

# APPENDIX G

## Waitarere Beach Road Curves Project Ecological Assessment Report

Prepared for The New Zealand Transport Agency

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# New Zealand Transport Agency

## Otaki to Levin Road of National Significance: Waitarere Beach Road Curves Project Ecological Assessment

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# 1 Introduction

## 1.1 Project Description

The Waitarere Beach Road Curves Project (the Project) is part of the Otaki to North of Levin section of the Wellington Northern Corridor Roads of National Significance (RoNS) programme. The Project involves the realignment of a section of State Highway 1 at Waitarere to improve safety for road users. The aim of the Project is as follows:

- To enhance inter-regional and national economic growth and productivity;
- Improve journey times on the state highway network;
- Enhance safety of travel on the state highway network;
- Appropriately balance the needs of both interregional traffic and local road users; and
- To achieve the above objectives in a cost effective manner.

The Project will improve this section of State Highway 1 by:

- Replacing the three existing curves with two curves;
- Increasing the radii of the curves to improve the alignment of the road;
- Widening the highway cross section to provide a median strip and wider shoulders (tapering in to connect to the sections of highway outside the project area);
- Providing a wire rope median barrier within the median strip;
- Providing wire rope barriers on the outer edge of the hard shoulder (this does not include across private accessways);
- Improving the layout of, and visibility at, the Waitarere Beach Road/SH1 intersection;
- Improving the layout of, and visibility at, the Clay Road/SH1 intersection; and
- Closing the Paeroa Road intersection with SH1, and connecting Paeroa Road by a parallel road to a new intersection with SH1 further to the south, at the curve north of the Huia Marae access.
- Minor improvements near to Poroutawhao School, including provision of a turning bay.

The Project will require significant earthworks due to the undulating topography. Improvements to stormwater management will be achieved through the use of roadside swales and stormwater retention ponds at key locations. New culverts will be installed for the realigned sections of the road, and existing culverts will be upgraded where the existing State Highway 1 alignment will be retained.

The construction of the proposed road will require the clearance of vegetation and habitat for native flora and fauna and requires piping and discharges to watercourses. For this reason an ecological assessment is required. For the purposes of the ecological assessment, the affected footprint has been assumed to comprise the entire area to be designated (the Designation), including the road footprint and a buffer for manoeuvring of plant.

## 1.2 Site Location

The Project is located on State Highway One, approximately seven kilometres north of the centre of Levin. The realignment extends from the existing highway north of Waitarere Beach Road to south of Clay Road.

Engineering plans for the Project are provided in Volume III of the Notice of Requirement documentation.

## 1.3 Report Purpose

The purpose of this Report is to provide an assessment of ecological effects of the Project. The report provides an overview of terrestrial and aquatic ecology, and identifies actual or potential effects of the Project. Effects are classified as “less than minor”, “minor”, “moderate” and “significant”. The report includes mechanisms for how to avoid, minimise or mitigate adverse effects of the Project under the Resource Management Act (1991) and also adheres to the requirements of the Wildlife Act (1953).

## 2 Methodology

The ecological assessment for the Project involved a combination of literature review, analysis of existing biological databases, consultation with regulatory authorities, and site visits on 26 April and 11-12 June 2015.

### 2.1 Terrestrial Ecology

#### 2.1.1 Vegetation

Vegetation was assessed during the site visit on 26 April 2015, during which the proposed route was accessed on foot and by car from the existing State Highway and adjacent private properties. A list of all native vegetation within and adjacent to the route was recorded, along with most exotic species and weeds. Areas of exotic and native trees were identified and mapped.

#### 2.1.2 Avifauna

Avifauna were surveyed using qualitative methods during the site visit on 26 April 2015. Avifauna were surveyed by way of line transects (Gregory, Gibbons, & Donald, 2004) and five minute birds counts (Dawson & Bull, 1975) within and adjacent to the alignment. All birds seen or heard during the site visit were recorded and suitable habitat for avifauna was also noted, including potential food trees, roosts and nesting sites. The weather was clear and calm during the site visit.

Habitat-specific methods such as taped playback and wetland bird surveys were not conducted. No habitat for cryptic wetland species occurs within the Designation.

#### 2.1.3 Herpetofauna

A search of the New Zealand Herpetofauna Database was undertaken to determine what (if any) previous surveys have been conducted within or near the Project. The number and distance of each record was documented in order to provide an indication of species that may be present. Consultation was also undertaken with the Department of Conservation regarding known herpetofauna records in the vicinity.

During the site visit suitable lizard habitat was observed and documented in order to determine the likely presence or absence of herpetofauna. A physical search for lizards and survey using traps or artificial cover objects (ACOs) was outside the scope of this report.

### 2.2 Aquatic Ecology

#### 2.2.1 Stream Classification

All waterbodies within or downstream of the proposed realignment were located and assessed to determine whether they were natural streams, artificial watercourses or wetlands under the definitions in the Resource Management Act (1991):

- **River** means a continually or intermittently flowing body of fresh water; and includes a stream and modified watercourse; but does not include any artificial watercourse (including an irrigation canal, water supply race, canal for the supply of water for electricity power generation, and farm drainage canal)
- **Water body** means fresh water or geothermal water in a river, lake, stream, pond, wetland, or aquifer, or any part thereof, that is not located within the coastal marine area

Natural streams were also assessed to determine whether they were perennial or intermittent streams, based on in-stream conditions, current flows, and predicted flows during summer months.

## 2.2.2 Physical Habitat

For all natural streams, physical habitat was assessed using the Environment Waikato Qualitative Habitat Assessment methodology (Collier & Kelly, 2005). This provides an assessment of riparian and in-stream condition and produces an overall score for the stream ranging from a theoretical low of 9 (an extremely modified stream) to a maximum score of 180 (a pristine, high quality stream).

Photos of each site were taken and a brief description of each site was provided including recording channel and riparian features, stream width and depth, and streambed substrate.

## 2.2.3 Wetlands

Under the Resource Management Act (1991), wetlands are defined as:

*“...permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions.”*

The preservation of the natural character of wetlands, lakes, rivers and their margins, is considered to be a matter of national importance under section 6a.

Areas of wetland within or adjacent to the Designation were identified and classified according to the New Zealand wetland classification system (Johnson & Gerbeaux, 2004). The threat status of the wetland was assessed against the provisions of the One Plan. The ecology of the wetland including vegetation composition, habitat, and wetland conditions were recorded and described.

## 2.2.4 Fish

The New Zealand Freshwater Fish Database (NZFFD) was used to determine if any fish surveys have been undertaken within or near the Designation. This was used to ascertain the likely fish communities present. This was complemented by field surveys of fish communities.

Brown mudfish (*Neochanna apoda*) were specifically targeted for survey as they are known to occur in the Manawatu River catchment, including in the nearby Moputaroa Stream. The survey followed the Department of Conservation methodology for surveying and monitoring native mudfish (Ling, O'Brien, Miller, & Lake, 2013). Twelve unbaited gee minnow traps (Figure 2-1) were set overnight on 11-12 June 2015 at three sites located within and downstream of the road alignment. A fourth site, located within a wetland near the south of the Project, was unable to be surveyed due to landowners restricting access. The following day, any mudfish caught in the traps were identified and measured before being released back into the stream.

At the conclusion of the mudfish survey, the streams were surveyed by single pass electric fishing. Fish were surveyed using a Kainga 300 electric fishing machine, manufactured by NIWA Instrument Systems. Each reach was surveyed by slowly wading upstream and targeting fish habitat including macrophytes, in-stream debris and undercut banks. All fish caught were identified and measured before being released back into the stream.

A map of the streams showing gee-minnow trap locations is provided in Appendix A. These reaches were also the site of the electric fishing surveys.



**Figure 2-1: Unbaited gee-minnow trap set to capture brown mudfish at Site 2 (D/S)**



**Figure 2-2: Macroinvertebrate sampling targeting macrophytes at Site 2 (D/S)**

### 2.2.5 Macroinvertebrates

Macroinvertebrates were sampled following Protocol C2 of the national protocols for sampling macroinvertebrates in wadeable streams (Stark, Maxted, & Scarsbrook, 2001). This is the semi-quantitative sampling protocol for soft-bottomed streams. As per the methodology, a single sample was collected from a fixed area of approximately three square meters per site (10 replicate unit efforts of 0.3m<sup>2</sup> each), with habitats sampled in proportion to their occurrence. Samples were collected using a 500 micron mesh invertebrate net (Figure 2-2), transferred to plastic sample containers, and preserved in isopropyl alcohol.

Samples were couriered to the laboratory and processed according to Protocol P3: full count with subsampling option. This allows a direct and accurate measure of macroinvertebrate abundance and community composition.

The following invertebrate community metrics were calculated:

- **Total abundance:** The number of macroinvertebrate individuals present in the sample.
- **Taxa richness:** The number of taxa present, i.e. taxa diversity.
- **EPT taxa:** The number of mayfly (*Ephemeroptera*), stonefly (*Plecoptera*), and caddisflies (*Trichoptera*) taxa present. These are generally more sensitive taxa, with the exception of *Oxyethira* and *Paroxyethira*.
- **EPT individuals:** The number of individual mayfly (*Ephemeroptera*), stonefly (*Plecoptera*), and caddisflies (*Trichoptera*) present in the sample.
- **Soft-Bottomed Macroinvertebrate Community Index (MCI-sb):** A biotic index of stream health calculated from the sensitivity of macroinvertebrate taxa present in the sample. The version of this method developed for soft bottomed streams, denoted MCI-sb (Stark & Maxted, 2007) has been used in this report.
- **Soft-Bottomed Semi-quantitative MCI (SQMCI):** A biotic index of stream health calculated from macroinvertebrate taxa presence and abundance. A version of this method developed for soft bottomed streams, denoted MCI-sb (Stark & Maxted, 2007) has been used in this report.

The macroinvertebrate communities present can be used as an indicator of stream health, water quality and physical habitat quality.



## 3 Existing Environment

### 3.1 Terrestrial Ecology

#### 3.1.1 Ecological Context

The Project is located on the boundary between the Foxton Ecological District (ED) and Manawatu Plains ED in the Manawatu Ecological Region. The majority of the Designation and surrounds is historic sand dune country and therefore the Foxton Ecological District data is most applicable.

The Foxton ED covers 105,500 hectares of sand country running along the coast from Patea in the north to Paekakariki in the south (DOC, 1997). It includes extensive sand dunes, several estuaries, wetlands, lagoons and some coastal swamp forest remnants (DOC, 1987). Vegetation has been modified by planting of pine forests, introduction of marram grass and the spread of weeds. Native fauna includes dabchick and bittern which are abundant, and brown skink (*Oligosoma zelandicum*) which are widespread (DOC, 1987). The ED now contains mostly farmland, pine plantations and urban areas with few remaining natural areas (DOC, 1997).

The Manawatu Plains ED covers 312,300 and consists of flat-surfaced flood plains and terraces (DOC, 1997). The vegetation of the ED formally comprised kahikatea and pukatea semi-swamp forest, with areas of totara forest, mixed podocarps, black beech, flax swamp, grassland and shrubland (DOC, 1987). The district's original forests and wetlands have been largely displaced by farming and urban developments (DOC, 1997).

The Landcare New Zealand Land Cover Database (LCDB v4.0) lists the current vegetation of the Designation as high producing exotic grassland with small areas of exotic pine forest, low producing grassland, indigenous forest and herbaceous freshwater vegetation. The Landcare Potential Vegetation of New Zealand database lists vegetation that is likely to occur based on topography, soil type and climate. This indicates that the Designation could potentially support kahikatea, matai, tawa and mahoe forest, with areas of kahikatea, pukatea and tawa forest and wetland. The New Zealand Threatened Environment Classification lists the habitat as "acutely threatened" as there is less than 10% of indigenous vegetation cover remaining in this habitat type. This is in common with most lowland areas used for pastoral farming in New Zealand, which are under-represented in the reserves network.

#### 3.1.2 Vegetation

A map of the Project area showing vegetation types is provided in Appendix A. A botanical species list is provided in Appendix B.

The Designation has been highly modified by rural development and the formation of the existing State Highway. Very little native vegetation cover remains. Alongside the State Highway, vegetation consists of improved pasture which is heavily grazed, with shelterbelts and small copses of exotic trees (Figure 3-1 and Figure 3-2). Shelterbelt trees consists of pines (*Pinus radiata*), crack willow (*Salix fragilis*), poplar (*Populus sp.*), she-oak (*Allocasuarina littoralis*), banksia (*Banksia integrifolia*) and macrocarpa (*Cupressus macrocarpa*). Plantings of ornamental trees and shrubs also occur alongside residential dwellings. This vegetation is of low ecological value.

Native vegetation within the Designation consists of patches of revegetation planting, isolated trees and shrubs, and ornamental planting near private homes. There is a small area of natural regeneration on a cutting at the northern extent of the Designation. Native vegetation includes flax and cabbage trees, with some kohuhu, lemonwood, akeake, houpara, kanuka and bracken. This vegetation is of low ecological value but do provide habitat and food sources for common native and introduced fauna. No threatened or at risk plant species were observed along the Project route.

There are two small areas of restoration plantings within the Designation, totalling approximately 1,800m<sup>2</sup>. At 676-708 State Highway 1 (Figure 3-3) there are sparsely planted flax (*Phormium tenax*), kanuka (*Kunzea robusta*), purple akeake (*Dodonea viscosa* 'purpurea;'), and cabbage trees (*Cordyline australis*) along with regenerating bracken (*Pteridium esculentum*) and native spinach (*Tetragonia implexicom*). This vegetation acts as screening for the highway. At 9 Paeroa Road there are mature

totara trees (*Podocarpus totara*) with a border of immature lemonwood (*Pittosporum eugenioides*), akeake (*Dodonea viscosa*), karamu (*Coprosma* sp.). This property also has five mature cabbage trees along the State Highway 1 roadside which may or may not be planted.



**Figure 3-1: Most of the Designation consists of road reserve and grazed pasture**



**Figure 3-2: Unmown berm beside SH1 with pasture and exotic shelterbelts trees**



**Figure 3-3: Sparse native plantings along with regenerating bracken at 676-708 SH1**



**Figure 3-4: Stand of mature planted totara with plantings on the corner of Paeroa Road**

The farmland to the east of the Designation supports small pockets of remnant kahikatea swamp forest. This vegetation is unaffected by the Project, although the canopy of a single kahikatea tree (Figure 3-5) falls partly within the designation at chainage 6350 metres.

The swamp forest at 576-598 State Highway 1 is located within a dairy farm. The vegetation is mainly kahikatea (*Dacrycarpus dacrydioides*) with some tawa (*Beischmiedia tawa*), pohuehue (*Meuhlenbeckia australis*), and rautahi (*Carex geminata*). The trees are isolated into small groves and are separated by grazed, drained pasture (Figure 3-6). The trees are unfenced, the understorey is grazed, and the trees have buttressed roots with shrinkage of the peat soil evident. Most of the trees are located well away from the proposed road and Designation, with the exception of one kahikatea tree (Figure 3-5) that is located partially within the Designation. No works are to be undertaken beneath this tree.

A second stand of mature kahikatea swamp forest is located in a modified wetland at 463 State Highway 1 (Figure 3-7). This area is subject to periodic grazing by cattle. The vegetation consists of mature kahikatea with roots perched above the ground due to pugging and shrinkage of drained peat soils. The understorey is virtually bare except for supplejack (*Ripogonum scandens*), occasional small ferns and tradescantia (*Tradescantia fluminensis*). On the edge of the forest there are flax, cabbage trees, *Carex virgata*, *C. geminata*, bracken, willows and dense blackberry. Past drainage and weed invasion is also

evident, particularly adjacent to the existing State Highway 1 (Figure 3-8). On the neighbouring property to the south, the kahikatea forest is partially fenced and has a much higher diversity of species including a dense groundcover of *Asplenium oblongifolium*, with coprosmas, *Gahnia xanthocarpa*, mapou, tawa and *A. polyodon*. This kahikatea forest and associated wetland is not within the Designation, although it will receive stormwater discharges from the proposed Project. The wetland is further described in section 3.2.4.



**Figure 3-5: The kahikatea in the foreground is on the edge of the Designation at ch. 6350m**



**Figure 3-6: Kahikatea swamp forest remnants at 576-598 State Highway 1 (in background)**



**Figure 3-7: Grazed kahikatea swamp forest within the wetland at 436 State Highway 1**



**Figure 3-8: The modified edge of the wetland adjacent to State Highway 1**

### 3.1.3 Avifauna

No previous avifauna surveys are known to have been conducted within the Designation, however studies have been conducted at nearby Waitarere Beach and Wairewara Lagoon (Wildlands, 2011). Two threatened species and three at risk species have been recorded (Table 3-1), all of which are birds of coastal sites and open water wetlands. It is noted that Waitarere Beach is contiguous to the Manawatu River Estuary, located approximately seven kilometres along the coast to the north. The Manawatu Estuary is a Ramsar wetland of international importance. It covers about 250 hectares of salt marsh, mud flats and sand dunes, and supports 110 species of birds including 23 threatened species (Horowhenua District Council, 2009).

**Table 3-1: Avifauna species recorded at Waitarere Dunes and Wairewara Lagoon  
(modified from Wildlands, 2011)**

Scientific Name	Common Name	Threat Status (Robertson, et al., 2013)
<i>Ardea modesta</i>	White heron	Threatened - Nationally Critical
<i>Haematopus unicolor</i>	Variable (black) oystercatcher	At Risk - Recovering
<i>Himantopus himantopus leucocephalus</i>	Pied stilt	At Risk - Declining
<i>Larus dominicanus dominicanus</i>	Southern black-backed gull	Not Threatened
<i>Phalacrocorax carbo novaehollandiae</i>	Black shag	At Risk - Naturally Uncommon
<i>Phasianus colchicus</i>	Common pheasant	Introduced and Naturalised
<i>Poliiocephalus rufpectus</i>	New Zealand dabchick	Threatened - Nationally Vulnerable

During the April 2015 site visit, a total of 11 avifauna species were observed. This consisted of six native and five exotic bird species (Table 3-2).

The avifauna within the Designation and the adjacent area comprises common native and exotic birds of open sites and modified vegetation. Overall, avifauna diversity was low in areas of pasture, with greater diversity found near planted or natural vegetation. The vegetation present provides low quality feeding, roosting and nesting habitat for native and introduced birds. No threatened or at risk avifauna species or associated habitat was present.

Silvereyes were the most conspicuous native species during the site visit. A small flock of these birds was heard feeding in vegetation along Paeroa Road. A single tui and fantail was also observed in this location.

**Table 3-2: Avifauna species recorded in or near the Designation**

Scientific Name	Common Name	Threat Status (Robertson, et al., 2013)
<i>Carduelis carduelis</i>	Goldfinch	Introduced and naturalised
<i>Circus approximans</i>	Swamp harrier	Not threatened
<i>Fringilla coelebs</i>	Chaffinch	Introduced and naturalised
<i>Gerygone igata</i>	Grey warbler	Not threatened
<i>Gymnorhina tibicen</i>	Australian magpie	Introduced and naturalised
<i>Hirundo neoxena neoxena</i>	Welcome swallow	Not threatened
<i>Passer domesticus</i>	House sparrow	Introduced and naturalised
<i>Prothemadera novaeseelandiae novaeseelandiae</i>	Tui	Not threatened
<i>Rhipidura fuliginosa placabilis</i>	North Island fantail	Not threatened
<i>Sturnus vulgaris</i>	Starling	Introduced and naturalised
<i>Zosterops lateralis lateralis</i>	Silvereye	Not threatened

### 3.1.4 Herpetofauna

A search of the New Zealand Herpetofauna Database found six native species and two exotic species that have been recorded in previous surveys within 10km of the Designation (Table 3-3). This includes four 'at risk' native species.

The most number of records in the database near the Designation is for the whistling tree frog (*Litoria ewingii*) and southern bell frog (*L. raniformis*). These are both exotic species introduced from Australia. Four records of the native 'at risk' ornate skink (*Oligosoma ornatum*) are present, including one record that has been found within or immediately adjacent to the Designation. Between one and three records for each of the other native species were found, ranging from three kilometres to 7.3 kilometres from the Designation.

Note that New Zealand Herpetofauna Database indicates previous survey effort and does not capture the full extent of lizard distribution, nor indicate what species may be present given existing habitat values. This can only be achieved by targeted surveys using appropriate methodologies and tools. All native lizards and frogs are strictly protected under the Wildlife Act 1953. A Wildlife Act Authority is required to survey, disturb or relocate affected lizards under this Act.

The Department of Conservation has confirmed that native herpetofauna are known to exist in the kahikatea forest remnant located approximately 350 metres north of the main Project near Poroutawhao School (C. Purches DOC, pers. comm. 30/04/15). Although the remnant is well outside of the Designation, a turning bay is to be constructed near the school as part of the Project. Ornate skink and common geckos are known to exist within this remnant, and copper skink (*Oligosoma aeneum*) and common skink (*Oligosoma nigriplantare maccanni*) may also be present given the habitat (C. Purches DOC, pers. comm. 30/04/15). Wellington green geckos have also been observed approximately five kilometres to the north by the Whirokino Bridge (C. Purches DOC, pers. comm. 30/04/15).

**Table 3-3: Herpetofauna Database records within 10km of the Designation\***

Scientific Name	Common Name	Threat Status (Hitchmough et al., 2013)	No. of Records	Closest Record (km)
<i>Litoria ewingii</i>	Whistling tree frog	Introduced	43	0.2km
<i>Litoria raniformis</i>	Southern bell frog	Introduced (TO)	20	1.4km
<i>Mokopirirakau</i> "southern North Island"	Southern North Island forest gecko; Ngahere gecko	At Risk, Declining (DP)	1	7.3km
<i>Naultinus punctatus</i>	Barking gecko; Wellington green gecko	At Risk, Declining (PD)	1	3km
<i>Oligosoma ornatum</i>	Ornate skink	At Risk, Declining (CD)	4	0km
<i>Oligosoma polychroma</i>	Northern grass skink	Not Threatened (CD)	3	3.4km
<i>Oligosoma zelandicum</i>	Glossy brown skink	At Risk, Declining (CD, PD)	3	4.1km
<i>Woodworthia maculata</i>	Common gecko; Raukawa gecko	Not Threatened (CD, PD)	3	4.4km

\*Excludes marine records. Qualifiers: CD = Conservation Dependent; DP = Data Poor; PD = Partial Decline; RR = Range Restricted; TO = Threatened Overseas

The field assessment confirmed that the majority of the Project route is unsuitable for native herpetofauna. Grazed pasture and heavily mown or sprayed roadsides provide no habitat for skinks or geckos. Discrete areas of suitable habitat for terrestrial skinks were identified within the Designation. This comprised long grass with bracken, flax and sparse plantings at 805 State Highway 1, 676-708 State Highway 1 (Figure 3-9), and overgrown planted vegetation at 607 State Highway 1 (Figure 3-10). Some low quality habitat is also present in the unmown berms at a number of properties.

No suitable habitat for arboreal geckos was identified. Apart from the mature kahikatea swamp located outside of the Designation, habitat is unsuitable for arboreal gecko species given the absence of regenerating native vegetation such as kanuka and manuka scrubland and/or connections to older growth native forest.



**Figure 3-9: Bracken, toetoe and grass at 676-708 State Highway 1 provides skink habitat**



**Figure 3-10: Long grass and flax by the road at 676-708 State Highway 1 provides skink habitat**



**Figure 3-11: Dense ornamental plantings at 607 SH1 provide some skink habitat**



**Figure 3-12: This periodically mown grass outside 516 SH1 is low quality skink habitat**

## 3.2 Aquatic Ecology

### 3.2.1 Catchment Information

The Project is located within the Manawatu River catchment. It is located within the Manawatu Water Management Zone (Mana\_13) and the Coastal Manawatu (Mana\_13a) sub-zone (Horizons, 2014). The water quality in the Coastal Manawatu sub-zone is managed for a wide range of activities relating to environmental, social and cultural values.

The area around the existing State Highway is very flat and low lying and historically would have been occupied by large areas of wetland. Today, the area has been drained for farming and the landscape is criss-crossed with straight, artificial channels. Occasional streams and modified watercourses also remain. All streams are unnamed tributaries of the Manawatu River.

### 3.2.2 Stream Classification

Three modified natural streams were identified within or near the Designation (Table 3-4). The locations of these water bodies are shown in Appendix A. All streams within and adjacent to the Designation have been formed through excavation to drain surrounding farmland. They are considered to be modified natural watercourses which are likely to have supported natural streams or wetland areas in the past.

Stream 1 is located east of State Highway 1 north-east of Paeroa Road (Figure 3-13). This stream was flowing at the time of the site visit but is at the upper limits of the catchment and is likely to dry in summer. It is located within dairy farm land use and is partially fenced. It currently receives runoff from the highway. Upstream of State Highway 1 there is no natural stream and only artificial drains (Figure 3-14); no natural watercourse would have been present in this location prior to the construction of the existing road.

Stream 2 is located south of Paeroa Road. This stream has been channelized (straightened), but is considered to be a modified natural stream. It is likely to be perennial, even though some short sections may dry in summer. There is an existing short piped section upstream of State Highway 1 that is a relic from a previous realignment of State Highway 1. The stream runs through lifestyle blocks and is also piped under the existing State Highway 1 before discharging to dairy farming land use downstream. The culvert beneath State Highway 1 is a barrier to fish passage, and a second perched culverts is present a short distance downstream.

Stream 3 is located within the kahikatea swamp forest and wetland at 463 State Highway 1. It is near the upper limits of the catchment, but a roadside drain feeds water from roadside swales on State Highway 1 which are connected to a wetland on the corner of State Highway 1 and Kawia Road. This stream has been historically excavated to drain adjacent pasture.

All other watercourses identified within or adjacent to the Designation are classified as artificial drainage channels (refer for example Figure 3-21 and Figure 3-22). These have been excavated to drain the adjacent farmland, but have little ecological value and are not considered to be modified natural watercourses. Most of these were dry at the time of site visit.

**Table 3-4: Summary of natural streams within or downstream of the Designation**

#	Stream Type	Fish Barriers?	Description
1	Ephemeral Stream	Yes	Modified natural stream east of SH1 north-east of Paeroa Road. The stream commences at two perched pipes, one pipe below SH1 and one that is fed from a grate next to SH1. No natural stream is present upstream of SH1, only dug, artificial drains.
2	Perennial Stream	Yes	Modified natural stream with straightened and piped sections south of Paeroa Rd. Some shaded and open sections. There are two perched pipes downstream of SH1 which are significant barriers to fish passage.
3	Perennial Stream	Yes	Modified natural stream created by digging within the kahikatea swamp forest wetland (above) at 463 State Highway 1. Well shaded by native vegetation. Two perched pipes beneath SH1 are barriers to fish passage.



**Figure 3-13: Stream 1 east of SH1 is grazed, channelised and only partially fenced**



**Figure 3-14: Above SH1 there are no natural streams feeding into Stream 1, only dug drains**





**Figure 3-15: Stream 2 upstream of SH1 (within Designation) is to be piped**



**Figure 3-16: Stream 2 (within Designation) is currently diverted alongside SH1**



**Figure 3-17: A perched pipe is present on Stream 2 beneath SH1 (within Designation)**



**Figure 3-18: Downstream of the Designation a second perched pipe is present on Stream 2**



**Figure 3-19: The wetland at 463 SH1 (outside Designation) includes a modified stream (#3)**



**Figure 3-20: Stream 3 (within Designation) is fed by two perched pipes beneath SH1**



**Figure 3-21: Artificial drain east of SH1**



**Figure 3-22: Roadside swale adjacent to SH1**

### 3.2.3 Physical Habitat

Table 3-5 provides the Qualitative Habitat Assessment scores for Streams 1 downstream of State Highway 1 and Stream 2 both upstream (Site 2) and downstream (Site 3). Stream 3 was unable to be accessed.

Habitat scores ranged from 49 to 70, out of a maximum score of 180. This equates to a percentage of 38.8% at Site 1, 38.1% at Site 2 and 27.2% at Site 3. These are all low scores and reflect the poor in-stream and riparian conditions.

Stream 1 scored low for most parameters but had more stable banks than Stream 2 which lead to an overall higher score. Stream 2 had some riparian shade provided by the kahikatea trees present below State Highway 1 and was fenced from stock on both banks which is why this section scored higher than upstream. All three sections of stream were channelized and had dense macrophyte growths. No periphyton was evident at any of the sites, most likely due to limited availability of hard substrate, and higher stream flows present in winter which would prevent algae from proliferating.

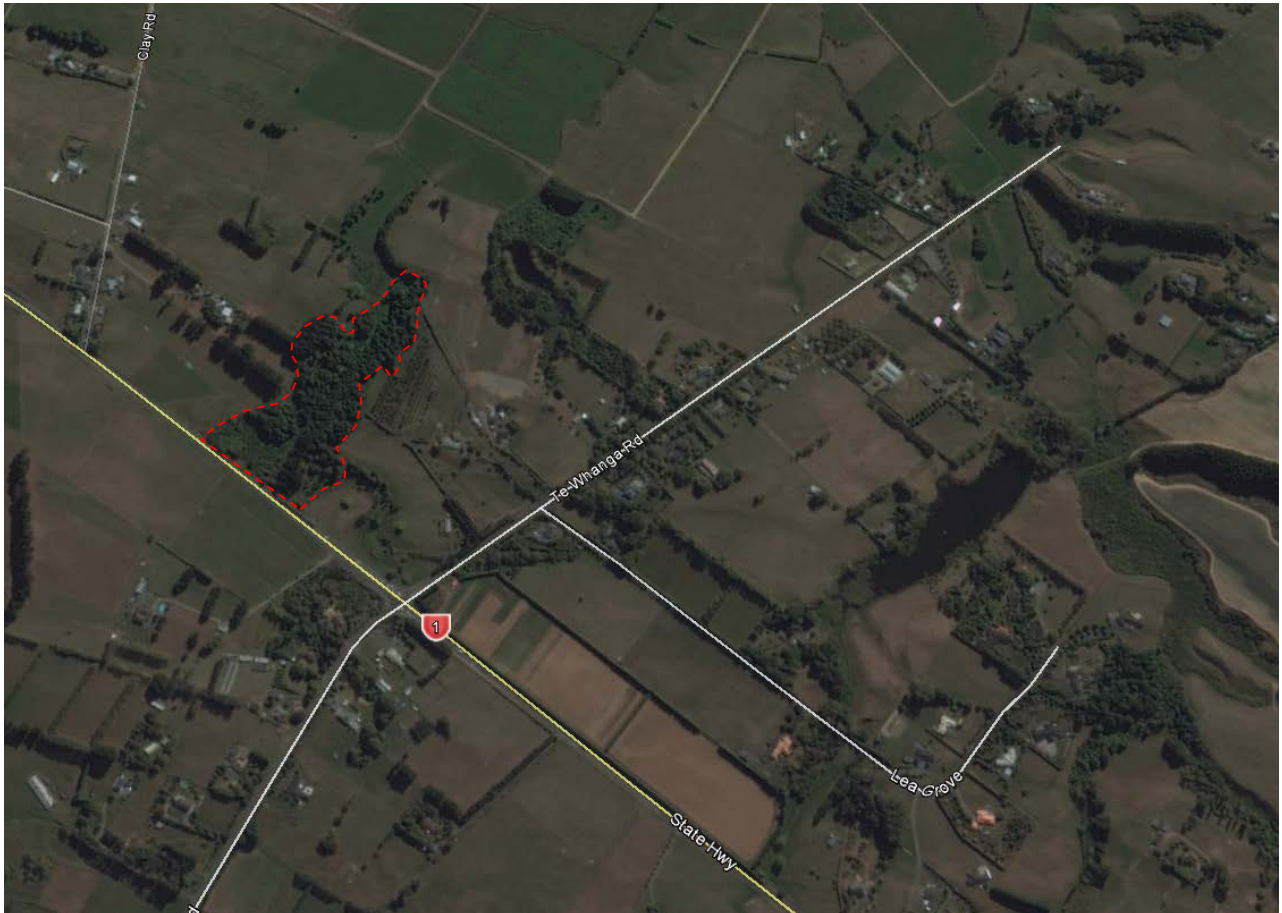
**Table 3-5: Qualitative Habitat Assessment scores**

Parameter	Site 1	Site 2	Site 3
Riparian vegetation zone width	3	5.5	2
Vegetative protection	5	5.5	2
Bank stability	18	9.5	5
Channel sinuosity	6	3	2
Channel alteration	13	13	13
Sediment deposition	3	5	2
Pool variability	2	6	2
Abundance and diversity of habitat	2	3	3
Periphyton	18	18	18
<b>TOTAL:</b>	<b>70</b>	<b>68.5</b>	<b>49</b>

### 3.2.4 Wetlands

One wetland was identified immediately adjacent to the Designation. The site is located immediately at the southern end of the Project, from chainage 6730m to 7800m (approximately). The wetland crosses a number of properties including 463 State Highway 1, 9 Te Whanga Road and 23 Te Whanga Road. It has a total area of approximately 4.48 hectares (Figure 3-23).

The wetland is located outside of the Designation but will receive stormwater discharges from the Project.



**Figure 3-23: The wetland was once part of a connected system which has become fragmented**

Under the New Zealand wetland classification system (Johnson & Gerbeaux, 2004), the wetland is classified as a swamp. In the One Plan, both 'kahikatea forest' and 'swamp' habitats are defined as threatened habitat types (Horizons, 2014). The wetland is therefore regionally significant.

The wetland hydrosystem is riverine (Johnson & Gerbeaux, 2004), meaning that the wetland is largely fed by surface water, complemented by groundwater. The wetland is near the upper limit of the catchment, although is fed from runoff from a wetland remnant on the corner of Kawiu Road and State Highway 1, as well as stormwater runoff from the road. The site also receives surface and groundwater flows from adjacent farmland. The wetland was once part of an interconnected system of wetlands feeding into the Manawatu River. As the surrounding farmland has been drained, the wetlands have reduced in size or disappeared altogether, leaving isolated remnants (Figure 3-23).

The wetland has six structural vegetation classes (Johnson & Gerbeaux, 2004). The majority of the site comprises mature kahikatea forest (Figure 3-24). The western edge of the wetland consists of *Carex geminata* and blackberry sedgeland with a small area of flaxland dominated by *Phormium tenax*. Exotic (grazed) grassland occurs to the north-west while exotic weedfield comprises the final structural class.

Weed invasion is an issue in open parts of the wetland away from the kahikatea forest. Blackberry, which is unpalatable to stock, is becoming dominant, as it is able to outcompete the native sedges and flax. This is complemented by invasive Japanese honeysuckle, which is climbing over shrubs and trees. Small patches of crack willow trees also occur. Grazing by stock is another problem. This is particularly pronounced at 463 State Highway 1 which has a bare understorey (Figure 3-26), compared to the neighbouring ungrazed property which has significant regeneration of native species (Figure 3-27). Vegetation in the wetland is further described in section 2.1.1.

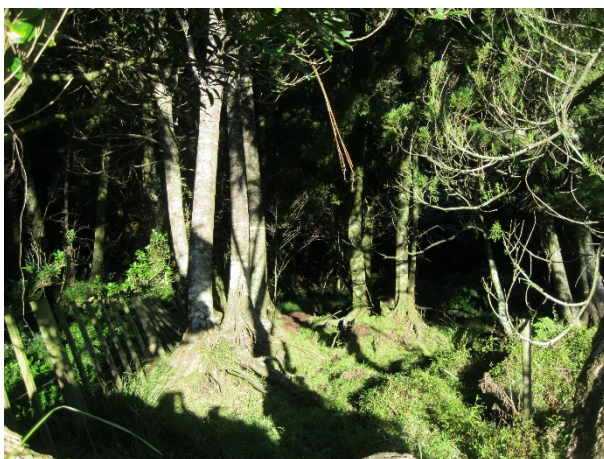
Drainage of the wetland has been an issue in the past. Two channels have been created; one running parallel to State Highway 1 and a second running perpendicular (which now forms Stream 3). The site is relatively stable with no evidence of recent excavation.



**Figure 3-24: Mature kahikatea forest constitutes the majority of the wetland**



**Figure 3-25: Flaxland and carex/blackberry sedgeland on the western edge**



**Figure 3-26: Bare, grazed understorey at 463 State Highway 1**



**Figure 3-27: The understorey at 9 Te Whanga Road where there is no grazing**

### 3.2.5 Fish

The New Zealand Freshwater Fish Database has no records for surveys conducted in or near the Designation, or elsewhere on the same (unnamed) tributary of the Manawatu River. However, there are a total of eight surveys which have been undertaken on the adjacent Koputaroa Stream. This stream has similar land use and topography to the Designation, and being within the same catchment, are likely to have similar fish species present.

A total of seven native fish species have been recorded in the Koputaroa Stream and tributaries. This includes three at risk species: longfin eel (*Anguilla dieffenbachii*), inanga (*Galaxias maculatus*) and brown mudfish (*Neochanna apoda*). Brown mudfish have been recorded at five of the eight sites that have been surveyed within the sub-catchment, four of these being wetlands adjacent to the stream and one being in an upstream tributary.

The landowners at 10 Clay Road confirmed that they used to catch koura and eels from the wetland at the bottom of their property, which is the kahikatea swamp forest wetland at 463 State Highway 1.

**Table 3-6: Fish survey records from the Koputaroa Stream sub-catchment (NZFFD accessed 28/04/15)**

Scientific Name	Common Name	Threat Status (Goodman, et al., 2014)
<i>Anguilla australis</i>	Shortfin eel	Not threatened
<i>Anguilla dieffenbachii</i>	Longfin eel	At risk: declining
<i>Galaxias fasciatus</i>	Banded kokopu	Not threatened
<i>Galaxias maculatus</i>	Inanga	At risk: declining
<i>Gobiomorphus aff. breviceps</i>	Upland bully (North Island)	Not threatened
<i>Gobiomorphus cotidianus</i>	Common bully	Not threatened
<i>Neochanna apoda</i>	Brown mudfish	At risk: declining

Freshwater fish surveys were conducted at three locations:

- Site 1 = Stream 1 downstream of State Highway 1;
- Site 2 = Stream 2 upstream of State Highway 1; and
- Site 3 = Stream 2 downstream of State Highway 1.

The location of individual gee-minnow traps is shown on Appendix A. These are the same reaches within which electric fishing was also undertaken.

Five brown mudfish were found in Stream 1 (Site 1) in the section of stream closest to State Highway 1 (Figure 3-28 and Figure 3-29). This section of stream was unfenced but had steeper banks and clearer water, unlike downstream which was muddy and choked with water celery. The downstream portions of the stream had no mudfish present.

No mudfish were found at Stream 2 either upstream or downstream of State Highway 1. However it is considered likely that shortfin eels are present because eel slime was observed at the entrance to one of the gee-minnow traps. It is noted that Stream 2 is a perennial watercourse which is less suitable for mudfish, which are more likely to occur in ephemeral streams, drains and wetlands that dry in summer.

Electric fishing failed to find any fish at and of the sites. It appeared that the peat soils or high levels of dissolved ions in the water column made the conductivity too high for electric fishing to be effective.

The brown mudfish occupies central New Zealand, from Taranaki, through Wellington and the Wairarapa, and down the northwest coast of the South Island. It is the most widely distributed species in New Zealand and may be found in a wide range of habitats, from small streams to raupo wetlands, peat bogs and shallow forest pools (Ling, O'Brien, Miller, & Lake, 2013). Like the other mudfish species, the loss of 85–90% of New Zealand's wetlands has affected distribution. The conservation of brown mudfish is a priority for Horizons Regional Council, with only 14 known populations of this fish in the region (Horizons Regional Council, 2014). Mudfish are one of the nine indicator species used to determine Sites of Significance – Aquatic (SOS-A) in the region (Patterson & Shell, 2014). SOS-A are sites which Horizons Regional Council identified as being significant for aquatic biodiversity.



**Figure 3-28: Two of the five mudfish caught in gee-minnow traps at Site 1**



**Figure 3-29: Mudfish were present in the stream closest to SH1 with less stock damage**

### 3.2.6 Macroinvertebrates

Macroinvertebrate data is summarised in Table 3-7 with full data presented in Appendix C. Community composition is illustrated in Figure 3-30.

Between 10 and 14 macroinvertebrate taxa were present in each sample. Taxa diversity was higher in Stream 1 compared to both sites in Stream 2. Macroinvertebrate abundance was more variable, with highest abundance at Stream 2 downstream of SH1 and lowest at Stream 2 upstream.

There were no sensitive EPT taxa present in any of the samples. Only one caddisfly (Trichoptera) taxa was present, the insensitive *Oxythira albiceps* which indicates poor water quality and nutrient enrichment. These were found at Stream 2 upstream.

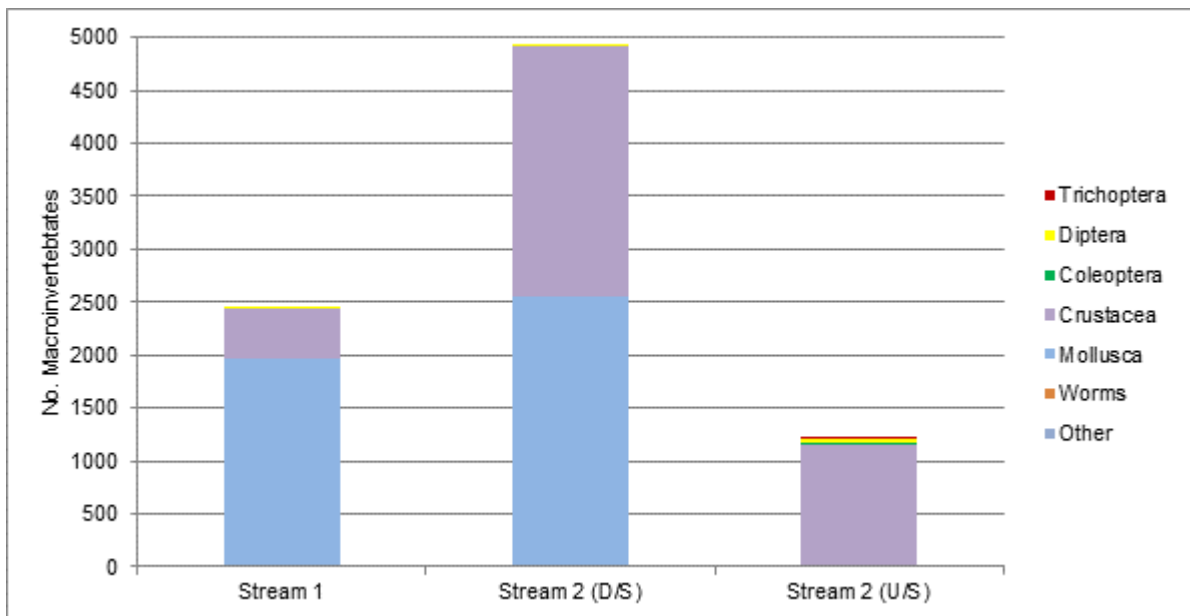
Streams 1 and 2 had a large proportion of molluscs, due to high numbers of the native freshwater snail *Potamopyrgus antipodarum*. This taxa is common in streams with high levels of macrophytes, often associated with nutrient enrichment from farmland. Conversely, molluscs were in very low abundance at Stream 2 upstream of SH2, even though this site had similar habitat conditions, including the presence of macrophytes, albeit with less intensive land use. Crustaceans were common at all sites. Stream 1 and Stream 2 D/S had high numbers of amphipod crustaceans, while Stream 2 U/S had higher levels of ostracod seed shrimps, both taxa abundant in streams that are nutrient enriched.

Most other taxa across the three sites were insensitive species tolerant of poor water and/or habitat quality. The prevalence of insensitive macroinvertebrates is reflected in low scores for both the MCI<sub>sb</sub> and QMCI<sub>sb</sub> indices. All three sites had MCI<sub>sb</sub> scores less than 80 and SQMCI<sub>sb</sub> scores below 4.0, which indicates "poor" conditions (based on the quality classes proposed by Stark & Maxted, 2007).

The macroinvertebrate results indicate poor water quality and habitat conditions at all three monitored sites. The results also reflect differences in land use between Stream 2 upstream of State Highway 1, located within lifestyle blocks, compared to Stream 1 and Stream 2 downstream which is in intensive dairying land use.

**Table 3-7: Macroinvertebrate indices summary**

Parameter	Stream 1	Stream 2 (D/S SH1)	Stream 2 (U/S SH1)
No. macroinvertebrates	2445	4921	1228
No. taxa	14	11	10
No. EPT taxa	0	0	1
No. EPT individuals	0	0	10
No. insect taxa	4	2	5
MCIsb score	71.3	61.8	55.4
QMCIsb score	2.7	3.6	2.0


**Figure 3-30: Graphs of macroinvertebrate community composition**

## 4 Assessment of Effects

The proposed State Highway realignment is to be constructed in a highly modified environment. The presence of the existing State Highway and adjacent farmland means that habitat for native flora and fauna is sparse and degraded. That being said, there are discrete areas of ecological value within or near the Designation. This includes 'regionally threatened' habitats (kahikatea swamp forest), 'at risk' mudfish and suitable habitat for 'at risk' native skinks. Actions are required to avoid, remedy or mitigate adverse effects of the development on terrestrial and aquatic ecology.

### 4.1 Terrestrial Ecology

#### 4.1.1 Vegetation

A total of 1.59 hectares of native and exotic vegetation is present within the 22.92 hectare Designation. This figure includes all planted and naturalised vegetation, excluding areas of pasture. For the purposes of the ecological assessment, it is assumed that all vegetation within the Designation will be cleared. In reality, some of this vegetation may be retained, dependent upon detailed design and the final construction methodology.

The extent of vegetation removal is summarised in Table 4-1 and mapped in Appendix A.

**Table 4-1: Vegetation to be cleared**

Vegetation Type	Area Within Designation (ha)	Percentage of Designation (%)
Project Designation (total)	22.92	100%
Total area of vegetation clearance within the Designation	1.585	6.98%
- Exotic vegetation	1.307	5.72%
- Mixed plantings	0.245	1.09%
- Native vegetation excluding kahikatea swamp forest	0.026	0.13%
- Kahikatea swamp forest (partial canopy of one tree)	0.007	0.04%

The majority of the Designation consists of road pavement, road berm and exotic improved pasture. Out of a total of 1.6 hectares trees and shrubs within the designation, 1.3 hectares or 82% is exotic species. This comprises planted shelterbelts of pine, poplar, willow and she-oak. A further 0.25 hectares (16%) consists of mixed plantings with occasional planted and regenerating native shrubs. This vegetation is of little conservation significance.

There is very little native vegetation to be impacted by the Project. Approximately 0.3 hectares or 2% of the Designation consists of native vegetation. Almost all of this vegetation is planted. The only non-planted native vegetation consists of one kahikatea on the edge of the Designation at 576-598 State Highway 1 (part of kahikatea swamp forest); kanuka, cabbage tree and bracken on a the roadside cutting at 805 State Highway 1; a group of five cabbage trees at 9 Paeroa Road on the opposite side of the highway; as well as occasional shrubs and groundcovers colonising planted and non-grazed areas. Alterations to the engineering design have successfully avoided the need to impact the kahikatea tree as well as the kahikatea swamp forest wetland located to the south of the Project.

The loss of 0.3 hectares of predominantly planted native vegetation is considered to a minor adverse effect. This vegetation is of unknown provenance (may or may not be from local seed sources) and is not part of a natural ecosystem, but does support local biodiversity in an area largely devoid of native flora and fauna. Consideration should be given to retaining some or all of the mature totara trees on the



corner of Paeroa Road, if it is practical to do so. Should the mature totara trees be unable to be avoided, mitigation by way of replacement planting is recommended. The clearance of other native trees and shrubs can be successfully mitigated by the use of native species for revegetation within the Designation.

#### 4.1.2 Avifauna

Avifauna values within the Designation are low, with values mainly associated with mature native and exotic trees. No suitable habitat for threatened avifauna species is present.

The Project will result in the clearance of exotic and native vegetation, which will result in the loss of 1.2 hectares of feeding and roosting habitat for common native and exotic birds, and the possible destruction of nests, eggs and/or chicks. Given the low values of the avifauna habitat present, this effect is considered to be minor.

Mitigation for loss of avifauna habitat will be achieved through landscape and restoration plantings to be established as part of the Project. If practical, consideration could also be given to undertaking vegetation clearance outside of the main nesting season (01 September to 31 December inclusive).

#### 4.1.3 Herpetofauna

The majority of the Designation is unsuitable habitat for native herpetofauna. However, the 'at risk' ornate skink is known to occur in the vicinity of the Designation. Ornate skinks occupy a range of habitats including rank grassland, rough pasture, secondary and mature forest. There is also a low probability that the northern grass skink and glossy brown skink may be present. Raukawa gecko, forest gecko and/or barking gecko are considered unlikely to occur.

Given the paucity of herpetofauna habitat within the Designation, the Department of Conservation (DOC) was consulted regarding whether any further survey or salvage effort was justified. DOC agreed that "the majority of the proposed route...is highly modified" and stated that "the probability that native herpetofauna are present...will be low" (refer correspondence in Appendix D). DOC confirmed that no further survey effort or salvage for herpetofauna was required. This is understood to adhere with the requirements of the Wildlife Act.

Under the Resource Management Act, effects on native herpetofauna are considered to be minor given the paucity of suitable habitat. However, due to the presence of 'at risk' lizard species within or adjacent to the Designation, further survey and salvage effort is justified prior to vegetation clearance. In addition, an accidental lizard discovery protocol should be implemented during construction. These actions will ensure that any residual adverse effects on lizards are negligible.

## 4.2 Aquatic Ecology

Three modified natural streams are present within and adjacent to the Designation. The potential impacts on these watercourses are summarised in Table 4-2 and discussed in more detail in sections 4.2.1 to 4.2.3.

In total, the Project will result in 45 metres of stream to be piped, 118 metres of stream diversion, and small increases in impervious surface area. Some increases in impervious area and stormwater discharges will also occur. The use of environmental swales and stormwater detention ponds will provide treatment of water quality and quantity. It is expected that the swales will remove approximately 80% of total suspended solids (NZTA, 2010).

**Table 4-2: Summary of impacts on natural streams**

Stream #	Summary of Impact	Significance of Effect
1	<p>No loss of stream channel or piping is to occur.</p> <p>&gt;3% increase in catchment imperviousness, therefore potential increase in flow volume and/or velocity. Downstream channel erosion control is proposed through the use of stormwater detention.</p> <p>Environmental swales and a stormwater pond (2a) will treat water quality and quantity.</p> <p>Engineering design will need to ensure that no impacts on mudfish occur from changes to hydrology.</p>	<p>Effects are considered to be more than minor, due to presence of an isolated population of 'at risk' mudfish.</p>
2	<p>2 x piped sections beneath the new Highway and a new access road (15m + 30m).</p> <p>118m of stream diversion.</p> <p>&lt;3% catchment imperviousness, therefore no downstream erosion control is proposed.</p>	<p>Effects are considered to be more than minor due to piping and diversion of 163m of stream.</p>
3	<p>No loss of stream channel or piping is to occur.</p> <p>&gt;3% catchment imperviousness, therefore potential increase in flow volume and/or velocity. No downstream erosion control is proposed as the wetland receiving environment is considered to be a stable receiving environment (MWH, 2015).</p> <p>Stormwater quality will be treated through roadside swales prior to discharge.</p>	<p>Effects are considered to be minor, so long as no erosion occurs.</p> <p>The presence of mudfish at this site cannot be discounted.</p>

#### 4.2.1 Mudfish

Stream 1 is located outside of the Designation but will receive stormwater discharges from the new State Highway via Stormwater Pond 2a. The upper reaches of Stream 1 provide habitat for 'at risk' brown mudfish. This local population appears to be isolated in a small length of stream habitat. The presence of mudfish meets the criteria for a Site of Significance – Aquatic under the One Plan.

The highway results in an increase in impervious surfaces draining to Stream 1 (MWH, 2015). Impacts on this stream have been addressed by the use of dry ponds which constrain flows and discharge water gradually during high flow events. This treats water quantity to ensure that high velocity flows are not discharged to the stream. Treatment of water quality is provided by grassed environmental swales. These have been designed for a nine minute residence time to provide approximately 80% removal of suspended solids, as per NZ Transport Agency guidelines (NZTA, 2010).

An alternative methodology is to avoid stormwater discharges to Stream 1. This could be achieved by discharging stormwater from Pond 2a into Stream 2 via pond 2b. However, this would potentially remove some of the existing base flow from Stream 1 and was considered to result in a larger adverse impact. This methodology has therefore been discounted.

Stream 3 runs through a modified wetland with moderate to high ecological values. Stream 3 is located outside of the Designation but will receive stormwater discharges from the new State Highway. Although not surveyed due to lack of access from the landowners, Stream 3 provides potential habitat for brown mudfish.

It is recommended that methods to avoid or minimise the impacts of construction and operation of the State Highway on mudfish be developed. This could include avoiding in-stream works in Streams 1 and 3; working with private landowners to encourage the fencing and/or planting of streams, tributaries and wetlands; and provisions in conditions to guide management and monitoring of mudfish during construction.

#### **4.2.2 Stream Piping and Diversions**

Stream 2 is proposed to be piped and diverted alongside the new State Highway. In total, 45 metres of stream will be piped and 118 metres of stream diversion will occur, resulting in 163 metres of stream to be impacted.

To mitigate for 163 metres of stream piping and diversion on Stream 2, riparian restoration should include riparian planting, daylighting of streams and/or the removal of existing barriers to fish passage. The length of stream restoration required can be calculated by use of the Stream Ecological Valuation methodology (Auckland Council, 2011) or similar, once the restoration sites are confirmed, or through negotiation with the regulatory authority.

#### **4.2.3 Water Quality and Quantity**

The construction of the highway will potentially result in changes to water quality through the discharge of sediments during construction, and through contaminants such as oil, grease and heavy metals discharged during operation. Potential changes in water quantity will occur due to the increase in impervious surfaces created by the widened highway.

The effects of water quality during construction will be addressed by the preparation of an Erosion and Sediment Control Plan, prepared as part of the Construction Management Plan.

The changes in water quality and quantity during operation are addressed in the Stormwater Design Report (MWH, 2015) which concludes that the installation of vegetated environmental swales along much of the State Highway will improve water quality prior to discharge to the receiving environment.

## **5 Conclusion**

The ecological assessment has confirmed that the majority of the Designation has low ecological values, however there are discrete areas of ecological value, including at risk species and threatened habitats.

This report has addressed the actual or potential effects of Project design, construction and operation. Effects of the Project are considered to be minor or less than minor for native vegetation and avifauna. Effects are considered more than minor for stream piping and diversions, mudfish and herpetofauna. Appropriate mitigation is recommended to ensure that the Project has no more than minor adverse impacts on terrestrial and aquatic ecology.









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## **Appendix A Ecology Map**



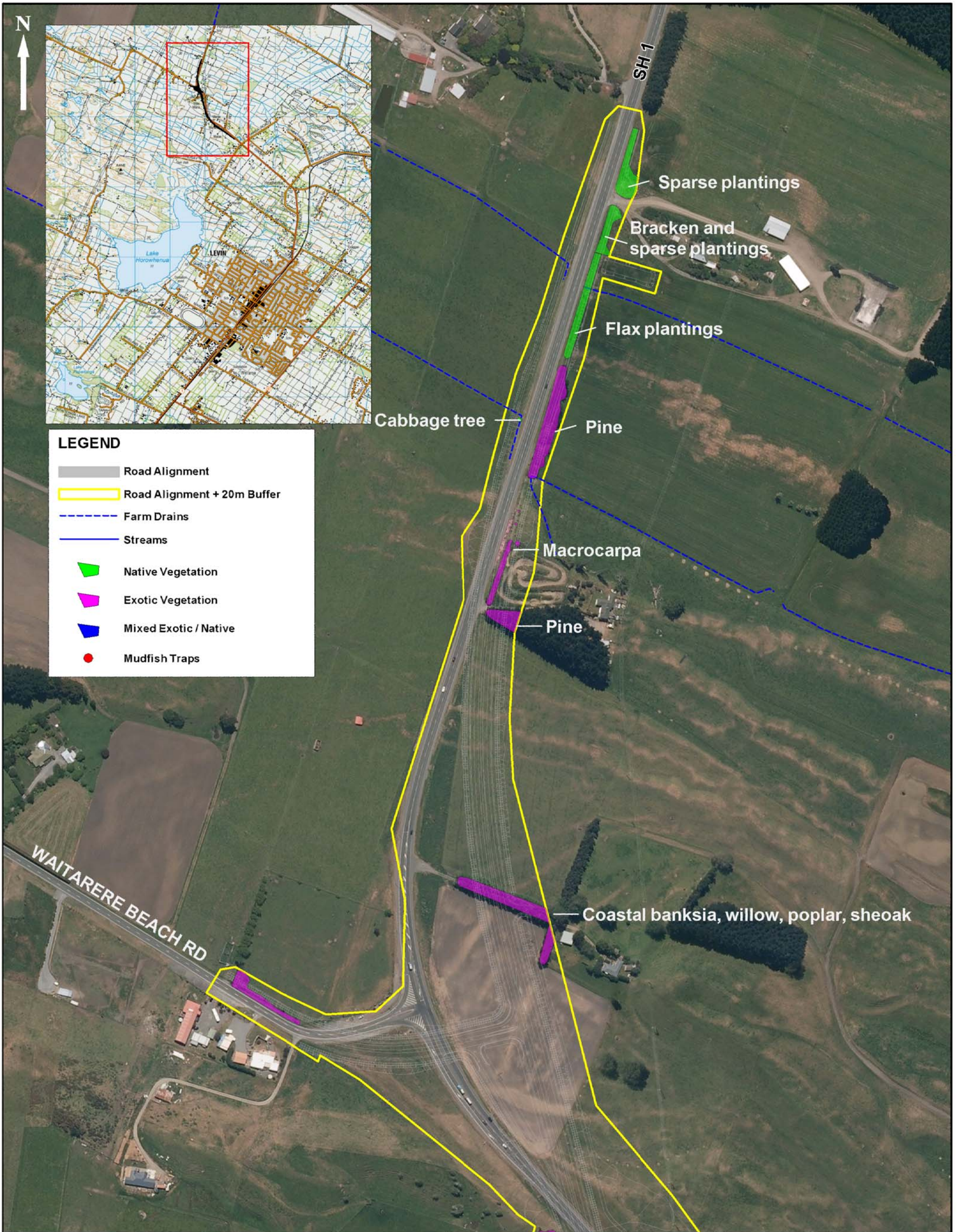
**LEGEND**

-  Road Alignment
-  Road Alignment + 20m Buffer
-  Farm Drains
-  Streams
-  Native Vegetation
-  Exotic Vegetation
-  Mixed Exotic / Native
-  Mudfish Traps



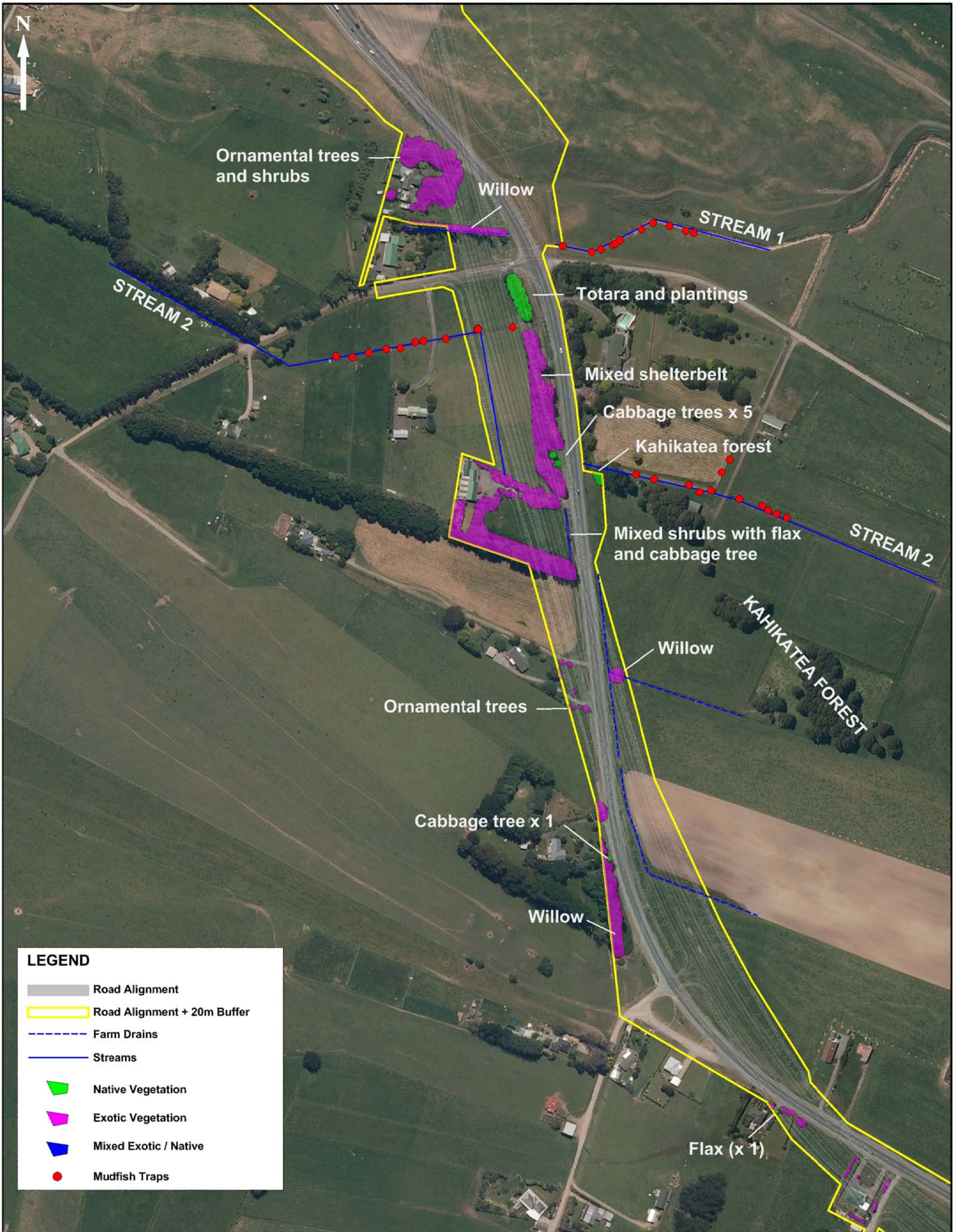
Map 1 of 4  
SCALE 1:3000 (@A3)

Waitarere Curves  
Ecology Map



**LEGEND**

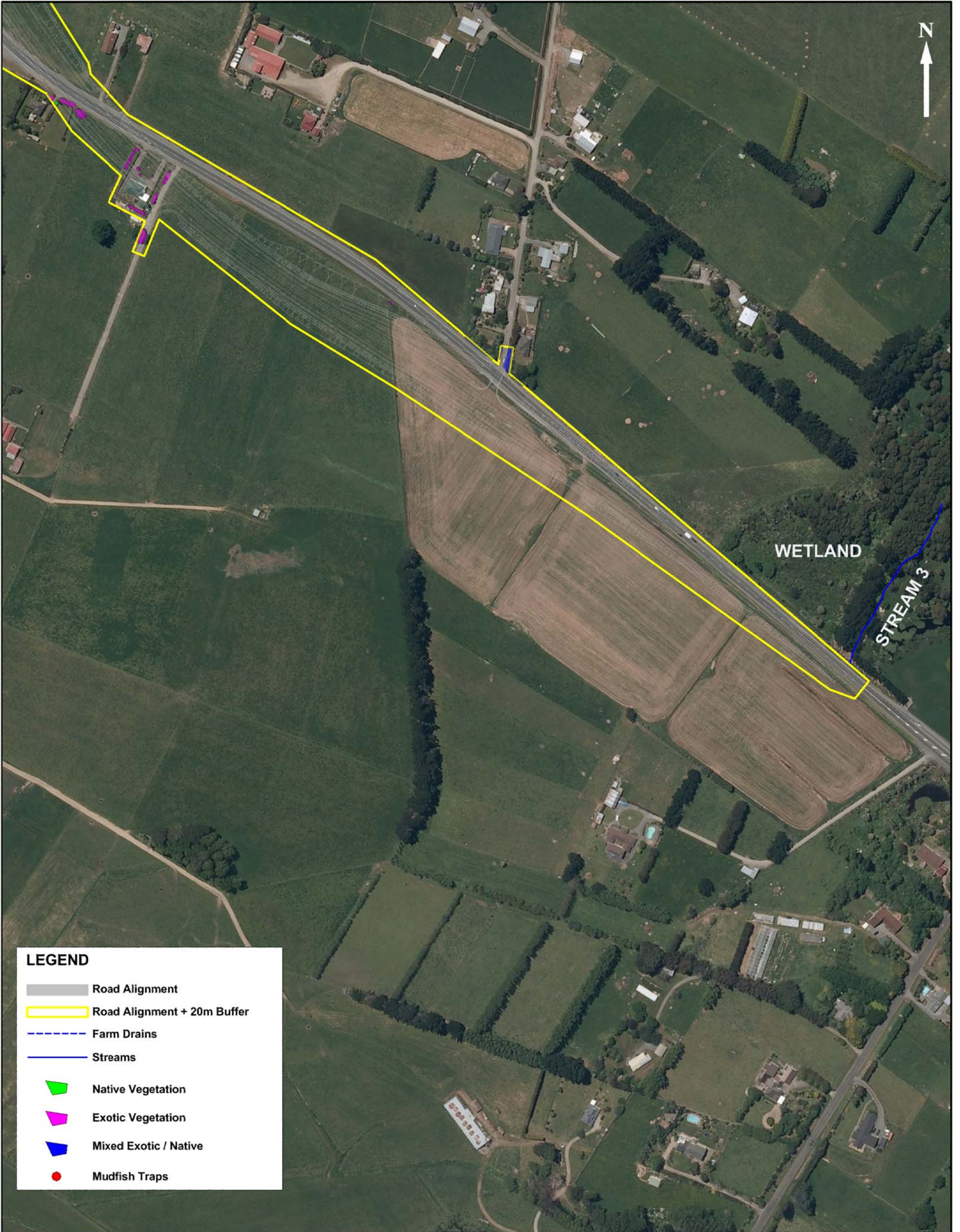
- Road Alignment
- Road Alignment + 20m Buffer
- Farm Drains
- Streams
- Native Vegetation
- Exotic Vegetation
- Mixed Exotic / Native
- Mudfish Traps











**LEGEND**

- Road Alignment
- Road Alignment + 20m Buffer
- Farm Drains
- Streams
- Native Vegetation
- Exotic Vegetation
- Mixed Exotic / Native
- Mudfish Traps





**LEGEND**

-  Road Alignment
-  Road Alignment + 20m Buffer
-  Farm Drains
-  Streams
-  Native Vegetation
-  Exotic Vegetation
-  Mixed Exotic / Native
-  Mudfish Traps



## **Appendix B Botanical Species List**

List of plant species identified within and adjacent to the proposed route. This includes all native species and most exotics, excluding pastoral grasses and some ornamental species. Plant list compiled by Kristy Hall, Senior Environmental Consultant, MWH from a site visit conducted on 23 April 2015.

(P) indicates a planted or presumably planted specimen.

## Native Species

Scientific Name	Common Name	Status
<i>Asplenium bulbiferum</i>	Hen and chicken fern	Not threatened
<i>Asplenium oblongifolium</i>	Shining spleenwort	Not threatened
<i>Asplenium polyodon</i>	Sickle spleenwort	Not threatened
<i>Austroderia fulvida</i>	Toetoe (P)	Not threatened
<i>Beilschmiedia tawa</i>	Tawa	Not threatened
<i>Carex geminata</i>	Rautahi	Not threatened
<i>Carex virgata</i>	Pukio	Not threatened
<i>Coprosma lucida</i>	Shining karamu	Not threatened
<i>Coprosma propinqua</i>	Mingimingi	Not threatened
<i>Coprosma repens</i>	Shining karamu	Not threatened
<i>Cordyline australis</i>	Cabbage tree	Not threatened
<i>Dacrycarpus dacrydioides</i>	Kahikatea	Not threatened
<i>Dicksonia squarrosa</i>	Wheki	Not threatened
<i>Dodonea viscosa</i>	Akeake (P)	Not threatened
<i>Dodonea viscosa 'Purpurea'</i>	Purple akeake (P)	Native cultivar
<i>Ficinia nodosa</i>	Knobbly clubrush	Not threatened
<i>Gahnia xanthocarpa</i>	Mapere	Not threatened
<i>Griselinia sp.</i>	Gresilinea (P)	Not threatened
<i>Hebe sp.</i>	Hebe cultivar (P)	Not threatened
<i>Kunzea robusta</i>	Kanuka	Not threatened
<i>Melicytus ramiflorus</i>	Mahoe	Not threatened
<i>Muehlenbeckia australis</i>	Large leaved pohuehue	Not threatened
<i>Myrsine australis</i>	Mapou	Not threatened
<i>Phormium tenax</i>	Harakeke, flax	Not threatened
<i>Pittosporum crassifolium</i>	Karo	Not threatened
<i>Pittosporum eugenioides</i>	Tarata, lemonwood (P)	Not threatened
<i>Pittosporum tenuifolium</i>	Kohuhu (P)	Not threatened
<i>Podocarpus totara var. totara</i>	Totara (P)	Not threatened

Scientific Name	Common Name	Status
<i>Pseudopanax crassifolius x lessonii</i>	Lancewood hybrid	Not threatened
<i>Pseudopanax lessonii</i>	Houpara	Not threatened
<i>Pteridium esculentum</i>	Bracken	Not threatened
<i>Ripogonum scandens</i>	Supplejack	Not threatened
<i>Tetragonia implexicoma</i>	NZ spinach	Not threatened

## Exotic Species

Scientific Name	Common Name	Status
<i>Acacia melanoxylon</i>	Tasmanian blackwood	Exotic
<i>Agapanthus praecox subsp. orientalis</i>	Agapanthus	Exotic
<i>Alnus glutinosa</i>	Common alder	Exotic
<i>Apium nodiflorum</i>	Water celery	Exotic
<i>Banksia integrifolia</i>	Coastal banksia (P)	Exotic
<i>Betula pendula</i>	Silver birch (P)	Exotic
<i>Buddleja davidii</i>	Buddleia	Exotic
<i>Camellia sp.</i>	Camelia (P)	Exotic
<i>Carpobrotus sp.</i>	Ice plant (P)	Exotic
<i>Casuarina sp.</i>	She oak (P)	Exotic
<i>Cortaderia sp.</i>	Pampas	Exotic
<i>Cotoneaster glaucophyllus</i>	Cotoneaster	Exotic
<i>Cryptomeria japonica</i>	Japanese cedar	Exotic
<i>Cupressus lusitanica</i>	Mexican cypress (P)	Exotic
<i>Dacrycarpus dacrydioides</i>	English oak (P)	Exotic
<i>Daucus carota</i>	Wild carrot	Exotic
<i>Drosanthemum floribundum</i>	Rosea iceplant (P)	Exotic
<i>Euonymus japonicus</i>	Japanese spindleberry	Exotic
<i>Hedera helix subsp. Helix</i>	English ivy	Exotic
<i>Hydrangea macrophylla</i>	Hydrangea (P)	Exotic
<i>Juncus effusus</i>	Soft rush	Exotic
<i>Liquidambar styraciflua</i>	Liquidamber (P)	Exotic
<i>Lonicera japonica</i>	Japanese honeysuckle	Exotic

Scientific Name	Common Name	Status
<i>Lupinus arboreus</i>	Tree lupin	Exotic
<i>Magnolia grandiflora</i>	Magnolia (P)	Exotic
<i>Persicaria hydropiper</i>	Water pepper	Exotic
<i>Pinus radiata</i>	Radiata pine	Exotic
<i>Populus sp.</i>	Poplar (P)	Exotic
<i>Prunus sp.</i>	Flowering cherry (P)	Exotic
<i>Rubus fruticosus</i>	Blackberry	Exotic
<i>Salix fragilis</i>	Crack willow	Exotic
<i>Tradescantia fluminensis</i>	Tradescantia	Exotic
<i>Zantedeschia aethiopica</i>	Arum lily	Exotic

## **Appendix C    Macroinvertebrate Results**

TAXON	MCI-sb score	Waitarere 1	Waitarere 2 (DS)	Waitarere 2 (US)
<b>ARACHNIDA</b>				
<i>Dolomedes species</i>	6.2	1	2	
<b>COLEOPTERA</b>				
Scirtidae	6.4			10
<b>COLLEMBOLA</b>	5.3	5		
<b>CRUSTACEA</b>				
Ostracoda	1.9	30	94	1150
<i>Paracalliope fluviatilis</i>	5.5	345	2075	3
Talitridae	5.5	94	199	
<b>DIPTERA</b>				
<i>Austrosimulium species</i>	3.9		1	10
<i>Chironomus species</i>	3.4			11
Orthoclaadiinae	3.2	2		28
<i>Paralimnophila skusei</i>	7.4	1		
<i>Zelandotipula species</i>	3.6	1		
<b>HIRUDINEA</b>	1.2	1		2
<b>MOLLUSCA</b>				
<i>Physa / Physella species</i>	0.1	8	80	3
<i>Potamopyrgus antipodarum</i>	2.1	1915	2440	
Sphaeriidae	2.9	26	19	
<b>ODONATA</b>				
<i>Xanthocnemis zealandica</i>	1.2	1	4	
<b>OLIGOCHAETA</b>	3.8	15	6	
<b>PLATYHELMINTHES</b>	0.9		1	1
<b>TRICHOPTERA</b>				
<i>Oxyethira albiceps</i>	1.2			10
Number of invertebrates		2445	4921	1228
Number of taxa		14	11	10
Number of EPT taxa (incl. Hydroptilidae)		0	0	1
Number of EPT taxa (excl. Hydroptilidae)		0	0	0
Number of EPT individuals (incl. Hydroptilidae)		0	0	10
Number of EPT individuals (excl. Hydroptilidae)		0	0	0
Number of insect taxa		4	2	5
MCI-sb score		71.3	61.8	55.4
QMCI-sb score		2.7	3.6	2.0

## **Appendix D Herpetofauna Letter from DOC**





Department of  
Conservation  
*Te Papa Atawhai*

30<sup>th</sup> June 2015

MWH New Zealand Limited  
MWH House Level 3  
111 Carlton Gore Road  
Newmarket  
Auckland 1023

**Attn: Kristy Hall**  
Senior Environmental Consultant

Dear Kristy,

**Re: Waitarere Curves State Highway 1 Realignment: Herpetology**

Further to your letter dated 5<sup>th</sup> June 2015 and conversations with Clinton Purches, Senior Ranger (Biodiversity), the Department concurs that the majority of the proposed route for the Waitarere Beach Road Curves Upgrade Project is highly modified. Since the probability that native herpetofauna are present at those sites will be low, I confirm that the Department finds acceptable MWH's proposal that no further lizard surveys or salvage during vegetation clearance will occur on the project site.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Rod Smillie'.

Rod Smillie  
Conservation Services Manager  
Manawatu, LNI Region