below:

- Location 6: The concrete edging located around the former hummus tank and partially within 10m of the wetland will be removed and the edges regraded to tie soil in with the existing ground. All the soil to be disturbed in this area is inferred to be bedding for the former tank and therefore there will be limited disturbance to the underlying natural ground.

- Location 12: A fence will be removed from within the 10m buffer and relocated adjacent to surround the new wastewater pump station.
- Location 7: The above ground trickling filter and stone media (partially located within 10m of the wetland) will be removed. There is expected to be minor disturbance of the underlying natural ground. Only approximately 10% of the trickling filter area is located within the wetland 10m buffer zone.
- Location 4: The outfall pipe will be removed during the summer dry period. The pipe will be removed, in sections, with a small excavator (8T or 13T). Swamp mats will be utilised for the removal.
- Location 8: The concrete block grit chamber and grated metal lid, located within the wetland/stream area, will be removed to ground level. This work will be completed manually from the footbridge as it is not possible for an excavator to access this area.
- Location 9: The wastewater inlet pipe and any ancillary cabling currently strapped to footbridge will be removed by hand and/or small excavator when possible. When access is available to an excavator swamp matting will be used. The pipe will be removed to 0.8m depth (likely at the stream bank) and plugged with concrete.
- Location 11: Any ancillary cabling or cable ducting attached to the footbridge or found within the stream/wetland will be removed/pulled out.
- Location 10: The footbridge, including the timber support posts will be removed, likely by a large excavator working from the WWTP.
- Location 13: Three wastewater pipes and associated manholes and one stormwater pipe will be removed down to 800mm depth.

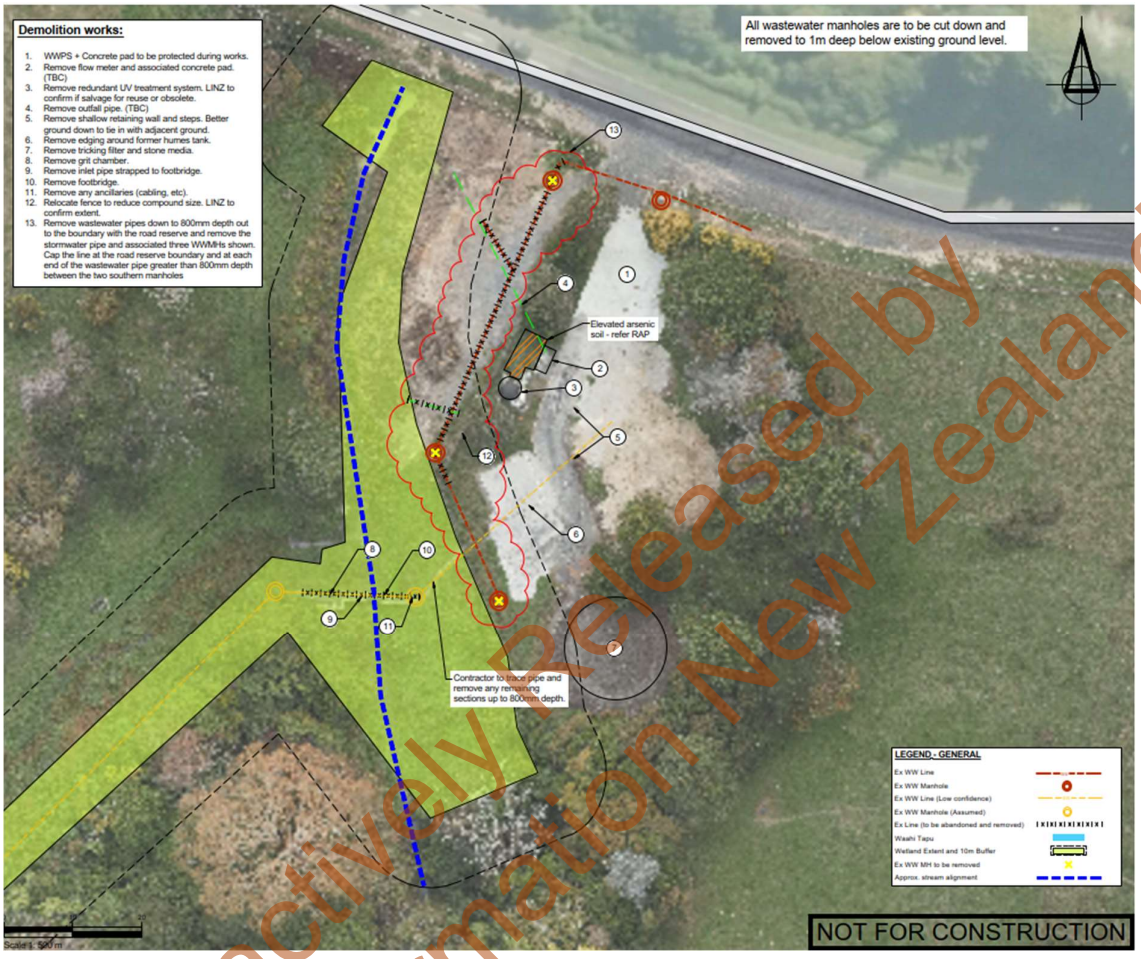


Figure 2: Works within or within 10m of Wetland 1 (excerpt of plan 33205/2010)

3.2 Trunk stormwater pipe repair

The trunk stormwater pipe system has 5 inlets receiving runoff from off-site, upgradient rural areas (see purple lines on Figure 3). It also drains some flood detention basins within the Site via open grates. It discharges to a tributary of the Wharekōrino Stream, within 10m of Wetland 1. The downstream end of the pipe is flooded either due to partial blockage or backwater effects from the main stream.

The pipe system comprises the following:

- 1170m x 900dia pipe.
- 143m x 825dia pipe.
- 292m x 750dia pipe.
- 163m x 675dia pipe.

During site investigations into horizontal infrastructure, including review of CCTV, it was found that limited sections within these pipe lengths are damaged. To ensure that

stormwater flow from upgradient properties is able to continue across the site, a means of conveying the runoff is required. The approved option involves lining the trunk stormwater system with an internal sleeve to extend its life by at least 50 years.

The lining works are likely to take around 3-6 weeks and would be conducted during dry summer conditions. Given the size of the contributing catchments and photos/videos of flow in pipes from CCTV survey, it is considered unlikely these works can be done in a time of no flow. Works are likely to involve the following steps:

(a) Sand bagging or similar at downstream end near O1 to cut off backwater from the Wharekōrino Stream. This dam would remain in place for the duration of works. Install “outlet pump” above dam to pump out backwater in pipes (one-off event) and continue pumping out flows down pipe.
(b) Divide pipe into work sections, based on approximately 3-5 day work packages. Each work package would depend on distance between manholes and magnitude of repairs required in each section.
(c) Works would proceed from O1 upstream.
(d) Install upstream dam in manhole at upper end of works package 1, with pump to divert flows around works package to outlet pump or stream itself.
(e) Undertake lining works in works package 1 area.
(f) On completion and allowing for relevant curing time, relocate upstream dam and upstream pump to upper end of works package 2. Upstream pump to pump any water in pipe past works area 2 to works area 1 upper manhole, with water flowing down lined pipe and being pumped to stream via outlet pump.
(g) Continue steps (e) and (f) until all damaged pipe is lined.
(h) Remove all internal dams and allow natural flows through pipe system from five inlets to O1.

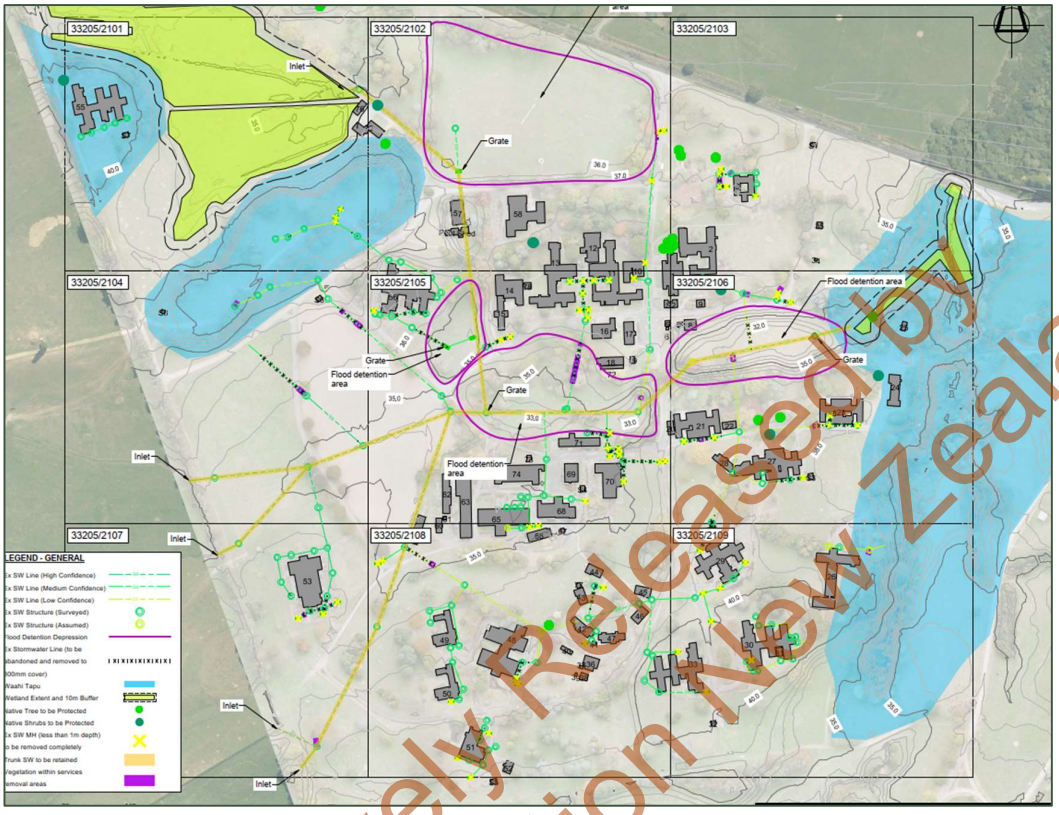


Figure 3: Overview of stormwater line locations (trunk in yellow, other in green)

3.3 Culvert 2 removal

There is a redundant road embankment crossing the Wharekōrino Stream that provided an historical side road entrance to the Site. The location of this road crossing is shown as Culvert 2 on Figure 4. A site inspection of this crossing indicated that there appears to be a culvert running under the embankment, but this has not been able to be confirmed due to the culvert being completely submerged. This culvert (Culvert 2) is estimated to have a diameter of 1350mm to be consistent with the upstream Culvert 3.

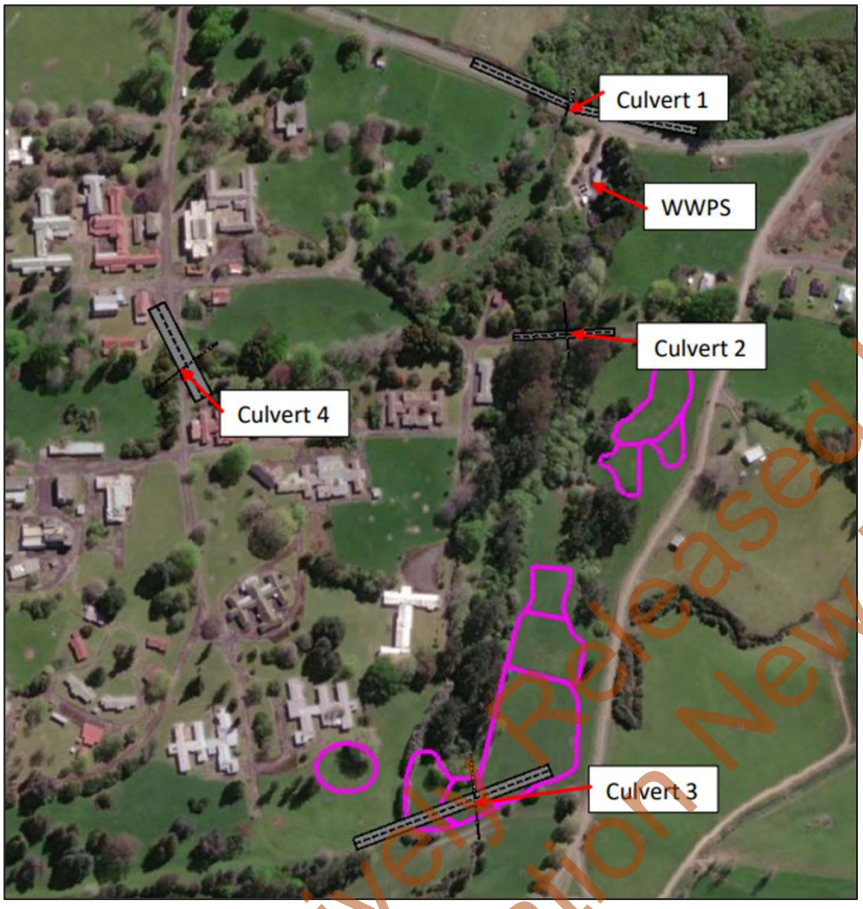


Figure 4: Culvert locations

The road embankment is approximately 6m wide (at the top) by 50-60m long. It is relatively high, with an estimated height of 5.5m from the stream bed to the embankment crest. This culvert has a significant influence on flood levels affecting the existing disposal site (highlighted in pink on Figure 4 above) while the road embankment acts as a dam, affecting stream flow patterns and ecology.

The removal of Culvert 2 has been agreed to as part of the Ministerial decision on horizontal infrastructure removal in September 2023. Removal of this culvert is expected to involve the following works over an area of approximately 3,000m², involving total excavation volume (soil and roading materials) of 6,800m³:

(a) Vegetation and tree removal;
(b) Establishment of erosion and sediment controls; including temporary damming of stream (likely both upstream and downstream) and diversion of stream runoff by pumping around the works area, with fish relocation as per the Fish Management Plan (FMP);
(c) Removal of redundant road paving, basecourse and subbase material to stockpile. Reuse suitable materials on-site as backfill material and dispose of other materials off-site to appropriate processing or disposal facility;

(d) Remove road embankment (assumed soil material) to stockpile. Reuse suitable materials on-site for backfill material and dispose of excess spoil off-site to appropriate facility;
(e) Remove culvert and associated inlet/outlet structures;
(f) Trim stream banks to tie in with existing stream profile (3,000m²);
(g) Place clean topsoil along stream batters – estimated 100-150mm thick and cover with biodegradable coir matting or similar;
(h) Grass upper stream banks and plant lower stream banks as per the Planting and Management Plan (PMP); and
(i) Remove temporary dams and erosion/sediment controls.

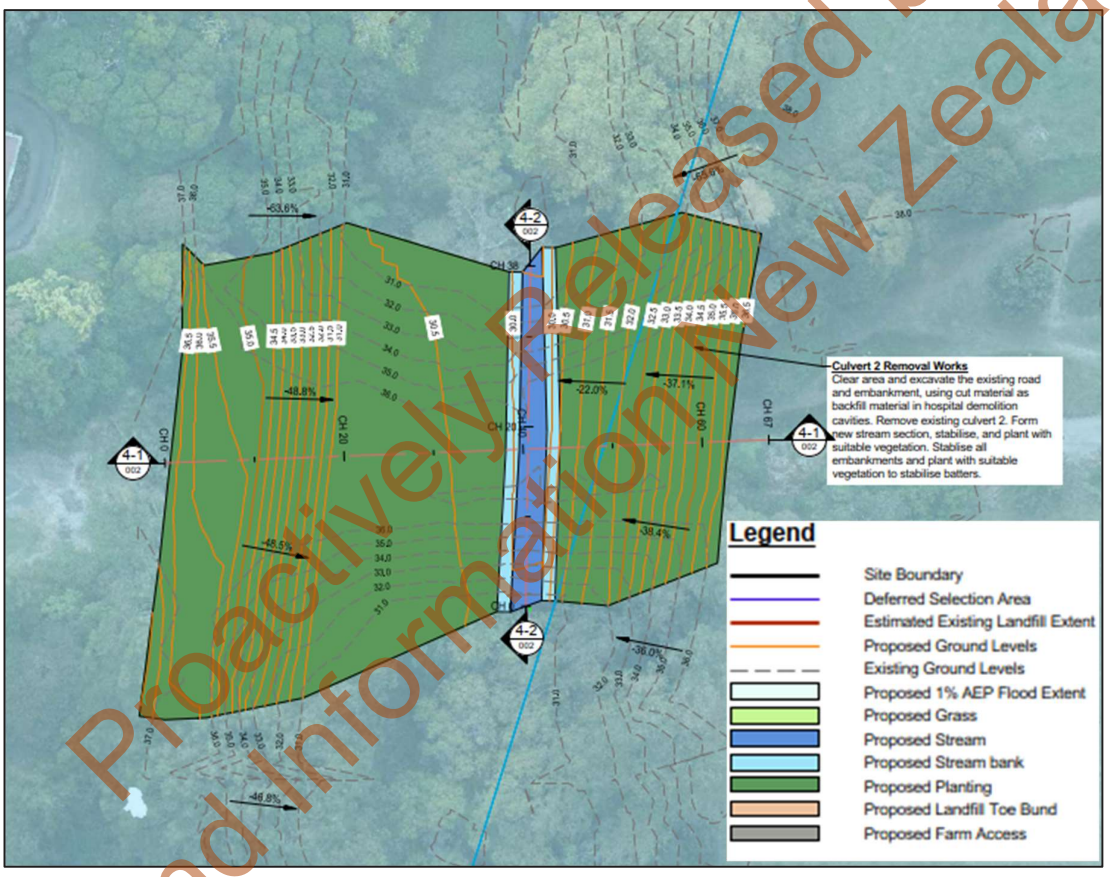


Figure 5: Works area for Culvert 2 removal

3.4 Wetland 2

This wetland is located toward the northwest of the site, between building 55 and 76 (Figure 1). Works proposed within, and within 10m of this wetland and associated methodology are detailed below and shown in Figure 6:

- An above ground wastewater reticulation network comprising 150-160mm pipework and associated support structures will be removed. The support structures are varied

and described as follows and illustrated in Figure 6 below (refer to plans 33205/2011 and 2012 attached to the AEE):

- The pipe supports on the southern pipeline comprise metal footings (approximately 860mm in length) and are spaced at 3m intervals. These extend into a concrete foundation which is approximately 1000mm wide and 1200mm long and is embedded approximately 200mm into the ground in this area.
- The pipe supports of the southern pipeline on the northern side of the waterway comprise of concrete piles that are at 3m intervals. These range from 200 – 450mm wide and 200 – 450mm high. They are embedded approximately 200mm bgl. Two concrete chambers also encase the pipeline in this area. One measures 500mm wide, 1040mm long and 360mm high. The second measures 540mm wide, 640mm long and 340mm in height. Both are embedded approximately 200mm bgl.
- The remaining pipelines are generally located on a concrete slab foundation which is approximately 500mm wide and 420mm high throughout the extent of the pipeline. The embedment of the concrete foundation varies across the extent of the pipeline, ranging from 150mm bgl to the entire foundation below ground level. Some parts of the western and eastern pipelines are buried, while one section of the eastern pipeline is encased in concrete – this concrete chamber extends along the eastern pipeline approximately 17m, measuring 450mm wide and 280mm high. The concrete chamber is embedded an additional 400mm into the ground.
- At the point where all four sections of pipeline connect, the pipes connect into a concrete chamber which is approximately 1220mm wide, 1520mm long and 600mm high. The chamber is embedded an additional 400mm bgl.
- An additional pipeline, that was not identified in the GIS imagery was observed during the site walkover. This was located within the eastern portion of the wetland, running under the eastern pipe across the waterway. It is not visible above ground throughout the remainder of the wetland, and it is unknown where it extends to. Further, service plans do not show any pipe in this location, therefore the full extent of the pipe is not known.

The pipework and support structures will be removed during the summer months. A small excavator (8T or 13T) travelling on swamp mats will be used to remove the pipe in small sections and transported out of the wetland by a small excavator or truck (4W or 6W) travelling on swamp mats. Pipe supports will also be lifted out by the small excavator and removed from the wetland. Voids created by the removal of the pipe supports (approximately 53m^3 and 0.2-0.4m deep) will be backfilled with topsoil that will be placed and tamped down (but not compacted) and the exposed areas revegetated with appropriate wetland vegetation (to match existing).

- Approximately 210m of underground power cabling and a small section of overhead cabling at the southern tip of the wetland will also be removed. Underground cabling is thought to be an 11kV line that is either directly buried or ducted in steel pipes. Site investigations found that electrical infrastructure is, on average, 0.9m deep. The cabling will be removed by exposing the cable at each end and lifting it out in sections. This will be carried out using a small excavator (8T or 13T), travelling on swamp mats. The narrow trench created by the removal of the of the cabling will then be back filled with the same soil and tamped down and exposed areas revegetated with appropriate

wetland vegetation (to match existing). The overhead cable can be removed without entering the wetland. Refer plans 33205/2401 and 2402 attached to the AEE.

- Building 76 (being a garage to the old Doctor's Flats) is located within 10m of the wetland and will be removed. The building is approximately 24m^2 and is constructed on a concrete plinth with post brackets, the total ground disturbance for the removal of the footings will be approximately 7m^3. These will be removed with a small excavator and soil reinstated.

- Historical plans show an underground water pipe running adjacent to Wetland 2 along the northern boundary (Figure 7). However, Ground Penetrating Radar (GPR) was unable to locate this pipe. Potholing will be undertaken to confirm whether it exists. If so, and the pipe is asbestos or buried less than 800mm deep to the top of pipe, there may be minor earthworks and vegetation clearance within 10m of the northern edge of the wetland. The intention is to minimise any disturbance to the wetland, including vegetation removal, to the extent possible. Should this occur, the area will be reinstated with soil and vegetation similar to that removed.

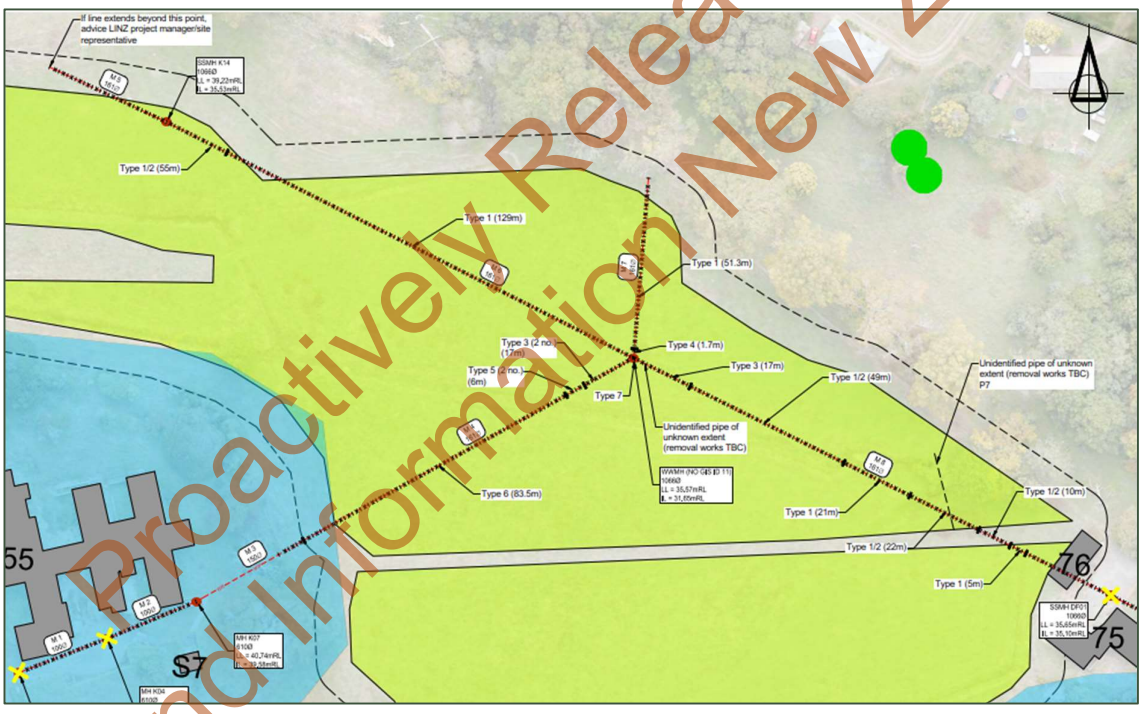


Figure 6: Wastewater demolition plan in Wetland 2

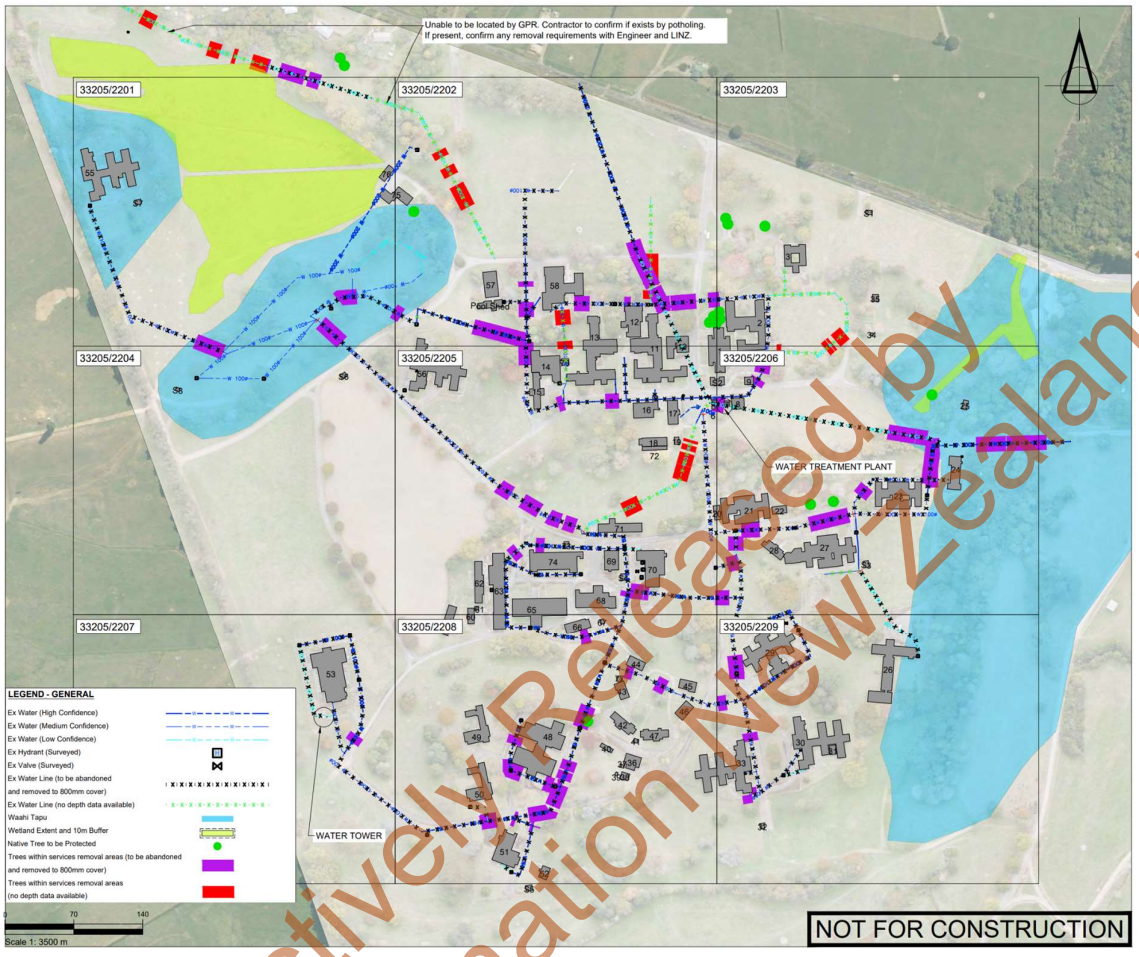


Figure 7: Potential location of the underground water pipe along the northern edge of Wetland 2

3.5 Road and paving removal

Some of the main and minor roads will be repurposed as farm tracks, and a small retaining wall below a road will be kept. The rest of the existing roading and paving will be removed. Figure 8 below gives an overview of the road and paving removal. The full plan is attached to the AEE (ref 33205/2700).

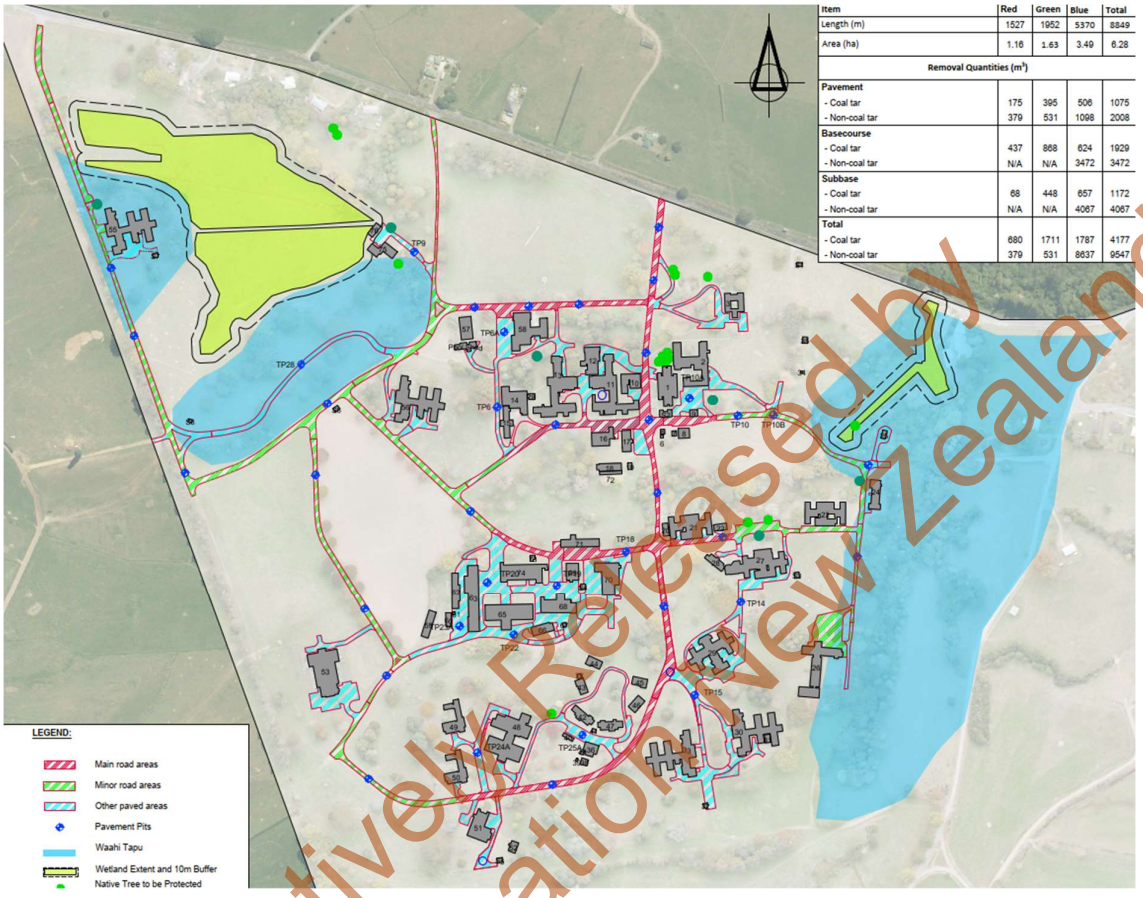


Figure 8: Overview of roads to be repurposed as farm track (red and green) and to be removed (blue)

The road network is approximately 8.8km in length, and has expanded over the lifetime of the hospital and been subject to ongoing repairs, resealing and maintenance works over the years.

The roading network has been split into three portions, primarily based on road function, degree of use and age. These are shown in red, green and blue on Figure 8, and each has their own management/removal requirements. Section 12.1.3 of the DRRMP (attached to the AEE) provides full details of the removal requirements.

The portion of the road network shown in blue (5.37km, 3.49ha) is to be fully removed (surface, basecourse and subbase). This portion of the road network will be reinstated with clean soils to existing ground level.

The red and green portions of the road network areas (3.48km, 2.79ha) will be partially removed, essentially removing the surface pavement down to basecourse, then topping up the basecourse to existing ground level, forming farm tracks for future use.

As set out in section 3.1.2of the Remedial Application, coal tar is present across all three road network colours and roading layers. All confirmed coal tar roading materials are to be removed from the site, regardless of depth within the road network. The proposed methodology for this is:

- Remove all surface pavement in 50mm deep increments (to limit cross contamination), utilising excavators and/or milling plant (if proposed by contractor). Surface material to be placed directly into bins adjacent to works area and/or stockpiled in controlled areas until sufficient volume is generated to fill trucks for offsite disposal. All excavated surface material to be placed in like for like bins or stockpiles, i.e. coal tar into coal tar bins/stockpiles, asphalt into asphalt bins/stockpile and chipseal into chipseal bins/stockpiles;
- In red/green road network areas, any surface layers that have been identified at depth (multiple layers of surface material) will also require removal by excavator and/or milling plant. Material to be handled and placed in bins/stockpiles as detailed above;
- In red/green road network areas, any material removed will be "topped up" with basecourse to form rural farm tracks for ongoing use;
- In blue road network areas, all material (surface, basecourse & subbase) will be removed by excavator and/or milling plant. Material to be handled and placed in bins/stockpiles as detailed above;
- In blue road network areas, entire removal area to be reinstated with soil and returned to grazing land use;
- All roading material removed during this process to be disposed of offsite to suitably licensed disposal facility, or contractor facility for recycling and reuse.

The estimated total volume of roading materials to be removed is ~13,750m³, and ~4,200m³ of this is estimated to be coal tar.

4.0 Effects to Wetland Hydrology

4.1 Wetland 1

Works are planned to occur within, and within 10m setback of a natural inland wetland. From a hydrological perspective, these works, when undertaken in accordance with the removal methodology stipulated, are unlikely to result in the complete or partial drainage of the wetland, for the reasons outlined below:

- The works within a 10m setback of Wetland 1 involve removal of concrete edging, a fence, the above ground trickling filter and stone media, and outlet pipe. Disturbance of the natural ground is minimal. The risk is considered very low.
- Works within Wetland 1 involve removal of the outlet pipe; concrete block grit chamber and metal lid to ground level; wastewater inlet pipe; ancillary cabling/cable ducting; and the footbridge and timber supports. The removal methodology has been developed to minimise impact on the wetland hydrology, through:
    - Works to occur from the edge of the wetland, where possible;
    - Works in the wetland to occur in summer dry periods when water levels are lower and soils harder, thereby reducing the risk of submergence and damage to underlying soils;
    - Use of a small excavator and swamp mats to spread the weight of the excavator over a larger area;
    - Backfilling any cavities with like-for-like wetland soils; and

- Revegetating any planting gaps resulting from infrastructure removal or excavator works with like-for-like wetland plant species.

Only a small portion of the wetland will be directly impacted by these works. There is not expected to be any change to inflows or outflows from the wetland. The risk to wetland hydrology is considered low.

4.2 Trunk stormwater pipe repair

Works are planned to occur within, and within 10m setback of a natural inland wetland. Works will involve temporarily damming the stormwater outlet and pumping any flow around the outlet into the wetland, until the outlet work section is completed. From a hydrological perspective, these works, when undertaken in accordance with the methodology stipulated, are unlikely to result in the complete or partial drainage of the wetland.

The works will involve a temporary diversion of water within a 100m setback from Wetland 1. The diversion is to facilitate the stormwater pipe repair allowing works to occurring in dry conditions. The pipe will be repaired in segments with stormwater runoff from upstream of the work section being diverted to below the work section.

Works are expected to result in an initial increase in flow to the wetland as backflow in the pipe is removed. This will be minimised through construction occurring in drier summer conditions. Following this initial clearing of the backflow, runoff to the wetland will remain unchanged throughout the works period thereby resulting in less than minor effects to Wetland 1.

4.3 Culvert 2 removal

The works will involve a diversion of water within a 100m setback from Wetland 1 through the temporary damming of Wharekōrino Stream and diverting runoff around the works area through pumping. Runoff to the wetland will remain unchanged throughout the works period thereby resulting in less than minor effects to Wetland 1.

Stream hydrology will be slightly impacted by the removal of the old access road and Culvert 2. This will result in less pooling directly upstream of the currently blocked Culvert 2. The low gradient of the stream will result in no change in stream hydrology or flow across the subject reach, although flow will be restored in the immediate vicinity of Culvert 2.

Flood flows to Wetland 1 are expected to change slightly from the proposed works at Culvert 3. Modelling of these works showed the changes are not expected to result in adverse effects to Wetland 1 for more regular storms (50% - 5% AEP events). The hydrological connectivity to the wetland will remain. The risk to wetland hydrology is considered low.

The proposed methodology for the damming and diversion of the Wharekōrino Stream to enable Culvert 2 and the redundant road embankment to be removed, will take up to 3 months. Any hydrological and flooding effects from the diversions are temporary. Works will take place in low flow conditions with erosion control measures in place to minimise any potential flooding and erosion effects. The temporary dams will restrict the entire cross sectional area of the stream, and stream flows will be pumped around the works areas so that downstream flows are maintained. The effects on hydrology and flooding arising from the temporary diversions are considered to be less than minor.

4.4 Wetland 2

Works are planned to occur within, and within 10m setback of a natural inland wetland. The works involve removal of an above ground wastewater reticulation network and associated support structures; underground and overhead power cabling; underground water pipe and Building 76 (a garage). From a hydrological perspective, these works, when undertaken in accordance with the removal methodology stipulated, are unlikely to result in the complete or partial drainage of the wetland, for the reasons outlined below:

- The works within a 10m setback of Wetland 2 involve removal of a concrete plinth associated with Building 76, and removal of an underground water pipe. The total ground disturbance for the removal of the concrete plinth footings will be approximately 7m^3. The soil will be reinstated. Removal of the underground water pipe may involve earthworks and vegetation removal to a small area adjacent to the northern edge of the wetland. The soil and vegetation will be reinstated. The risk of altering the hydrological connectivity of the wetland is considered very low.
- Works within Wetland 2 involve removal of the wastewater reticulation network and support structures which are predominantly concrete bases embedded into the ground at varying depths, commonly 200-400mm; and power cabling. The removal methodology has been developed to minimise impact on the wetland hydrology, through:
    - Works to occur from the edge of the wetland, where possible;
    - Works in the wetland to occur in summer dry periods when water levels are lower and soils harder, thereby reducing the risk of submergence and damage to underlying soils;
    - Use of a small excavator and swamp mats to spread the weight of the excavator over a larger area;
    - Backfilling any cavities with like-for-like soils; and
    - Revegetating any planting gaps resulting from infrastructure removal or excavator works with like-for-like wetland plant species.

  Only a small portion of the wetland will be directly impacted by these works. There is not expected to be any change to inflows or outflows from the wetland. The risk to wetland hydrology is considered low.

4.5 Road and paving removal

Works are planned to occur within a 10m setback of a natural inland wetland. Works are temporary in nature to remove road and paving material and be replaced with basecourse to form farm tracks, or with soil and grass. These works are unlikely to result in the complete or partial drainage of all or part of a natural inland wetland. Instead runoff to surrounding land, including wetlands, should improve by increasing the perviousness of the ground surface facilitating more infiltration.

5.0 Conclusion

Having reviewed the proposed works within, and within proximity to natural inland wetlands, I consider the effects on wetland hydrology to be less than minor and unlikely to result in the complete or partial drainage of all or part of the two natural inland wetlands. The works are

intended to be carried out in a manner that will minimise damage to the wetlands and are expected to result in improved hydrological connection throughout the catchment.

The following recommendations are made to minimise the potential impact to wetland hydrology:

1. Works to occur from the edge of the wetland, where possible;
2. Works in the wetland to occur in summer dry periods when water levels are lower and soils harder, thereby reducing the risk of submergence and damage to underlying soils;
3. Use a small excavator and swamp mats to spread the weight of the excavator over a larger area;
4. Backfill any cavities with like-for-like wetland soils/topsoil; and
5. Revegetate any planting gaps resulting from infrastructure removal or excavator works with like-for-like wetland plant species.

Regards,

SLR Consulting New Zealand

Charlotte Lockyer
Principal Hydrologist

Appendix A Wetland 2 photos

Southern pipeline with footings

Southern pipeline footings and concrete foundation

Southern pipeline with concrete casing

Southern pipeline with concrete pile

Pipeline situated on concrete foundation

Pipeline situated on concrete foundation

Westernmost pipeline below ground level

Concrete chamber connecting all four pipelines

Eastern pipeline within concrete chamber

Additional pipeline underlying eastern pipeline

Appendix E Planting and Maintenance Plan

Ecological Impact Assessment

Tokanui Hospital Remediation

Land Information New Zealand

SLR Project No.: 880.V11547.00001

19 November 2024

SLR

Planting and Maintenance Plan

Tokanui Hospital Remediation

Land Information New Zealand

Level 7, Radio New Zealand House
115 The Terrace, Wellington 6011

Prepared by:

SLR Consulting New Zealand

SLR Project No.: 880.V11547.00001

Client Reference No.: 11547

18 November 2024

Revision: 1.0

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
1.0	18 November 2024	Kendall Leitch	Hamish Dean	Hamish Dean

Basis of Report

This report has been prepared by SLR Consulting New Zealand (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Land Information New Zealand (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

Table of Contents

Appendices

1.0 Introduction

1.1 Background

The former Tokanui Hospital is located approximately 14 kilometres south of Te Awamutu, Waikato. Toitu Te Whenua - Land Information New Zealand (LINZ) is responsible for the 80 ha site where the hospital resides and are seeking to remediate the former Tokanui Hospital to an agreed state to offer the property ownership to Te Nehenehenui, the Ngati Maniaopto post Settlement Governance Entity, for purchase.

A portion of the Wharekōrino Stream, a tributary of the Pūniu River, flows through the eastern boundary of the site. Three culverts intersect the stream. “Culvert 1” is located at the Northernmost extent of the site, beneath Te Mawhai Road, connecting the stream and wetland habitat to densely vegetated habitat downstream. “Culvert 2” is within the site, beneath an embankment created for a previous access road to Tokanui Hospital. The third culvert, “Culvert 3” is located at the most upstream extent of the site, beneath a farm crossing. This connects the stream to a recently planted and channelised watercourses upstream. At the southern extent of the stream a herbaceous wetland is present on the stream margins. A second wetland is also present on the western end of the site.

1.2 Proposed Works

Included within the proposed remediation works are the removal and replacement of two culverts within the Wharekōrino Stream. Works proposed will require approximately 4412 $m^2$of the riparian vegetation to be replanted (Figure 1 and Figure 2) including:

- Removal of Culvert 2 and the roading above (2722 m^2) and;
- Replacing Culvert 3 with a shorter culvert and creating stream habitat (1690 m^2). This will also result in 28 m of stream being disconnected from the Wharekōrino Stream.

Removal of horizontal infrastructure within pastural wetland and Wharekōrino Stream wetland on site will also be required (Figure 3 and Figure 4). The 800 mm deep trenches where infrastructure is removed will be backfilled to previous ground levels. Stabilisation of all disturbed areas will be undertaken by grassing.

1.3 Purpose

As part of the sites ecological assessment, it was identified that a Planting and Management Plan (PMP) for the areas where riparian vegetation is removed or disturbed would be required to mitigate loss of habitat. LINZ engaged SLR Consulting to provide the PMP as supporting documentation for a resource consent application. This document details the planting and management efforts that will need to be undertaken to ensure successful establishment of riparian vegetation.

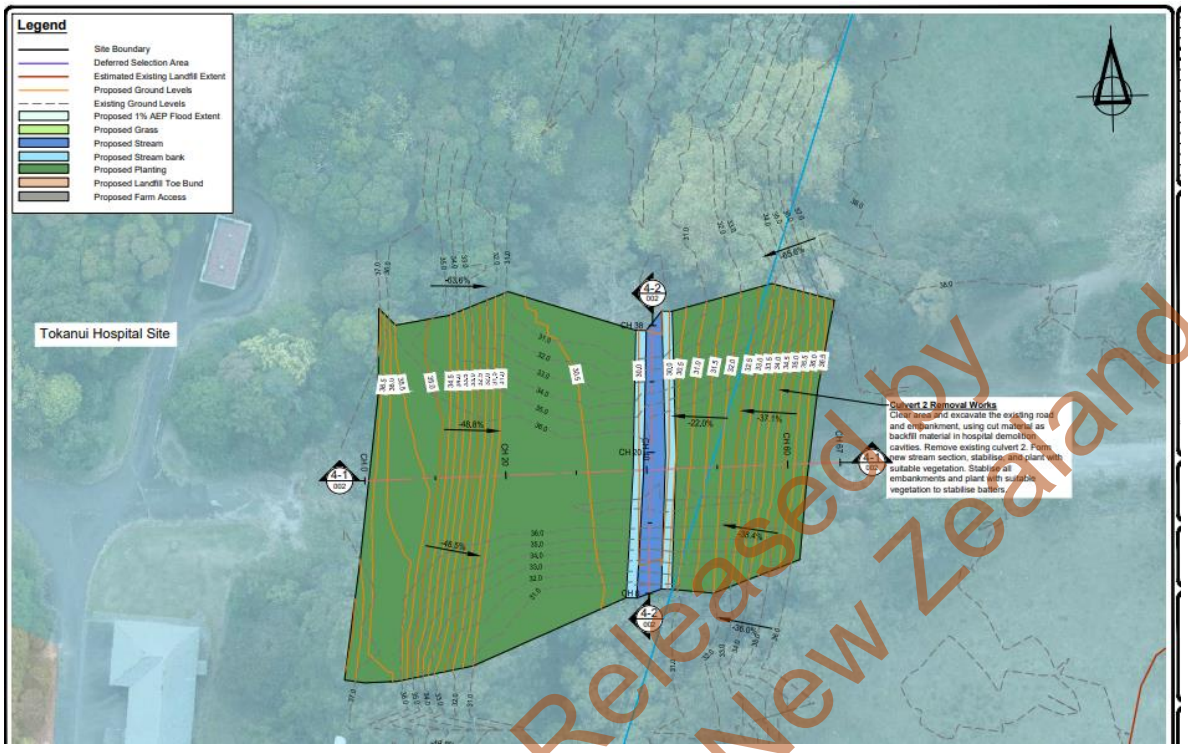


Figure 1: Culvert 2 works area.

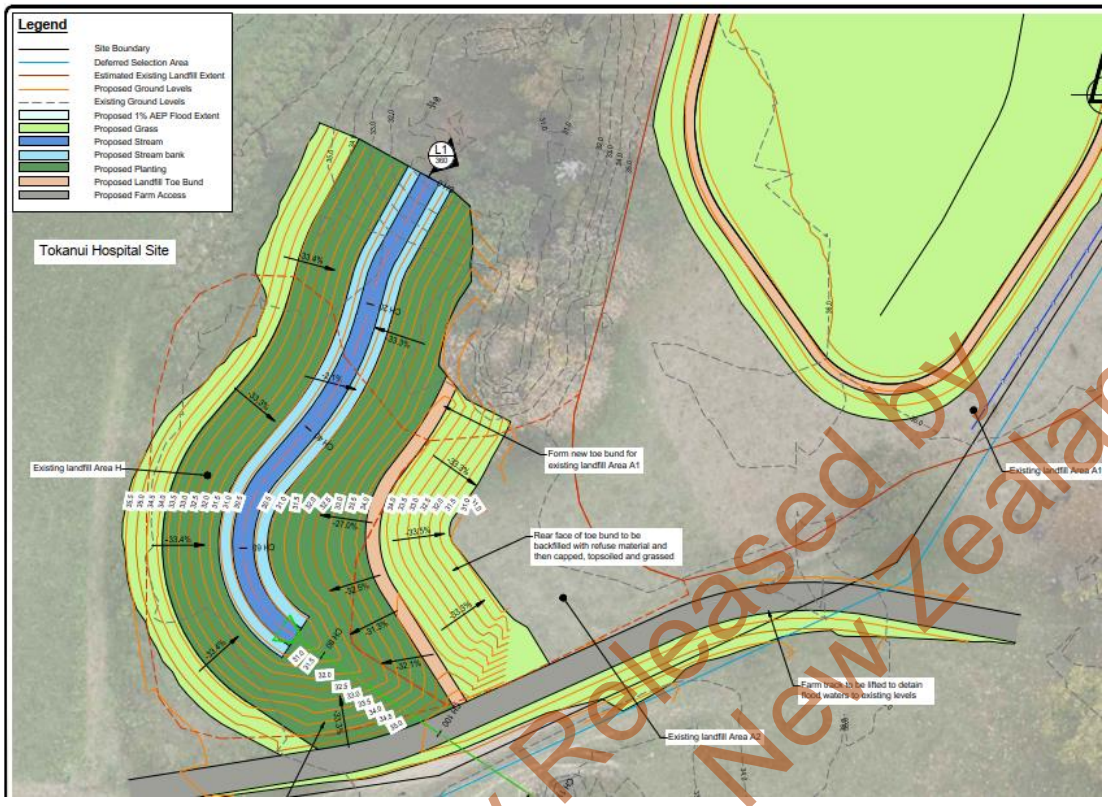


Figure 2: Culvert 3 works area.

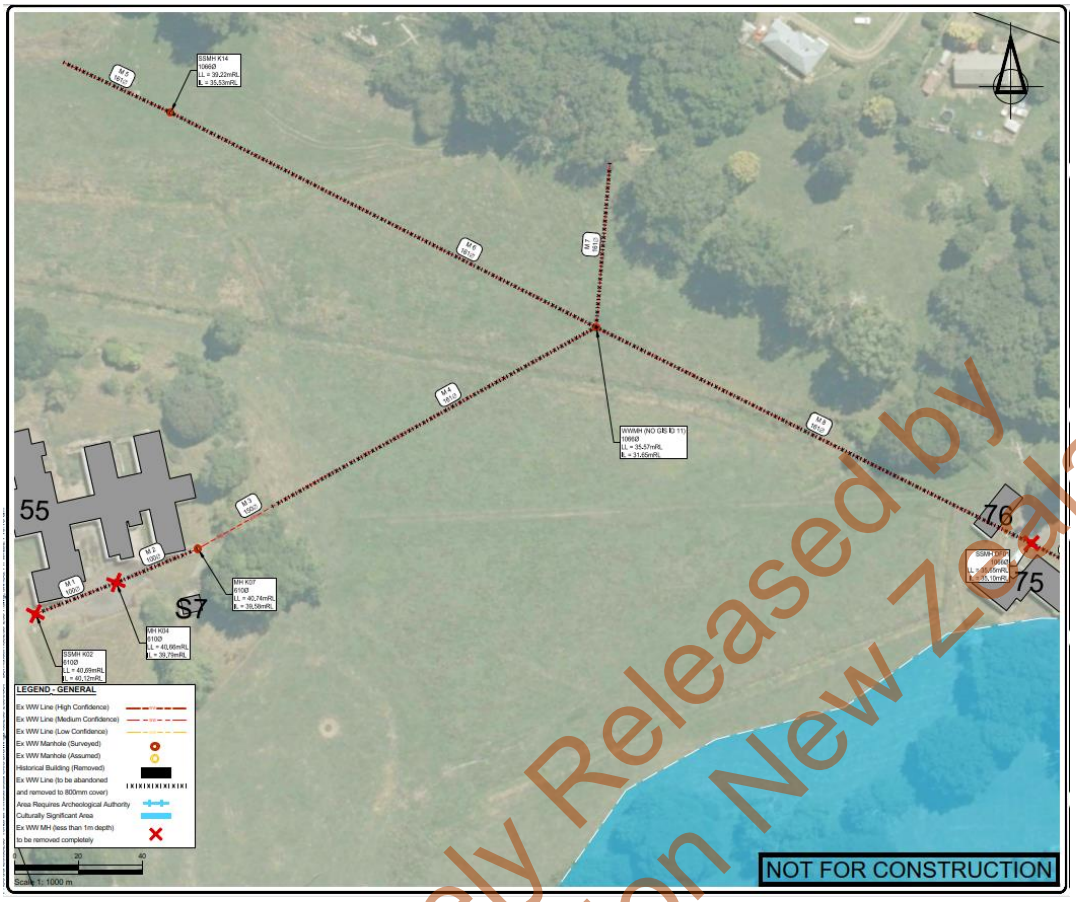


Figure 3: Wastewater lines to be removed within Wetland 2.

Figure 4: Infrastructure to be removed within the Wharekōrino Stream wetland.

2.0 Vegetation Description

The majority of the Wharekōrino Stream riparian vegetation was exotic deciduous hardwoods, with a canopy of gum trees (*Eucalyptus* sp) and crack willow (*Salix fragilis)*. The understorey was dominated Tradescantia *(Tradescantia fluminensis)* on both banks. Tree privet (*Ligustrum lucidum*), cabbage tree (*Cordyline australis*), pine (*Pinus* sp.), and Japanese honeysuckle (*Lonicera japonica*) were also present (

Figure **5** and Figure 6).

The pastural wetland, Wetland 2, is a modified natural wetland with drainage channels created to allow for grazing of the area. The area was dominated by creeping bent (*Agrostis stolonifera*), with occasional buttercup (*Ranunculus repens*) and soft rush (*Juncus effusus*) and was wet underfoot during the site visit (Figure 7).

Figure 5: Representative reach of the Wharekōrino Stream dominated by exotic vegetation.

Figure 6: Exotic vegetation within the Culvert 2 works area.

Figure 7: Pastural wetland.

3.0 Planting Plan

3.1 Pest Plant Control

Exotic species currently dominate the vegetation surrounding the Wharekōrino Stream. Pest plants that will need targeted control include Tradescantia, which dominates the understory, crack willow, tree privet, and Japanese honeysuckle. Pest plant control will need to be undertaken for each species as described below to ensure native plantings establish. After the initial control of pest plants is undertaken further pest plant control will be required every second month for three years, or until the native planting has established a contiguous canopy.

3.1.1 Tradescantia

Tradescantia fluminensis

Description

Scrambling herb which forms dense mats in shaded areas and prevents regeneration of native species.

Approach

Remove Tradescantia from the planting area and maintain at low levels until plants are established. Leave a strip along the stream edge as this species provides habitat for fish. Remove streamside weeds once the natives have established.

Control method

Spray with triclopyr at label rates and follow up with 2nd treatment within 3 months. Small infestations can be hand pulled or raked up provided all fragments are recovered. Plants must be composted on site to prevent regrowth.

Timing

Final treatment should be at least 3 months prior to planting to avoid residual herbicide in the soil affecting planted natives.

3.1.2 Crack willow

Salix x fragilis

Description

Spreading, deciduous tree which favours riparian or damp areas. Spreads by root and shoot fragments floating downstream. Can block waterways or alter channel morphology.

Approach

Control all plants within planting area.

Control method

For large trees, drill holes in the trunk every 10 cm and fill with undiluted glyphosate. Saplings can be sprayed with glyphosate or metsulfuron.

Timing

Can only be controlled when in full leaf (spring to summer) and before senescence begins in autumn.

3.1.3 Tree privet

Ligustrum lucidum

Description

A small evergreen tree which thrives in shaded situations and excludes native species. It produces masses of seed which is readily spread by birds.

Approach

Control prior to planting and then maintain low levels by controlling seedlings.

Control method

Cut down and paint stumps with glyphosate (200mL/L of water) or for very large trees drill holes in trunks and fill with metsulfuron (5g/10L of water + penetrant). For seedlings, spray with metsulfuron at label rates.

Timing

Control at least 3 months prior to planting to avoid residual herbicide in the soil affecting plants.

3.1.4 Japanese honeysuckle

Lonicera japonica

Description

A climber with tough woody stems that can exclude or smother native shrubs and trees and can be very difficult to control. Forms dense mats on open ground.

Approach

Completely eradicate from the planting area and immediately adjacent areas to prevent smothering of new plantings. Follow-on control will be needed.

Control method

Large plants can be cut and both cut surfaces painted with metsulfuron (5g/10L of water + penetrant), or spray entire plant with metsulfuron or brushkiller (picloram/triclopyr mix).

Timing

Ensure at least 3 months between use of chemical and planting.

3.2 Site Preparation

Planting can be undertaken in areas where effective pest plant control has been achieved. Plants should be eco-sourced from the Waipa Ecological District or as close to the site as practical. Eco-sourcing is the process of propagating native plants from local areas and planting them back within the same region. This helps maintain the genetic diversity of local plants, ensures plants are adapted to local conditions and retains the unique character of a landscape.

Planting of areas within the immediate stream margins should be undertaken in early summer when water levels are low. Planting should be done according to best practice as follows:

- Plants are watered well prior to planting and if possible, once pots are removed plants are not left in the sun and wind for more than five minutes;

- Planting holes are twice the size of the plant container;
- The collar of the plant is located above the soil and;
- Trees and plants shall be positioned in the locations and quantities described on this plan. Smaller shrubs and grasses should be planted in a randomised sequence in clusters, ensuring a variety of microhabitats.

3.3 Native planting

Native species will differ based on planting zones as described below. Planting plans for each area that depict each planting zone are present in Appendix A.

3.3.1 Planting Zones

Watercourse margins (2 m either side of the stream)

Species	Common name	Spacing (m)	Proportion of mix	Number of plants Culvert 2 (116 m^2)	Number of plants Culvert 3 (300 m^2)
Carex geminata	Rautahi	0.5	10%	23	60
Carex secta	Purei	0.5	20%	46	120
Carex virgata	Pukio	0.5	20%	46	120
Phormium tenax	Harakeke	1	50%	58	150

Riparian Banks

Species	Common name	Spacing	Proportion of mix	Number of plants Culvert 2 (2606 m^2)	Number of plants Culvert 3 (1690 m^2)
Coprosma robusta	Karamū	1.5	25%	287	186
Melicytus ramiflorus	Māhoe	1.5	20%	229	149
Fuchsia excorticata	Kōtukutuku	1.5	10%	115	74
Alectryon excelsus	Tītoki	1.5	10%	115	74
Aristotelia serrata	Makomako	1.5	15%	172	112
Geniostoma ligustrifolium	Hangehange	1.5	5%	57	37

Species	Common name	Spacing	Proportion of mix	Number of plants Culvert 2 (2606 m^2)	Number of plants Culvert 3 (1690 m^2)
var ligustrifolium					
Hedycarya arborea	Porokaiwhiri	1.5	15%	172	112

3.3.2 Pasture wetland

Areas that require revegetation within the pasture wetland should be reseeded with grass seed.

3.3.3 Wharekōrino Stream wetland

Vegetation impacted by the works are herbaceous exotic species and the area is likely to be small. Native planting required is dependent on the areas disturbed but should be consistent with Sections 3.3.1 and 0.

3.3.4 Wharekōrino Stream disconnected reach

The Culvert 3 works will result in a reduction of flows through 28 m of watercourse that is currently connected through the main reach of the Wharekōrino Stream. It is uncertain exactly how this will impact habitat. Currently this section of stream supports run habitat. It is possible that, once flows reduce, water may pool, becoming stagnant when rainfall is minimal. To account for habitat changes within this reach native species should be planted as outlined in Section 3.3. A suitably qualified ecologist should determine what areas require planting after the Culvert 3 works has been completed to observe any habitat changes that result although it is likely that only the margins of the channel will be able to be planted.

4.0 Pest Animal Management

It is likely that possums, hares and rabbits are present at least occasionally within and surrounding the site. These species are known to impact the successful establishment of native planting. Although not a pest animal species, pukeko are also known to impact native planting success as they pull out new plants before a strong root system has developed. Management of these pests will be required to reduce impacts on planted indigenous vegetation and ensure they establish. It is recommended that plant guards are installed around newly planted vegetation for a minimum of 1 year.

5.0 Fencing

To prevent stock access into the enhancement areas, a stock-proof fence will need to be erected where grazing occurs. Fences will need to be appropriate for the type of livestock being grazed. Gates may be allowed for access purposes such as pest animal monitoring and weed control. However, any gates should be kept shut and properly secured at all times to keep any livestock out of the planting areas. The pasture wetland is excluded from this requirement.

6.0 Biosecurity

The risk of spreading diseases and weeds can be minimised by ensuring that all machinery, tools and footwear are well cleaned and weed free when entering the site.

7.0 Maintenance

7.1 Pest plant control

As a result of pest plant control the ground is open to re-invasion by the same or a different suite of pest plants. Therefore, following initial removal, ongoing monitoring for pest plant regrowth and follow up control will be required. In addition, any grasses or other species competing for space with the planted natives should be removed periodically to ensure maximum success. Maintenance of plantings will be required for three to five years, depending on success of native plantings. Weed control will no longer be required once native cover reaches 90%.

7.2 Planting

Ongoing plant maintenance shall include the following to ensure plants establish and reach a sufficient maturity to be self-sustaining:

- Weeding of all planted areas up to 9 times annually following planting in the first year and reducing thereafter.
- Weed control by hand and/or chemical as required; and
- Any natural or unnatural loss of vegetation shall be immediately replaced like for like within the next planting season after loss and therewith maintained.
- The frequency of maintenance shall be determined by the planting contractor as necessary to achieve 90% canopy cover.

It takes between 3-5 years before native plantings are well established and their certainty of survival is assured.

Monitoring shall be undertaken bi-annually in summer to check for plant disease and pest animal damage, and in March/April to assess the requirement for infill planting where plants may have died. Planted species that die, are damaged, or are suffering from disease during or before the end of the 5-year period, shall be replaced every planting season (April – October) for the 5-year maintenance period, with a plant of the same species and grade until a native cover of no less than 90% has been achieved.

7.3 Pest animal control

All pest animals should be controlled in accordance with Section 4.0 of this report at the time of initial planting and on an ongoing basis to ensure plants establish and reach a sufficient maturity to be self-sustaining.

7.4 Fencing

As fences are subject to damage over time the condition of the fences should be monitored, and any damaged sections restored as soon as possible.

8.0 Timeline

A timeline of when to undertake maintenance and works is presented in Table 1 below.

Table 1: When to undertake works on site for successful establishment of plants.

Year 1-3	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Initial/replacement planting				✓	✓	✓	✓	✓	✓			
Pest plant control		✓		✓		✓		✓		✓		✓
Pest animal controls (1 year only)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year 4-5												
Pest plant control						✓						✓

Sincerely,

SLR Consulting New Zealand

Kendall Leitch
Senior Ecologist

Hamish Dean
Principal Ecologist

9.0 Feedback

At SLR, we are committed to delivering professional quality service to our clients. We are constantly looking for ways to improve the quality of our deliverables and our service to our clients. Client feedback is a valuable tool in helping us prioritise services and resources according to our client needs.

To achieve this, your feedback on the team's performance, deliverables and service are valuable and SLR welcome all feedback via https://www.slrconsulting.com/en/feedback. We recognise the value of your time and we will make a $10 donation to our Charity Partner - Lifeline, for every completed form.

Appendix A Planting Plans

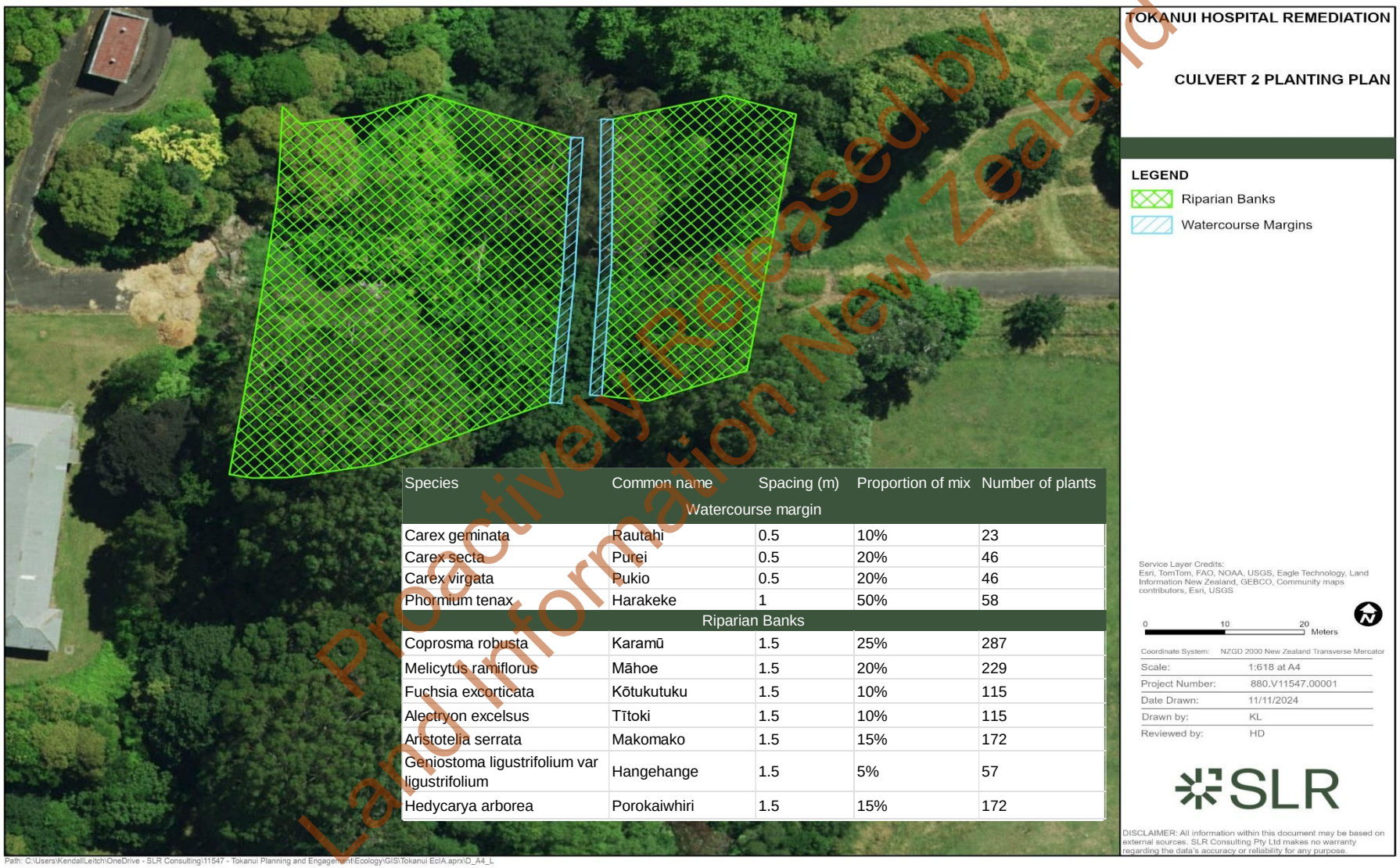
Planting and Maintenance Plan

Tokanui Hospital Remediation

Land Information New Zealand

SLR Project No.: 880.V11547.00001

18 November 2024



Species	Common name	Spacing (m)	Proportion of mix	Number of plants
Watercourse margin				
Carex geminata	Rautahi	0.5	10%	23
Carex secta	Purei	0.5	20%	46
Carex virgata	Pukio	0.5	20%	46
Phormium tenax	Harakeke	1	50%	58
Riparian Banks				
Coprosma robusta	Karamū	1.5	25%	287
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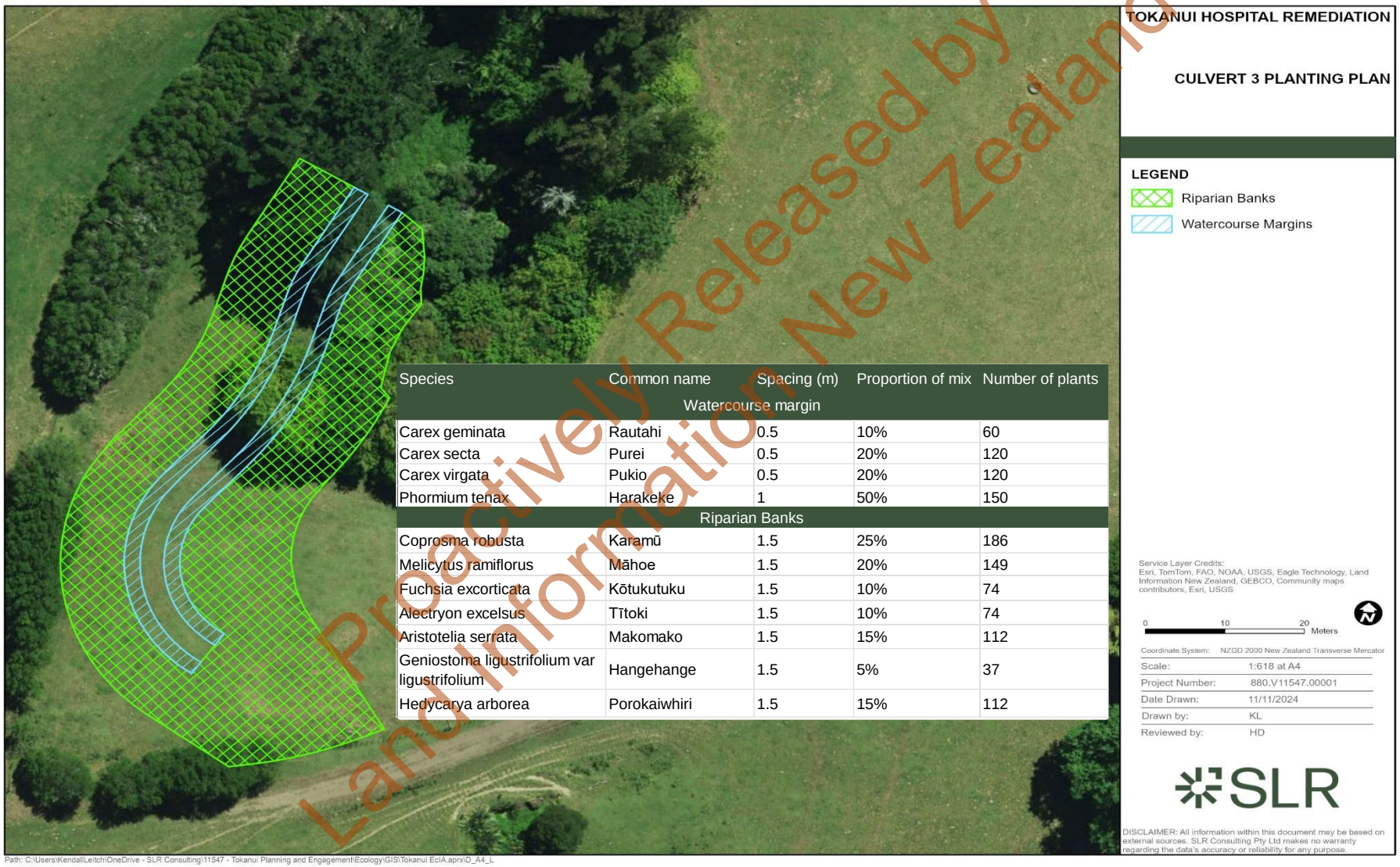
Hedycarya arborea	Porokaiwhiri	1.5	15%	172



Species	Common name	Spacing (m)	Proportion of mix	Number of plants
Watercourse margin				
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Carex secta	Purei	0.5	20%	120
Carex virgata	Pukio	0.5	20%	120
Phormium tenax	Harakeke	1	50%	150
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Aristotelia serrata	Makomako	1.5	15%	112
Geniostoma ligustrifolium var ligustrifolium	Hangehange	1.5	5%	37
Hedycarya arborea	Porokaiwhiri	1.5	15%	112

Making Sustainability Happen

Appendix F Fish Management Plan

Ecological Impact Assessment

Tokanui Hospital Remediation

Land Information New Zealand

SLR Project No.: 880.V11547.00001

19 November 2024

SLR

Technical Memorandum

To:	Bryan Daly	**From:**	Kendall Leitch and Nicola Pyper
Company:	Land Information New Zealand	**SLR Consulting New Zealand**	
		Date:	18 November 2024
		Project No.	880.V11547.00001

RE: Tokanui Hospital Remediation
Fish Management Plan

1.0 Introduction

1.1 Background

Tokanui Hospital is located approximately 14 km south of Te Awamutu, Waikato. Toitu Te Whenua - Land Information New Zealand (LINZ) is responsible for the 80 ha site where the hospital resides. LINZ is seeking to remediate the former Tokanui Hospital site and will offer the property to Te Nehenehenui, the Ngati Maniapoto post Settlement Governance Entity, for purchase.

A portion of the Wharekōrino Stream, a tributary of the Pūniu River, flows in a northerly direction along the eastern boundary of the site (Figure 1). The headwaters to the south of the site are modified watercourses surrounded by pastural land. In order to inform an Ecological Impact Assessment (EcIA), SLR Consulting New Zealand (SLR), carried out fish surveys in the reach within site bounds. Native fish species identified by the survey included shortfin eel (*Anguilla australis*) (Not Threatened) and longfin eel (*Anguilla dieffenbachia)* (At–Risk – Declining)[1] of varying sizes.

Three culverts intersect the stream, as depicted in Figure 1. “Culvert 1” is located at the northernmost extent of the site, beneath Te Mawhai Road, connecting stream and wetland habitat to the south of the culvert with densely vegetated riparian margins downstream. The culvert was unable to be observed, however the pooling of water and surface scum directly above the culvert indicates the culvert was at capacity during the time of the assessment. “Culvert 2” is within the site bounds, beneath an embankment constructed as part of an access road for Tokanui Hospital. Accumulated debris and the pooling of water upstream of this culvert, as well as the lack of flow downstream, indicates this culvert has impeeded flows and likely impeds fish passage. The third culvert, “Culvert 3” is located at the upstream extent of the site, beneath a farm crossing.

[1] Dunn, N. R., Allibone, R. M., Closs, G. P., Crow, S. K., David, B. O., Goodman, J. M., Griffiths, M., Jack, D. C., Ling, N., Waters, J. M., & Rolfe, J. R. (2018). Conservation status of New Zealand freshwater fishes, 2017 (New Zealand Threat Classification Series No. (24). Department of Conservation. Wellington.

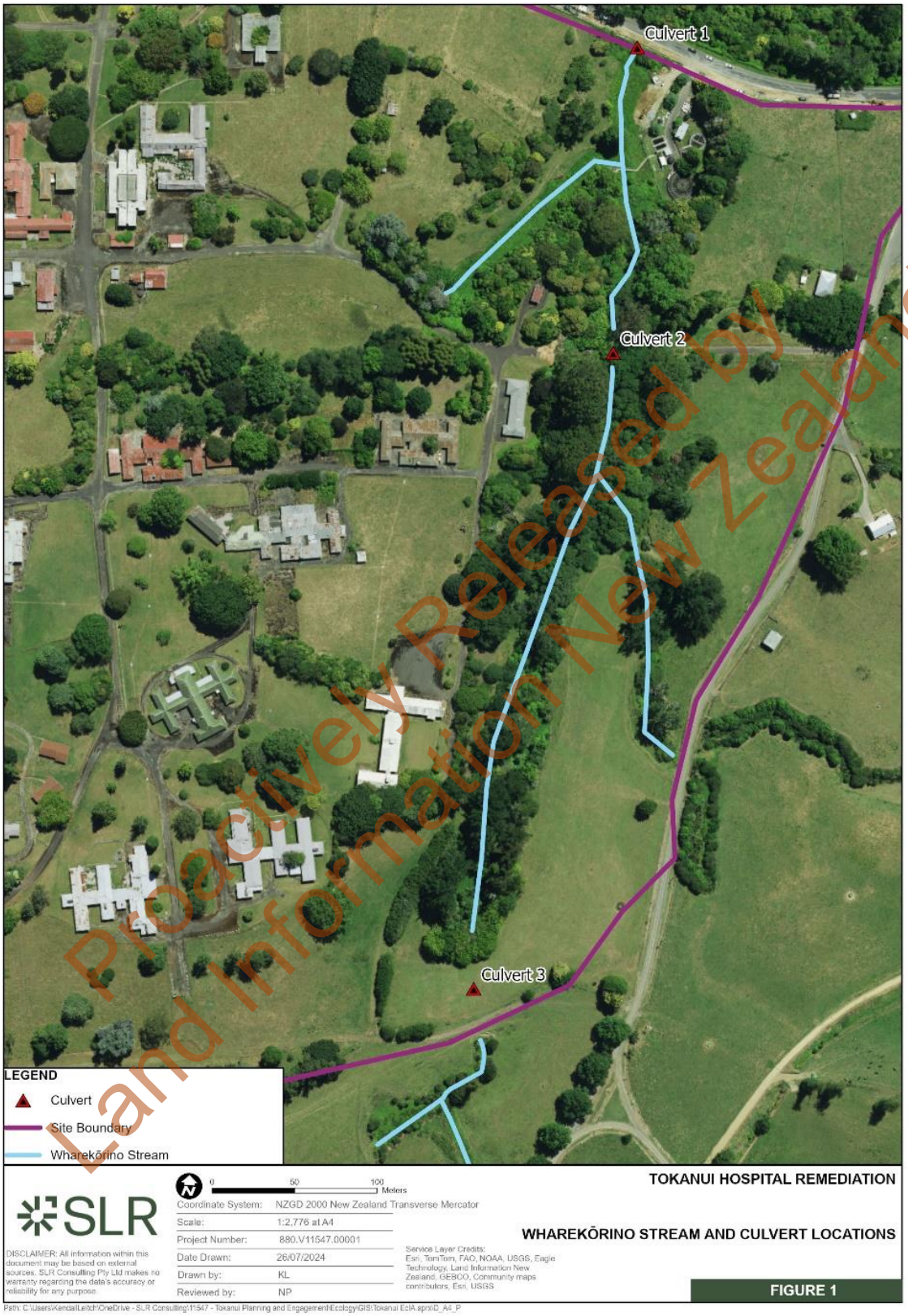

Figure 1 Wharekōrino Stream and culvert locations.

1.2 Purpose

As part of the EcIA, it was identified that a Fish Management Plan (FMP) would be required to avoid injury and / or mortality of native fish species during instream works. LINZ engaged SLR Consulting to provide the FMP as supporting documentation for a resource consent application. This document details the relocation methodology that will need to be implemented to mitigate adverse effects on native fish species.

1.3 Proposed Works

Included within the proposed remediation works is the removal or replacement of two culverts that intersect the Wharekōrino Stream. Instream earthworks are required for:

- Removal of Culvert 2 and the roading above (Figure 2), and;
- Replacing Culvert 3 with a shorter culvert and creating a new section of stream (Figure 3).

2.0 Watercourse Description

Within the site bounds, the majority of the Wharekōrino Stream's riparian vegetation was exotic deciduous hardwoods with a canopy of gum trees (*Eucalyptus globulus subsp. globulus*) and crack willow (*Salix fragilis)*. The understory was dominated *Tradescantia (Tradescantia fluminensis)* on both banks (Figure 4). The soft bottomed watercourse meandered along a natural flow path with a gently sloping gradient and wide, deep channel. The stream substrate constituted large amounts of sand and fine sediment, which was loosely packed, resulting in bars and many large, deep pools. Water was clear, cool, and relatively fast-flowing, however, due to the naturally shallow gradient, flow velocity slows further downstream.

Water had pooled both upstream and downstream of Culvert 2 (Figure 5 and Figure 6). Submerged macrophytes were prolific with native blunt pondweed (*Potamogenton ochreatus*) dominating the community upstream of the culvert. Exotic macrophytes, including water purslane (*Ludwigia palustris*), primrose willow (*Ludwigia peploides sub. monteridensis*) and water pepper were also present. The abundance of macrophytes, deep pools, root mats, woody debris and over hanging *Tradescantia* provides a large amount of habitat for freshwater fish.

The channel upstream of Culvert 3 is incised and dominated by gypsywort*)* in the flood plain, with planted native species on the upper banks (Figure 7). Downstream of the culvert reflected habitat observed surrounding Culvert 2 (Figure 8).

Figure 2: Proposed removal of road embankment and Culvert 2 intersecting the Wharekōrino Stream.

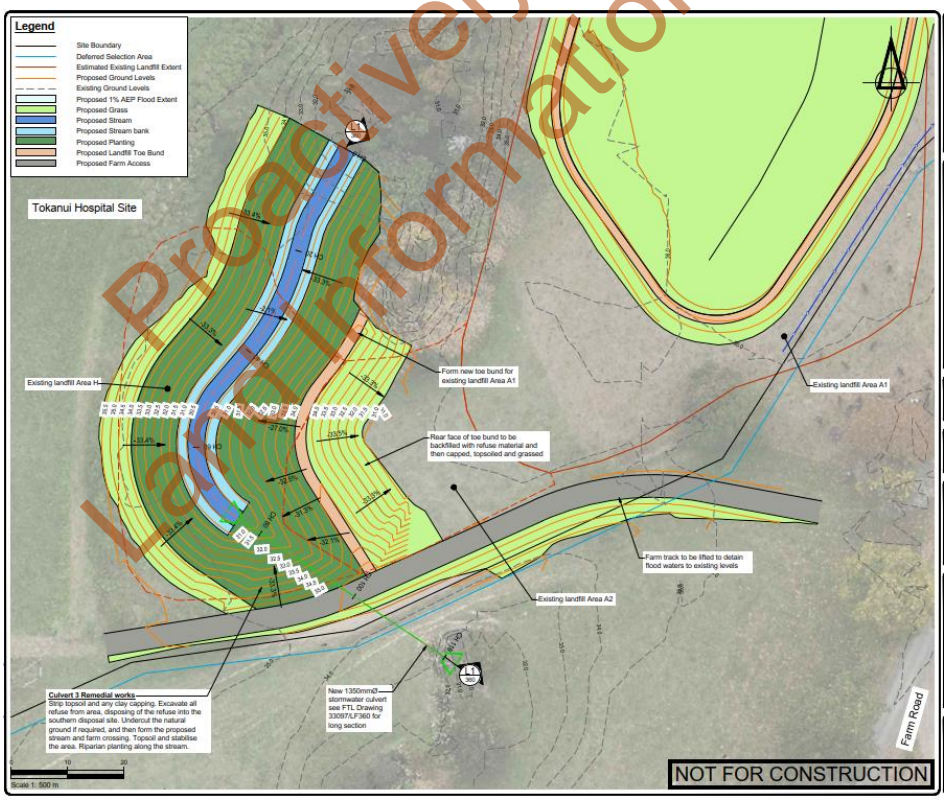

Figure 3: Proposed Culvert 3 replacement and stream creation.

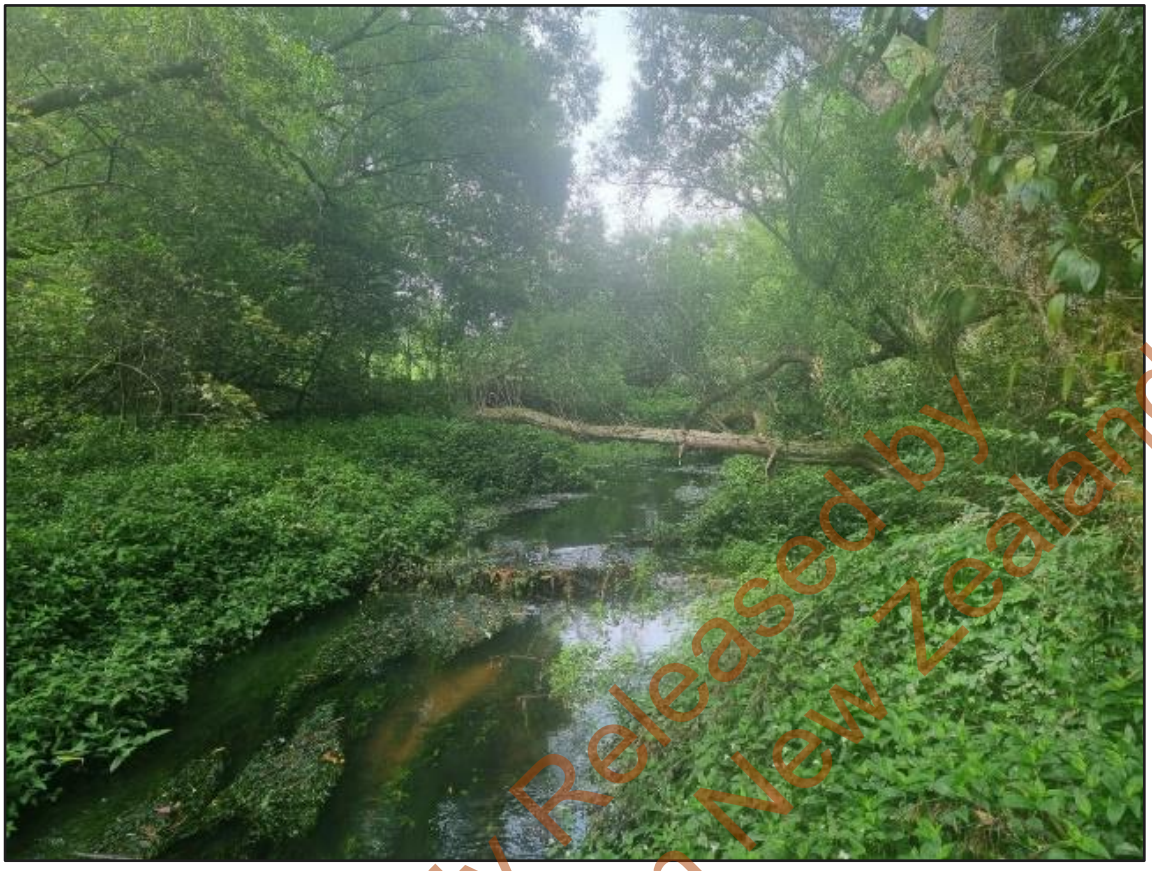

Figure 4: Stream habitat upstream of Culvert 2.

Figure 5: Inlet of Culvert 2 with Pooled water and debris directly upstream.

Figure 6: Culvert 2 outlet.

Figure 7: Culvert 3 outlet

Figure 8: Culvert 3 inlet.

Fish Relocation

Fish relocation efforts will be required within the watercourses / reaches that will be impacted by works if:

- Standing water is present;
- No standing water is present but wetted substrate is, as eels are known to inhabit muddy sediment and;
- If any culvert impacted by the works is wet.

Relocation requirements will be dependent on site conditions and will be determined by the Ecologist undertaking the relocation works. Details of the methodology will be finalised on the day relocation works are to commence to ensure methods are appropriate for site conditions.

Prior to fish capture, the impacted reaches shall be isolated by both downstream and upstream barriers. This is to prevent fish recolonising the targeted reach. Isolating the reach can be achieved by creating exclusion barriers such as earth bunds or nets. The Ecologist will advise the Contractor as to what is appropriate based on the site conditions. Barrier checks will be required daily to ensure they are not compromised. Once barriers are established, fish capture and relocation can commence.

It is anticipated that pumping of water will be undertaken as a stream diversion that will be required for flows after the impacted reach has been isolated. A fish guard must be used on the pump inlet to avoid sucking up native fish.

2.1 Fish Capture Methods

The type of fish capture method utilised will be determined by the Ecologist and will be the most appropriate for site conditions. The methods that may be used are detailed below. A combination of methods may be required depending on wetted width and water depth.

- Baited nets and traps – Fyke nets and Gee minnow traps baited with cat food (or equivalent) to be deployed and left in situ overnight. All nets and traps will be checked the following morning before being redeployed. Sections of waterway channels may be excavated, under the supervision of the Ecologist, to allow enough space for fyke nets to be deployed if required.
- Electric fishing - Electric fishing will be conducted by ecologists that have completed the electric fishing training course and using the EFM300 model, a machine used commonly by ecologists throughout New Zealand.
- Stream bed excavation (mucking out) – Salvaging native fish through excavation of the top layer of stream substrate. Under the supervision of the Ecologist, an excavator will remove the substrate/debris and place it adjacent to the reach. The Ecologist will search the material to capture any native species. Water may be pumped from the targeted reach if necessary, however a fish guard must be used on the pump inlet. This method is likely to only be used after netting and electric fishing have been implemented, or if water levels are not sufficient for electric fishing or setting nets.

Fish relocation efforts will continue within each targeted reach until the number of native fish captured is less than 10% of fish relocated in the initial effort, or at the discretion of the Ecologist.

Contractors working on site will be trained to relocate native fish downstream from the works site should they identify any stranded native fish after relocation efforts have been completed.

2.2 Fish Relocation Site

Native species captured will be immediately transferred to containers filled with water from the Wharekōrino Stream. Fish will need to be separated based on size to avoid predation. Native fish will not spend more than one hour within a container before being transferred to the relocation site and will be carefully monitored during that time.

Native fish shall be released within the same catchment. An appropriate release site will be determined by the Ecologist based on site conditions.

All native fish species and numbers will be recorded, including approximate lengths and size ranges. Exotic pest fish captured during fish relocation efforts will be disposed of humanely. Any native fish killed during relocation efforts will be buried onsite near the waterway.

2.3 Summary of fish relocation efforts

1. Contractor to advise ecologist of instream works at least 2 weeks before works commence.
2. Contractor blocks off targeted watercourse reach(es) with input from Ecologist.
3. Ecologist to identify suitable relocation site.
4. Ecologists to undertake appropriate fish relocation efforts as described in Section 2.1. Efforts can take between days or weeks depending on the number of native fish captured.
5. Ecologist to inform contractor when fish relocation efforts are complete.
6. Instream works can commence, works must commence within 1 week (7 days) of fish relocation being completed. If native fish are identified during works, the contractor is to relocate them and inform the ecologist.

7 If barriers are compromised before works are complete, the Contractor must inform the Ecologist to determine whether further fish relocation is required.

3.0 Permit Requirements

All fish relocation must be undertaken by suitably qualified ecologists. This includes ecologists with experience undertaking fish relocation and with appropriate permits. These permits authorise the translocation of freshwater aquatic life or equivalent.

4.0 Reporting

Upon completion of the fish capture and relocation a memorandum will be prepared for LINZ to confirm fish relocation has been completed as per this FMP.

The memorandum will outline the species, number, and size of fish captured and the location of the relocation site. Post-works monitoring is not required.

Regards,

SLR Consulting New Zealand

Kendall Leitch
Senior Ecologist

Hamish Dean
Principal Ecologist

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