

# McFetridge Lane & Awaiti Place stormwater remediation

Ecological impact assessment  
Prepared for Tauranga City Council



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## Document Quality Assurance

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# Executive Summary

Tauranga City Council wishes to obtain resource consents to undertake stormwater remediation works at several sites in Ohauti (near McFetridge Lane and Awaiti Place and downstream of Poike Road) within the same catchment. The proposed stormwater remediation works, which include a flood detention dam, will assist in reducing the risk of flooding to nearby residential properties and infrastructure.

Ecological features present at the proposed works sites and which will be affected by the works include a stormwater wetland upstream of McFetridge Lane, a stormwater pond near Awaiti Place and several reaches of the downstream watercourse. The McFetridge Lane online stormwater wetland is part of a gully system with a stream at the base that flows north from Ohauti, through Hairini, and into the Waimapu Estuary. The Awaiti Place stormwater pond forms part of a smaller gully arm that connects to the larger gully system.

Desktop analyses and a site visit, which included collecting samples, conducting fauna surveys and assessing terrestrial and freshwater habitat, were conducted to assess the values of ecological features present within the catchment.

The aquatic features within the catchment have been modified to varying extents through the creation of online stormwater devices and watercourse modification. The vegetation near the proposed dam consists mostly of exotic species with pockets of common native species also present. The vegetation and aquatic habitats are subject to pressures from adjacent residential land use and established pest species. The vegetation, watercourses and online stormwater devices (or modified streams) upstream of Poike Road were assessed as having low ecological values. The watercourse downstream of Poike Road was assessed as having moderate ecological value due to a more diverse fish community.

The flood attenuation dam will be constructed south of McFetridge Lane within the modified stream habitat. A new culvert will be installed beneath McFetridge Lane. There will be further works along Awaiti Lane with flood flows diverted to another culvert rather than the existing channel. Rock revetment will be required at two locations downstream of the works to reduce potential effects of stream erosion. Potential and likely effects from the proposed works include modification of stream habitat, death and / or injury to native fish during instream works and clearance of vegetation. Other potential effects include erosion and sediment discharges into the downstream receiving environment and creating fish passage barriers.

The level of effects on ecological values range from moderate to very low, and fish passage is expected to improve. Based on the recommendations contained in this report, TCC proposes to manage adverse effects from the works through relocating native fish, implementing best practice erosion and sediment controls, and enhancing stream habitat upstream in a nearby catchment. Provided the ecological recommendations are implemented,

adverse ecological effects from the proposed works will be avoided, remedied or appropriately managed.

# CONTENTS

Executive Summary	i
1.0 Introduction	1
1.1 Background	1
1.2 Site description	1
1.3 Scope of this report	1
2.0 Methods	2
2.1 Desktop analysis	2
2.2 Site visit	2
2.3 Assessment of ecological effects	3
3.0 Results	5
3.1 Site description	5
3.2 Vegetation	5
3.3 Fauna	6
3.4 Stormwater wetlands/ponds	7
3.5 Stream habitat	9
3.6 Ecological significance	17
3.7 Summary of ecological values	17
4.0 Assessment of effects	19
4.1 Description of potential effects	19
4.2 Level of effects	25
5.0 Recommendations	26
6.0 Conclusion	28
7.0 References	29

## Appendices

Appendix 1: Figure 1

Appendix 2: Macroinvertebrate results



# 1.0 Introduction

## 1.1 Background

Tauranga City Council (TCC) is applying for resource consents to conduct remediation works to stormwater infrastructure near McFetridge Lane and Awaiti Place in Ohauiti as well as further downstream. The purpose of the proposed works is to assist with reducing the risk of flooding to nearby private properties and associated infrastructure. Boffa Miskell Ltd (BML) was engaged to undertake an ecological impact assessment of the proposal.

## 1.2 Site description

There are several work sites, including one located west of Ohauiti Road and south of McFetridge Lane (as well as McFetridge Lane itself), another site adjacent to Awaiti Place and two other sites located downstream. The sites are connected by a network of watercourses and are all within the same small catchment.

The headwaters of the catchment begin near Boscabel Drive with tributaries combining to form the main stem which flows north below McFetridge Lane and several other roads, including State Highway 29, and discharges into Waimapu Estuary. Another tributary flows in a north easterly direction in a sub-catchment between Ruba Way and Hollister Lane, joining the main stem at the southern end of Awaiti Place.

The proposed works include constructing a flood attenuation dam, modifying existing stormwater infrastructure (i.e. ponds), diverting stormwater, and installation of rock revetment to reduce potential instream erosion. Section 4.1 provides an overview of the proposed works and more detail is provided in the resource consent application.

The sites are located within residential areas of Ohauiti, with houses and/or passive green space located beyond the site boundaries. A subdivision (Quail Ridge) is currently being developed on the land between the sub-catchment and the main stem of the catchment. This area was previously used for horticulture.

## 1.3 Scope of this report

The purpose of this report is to:

- Describe and assess existing ecological values present in the proposed works sites,
- Discuss the likely and potential effects on the ecological values of the proposed works, and
- Provide recommendations to avoid, remediate and/or mitigate any adverse effects from the proposed works on the ecological values of the sites.

## 2.0 Methods

### 2.1 Desktop analysis

BML reviewed available literature, records from the New Zealand Freshwater Fish Database and aerial/satellite imagery to assist in identifying ecological values present over the proposed works sites.

We reviewed the 2017 Tauranga City Council State of the Receiving Environment monitoring report (Boffa Miskell Limited, 2017), which included a sampling site immediately downstream of Harrisfield Drive near Ila Place. The report included site specific data such as habitat parameters, water quality, macroinvertebrate data and results from a fish survey. We acknowledge that the data is over four years old. However, there has been little change within the catchment during that time and we consider the results remain indicative of the likely values, particularly for the most downstream impact site.

The Tauranga City Council (TCC) City Plan was reviewed to identify if any significant ecological areas were present on or near the site. Bay of Plenty Regional Council's (BOPRC) matters of national importance criteria were also used to assess the significance of habitats on site and the Regional Natural Resources Plan (RNRP) was reviewed to identify waterways and their classifications.

### 2.2 Site visit

Fieldwork was conducted on the 11th and 12th of March 2020. Weather conditions during the fieldwork were clear with minimal cloud cover and wind. There was just over 10mm of rainfall over the previous 48 hours<sup>1</sup> and a further 13mm of rainfall approximately 1 week before the fieldwork. Note that Tauranga had received minimal rainfall over the 2019/2020 summer period, however we do not consider this to have had any significant impacts on the results and conclusions.

Terrestrial, riparian and wetland ecological values were established by walking over the sites and recording the native and exotic flora and fauna species present. Quantitative survey methods were not considered necessary to describe the vegetation as the areas were small and not complex.

Aquatic ecological values were assessed within and immediately upstream and downstream of the proposed works sites. The assessments included recording riparian vegetation, waterway channel morphology and habitat diversity, sampling macroinvertebrates, collecting spot water quality measurements and sediment samples and a fish survey.

Stream values were assessed following the rapid habitat quality assessment described in Clapcott (2015). Spot water quality measurements (dissolved oxygen, temperature, pH, conductivity) were taken using a calibrated YSI ProPlus multiparameter meter. Sediment quality samples were collected in stream habitats downstream of Awaiti stormwater pond and McFetridge stormwater wetland, and from McFetridge Lane stormwater wetland. The water level was too deep to collect a sediment sample from Awaiti Lane stormwater pond. The sediment quality samples were chilled before being sent to Hill Laboratories for analysis of nutrient and

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<sup>1</sup> Rainfall data sourced from Tauranga Aero Automatic Weather Station via <https://cliflo.niwa.co.nz/>



heavy metal concentrations. Figure 1, Appendix 1, shows the locations of the spot water quality measurements and sediment quality samples.

Macroinvertebrate samples were collected downstream of Awaiti stormwater pond and McFetridge stormwater wetland. Sample locations are shown on Figure 1, Appendix 1. The samples were collected using a 500-micron net following Protocol C2 (Stark *et al.* 2001), preserved in ethanol and analysed according to Protocol P1: coded abundance. Soft-bottom macroinvertebrate indices (MCI-sb and QMCI-sb) were calculated for both samples (Stark & Maxted 2007) as well as species richness and number of EPT<sup>2</sup> taxa.

The fish survey involved setting nets within Awaiti stormwater pond and McFetridge stormwater wetland and within representative watercourse reaches immediately upstream of both stormwater features. A total of six unbaited fyke nets and Gee's minnow traps were set during the fish survey, including two locations within each of the stormwater devices and a site upstream within stream habitat. Nets and traps were set during the afternoon and retrieved the following morning. An electric fishing survey was conducted over a 150m reach within the open channel of the main stem that runs parallel to Awaiti Place (downstream of both proposed works sites). All native fish caught were identified, measured, and released. Any fish species observed during the site walk over were also recorded. The fish survey was based on modified methods outlined in Joy *et al.* (2013) and considered to be adequate to provide an overview of the fish species present within the waterways.

In addition, a follow up site visit was conducted on the 7th May 2021 to assess additional impact sites in the lower reach of the catchment as well as immediately upstream of the confluence between the Awaiti stormwater pond outlet and the main stem. No samples or surveys were conducted at these sites as field data collected previously from this project as well as data from other projects was adequate in determining the existing values.

## 2.3 Assessment of ecological effects

This assessment of ecological effects followed the updated Ecological Impact Assessment Guidelines (Roper-Lindsay *et al.* 2018). The method involved assessing the magnitude of the project's adverse effects on the site's ecological values using a matrix to assess the ecological level of any effects. Table 1 describes the categories for the possible effect magnitudes, while Table 2 provides a matrix in which to determine the significance of the effect on the ecological values.

Terrestrial and wetland features were assigned ecological values based on the attributes outlined in the Ecological Impact Assessment Guidelines including representativeness, rarity/distinctiveness, diversity and pattern and ecological context (section 5.2). Freshwater features were assigned values based on the attributes outlined in the Ecological Impact Assessment Guidelines ecological integrity of freshwater ecosystems including nativeness, pristineness, diversity and resilience (section 5.3.3). Results from the ecological assessment were used to assist in identifying ecological values.

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<sup>2</sup> EPT: Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies), the most sensitive aquatic macroinvertebrate species indicative of good water quality and habitat.

**Table 1: Magnitude of effects**

<b>Magnitude</b>	<b>Description</b>
Very high	Total loss of, or very major alteration to, key elements/features/ of the existing baseline conditions, such that the post-development character, composition and/or attributes will be fundamentally changed and may be lost from the site altogether;  AND/OR  Loss of a very high proportion of the known population or range of the element/feature.
High	Major loss or major alteration to key elements/features of the existing baseline conditions such that the post-development character, composition and/or attributes will be fundamentally changed;  AND/OR  Loss of a high proportion of the known population or range of the element/feature.
Moderate	Loss or alteration to one or more key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be partially changed;  AND/OR  Loss of a moderate proportion of the known population or range of the element/feature.
Low	Minor shift away from existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances or patterns;  AND/OR  Having a minor effect on the known population or range of the element/feature.
Negligible	Very slight change from the existing baseline condition. Change barely distinguishable, approximating to the 'no change' situation;  AND/OR  Having negligible effect on the known population or range of the element/feature.

**Table 2: Level of ecological effects**

		<b>Ecological value</b>				
		<b>Very high</b>	<b>High</b>	<b>Moderate</b>	<b>Low</b>	<b>Negligible</b>
<b>Magnitude</b>	<b>Very high</b>	Very high	Very high	High	Moderate	Low
	<b>High</b>	Very high	Very high	Moderate	Low	Very low
	<b>Moderate</b>	High	High	Moderate	Low	Very low
	<b>Low</b>	Moderate	Low	Low	Very low	Very low
	<b>Negligible</b>	Low	Very low	Very low	Very low	Very low
	<b>Positive</b>	Net gain	Net gain	Net gain	Net gain	Net gain

## 3.0 Results

### 3.1 Site description

The headwaters of the small catchment are comprised of two small tributaries beginning within urbanised areas near Boscabel Drive and Rowsdale Drive, south of the proposed work sites. The tributaries consisted of mostly open channels but there was some modification as a result of upstream ponds (i.e. damming the watercourses) and culverts under roads and accessways.

The tributaries combined to form a main stem which then flowed into a large online stormwater wetland at the base of a steep sided gully. One of the proposed work sites is located midway along the stormwater wetland. The stormwater wetland, as well as portions of the upstream watercourse, had tall stature riparian vegetation on both sides. There was an access track at the base of the stormwater wetland on the eastern side and at the top of the gully on the western site.

A stream comprised of open channels and culverts flowed north from the stormwater wetland beneath McFetridge Lane and through residential land. The main stem continued to flow north along an open channel, parallel to Awaiti Place, before entering a culvert and flowing beneath Poike Road. The watercourse continued to flow north through another proposed work site, eventually flowing beneath Harrisfield Drive and State Highway 29 and into Waimapu Estuary.

The gully between Ruba Way and Hollister Lane, included a small watercourse that flowed in a north easterly direction into the main stem, immediately south of Awaiti Lane. The watercourse had an online stormwater pond upstream of the confluence with the main stem, which is the location of the proposed works site. The watercourse had some tall stature riparian vegetation towards the downstream extent (upstream of the stormwater pond).

### 3.2 Vegetation

Riparian vegetation was present along both of the steep gully sides of the stormwater wetland immediately upstream of McFetridge Lane. Riparian vegetation varied in width between 10m to 20m on the true right bank and 15m to 40m on the true left bank. Vegetation on both sides included a mix of native and exotic species, with native vegetation consisting of early succession species estimated to have been planted five to ten years ago, as well as some plants which had established earlier (particularly tree ferns). Exotic species included large conifers and deciduous trees growing above the planted native species as well as pest plants establishing in places along the riparian margins.

Species present included lemonwood (*Pittosporum eugenioides*), karo (*Pittosporum crassifolium*), kohukohu (*Pittosporum tenuifolium*), mahoe (*Melicytus ramiflorus*), kanuka (*Kunzea robusta*), lacebark (*Hoheria* sp.), karamu (*Coprosma robusta*), taupata (*Coprosma repens*), wineberry (*Aristotelia serrata*), akeake (*Dodonaea viscosa*), broadleaf (*Griselinia littoralis*), tree ferns (*Cyathea* and *Dicksonia* spp.), flax (*Phormium tenax*), mapou (*Myrsine australis*), kawakawa (*Piper excelsum*), cabbage tree (*Cordyline australis*), kahikatea (*Dacrycarpus dacrydioides*), lancewood (*Pseudopanax crassifolius*), pampas (*Cortaderia* sp.), pine (*Pinus* sp.), cherry tree (*Prunus* sp.), blackberry (*Rubus fruticosus*), Chinese privet (*Ligustrum sinense*), tree privet (*Ligustrum lucidum*), eucalypts (*Eucalyptus* sp.), brushwattle (*Paraserianthes lophantha*), avocado (*Persea americana*), feijoa (*Acca sellowiana*), Japanese cedar (*Cryptomeria japonica*) and oak (*Quercus* sp.). Note that the list is not exhaustive.

Riparian vegetation was also present along the upstream extent of the stormwater pond to the southwest of Awaiti Place as well as further upstream adjacent to the watercourse. There was also a small area (approximately 500m<sup>2</sup>) of planted vegetation immediately north of the stormwater pond. Vegetation was comprised of a mix of native and exotic species including flax, karamu, cabbage tree, tree ferns, lemonwood, kohukohu, karo, kawakawa, kowhai (*Sophora microphylla*), lancewood, rushes (*Juncus* sp.), sedges (*Carex* sp.), willow (*Salix* sp.), blackberry, bind weed (*Calystegia* sp.), taro (*Colocasia esculenta*), woolly nightshade (*Solanum mauritianum*), ginger (*Hedychium* sp.), gorse (*Ulex europaeus*), pampas and wandering jew (*Tradescantia fluminensis*). Note that the list is not exhaustive.

Images 1 and 2 show some of the vegetation surrounding the stormwater devices at both sites.



Image 1: Mix of native and exotic species growing in the riparian margin of the McFetridge stormwater wetland.



Image 2: Mix of native and exotic species growing in the riparian margin towards the upstream extent (and stream habitat) of the Awaiti Place stormwater pond.

The remainder of the vegetation downstream of Awaiti Pond and McFetridge Lane wetland consists mostly of maintained grass to the waterway edge. There were small reaches where ornamental garden plants, as well as native and exotic species provided cover over the watercourse, however, these reaches were generally short.

### 3.3 Fauna

Native bird species observed during the initial site visit included, pukeko (*Porphyrio melanotus*), tui (*Prosthemadera novaeseelandiae*) fantail (*Rhipidura fuliginosa*), kingfisher (*Todiramphus sanctus*), grey warbler (*Gerygone igata*) and silvereye (*Zosterops lateralis*). Other native and exotic species commonly associated with urban green space areas were also likely to be present. No *Threatened* or *At-risk* native bird species are expected to use the site due to the low-quality habitat and surrounding rural landscape.

No lizards were observed during the ecological assessment, although an in-depth survey for herpetofauna was not carried out. In general, lizard habitat quality across the site was poor with high modification. There were several areas with more groundcover which may provide slightly better habitat for skinks. Based on the site assessment, copper skinks (*Oligosoma aeneum*) were likely to be the only native species present, albeit in low abundance, if at all. Exotic rainbow skinks (*Lampropholis delicata*), considered a pest species, may also be present.

Rabbits (*Oryctolagus cuniculus*) were the only pest animal species observed during the site visit. Other species also likely to be present include, possums (*Trichosurus vulpecula*), feral cats (*Felis catus*), mustelids (*Mustela* spp.), rats (*Rattus norvegicus* and *Rattus rattus*), and mice (*Mus musculus*).

### 3.4 Stormwater wetlands/ponds

#### 3.4.1 McFetridge Lane stormwater wetland

The stormwater wetland immediately upstream of McFetridge Lane was an online stormwater device, created at the base of a gully which would originally have been stream habitat.

A raised concrete outlet was located at the downstream end of the stormwater wetland. Water entered the outlet and flowed through a culvert beneath McFetridge Lane before following an open channel further north. The raised outlet had created a narrow stormwater wetland approximately 350m in length with a width varying between 10m to 40m. Stream habitat was present upstream of the stormwater wetland, but there was no obvious channel through the wetland area.

The stormwater wetland was almost completely covered in dense reed sweetgrass (*Glyceria maxims*). Other wetland species present were restricted to the stormwater wetland margins and were sporadic. These included flax (*Phormium tenax*), cabbage tree, blackberry, arum lily, willow, and several other exotic trees. Images 3 and 4 show the stormwater wetland.





Image 3: Downstream end of the McFetridge Lane stormwater wetland.



Image 4: Dense swards of reed sweet grass growing throughout the McFetridge Lane stormwater wetland.

### 3.4.2 Awaiti Place stormwater pond

The stormwater pond immediately south west of Awaiti Lane was an online stormwater device. The stormwater pond was constructed around 2005 at the base of a gully which was originally stream habitat.

A raised concrete outlet was located at the downstream end of the stormwater pond. Water entered the outlet and flowed through a culvert beneath residential properties and discharged into the main stem of the small catchment just beyond the southern end of Awaiti Lane. The raised outlet had created a stormwater pond approximately 80m in length and with an average width of approximately 20m. Most of the pond was comprised of open water, although there were some wetland areas around the shallow margins and at the upstream end. Stream habitat was present upstream of the stormwater pond.

The stormwater feature was comprised of mostly open water and featured aquatic pest plants (thought to be Canadian pondweed (*Elodea canadensis*) and curly pondweed (*Potamogeton crispus*)), that became more dense towards the centre of the pond. Reed sweetgrass formed dense swards around the edge of the pond with other common sedges (*Carex* sp.) and rushes (*Juncus* sp.) also present. Image 5 shows the stormwater pond.



*Image 5: Awaiti Place stormwater pond.*

## 3.5 Stream habitat

### 3.5.1 Waterway morphology

Stream habitat throughout the small catchment, including the proposed works areas, was variable in complexity, modification and ecological value. The reaches upstream of the Awaiti Place stormwater pond and McFetridge Lane stormwater wetland appeared to be the least modified with reaches of natural flowpath and diverse habitats. The two stormwater features described in section 3.4 were constructed within stream habitat and there were now few, if any, features characteristic of stream habitat. The main stem immediately downstream of the McFetridge stormwater wetland included some natural elements but had been modified on the banks and riparian margins. Large rocks that lined the stream bed had, to an extent, healed over with rank grasses. Habitat values were slightly better downstream with larger stature riparian vegetation, although modifications from culverts and scour and erosion controls (gabion baskets) were present.

The upstream reaches of the smaller sub-catchment upstream of Awaiti Place were also less modified compared to the remainder of the catchment.

The confluence of the sub-catchment with the main stem was upstream of Awaiti Place and just over 300m downstream of McFetridge Lane. Water from Awaiti Place stormwater pond flowed through an approximately 100m culvert into the main stem approximately 50m from the

southern end of Awaiti Place. The main stem flowed north via an approximately 60m long culvert beneath residential properties and into an open channel on the eastern side of Awaiti Place. This reach of stream channel was highly modified with a straight concrete-lined flat bed and vertical concrete and/or wood lined sides extending for nearly 200m. The downstream reach (60m to 70m), immediately before the culvert beneath Poike Road, had a mix of silt, concrete lining, gabion baskets and soil medium along the stream banks.

The downstream reach contained slightly more diverse aquatic habitat with varying channel widths and depths and overhanging grass. The upstream concrete lined channel was approximately 0.5m wide with water depths less than 0.1m at the time of the site visit. There was some herbaceous vegetation growth within the watercourse where sediment had built up. The watercourse comprised poor aquatic habitat diversity with limited habitat types.

Downstream of the Poike Road culvert, the stream had an approximately 5m long highly modified open channel which entered another 90m culvert then flowed through an open channel to Waimapu Estuary via culverts beneath Harrisfield Road and SH29. The open channel between Poike Road and Harrisfield Drive had been straightened and consisted of areas where rock revetment and gabion baskets lined the banks, although grass and other herbaceous species had grown over most of these areas. Instream habitat was poor and limited to dense areas of macrophytes (reed sweetgrass), which are periodically removed and occasional undercut banks.

Riparian vegetation was variable within the catchment. Maintained grass to the stream edge was common, particularly from downstream of the sub-catchment and main stem confluence. There were pockets of larger stature riparian vegetation upstream of Awaiti Place stormwater pond as well as immediately upstream and downstream of McFetridge stormwater wetland.

Images 6 and 7 showed the stream flowing downstream of McFetridge Lane and adjacent to Awaiti Place. Images 8 and 9 show the open channel between Poike Road and Harrisfield Drive.





*Image 6: Stream channel immediately downstream of McFetridge Lane.*



*Image 7: Stream channel flowing adjacent to Awaiti Place.*



*Image 8 and 9: Stream channel flowing north between Poike Road and Harrisfield Drive.*

### 3.5.2 Water and Sediment quality results

A summary of the water and sediment quality results collected for the proposed project sites is provided in Table 3 below. The results are compared against Australian and New Zealand Guidelines for Fresh and Marine Water Quality and sediment quality default guidelines (ANZG 2018, more commonly referred to as ANZECC). ANZECC guidelines provide trigger values for physical and chemical stresses of contaminants to aquatic organisms. Trigger values have been defined as indicating that there is a potential risk of adverse effects to instream fauna.

Spot measurements showed similar characteristics for all four monitoring sites, despite the difference in hydrology features (i.e. stormwater device versus stream habitat). Dissolved oxygen and pH were slightly below ANZECC guideline values, but still reasonable considering the urban catchment and extensive habitat modification. There was some variation in temperature as expected. Dissolved oxygen and temperature are likely to fluctuate daily and with seasons.

Sediment quality results showed that all parameters were below ANZECC guideline values, where guideline values are available. Measured parameters were generally high within the McFetridge Lane stormwater wetland, particularly phosphorus. McFetridge Lane stormwater wetland is much slower flowing, compared to upstream and downstream habitats, and also has a dense cover of reed sweetgrass, both factors assist in settling contaminants. High levels of these contaminants can cause adverse effects such as toxicity to aquatic fauna as well as excessive macrophyte and algal growth. There was a low potential for biological harm to stream biota.

Water quality results from the 2017 monitoring downstream of Harrisfield Drive included concentrations for a range of parameters including temperature, pH, dissolved oxygen, heavy metals, nutrients and petroleum hydrocarbons. The results show that none of the parameters exceeded the water quality trigger values listed as part of the associated consent condition and many parameters had concentrations that were below laboratory detection limits. This indicates a low potential for biological harm to stream biota.

**Table 3: Water and sediment quality results**

Analytes	Units	Awaiti Place watercourse	Awaiti Place stormwater pond	Downstream of McFetridge Lane stormwater wetland	McFetridge Lane stormwater wetland	Applicable guideline values - ANZECC <sup>3</sup>
Field measurements						
Temperature	°C	18.2	21.4	17.2	16.9	-
Dissolved oxygen	mg/l	8.34	7.88	8.05	7.89	-
	%	<b>88.6</b>	<b>90.1</b>	<b>84.0</b>	<b>80.81</b>	92 - 103
Conductivity	µs/cm	<b>181.2</b>	<b>194.2</b>	<b>197.6</b>	<b>197.0</b>	115
pH	pH units	<b>6.03</b>	<b>6.02</b>	<b>5.93</b>	<b>6.48</b>	7.26 - 7.7
Sediment quality						
Total copper	mg/kg	10.3	-	5.1	17.5	65
Total lead	mg/kg	7.6	-	5.5	12.3	50
Total zinc	mg/kg	147	-	39	123	200
Total phosphorus	mg/kg	420	-	310	2,300	-
Total nitrogen	g/100g	0.16	-	0.13	0.54	-

<sup>3</sup> Australian and New Zealand Environment and Conservation Council: Agriculture and Resource Management Council of Australia and New Zealand 2018. Australian and New Zealand Guidelines for Freshwater and Marine Waters Quality and aquatic sediment quality. Default trigger values for physical and chemical stressors of water (80<sup>th</sup> percentile – as well as 20<sup>th</sup> percentile for dissolved oxygen and pH) as well as sediment quality default guideline values.

### 3.5.3 Macroinvertebrate results

Snails (*Potamopyrgus* sp.) and seed shrimps (Ostracods) were dominant across both sampling sites, while oligochaete worms, freshwater shrimp (Paratya), flatworms (Platyhelminthes) and stick caddis (Triplectides) also featured prominently in the Awaiti Place watercourse sample. These taxa, excluding stick caddis to some extent, are tolerant of poor water and habitat quality and are generally found in abundance in degraded waterways. The number of EPT taxa and percent EPT abundance was similar at both sampling sites. Free-living caddis (Polypsectopus) were found at both sites, although in low abundance, and are a relatively more sensitive caddisfly (Trichoptera) taxa compared to other species identified.

The MCI and SQMCI scores from both sampling sites were indicative of poor water and/or habitat quality (Stark & Maxted 2007). The SQMCI score considers the relative abundance of each taxa in the sample and is calculated using the proportional abundance of each scoring taxa. It is thus a better index of a community's composition, whereas the MCI is strongly influenced by rare taxa which contribute to the MCI score disproportionately to their abundance. Full macroinvertebrate results are provided in Appendix 2 and a summary table is shown Table 4.

Macroinvertebrate results from the 2017 monitoring downstream of Harrisfield Drive included three freshwater soft-bottom samples, however, the samples were likely to have been influenced by saltwater to some degree. The samples were dominated by estuarine snails with limited other species (and numbers) present. Two caddisfly species were present, however, one of these species (axe-head caddis) is tolerant of poor instream conditions. MCI scores were indicative of poor to fair water/habitat quality, while SQMCI, a better index of community composition was reflective of poor water and/or habitat quality. A summary of the results is provided in table 4.

**Table 4: Summary of the macroinvertebrate results**

Metric	Site		
	Downstream of McFetridge Ln stormwater wetland	Awaiti Place watercourse	TCC state of receiving environment monitoring
Taxonomic richness	15	21	7 – 10
No. of EPT taxa	1	2	2
Percent EPT taxa	6.7	9.5	20 – 29
MCI-sb	65.7	72.3	75.1 – 85.2
SQMCI-sb	2.5	2.3	2.11 – 2.16

### 3.5.4 Fish data

A total of three native fish species were identified during the fish surveys (excluding the survey conducted as part of TCC state of the receiving environment monitoring), namely shortfin eel (*Anguilla australis*), longfin eel (*Anguilla dieffenbachii*) and banded kokopu (*Galaxias maculatus*). All three species are likely to be present throughout the catchment despite not being identified at each survey site. Shortfin eels are likely to be particularly abundant within the



two stormwater devices. Longfin eel are classified as *At Risk: Declining* while shortfin eel and banded kokopu are both classified as *Not Threatened* (Dunn *et al.* 2018). Mosquito fish, an exotic pest fish species, were also captured during the fish survey and are likely to be abundant throughout the catchment. Table 5 provides an overview of the fish species identified from the survey.

The fish survey conducted as part of TCC's state of the receiving environment monitoring identified six native fish, including three *At Risk* species (longfin eel, inanga and giant bully). These species are likely to be present within the stream habitat downstream of Poike Road. The culverts and other instream structures immediately downstream of Poike Road are likely to provide sequential fish passage barriers to fish species with lesser swimming abilities such as inanga and bully species, as supported by the absence of these species in the fish survey results upstream.

There was one 2017 record from the NIWA freshwater fish database which were the results from TCC's state of the receiving environment monitoring.

Although the McFetridge Lane and Awaiti Place stormwater devices both contained fish ladders, these will provide a partial barrier to fish passage for species which are not adept swimmers / climbers, particularly as both fish ladders / ramps appeared to have had minimal maintenance (Images 8 and 9). The network of culverts downstream of the stormwater pond/ wetland may also pose a barrier(s) to fish passage. The online stormwater devices can also be a barrier to fish passage, particularly if there are periods of high temperature, low dissolved oxygen and / or proliferation of pest fish species.



Image 11: Inlet / outlet structure of McFetridge stormwater wetland. Note the fish ladder.



Image 12: Inlet / outlet structure of Awaiti stormwater pond. Note the fish ladder.

**Table 5: Fish survey results**

Common name	McFetridge Lane stormwater wetland and upstream (nets)	Awaiti Place stormwater pond and upstream (nets)	Awaiti Place watercourse (electric fishing)	TCC state of receiving environment monitoring (nets)	Conservation status
Shortfin eel <i>Anguilla australis</i>	2 (300 – 400)	20 (250 – 700)	5 (200 – 500)	4 (500-700)	Not threatened
Longfin eel <i>Anguilla dieffenbachia</i>	1 (600)			3 (500-600)	At risk: declining
Unidentified eel / elver <i>Australis</i> sp.			23 (100 – 150)		-
Banded kokopu <i>Galaxias maculatus</i>	21 (60 – 150)	2 (100)			Not threatened
Inanga <i>Galaxias maculatus</i>				32 (50 – 90)	At risk: declining
Whitebait <i>Galaxias</i> sp.				2 (40)	-
Common bully <i>Gobiomorphus cotidianus</i>				2 (70 – 80)	Not threatened
Redfin bully <i>Gobiomorphus huttoni</i>				4 (40 – 70)	Not threatened
Giant bully <i>Gobiomorphus gobioides</i>				4 (70 – 150)	At risk: naturally uncommon
Unidentified bully <i>Gobiomorphus</i> sp.				15 (20 – 70)	-
Mosquito fish <i>Gambusia affinis</i>		>50		5 – 10	Introduced

## 3.6 Ecological significance

### 3.6.1 Tauranga City Council city plan

The proposed works sites have not been identified as special ecological areas under the Tauranga City Council City Plan.

### 3.6.2 Bay of Plenty Regional Natural Resources Plan (RNRP)

The catchment has been identified under the RNRP as “Bay of Plenty regional base line”. The classification relates to water quality classification standards and criteria in the plan.

### 3.6.3 Bay of Plenty Regional Policy Statement (RPS)

Appendix F (Set 3) of the RPS provides criteria for assessing matters of national importance including indigenous vegetation and habitats of indigenous fauna. The catchment is considered nationally important (ecologically significant) by meeting one of the 13 ecology criteria:

3.2 *Indigenous vegetation or habitat of indigenous fauna supports an indigenous species or associations of indigenous species threatened or rare nationally, regionally, or within the relevant ecological district.*

The catchment supports longfin eel which are classified as *At Risk: Declining*. Inanga (*At Risk: Declining*) and giant bully (*At Risk: Naturally Uncommon*) were also identified lower in the catchment.

Other habitats present on site are not considered nationally important.

## 3.7 Summary of ecological values

Vegetation surrounding the stormwater devices were comprised of common native and exotic plant species. Secondary scrub habitat is reduced within the Tauranga Ecological District but this is unlikely to include sites which have been previously cleared and recently replanted or left unmanaged to form a complex of native and exotic vegetation. However, the vegetation does provide a riparian buffer to some reaches of the modified stream. Table 6 provides an overview of attributes used to assess the vegetation patches on site. The exotic and native scrub has been assessed as having low ecological value.

**Table 6: Native and exotic scrub and wetland feature’s characteristics and associated ecological values**

Attribute	Native and exotic scrub
Representativeness	<u>Low</u>  Vegetation has been modified through previous clearance activities and introduction of pest plants and amenity species. It would be expected that the vegetation would have more

Attribute	Native and exotic scrub
	diverse canopy and understory species under active management, and pest plant numbers would be lower.
Rarity / distinctiveness	<p><u>Negligible</u></p> <p>The vegetation is comprised of mostly exotic species and includes common native species.</p> <p>There is just 78.5ha of secondary scrub and shrubland in the Tauranga Ecological District (Wildlands 2008). However, it is not clear whether this figure considers scrub recently planted and consisting of native and exotic species.</p>
Diversity and pattern	<p><u>Negligible</u></p> <p>Vegetation comprises low levels of diversity, consisting of common native and exotic species.</p> <p>The vegetation patches are elongated (following the gully sides) with a high edge to interior ratio. The vegetation also does not provide diverse habitat types.</p>
Ecological context	<p><u>Low</u></p> <p>Vegetation patches provide some ecological habitat, mostly for tolerant and common native species.</p> <p>The vegetation patches are adjacent to modified stream habitat and likely provides some buffer functions (i.e. shading, organic input, etc). The integrity of the vegetation is under continual threat from exotic pest plants.</p>
Overall ecological value	<b>Low</b>

Under the definitions of the BOPRC RNRP, the two stormwater treatment devices are not considered wetland habitat. The treatment devices are also excluded under the wetland definition of the recently released National Policy Statement - Freshwater Management as they are both “a wetland constructed by artificial means”. However, the devices have been constructed on what was likely to have once been a stream bed (either natural or modified). Therefore, the stormwater devices have been assessed as modified stream habitat. The ecological value of the modified watercourse network, including stormwater devices and open channel habitat, has been assessed as one feature.

The assessed stream reaches upstream of Poike Road had moderate to high levels of modification with the stormwater devices constructed on what was previously natural (or modified) stream habitat, and a completely lined channel running the length of Awaitei Place. Macroinvertebrate assemblages, and associated indices, were indicative of poor habitat and/or water quality. Sediment quality results did not show elevated contaminant concentrations compared to relevant guidelines and water quality measurements were close to guideline values. The assessed stream reaches contained common native fish species, including longfin eel. The assessed stream reaches have been categorised as having low ecological value. It should be noted that most of the value provided by the channel along Awaitei Place is not the habitat itself but the connection to better quality upstream habitat.



The assessed stream reaches downstream of Poike Road had moderate levels of modification with a straightened stream channel, culverts beneath road crossings causing partial fish passage barriers and rock revetment along stream reaches which have healed over with mostly herbaceous vegetation. Macroinvertebrate assemblages (and associated indices) were indicative of poor habitat and/or water quality. Water quality results did not show elevated contaminant concentrations compared to relevant guidelines. The assessed stream reach supports numerous native fish species, which is the main reason the reach has been categorised as having moderate ecological value rather than due to habitat or water quality values.

**Table 7: Stream network characteristics and associated ecological values**

Ecological integrity components		Assessed watercourses downstream of Poike Road	Assessed watercourses upstream of Poike Road
Nativeness	Native fish species	Shortfin eel, longfin eel, banded kokopu (likely), common bully, redfin bully, giant bully, inanga.	Shortfin eel, banded kokopu, longfin eel.
	Presence of invasive macrophytes	Reed sweet grass (high density along most of the reach).	Reed sweet grass (High density where present), unidentified exotic macrophyte (moderate density where present).
Pristineness	SQMCI-sb	2.11 – 2.16 (Poor).	2.3 – 2.5 (Poor).
	Sediment & water quality	Good quality.	Moderate quality.
	Riparian cover	Low.	Low – Moderate.
Diversity	Macroinvertebrate taxonomic richness	7 – 10.	15 – 21.
	Instream habitat	Poor.	Poor.
Resilience	No. of EPT taxa	2.	1 – 2.
	Existing stream modification	Moderate.	Moderate – High.
Ecological value		<b>Moderate</b>	<b>Low</b>

## 4.0 Assessment of effects

### 4.1 Description of potential effects

The proposal includes vegetation clearance and further modification of stream habitat to accommodate the flow management devices.

TCC is proposing to remediate stormwater infrastructure near McFetridge Lane and Awaiti Place to assist in attenuating flood flows and reduce the risk of flooding to nearby residential properties. Further erosion protection works are proposed downstream of McFetridge Lane and downstream of Poike Road. The proposed works include constructing an attenuation dam near McFetridge Lane to provide online flood detention. Proposed works at Awaiti Place include diverting and managing flood flows and converting Awaiti pond into a dry pond.

The proposed works near McFetridge Lane include constructing a dam structure approximately 50m south of McFetridge Lane, including the installation of culverts, erosion control (riprap) and spillway and associated earthworks. Water will be detained behind the dam during storm events and released downstream as flood flows dissipate. Stream flows outside of storm events (low flows) will flow through the attenuation device by way of a culvert. A second culvert will be installed beneath McFetridge Lane and will convey flows during rainfall events (i.e. baseflows will continue to flow through the existing culvert).

The proposed works at Awaiti stormwater pond will redirect high flows from the Awaiti stormwater pond into a culvert which will run the length of Awaiti Place before discharging into the main stem of the stream. A new culvert will be installed from Awaiti pond to the junction box at the southern end of Awaiti Place. This culvert will replace the existing culvert and will continue to provide base flows from the pond and feed into the open channel. The proposed works will also lower the pond level to create a dry pond and revert the pond back into stream habitat.

Additional stream erosion protection works will be installed at two locations including a 20m reach upstream of the junction box (upstream of the confluence between Awaiti stormwater pond and the main stem) and a 120m reach downstream of Poike Road.

A detailed description of the proposed works is provided within the engineering reports of the resource consent application. Activities and effects associated with the proposed works and related to ecological issues across the site are likely to include:

- Modification of instream and riparian habitat south of McFetridge Lane to facilitate the installation of culverts and riprap associated with the proposed dam and installation of riprap within the stream immediately downstream (north) of McFetridge Lane.
- Conversion of the stormwater pond at Awaiti Place to a dry pond to allow for better flood storage. The existing pond will be drained and the habitat will revert to stream habitat.
- Modification of instream habitat upstream of the Awaiti Place stormwater device and main stem confluence as well as downstream of Poike Road. Modification includes reno mattress and similar hard engineering products covering the stream bed and part of the banks.
- Instream works during construction which has the potential to cause injury / death to instream fauna and temporarily disrupt fish passage,
- Permanent or partial barriers to fish passage as a result of the proposal due to long culverts and changes in velocity of water flows,
- Change in flow rates associated with flood flows with the potential to cause erosion of the outlets through increased velocities and reduced flushing flows within downstream reaches,
- Loss of native and exotic scrub habitat associated with construction of the attenuation dam south of McFetridge Lane, and
- Instream earthworks which have the potential to release damaging amounts of sediment downstream, including into the harbour.

The loss or modification of the two existing stormwater treatment devices are not considered under the assessment of effects on ecological values as they are not considered wetland habitat under the definition. However, they have been constructed on what was likely modified stream habitat and have been assessed as such.

#### 4.1.1 Modification of stream habitat at McFetridge Lane

Construction of the attenuation dam south of McFetridge Lane will involve replacing modified stream habitat with culverts and riprap. The McFetridge Lane dam is anticipated to replace approximately 60m of existing stream habitat with culverts (45m) and riprap (15m), reducing habitat quality within this reach. In addition, 18m of channel erosion mitigation works (reno mattress and gabion baskets) is proposed immediately downstream of McFetridge Lane. This equates to almost 80m of habitat modification.

As part of the works, the existing pond between the proposed dam and McFetridge Lane will likely change to stream habitat, although there remains uncertainty about the final layout design. A meandering channel will be created within this reach that will take the baseflows and form a stream. We understand that during heavy rain events, a pond will form within this area and revert to stream habitat as water level decreases. A meandering stream channel will also allow the dense reed sweetgrass patches to be shaded out and eventually replaced with appropriate riparian vegetation along the stream channel. The scour and erosion protection required around the outside of the ponding area will be located outside of the new stream channel and riparian margin.

Additional channel erosion mitigation works are proposed immediately downstream of Poike Road which will replace the existing highly modified habitat.

The magnitude of effect from the stream modification is considered to be moderate relative to the length of stream habitat (approx. 2 to 3km) and when considering the overall quantity of modification from all proposed works. The loss and/or modification of habitat will affect a moderate proportion of the catchment (approximately 10% in total). However, we do note that many reaches of the catchment are already modified (the works will modify already modified habitat), which has been considered as part of the values assessment.

#### 4.1.2 Modification of stream habitat at Awaiti Place

Proposed works at Awaiti Place largely consist of replacing existing culverts and diverting high flows along a new proposed culvert rather than modifying aquatic habitat. The proposed works will also result in the existing pond being converted into a dry pond, reverting to stream habitat. We understand that during heavy rain events, a pond will form behind the existing dam and will revert to stream habitat as water level decreases.

Conversion to stream habitat will assist with removing existing pest plants such as reed sweetgrass. Other benefits also include improving water quality by reducing exposure time to sun light, lowering water quality temperature and increasing dissolved oxygen levels. The conversion of the pond to stream habitat will displace fish species present within the pond. Fish within the pond are likely to be dominated by native shortfin eel and exotic mosquito fish, based on the fish survey results and our experience with working in similar urban pond habitats.

The majority of works associated with Awaiti Place and the stormwater pond include replacing existing culverts and changing the alignment of culverts. As such there will not be any changes to existing habitat as part of these works. The works will however create a dry pond and convert

the existing pond into stream habitat. This will have both negative and positive effects. However, we consider, on balance, the change to be positive for ecological values.

#### 4.1.3 Modification of stream habitat upstream of junction

Channel erosion mitigation works are proposed for a 20m stream reach of the main stem immediately upstream of the confluence between Awaiti stormwater pond discharge and the main stem. The proposed works will include reno mattress lining the stream bed with grouted boulders to create variable flow conditions. Grouted boulders will also line the bank on both sides of the stream.

The magnitude of effect from the stream modification is considered to be moderate relative to the length of stream habitat (approx. 2 to 3km) and when considering the overall quantity of modification from all proposed works. The loss and/or modification of habitat will affect a moderate proportion of the catchment (approximately 10% in total).

#### 4.1.4 Modification of stream habitat downstream of Poike Road

Similar channel erosion mitigation works are proposed for a 120m reach of the main stem downstream of Poike Road. The proposed works will include reno mattress lining the stream bed with grouted boulders to create variable flow conditions. Grouted boulders will also line the banks on both sides of the stream.

The magnitude of effect from the stream modification is considered to be moderate relative to the length of stream habitat (approx. 2 to 3km) and when considering the overall quantity of modification from all proposed works. The loss and/or modification of habitat will affect a moderate proportion of the catchment (approximately 10% in total).

#### 4.1.5 Instream works during construction

Instream works to install culverts and riprap during construction has the potential to cause injury and / or mortality to native fish and temporarily prevent fish passage. Details of construction methods, including sequencing, are provided within the construction management plan.

In summary, most of the proposed instream works will be constructed offline. The dam works area will be bunded off at the upstream and downstream extent with a temporary culvert conveying the stream flow. There will be an opportunity to relocate native fish using nets and traps as well as draining the works area and digging out sediments to salvage any remaining fish. Such an approach can avoid or minimise the adverse effect of killing native fish. The bunds will be removed when dam construction is complete.

Similarly, for the proposed channel erosion mitigation works downstream of McFetridge Lane, one half of the stream will be isolated while instream works are completed (i.e. divert flows down the other half) before the other half is isolated and works are completed. This is only a short reach and there will be an opportunity to conduct fish relocation when each of the reaches have been isolated.

The Awaiti Place works will involve replacing the existing culvert and associated infrastructure as well as adding new culverts. There are difficulties associated with salvaging fish within culverts that are going to be removed. The project ecologist will need to work with the contractor to determine if there are any opportunities to relocate fish when replacing culverts.

Instream construction works are still to be worked through for the proposed channel erosion mitigation works (upstream of the Awaiti Place stormwater device and main stem confluence as well as downstream of Poike Road). It is envisioned that flows will be diverted / pumped around the works areas which will provide an opportunity for fish relocation, however this has not been confirmed.

Instream works will be temporary (for the duration of construction) and effects on disruption to fish passage will be further reduced with most of the construction works conducted offline.

The magnitude of effect from instream works is considered to be negligible, provided fish salvage and relocation can be conducted. We anticipate the change (if any) to be barely distinguishable from existing baseline conditions.

#### 4.1.6 Creating fish passage barriers

Installing culverts and riprap within stream habitats has the potential to create fish passage barriers through introducing vertical structures, creating a long homogenous channel with no rest sites and/or increasing water flow velocities. The engineering drawings and associated reports that are part of the resource consent application show the dimensions and layout of the proposed infrastructure. Below is a summary of the features which are likely to have an effect on fish passage.

##### McFetridge Lane

The McFetridge Lane dam site will consist of an approximately 45m culvert through the dam (diameter of 1800mm). The culvert will be embedded into the existing wetland sediment level which will allow sediment and other debris to build up and provide roughness within the culvert. In addition, the gradient of the culvert will be less than 1%. We anticipate water flow and depth through the culvert during baseline flows to be similar to upstream and downstream conditions (i.e. slow flowing and almost stagnant).

There will also be riprap and/or reno mattress erosion protection immediately downstream of the dam culvert to protect the downstream environment from scour during heavy rainfall events. The design includes a grouted low flow channel within the erosion protection comprising embedded boulders and rocks to create diverse flow velocity.

A second culvert is proposed to be installed beneath McFetridge Lane. The culvert will be similar in length (38m) and gradient (both less than 2%) to the existing culvert but larger in diameter (1500mm vs existing of 900mm). The new culvert will be raised above the existing culvert and only receive water during high rainfall (i.e. baseflows will continue through the existing culvert). The inlet and outlet of the existing culvert will be modified to allow silt material to build up within the culvert to improve fish passage. The existing riser will not change (i.e. the height and location of the fish ladder will remain similar to what currently exists).

Riprap and/or reno mattress erosion protection downstream of the dam culvert will include a grouted low flow channel within the erosion protection and comprise embedded boulders and rocks to create diverse flows.

Collectively, we consider fish passage associated with the McFetridge Lane proposal to be similar to current conditions.

##### Awaiti Place

Two new culvert pathways will be constructed from Awaiti Place stormwater pond to the main stem of the stream. One of the pathways will take stormwater during high rainfall events from

the stormwater pond, down the length of Awaiti Place and discharge into the main stem immediately north of Poike Road. The other pathway will be similar to the existing pathway and take baseflows and smaller scale rain events from the stormwater pond to the existing junction box. This pathway will maintain existing fish passage from the main stem to Awaiti Place stormwater pond. The culvert will be just over 100m in length and approximately 525mm in diameter with a gradient of less than 1% and fitted with baffles to assist with fish passage.

The existing riser at the stormwater pond will be replaced including the fish ladder. The new riser will be similar in height to what is currently on site and will mean the new fish ladder will also be similar in height and extent to the existing structure.

The existing culverts beneath Poike Road will be extended by approximately 20m and fitted with spat ropes to improve fish passage. An energy dissipation structure will be installed immediately downstream of the existing and new culvert discharge points. This area is already highly modified and existing structures are likely to prevent fish passage for some species through high water flow velocity that is spread across a wider area (i.e. shallow depth). The energy dissipation structure will include a low flow channel which will improve the existing fish passage into the culverts.

Collectively, fish passage associated with the Awaiti Place and Poike Road works is considered to be similar to existing conditions or slightly better. As such we have assessed the magnitude of effect on fish passage to be positive.

#### Erosion protection reaches

Erosion protection works are yet to be designed to detail, however the design and construction will need to account for fish passage including those species found downstream of Poike Road. We understand that the design will provide for similar flow velocities that are currently found on site during normal flow conditions and will not include vertical structures (i.e. weirs). Erosion protection will also avoid an outcome where the entire stream flows beneath the rocks and surface water is not visible.

We consider the effect on fish passage for the erosion protection reaches to be negligible, where change is barely distinguishable.

#### 4.1.7 Downstream erosion risk

There is a risk of degradation to aquatic habitat downstream of the attenuation dam and modified stormwater infrastructure from altered flows causing erosion and subsequent sediment deposition into receiving environments (beyond the erosion protection reaches). We understand that peak flows downstream are likely to be reduced compared to existing conditions, although the duration of higher flows may be longer. We understand the risk of erosion downstream appears to be similar to pre-development conditions.

Habitats observed downstream consist mostly of highly modified and slow flowing reaches with stream beds comprised of either rock material and/or concrete associated with erosion and scour protection or silt and/or sand material. Instream aquatic fauna are likely to be adapted to or tolerant of silt and sand material. Small-scale erosion and deposition events are unlikely to cause discernible changes to aquatic ecological values. The magnitude of effect on ecological values from erosion is assessed as being negligible.

#### 4.1.8 Loss of native and exotic scrub habitat

Some exotic and native scrub habitat will be cleared as part of the proposed attenuation dam south of McFetridge Lane. Approximately 0.22ha of mixed exotic and native vegetation will be cleared from the eastern and western banks. We have assessed the magnitude of effects on ecological values as being low. The change to scrub habitat will be discernible but the clearance of vegetation will have a minor effect on the feature.

#### 4.1.9 Earthworks and sediment related discharges

Earthworks over the sites has the potential to reduce the water quality within the downstream receiving environments through erosion and sediment runoff and poor on-site management of earthwork spoil and exposed surfaces. An erosion and sediment control plan will be prepared and implemented as part of the proposed works and will require approval by BOPRC prior to commencement of earthworks.

On this basis, the risk of excessive sediment loss downstream is low and will be a temporary effect (at certain times for the duration of construction), small in spatial scale and therefore of negligible magnitude.

### 4.2 Level of effects

The level of effects on ecological values present from the proposed flood attenuation dam and associated works, the proposed works at Awaiti Lane as well as the erosion protection works range from moderate to very low, except for fish passage barriers and conversion of the pond back to stream habitat, which will likely have a positive outcome. Stream modification will have the highest level of effect, particularly for the reach downstream of Poike Road, where ecological values are higher due to a more diverse fish community. The remaining level of effects for the stream habitat are low, very low or net gain.

Table 8 provides an overview of the values and the magnitude of the effects and the final outcome (level) of the effect's analysis. The EIANZ guidance is that low and very low effects should not normally be of concern, but that these effects should still be minimised through appropriate design and management. Moderate level of effects requires more careful assessment and could be managed through avoidance, design or extensive offset or compensation actions.

We provide recommendations to manage effects within the next section.

**Table 8: Overview of the level of adverse effects on the site's ecological values.**

Feature	Ecological value	Effect	Magnitude of effect	Level of effect
Unnamed stream upstream of Poike Road	Low	Habitat modification (McFetridge Lane)	Moderate	Low
		Habitat modification (Awaiti Place)	Positive	Net gain
		Habitat modification (upstream of junction)	Moderate	Low
		Instream works	Negligible	Very low
		Fish passage barriers	Positive	Net gain
		Downstream erosion	Negligible	Very low
		Earthworks and sediment discharge	Negligible	Very low
Unnamed stream downstream of Poike Road	Moderate	Habitat modification (downstream of Poike Rd)	Moderate	Moderate
		Instream works	Negligible	Very low
		Fish passage barriers	Negligible	Very low
		Downstream erosion	Negligible	Very low
		Earthworks and sediment discharge	Negligible	Very low
Native and exotic scrub	Low	Clearance	Low	Very low

## 5.0 Recommendations

The level of ecological effects of the proposed attenuation dam and associated works on the aquatic habitat features range from moderate to very low. The most notable effect includes the modification of aquatic habitat. There are also relatively lesser effects associated with instream works, earthworks and sediment discharges and downstream erosion. Fish passage will also likely be improved throughout the works sites.

We recommend the following actions to mitigate, manage and limit potential adverse effects on the ecological values:

- Although the assessment indicates the proposal will generate low adverse effects for parts of stream network and a net gain for fish passage, based on our prior experience with similar consent applications, works modifying a stream typically require mitigation to manage the impacts of modification. This is especially important in the context of the



objective and policy framework of the newly enacted National Policy Statement for Freshwater Management which seeks, among other things, enhancement of degraded freshwater habitats.

On that basis, we recommend modified stream habitat is mitigated for by enhancing existing degraded stream habitat by a ratio of 2:1 for both low and moderate value watercourse reaches (i.e. for every 1m of modified linear stream habitat, 2m of existing stream habitat is enhanced). Approximately 220m of stream habitat will be modified as part of the proposed works. A ratio of 2:1 would require approximately 440m of linear stream length for enhancement.

There are limited stream enhancement opportunities within the catchment, whereby the planting would be more than a token effort. Instead stream enhancement could be conducted within a nearby catchment between Waterside Drive and Cheyne Road. Figure 2 shows the location of potential stream mitigation. This site would allow all mitigation to be conducted contiguously and join an existing area of stream enhancement / wetland creation downstream. There may also be an opportunity to enhance stream habitat between SH29 and Oropi Road.

Stream enhancement will include riparian planting with a width of approximately 5-10m on both sides of the stream although the width of planting would be restricted in a small section (approximately 40m) due to nearby property boundaries.

- Planting plans are prepared and implemented for the site where stream enhancement is proposed. The planting plans should include appropriate native plant selection for the riparian margins of the stream habitat.
- Preparation and implementation of a monitoring plan to measure the proposed enhancement activities on aquatic ecological values. Monitoring activities should include:
  - conducting a stream ecological valuation (SEV) within at least one location over the enhanced reach to measure changes in stream function.
  - collecting a single composite macroinvertebrate sample within the enhanced stream reach.
  - qualitative assessment of the riparian margin planting to guide future management activities such as pest plant control and infill planting.
  - conducting a fish survey upstream of the proposed works areas to assist in identifying if any new species are recorded upstream of potential fish barriers.

Monitoring should start before any works are conducted (baseline monitoring – Year 0), at two years after enhancement activities and after five years of enhancement activities.

- A suitably qualified ecologist conducts native fish salvage and relocation within the affected stream reaches of the proposed works. The methods used for fish relocation will need to be determined closer to the time and once construction works have been confirmed. Fish relocation may be conducted using electric fishing, combination of nets and traps and / or through mechanically digging out stream sediments. Native fish should be relocated upstream or downstream of the instream works reaches.
- Best practice erosion and sediment controls are implemented to reduce sediment discharge into the receiving environments.

Provided all recommendations are successfully implemented, adverse ecological effects from the proposed stormwater attenuation dam and associated infrastructure will be mitigated for and managed to very low levels.

## 6.0 Conclusion

The assessed aquatic habitat throughout the catchment comprises low ecological value due to the catchment's high modification of instream aquatic habitat, limited instream habitat diversity, impaired water and habitat quality, and reduced diversity of native fish compared to downstream reaches. The exotic and native riparian scrub has low ecological value.

Potential and likely effects of the proposed works include the modification of stream habitat, effects on fish passage and instream works potentially causing death and / or injury to native fish. Other effects also include clearance of exotic and native scrub and erosion and sediment discharges into the receiving environment.

The proposal design elements will result in a likely positive outcome for fish passage and enhanced stream habitat. Work sequencing, fish translocation, and erosion and sediment control will manage adverse effects at very low levels. Provided all recommendations are adhered to, adverse ecological effects from the proposed attenuation dam and associated infrastructure will be managed.

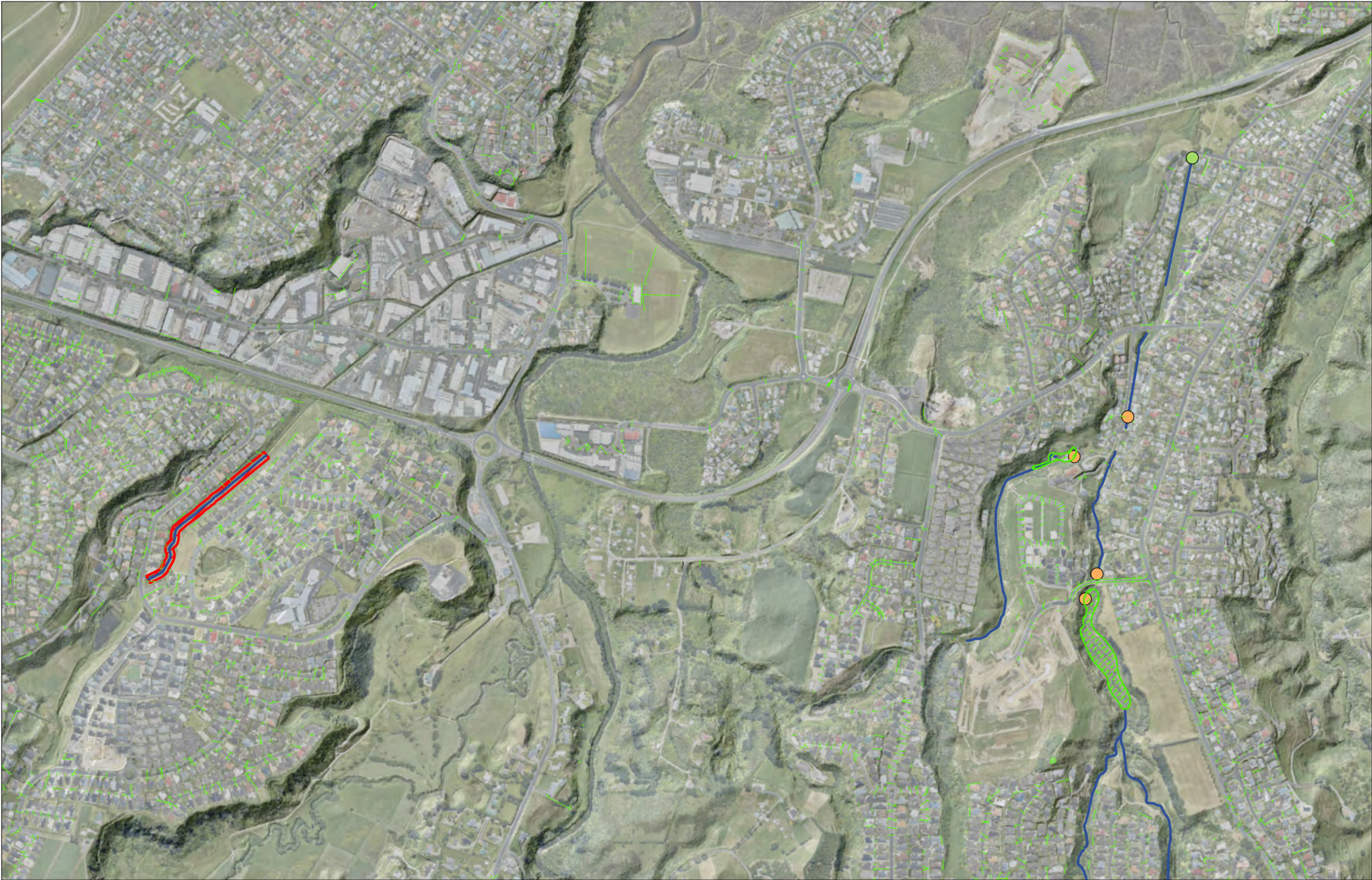
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## Appendix 1: Figure 1









## Appendix 2: Macroinvertebrate results



Group	Species	Awaiti Place March 2020 Awaite Lane Drain a	Awaiti Place March 2020 McFetridge Lane Downstream a
	1 Total abundance	707	157
	2 Number of taxa	21	15
	3 Number of EPT taxa	2	1
	4 MCI score	72.3	65.7
	5 QMCI	2.3	2.5
	6 Full count=1,Coded=2,Pres-abs=3, No form of data=4	2	2
ANNELIDA	HIRUDINEA		1
ANNELIDA	OLIGOCHAETA	20	5
CNIDARIA	Hydra	1	
Coleoptera	Elmidae	1	
Coleoptera	Hydraenidae		1
Coleoptera	Staphylinidae		1
COLLEMBOLA	COLLEMBOLA	1	5
CRUSTACEA	Cladocera	1	
CRUSTACEA	Copepoda	1	5
CRUSTACEA	Ostracoda	100	100
CRUSTACEA	Paratya	20	
Diptera	Austrosimulium	1	
Diptera	Ceratopogonidae	1	
Diptera	Chironomus	1	
Diptera	Tanypodinae	1	5
Diptera	Tanytarsini	1	
MOLLUSCA	Lymnaeidae		1
MOLLUSCA	Physa = Physella	1	1
MOLLUSCA	Potamopyrgus	500	20
MOLLUSCA	Sphaeriidae	5	
NEMATODA	NEMATODA	5	
NEMERTEA	NEMERTEA	5	1
Odonata	Xanthocnemis		1
PLATYHELMINTHES	PLATYHELMINTHES, excl. Rhabdocoela	20	5
Trichoptera	Polypsectropus	1	5
Trichoptera	Triplectides	20	



#### About Boffa Miskell

Boffa Miskell is a leading New Zealand professional services consultancy with offices in Auckland, Hamilton, Tauranga, Wellington, Christchurch, Dunedin and Queenstown. We work with a wide range of local and international private and public sector clients in the areas of planning, urban design, landscape architecture, landscape planning, ecology, biosecurity, cultural heritage, graphics and mapping. Over the past four decades we have built a reputation for professionalism, innovation and excellence. During this time we have been associated with a significant number of projects that have shaped New Zealand's environment.

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