Attachment 2

Ecological Assessment prepared by Beca

Ecological Assessment – 105A - 109A & 119 May Road

May Road Development

Prepared for May 1 Limited

Prepared by Beca Limited

22 June 2022

Revision History

Revision Nº	Prepared By	Description	Date
1	Sarah Busbridge	Feasibility Assessment	4/12/20
2	Jess Schofield / Sarah Busbridge	Ecological Impact Assessment	4/2/2022
3	Jess Schofield	Updated with Client Feedback	14/04/2022
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Document Acceptance

Action	Name	Signed	Date
Prepared by	Sarah Busbridge Jess Schofield	 	3/12/2020 14/06/2022
Reviewed by	Claire Webb		3/12/2020 14/06/2022
Approved by	Dale Paice		22/06/2022
on behalf of	Beca Limited		

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Executive Summary

May 1 Limited is considering redevelopment of their May Road properties in Mount Roskill (the Site). The proposed future development includes using engineered fill to create platforms raised above the AEP floodplain. To compensate, other areas are to be cut to create additional floodplain storage.

This report sets out an assessment of the ecological values, opportunities, and constraints of the Site to help inform the future redevelopment as well as an assessment of the ecological impacts associated with the proposed works to support an application for resource consent.

The Site is highly modified and consists of predominantly exotic vegetation, old warehouses and structures, and modified watercourses with low ecological value.

The main aspects of the proposed works that directly modify watercourses are:

- Realignment of an existing watercourse via the infilling of approximately 130 metres of channel and creation of approximately 195 metres of new watercourse with increased sinuosity;
- Riparian restoration and planting alongside an existing watercourse;
- Piping of a section of council stormwater network that currently discharges over land into the Site.

The potential ecological effects and opportunities identified are as follows:

- Loss and modification of in-stream habitat;
- Loss of existing vegetation cover;
- Potential injury and/or mortality of native freshwater species;
- Reduction in stream ecological function from possible sediment discharge and stream bed disturbance;
- Temporary disturbance to avifauna;
- Potential injury and/or mortality of lizards;
- In-stream enhancement;
- Enhancement via riparian plantings.

Effects management concepts proposed in this report to address these effects include implementation of environmental management during construction, including:

- Native Fish Salvage and Management plan;
- Erosion and Sediment Control Plan;
- Lizard management;
- Considerations of timing and staging of works;
- Stream offset;
- Riparian planting.

No major ecological constraints are anticipated in the development of the Site and there are opportunities to enhance aquatic habitat values within the Site. With the implementation of the mitigation and compensation measures listed above, the overall level of the ecological effects associated with these works is **Very Low** with no significant adverse residual effects expected, and a positive ecological gain anticipated over a 5 -10 year time period.

Introduction

1.1 Background

Beca Limited (Beca) has been commissioned by May 1 Limited to undertake an ecological investigation at their May Road properties in Mount Roskill (the Site). The Site is located on May Road in the suburb of Mount Roskill and encompasses the properties of 105, 105a-109a, and 119 May Road. The land at 54 Roma Road directly northeast of the Site will host a shaft for Watercare Services Limited (Watercare)'s Central Interceptor tunnel and 105 May Road is currently being leased to facilitate construction activities. Figure 1 shows the Site, Watercare's land and adjacent lots.

This report forms part of a suite of reports prepared to consider the feasibility of the future Site development. The other reports are:

- Geotechnical Factual Report;
- Geotechnical Interpretive Report;
- Land Contamination Assessment;
- Civil and Stormwater Assessment;
- Erosion Sediment Control Plan;
- Resource Consent Drawings.

Figure 1. Site Plan.

1.2 Proposed Works

The proposed works comprise earthworks across the majority of the Site in order to form platforms suitable for future development, to realign and naturalise an existing stream channel and to recontour floodplain areas within the Site to suit future developments and manage potential flood hazard effects. In addition to earthworks, the proposed works include landscape planting within floodplains and riparian margins and some modifications to public stormwater pipework to suit the final form.

The proposed works are shown on Beca Concept Design Drawing Set (June 2022) and Figure 2 shows cut-fill depths of the proposed bulk earthworks within the Site.

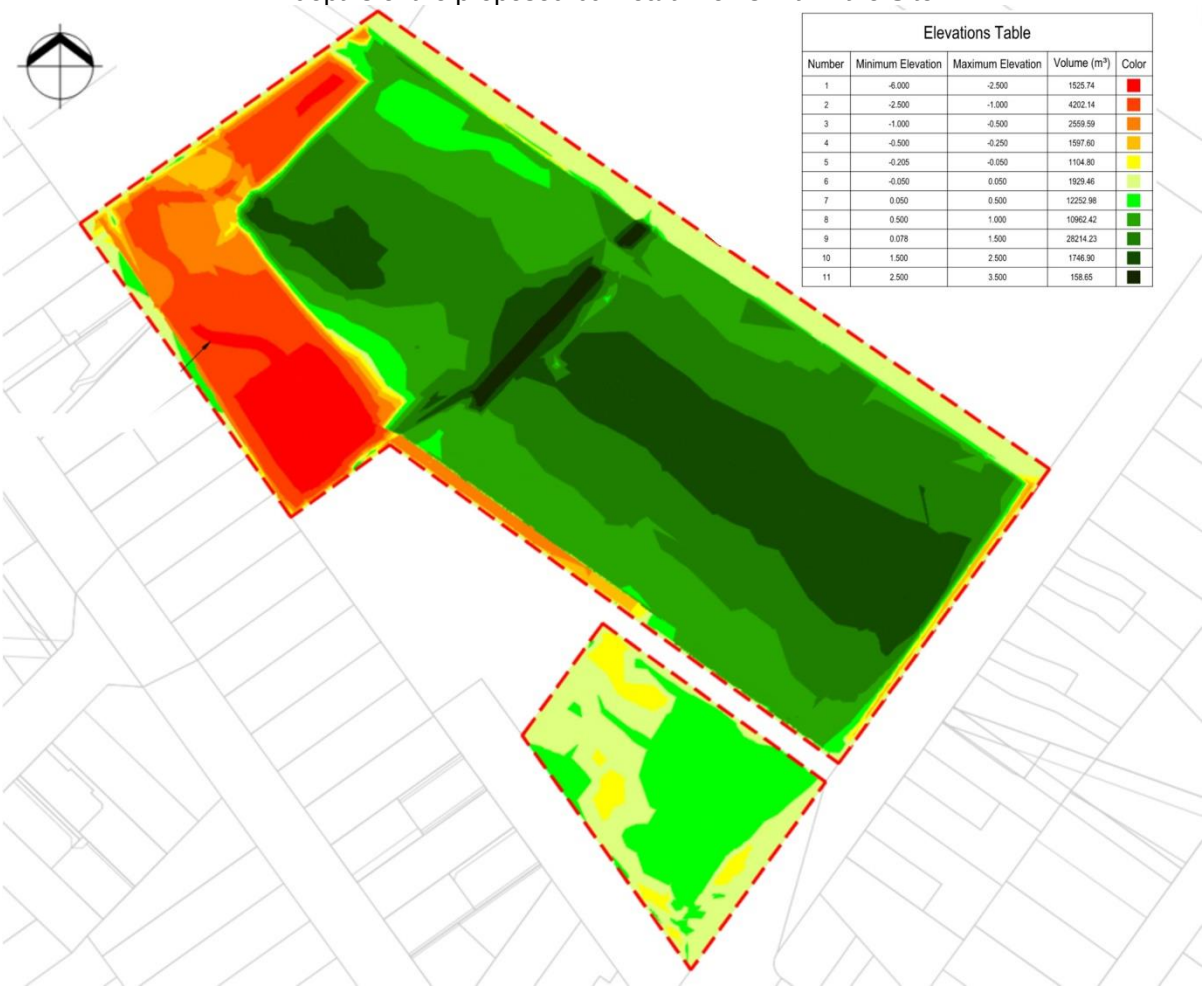

Figure 2. Earthworks Proposed Cut/Fill

The proposed stream realignment entails the infilling of approximately 130 metres of channel (~40 metres intermittent stream and ~90 metres permanent stream) and the creation of approximately 195 metres of new watercourse with increased sinuosity along the western perimeter of 105 May. The realigned channel will run around the western edge of the proposed new building platform, along the west and northwest edge of the Site. The stream realignment design is planned to maintain a natural clay channel, with some boulders embedded in the compacted clay to create rock riffles in sections for additional habitat heterogeneity, some riprap and structural boulders added to stabilise the stream channel, logs pinned at the channel edge to create additional eel and fish habitat, and riparian plantings with coco matting to allow plant establishment in the soil along the channel length of both banks.

Works are also proposed alongside the stream channel at the north-east boundary of the Site (referred to herein as the 'Foodstuffs stream'. Works are to include the removal of a building within 10 m of the stream bank, earthworks on an already established platform, and some restoration planting within the riparian margin. Standard H17.6.3 of the Unitary Plan requires the maximum impervious area within the 10m riparian yard not to exceed 10% (or 270m2). However, the proposal seeks to establish 65% (or approximately 1,755m2) of impervious surfaces within this area (with the balance comprising restoration planting).

At the north-western edge of the Site, works entail the piping of a council stormwater network that currently discharges over land as an intermittent, artificial watercourse into the Site.

Indicative staging for the proposed work is provided in the concept drawing set. With regards to ecology, the key elements are;

- Stage B: reclamation of 35 m of stream; restoration and riparian planting of 155 metres of existing stream channel approximately 9.5 metres wide; total landscaped area of 1470 m^2.
- Stage C: construction of 195 metres of stream channel; reclamation of 95 metres of stream and approximately 4600 m^2 of riparian and floodplain landscaping.

1.3 Purpose and Scope

The purpose of this ecological assessment is to quantify the ecological values (existing and potential) of the freshwater and terrestrial environmental features within and adjacent to the Site, and to determine the ecological impacts of the proposed redevelopment works at the Site.

The scope of this report includes:

- A site visit to the location of proposed works on the 27th and 28th of October.
- A Stream Ecological Valuation (SEV) of the impact reach.
- Fish surveys, macroinvertebrate sampling, and water quality measurements within the impact reach.
- A desktop-based review of:
  - Information held by Auckland Council;
  - New Zealand Freshwater Fish Database (Crow, 2017)
  - Previous ecological assessment prepared by Beca Ltd.; and
  - Other publicly accessible reports, data and information.
- An assessment of the ecological values within and adjacent to the Site.
  - An assessment of ecological constraints and opportunities at the Site.
- An assessment of ecological effects and recommended mitigation prepared in general accordance with the EIANZ Ecological Impact Assessment Guidelines (Roper-Lindsay et al., 2018).

2 Site Location and Ecological Context

The Site is located on May Road within the Auckland suburb of Mount Roskill, and encompasses the parcels of 105 (Legal Description SEC 2 SO 4685230), 105a-109a (Legal Description Lot 1 DP 586970, and 119 May Road (Legal Description Lot 3 DP 40979). It is located in an urban industrial area that has been subject to extensive development and modification since the 1950s (refer Figure 4). The Site is largely flat, with elevation between 49 – 51 mRL and a low-lying area in the north-western corner of the 105 May Road property. A drainage channel follows the north-eastern boundary of the Site, before discharging to a culvert in the Watercare site (54 Roma Road). A second drain crosses the centre of the Site following the boundary between 105 and 105a-109a May Road (refer Figure 3).0

The Site is located within the Tāmaki ecological district (McEwen, 1987). Historically, the Site would have been covered by broadleaved forest with abundant pūriri (WF7) which would have supported a diverse range of invertebrates, reptiles, birds and bats (Singers et al., 2017). Currently, the Site is surrounded by industrial, residential, and commercial land use. A number of large warehouse and smaller shed structures are present on the 105a-109a May Road lots with various stockpiles of wood, refuse, and soil fill, while 105 and 119 May Road are predominately vacant. 105 May Road is currently being leased and serves as the location of the contractor's site offices as part of Watercare's Central Interceptor project.

Figure 3. Site Location Plan; approximate property boundaries outlined in red. Blue lines represent the approximate location of watercourses at the Site (Image Source: Auckland Council Geomaps).

Aerial of May Road Site from 1940.

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Aerial of May Road Site from 1959.

Aerial of May Road Site from 2001.

Aerial of May Road Site from 2017.

Figure 4. Historic aerial imagery of the Site with the property boundary indicated in yellow. Sources: Auckland Council Geomaps.

3 Methodology

3.1 Desktop Review

A desk study was undertaken that sourced ecological information from the following sources:

- Information held by Auckland Council;
- Auckland Council GeoMaps data and geospatial layers including: catchment and hydrology, contours, ecosystems potential extent, SEAs;
- New Zealand Freshwater Fish Database (NZFFD) (Crow, 2017); and
- Other publicly accessible reports or information.

3.2 Field Investigations

3.2.1 Habitat Assessments

Watercourse assessments were completed on the 27th October 2020 following methods outlined in the Watercourse Assessment Methodology: Infrastructure and Ecology Document (Version 2.0) to assess the baseline condition of the existing watercourses(Lowe et al., 2016). Data collected included: channel condition and morphology, bank and channel modification, stream bank erosion, debris jams, streambed substrate composition, channel shade and riparian vegetation.

Terrestrial habitat assessments were also completed following Rapid Ecological Assessment methodology developed by Auckland Council (2012) to capture the species composition and ecological value of terrestrial vegetation at the Site.

3.2.2 Stream Ecological Valuation (SEV)

A Stream Ecological Valuation (SEV; Storey et al., 2011) was carried out for the impact reach at the Site on 27th October 2020. The methodology includes a fish survey, aquatic macroinvertebrate sampling, cross-sections to record habitat characteristics such as depth and substrate, and qualitative assessment of attributes such as channel modification and riparian vegetation class. Different weightings are given to the different collections of attributes and the values of a stream are quantified based on the performance of 14 ecological functions, which fall under broader categories of hydraulic, biogeochemical, habitat provision and biodiversity (Storey et al., 2011). These functions are used to determine an overall SEV value between 0 (a stream with the minimum ecological valuation) and 1 (a stream with the maximum ecological valuation) which is interpreted alongside SEV values for reference streams of the same stream type. Interpretation of SEV scores is given in Table 1.

Table 1. Interpretation of SEV scores (adopted from Golder Associates, 2009)

Score	Category
0 – 0.4	Poor
0.41 – 0.60	Moderate
0.61-0.80	Good
0.81+	Excellent

Reference sites for this assessment were selected based on their similarity in terms of land use and river environment classification (REC). Three urban streams were selected. The classification (climate, geology, landcover, network position) of the impact reach and three reference streams is described in Appendix B.

3.2.3 Water Quality

Field water quality measurements were recorded on the 27th October 2020 for pH, dissolved oxygen (DO), and temperature using a hand-held meter (YSI Plus) at two sample locations marked in Figure 5.

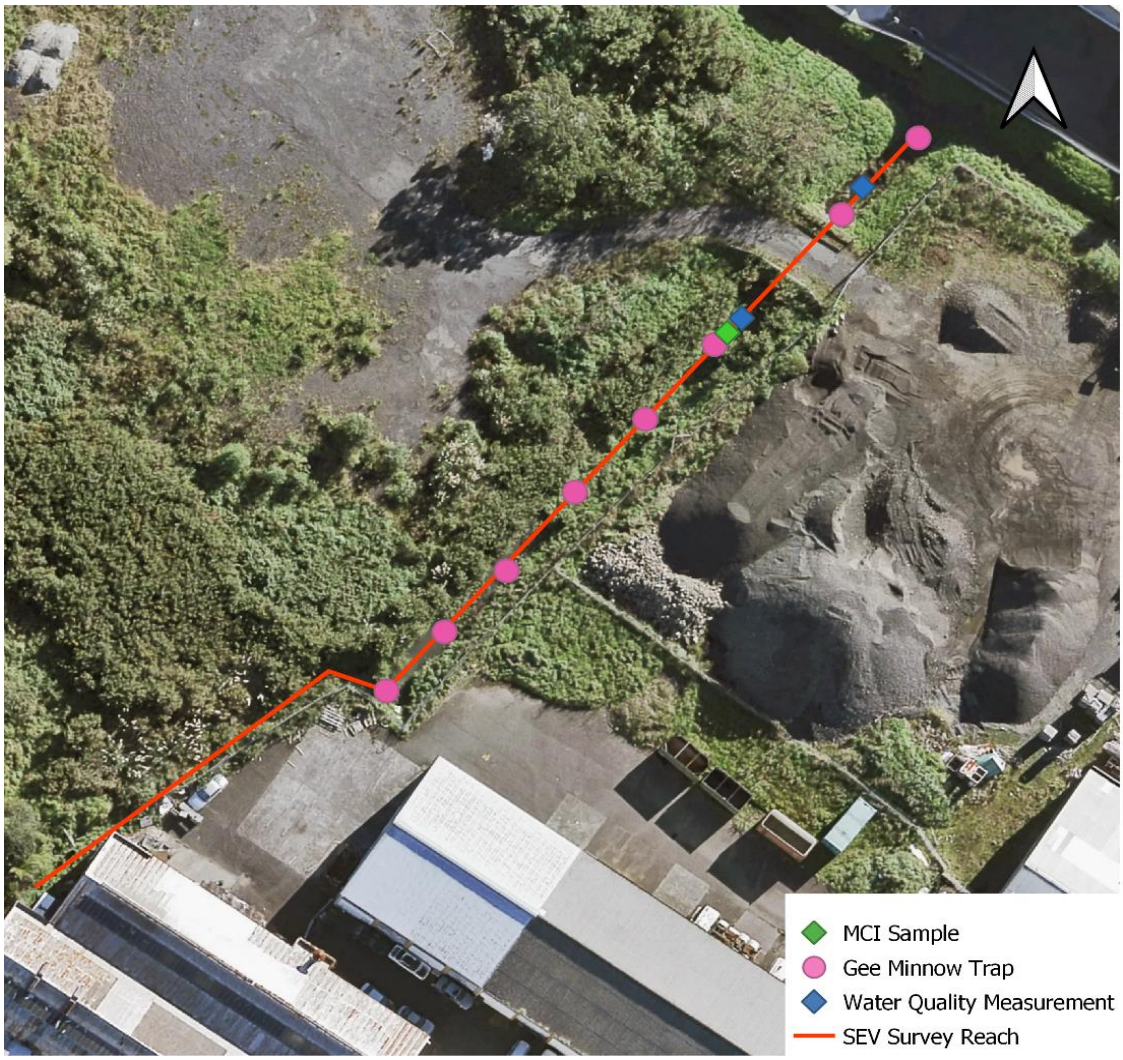

Figure 5. Location of SEV survey reach, MCI samples, Water Quality Measurements and Gee Minnow Traps within the impact reach.

3.2.4 Macroinvertebrate Sampling

A single macroinvertebrate sample was collected at one location (as marked in Figure 5) from the stream substrate and streambank vegetation using a kicknet. Samples were preserved in ethanol and analysed by EIA Ltd for Macroinvertebrate Community Index (MCI) and Semi-Quantitative Macroinvertebrate Community Index (SQMCI). Consistent with best practice, the soft-bottomed version of these indices were used for the sample reach. Both indices are used to measure stream health and organic enrichment. MCI is a presence-absence based index while the SQMCI uses a five-point scale of coded abundances (i.e. rare, common, abundant, very abundant, highly abundant (Maxted & Stark, 2007). Higher MCI and SQMCI scores indicate high habitat and water quality. The percentage of EPT (Ephemeroptera, Plecoptera and Trichoptera) taxa were also calculated for the sample location. EPT taxa are highly sensitive to environmental perturbations, and samples with higher numbers of these taxa indicate high environmental quality.

3.2.5 Fish Survey

Freshwater fish communities were sampled in general accordance with the New Zealand freshwater fish sampling protocols for wadeable rivers and streams (Joy et al., 2013). Freshwater fish were surveyed along the impact reach using 8 un-baited Gee-Minnow traps set 10 metres apart resting on the substrate with the top of the trap slightly protruding from the water (see Fig. 4 for locations). The traps were covered with vegetation to minimise risk of heat stress. Gee minnow traps were spread over approximately 80m. Traps were set overnight and cleared the next morning for one night (27th – 28th October, 2020).

One eDNA sample was also taken from the impact reach on the 27th October using a high turbidity eDNA kit with 1.2 µm and 5 µm CA filters. A multi-species test was undertaken on eDNA samples by Wilderlab Ltd using next-generation sequencing (NGS) to list out all of the species detected in each sample, within broad taxonomic groups.

1.1 Assessment Methodology

A desktop assessment of ecological effects was undertaken in accordance with Ecological Impact Assessment (EcIA) EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems (Roper-Lindsay et al., 2018).

The EIANZ guidelines set out a methodology to assign ecological value to species and ecosystems based on four assessment criteria which are consistent with significance assessment criteria set out in the Proposed National Policy Statement for Indigenous Biodiversity (2019) Appendix 1: Criteria for identifying significant indigenous vegetation and significant habitat of indigenous fauna. These are reproduced in this report as a series of tables in Appendix A. In summary:

- Particular attributes are considered when considering ecological value or importance. These relate to matters such as representativeness, the rarity and distinctiveness, diversity and patterns, and the broader ecological context;
- Determining factors for valuing any terrestrial species present; span a continuum of very high to negligible, depending on aspects such as whether species are native or exotic, have threatened status, and their abundance and commonality at the site impacted;
- Ecological Values are scored based on an expert judgement, and qualitative and quantitative data collected. The freshwater features assessment has additionally been guided by an adaption to the EIANZ methodology to provide linkage to some of the common stream ecological value assessment methodology

Once ecological values have been identified and valued, the severity of potential impacts is assessed by determining the change from baseline ecological values likely to occur as a result of the proposal/project. This provides a magnitude of effect as determined by the criteria set out in Appendix A.

Finally, once these two factors have been determined (the ecological value and the magnitude of effect), an overall level of effect on each of the identified ecological values is assessed.

4 Ecological Features and Values

There are three watercourses on the Site; the Foodstuffs stream (along the north-eastern site boundary), the Impact Reach to be realigned that crosses the centre of the Site, and a section of council stormwater network that flows from a public stormwater outlet at 33 Marion Avenue and currently discharges over land at the southwest corner of the Site for approximately 43 m and into Watercare's site (54 Roma Road).

4.1 Foodstuffs stream

This is a straightened and modified permanent stream that runs along the boundary of the property with Foodstuffs. The stream channel is approximately 1 – 1.5 m wide and retains water year-round. Water height is variable between seasons based on rainfall and can fill to channel height. The channel is soft bottomed, consisting of mud, silt, and clay with some cobble to boulder sized rocks. The water flow is low energy, and the stream is predominantly run habitat with some riffles. Some macrophyte growth is visible in sections of the stream channel. A stormwater pipe discharges into the stream at the Roma Road corridor conveying flow from Roskill South and Freeland Reserve upstream. Some smaller stormwater pipes discharge to it from adjacent sites.

The stream bank is between approximately 1 – 2 m high, with a moderate/steep sloped gradient. The bank riparian vegetation comprises herbaceous ground cover, sparse ngaio (*Myoporum laetum*), pūriri (*Vitex lucens*) and pōhutukawa (*Metrosideros excelsa*) that provide some limited shading. Weeds are also present in the riparian area, including dense onion weed (*Allium triquetum*).

This reach of the Foodstuffs stream is assessed to have Low ecological value. This is based on limited shading and quality of riparian vegetation (low representativeness), low freshwater fauna diversity, poor habitat provision (low rarity/distinctiveness and low diversity/pattern), poor biogeochemical and biodiversity function, and modified stream morphology in an urban catchment (low ecological context).

The NPS FM 2020 directs the consideration of the potential value of any freshwater features being impacted if they were restored. Based on this, the stream has the potential to have enhanced water quality, shading, and increased in-stream habitat heterogeneity. However, the water quality will still be affected by the highly modified, urban usage catchment, therefore potential ecological value of upstream reach of Foodstuffs stream is assessed as Moderate.

Figure 6. Foodstuffs upstream on Site (left) and downstream on Site (right). Images taken during site walkover 29th September 2020.

4.2 Impact Reach

The Impact Reach which is to be realigned crosses the centre of the Site and flows in the direction of the northeast border of the Site into the permanent Foodstuffs Stream. Water height is <0.2 m deep during the summer period, but is variable between seasons based on rainfall and can fill to channel height. The majority of this stream habitat length is characteristic of a permanent stream, but the stream becomes more typical of an intermittent stream towards its upstream limit (refer Figure 8).

The stream bank is predominantly 1-2 m high. Low fish and macroinvertebrate diversity were found within this reach (refer Section 5.3). Two water quality measurements (see Table 2) were taken from this reach at the locations shown in Figure 5 above. Water quality was reasonably poor, with high water temperatures and low dissolved oxygen below the National Policy Statement for Freshwater Management (NPS-FM 2020) National Bottom Line value (T). This is an indication of degradation of ecological and habitat functionality, and increased likelihood of local extinctions of keystone species.

Bank vegetation primarily consists of gorse and exotic herbaceous species, and a few young karamu (*Coprosma robusta*). Additionally, the soft rush (*Juncus effusus*) is present along the stream edge and various emergent macrophytes are present within the channel also (*Persicaria hydropiper, Nasturtium officinale*).

Similar to the Foodstuffs stream, this reach has limited riparian vegetation, limited habitat heterogeneity (low representativeness), low fish and benthic invertebrate diversity (refer Section 5.3), low SEV score (Table 3) (low rarity/distinctiveness and low diversity/pattern), poor biogeochemical and biodiversity function, and modified stream morphology in an urban catchment (low ecological context). Therefore, this Impact Reach is assessed to have Low ecological value.

A Stream Ecological Valuation (SEV) was completed for this reach, which identified a lower SEV score than all reference sites overall. Out of the four key functions the SEV assessed; the reach was determined to have limited habitat provision function, limited biogeochemical function, moderate hydraulic function, and

moderate biodiversity function (Table 3, Figure 7.). The overall SEV score for the impact reach is lower than that of reference streams. A summary of SEV values are shown in Figure 7.

The Environmental Compensation Ratio calculated from the SEV assessment identified that to compensate for the loss of 130 m of the Impact Reach stream, 166 m of additional stream would need to be created. The current planned length of the realignment is 195 m, therefore this is an appropriate length of additional stream to compensate.

Table 2. Water quality measurements from the unnamed tributary. Water quality is interpreted according to the National Policy Statement for Freshwater Management (2020)

Water quality variable	Relevance	Sample 1	Sample 2
Temp (°C)	Fish spawning (May – Sept)	20.3	16.6
DO (mg/L)	Oxygen for aquatic animals to breathe	3.86 (42.6%)*	1.12 (14.6%)*
pH	Can affect plants and fish	6.87	6.81
*Below NPS-FM (2020) national bottom line value of 4.0 mg/L one day minimum			

Table 3. SEV scores for the Impact Reach for four key ecological functions.

Function Category	Impact Reach Current	Impact Reach Potential with Restoration	Impact Reach Potential with Realignment
Hydraulic	0.45	0.47	0.54
Biogeochemical	0.18	0.49	0.54
Habitat Provision	0.15	0.23	0.42
Biodiversity	0.15	0.17	0.18
Overall mean SEV score	0.246	0.379	0.445

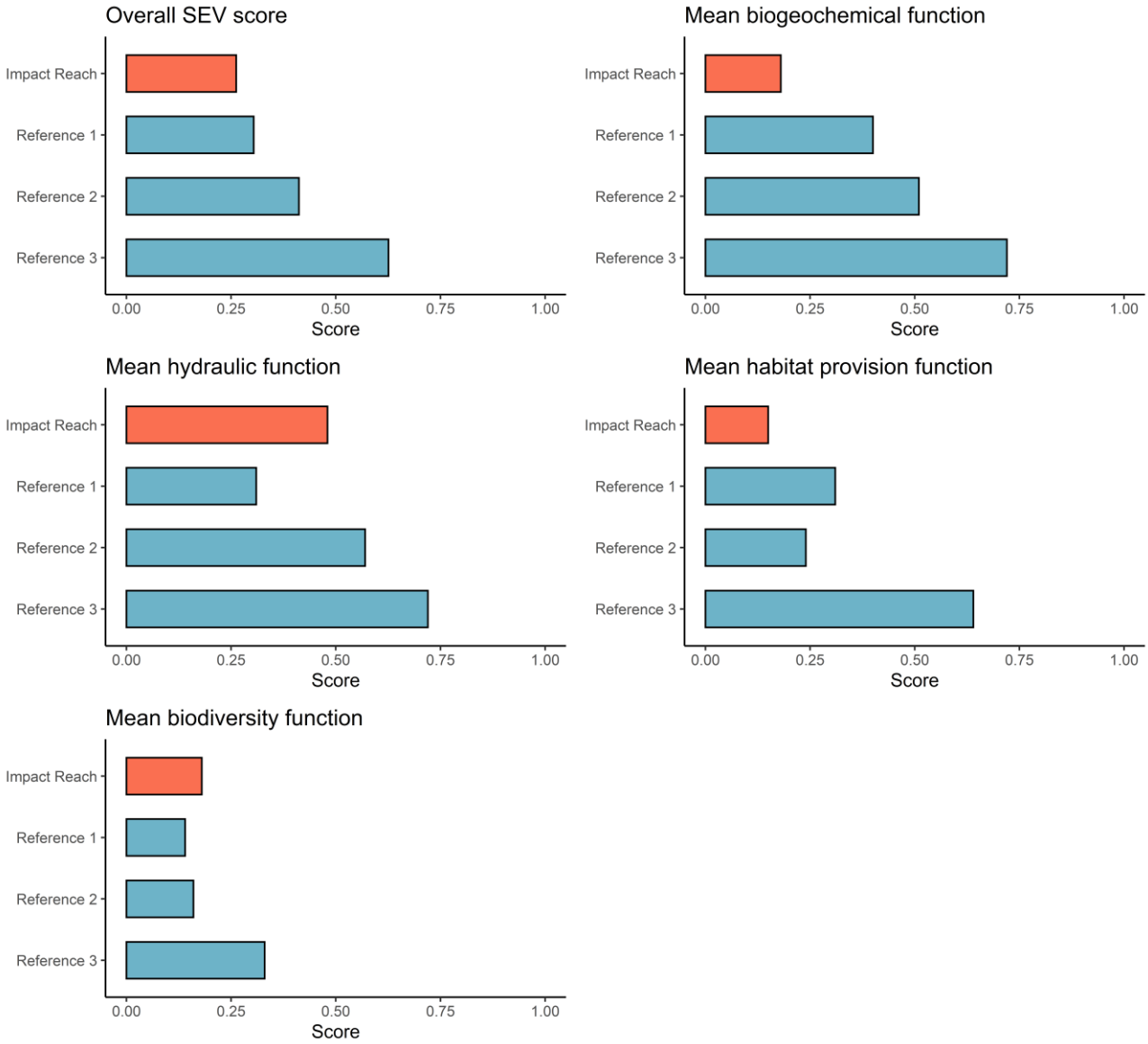

Figure 7. Overall SEV score and mean function scores for the impact reach in comparison to the three reference sites. A complete description of SEV values can be found in Appendix B.

Downstream section.

Midstream section.

Upstream section.

Oily film on water in the reach.

Figure 8. Impact Reach at three different sections – downstream, midstream, and upstream, becoming more characteristic of an intermittent stream in upstream section. Images taken during site walkover 29th September 2020.

4.3 Artificial Reach

A watercourse was identified that originates as a discharge from a stormwater pipe beneath 33 Marion Avenue (Figure 9). The water ponds immediately adjacent to the pipe discharge point before flowing diffusely overland for approximately 10 m through an overgrown area of weedy vegetation before a clearly defined channel begins. Underneath the overgrown vegetation there is evidence of a defined channel (albeit narrow and shallow), with a clear raised true left bank, although there is limited slope on the true right. At approximately 10 m from the pipe discharge, the reach becomes a clearly defined channel with weedy and exotic riparian vegetation providing limited shading or buffering, with cloudy water clarity and evidence of silt/sand sediment deposition.

This reach within the property is classified as artificial based on the following observations:

- There is no evidence of the channel prior to development (refer 1940 aerial imagery) with the stormwater pipe installation beneath 33 Marion Ave on Auckland Council geomaps being 30/05/1957;
- There is no evidence from contours or landform of any channel present upslope or downslope of this location historically which could have been modified/diverted. This is in contrast to the channel on the other boundary of May Road, which is very clear in the 1940s imagery.

The ecological value of this reach is classified as Negligible. This is on the basis of this being an artificial reach with no upstream connectivity to other streams in the catchment (Very Low representativeness), low value habitat with no evidence the-stream will support a diverse fish population or an at risk fauna community (Very Low Rarity/Distinctiveness), exotic and weedy vegetation surrounding with minimal in-stream habitat heterogeneity (Very Low Diversity and Pattern), degraded urban catchment (Very Low Ecological Context). Due to this classification, this feature has not been considered further in the assessment of effects.

Figure 9: Piped discharge at the artificial reach taken during May 2022 site visit.

4.4 Vegetation

The vegetation within the Site is largely dominated by weedy exotic herbaceous species which have spread over the Site. The species predominantly observed were the exotic species; narrow leaved plantain (*Plantago lanceolata*), jointed charlock (*Raphanus raphanistrum*), creeping buttercup (*Ranunculus repens*), Convolvulus sp., Yorkshire fog (*Holcus lanatus*), wild carrot (*Daucus carota*), kikuyu (*Pennisetum clandestinum*), and the species classified as regional pest plants hemlock (*Conium maculatum*) and pampas (*Cortaderia selloana*) (Auckland Council, 2021). Woody vegetation includes two young karamū (*Coprosma robusta*), willow (*Salix babylonica*), and the species classified as regional pest plants sparse wattle (*Acacia sp.)* and gorse (*Ulex europaeus*).

The ecological value of the vegetation at the Site is assessed as Negligible based on very low representativeness (weedy exotic herbaceous and woody vegetation), rarity/distinctiveness (majority weed/pest species, lack of indigenous species), diversity and pattern (extremely limited diversity), and ecological context (degraded urban environmental context).

Figure 10. Vegetation present on the Site.

4.5 Freshwater fauna

4.5.1 Macroinvertebrates

The Macroinvertebrate Community Index (MCI) value in the Impact Reach was 75.14, which is below the NPS-FM (2020) national bottom line value of 90 (Table 4). Seven taxa were observed in total, none of which were EPT taxa, which are sensitive to environmental contaminants and if present, indicators of greater ecological health. The most dominant taxa present were Crustacea ostracoda (seed shrimps) and oligochaete (worms) which are typically dominant in degraded freshwater environments. Therefore, the

macroinvertebrate community in the reach can be considered highly impacted. Detailed MCI results are listed in Appendix C.

Table 4: Summary of the macroinvertebrate community indices for the Impact Reach. Sample collected 27th October 2021 and processed by EIA Ltd. Refer to Appendix C for more detailed data.

Metric	Score
Number of Taxa	7
Number of EPT Taxa	0
Number of Individuals	2030
% EPT taxa	0
MCI Value (soft-bottomed)	75.14
SQMCI Value (soft-bottomed)	2.86

4.5.2 Fish

According to the NZFFD, Shortfin eel (*Anguilla australis*), Freshwater shrimp (*Paratya curvirostris*), Kōura (*Paranephrops* spp.), Mosquitofish (*Gambusia affinis*), and kākahi (*Hyridella menziesii*) are present in Foodstuffs stream (Crow, 2017). Kākahi have a conservation status of At Risk – Declining (Grainger et al., 2018) although observations from the Site are dated from 2010 and given habitat conditions it is considered highly unlikely they are still present.

Three shortfin eel and 36 mosquitofish were recorded in the set Gee's Minnow Traps during fish surveys in the impact reach. Full results of the fish survey are included in Appendix D.

Table 5: Fish species recorded in the eight Gee Minnow Traps within the Impact Reach over the night of the 27th October 2020. Refer to Appendix D and Figure 5 for further detail. Conservation status assigned using Dunn et al (2018)

Species	Conservation Status	Length	Abundance
Shortfin eel (*Anguilla australis*)	Not Threatened	200-500 mm	3
Mosquitofish (*Gambusia affinis*)	Introduced and Naturalised	30-50 mm	36

4.5.3 eDNA

An eDNA sample was also taken during the Site survey on 27th October 2021 supported the findings of the fish trap survey, as the eDNA identified mosquitofish and shortfin eel as the only freshwater fish species present. Full eDNA results are included in Appendix E.

4.5.4 Overall value

Overall, the current ecological value of the freshwater fauna present in the Impact Reach is Low.

4.6 Avifauna

Birds observed on site include the native, not threatened species; spur winged plover (*Vanellus miles novaehollandiae*), white-faced heron (*Egretta novaehollandiae*), and pūkeko (*Porphyrio melanotus*), and the introduced species mallard (*Anas platyrhynchos*). Five pūkeko nests were also identified during the Site walkover along the banks of the impact reach, one of which contained eggs.

The current ecological value of the bird species present on site is Low, although the margins of the impact reach provide some nesting and foraging habitat for pūkeko.

4.7 Lizards

No lizard surveys were undertaken within May Road properties however, a large population of copper skink (*Oligosoma aeneum*) has been discovered at the adjacent Central Inceptor site. An assessment of lizard habitat features found that the site is covered in overgrown grass, other herbaceous ground cover, debris and rip rap/rock piles which provides suitable skink habitat. There have also been numerous incidental

sightings of skinks during the Site visit, although these were not able to be identified to a species level. It is likely that copper skink (*Oligosoma aeneum*; At Risk - declining) and plague skink (*Lampropholis delicata*; Introduced) are present at the Site.

Based on known species presence on the neighbouring property as well as suitable habitat present on the Site, herpetofauna species values are High.

4.8 Natural Wetlands

A wetland identification and classification survey was carried out in December 2020. This report was completed prior to the release of the hydrology tool and guidance from MfE regarding the definition of a ‘natural wetland’ under the NPS-FM, however, the conclusion that there is no ‘natural wetlands’ present on site is still considered accurate. Although some scattered hydric vegetation was present in a small earthworked depression, it was not considered to have permanent wetland hydrology. The full wetland classification is included as Appendix F.

5 Assessment of Ecological Effects

Ecological effects are associated with the temporary effects arising from the construction phase as well as operational effects once the infrastructure and realignment have been constructed. The key construction and operational activities that informed this assessment (detailed in Section 1.2) are:

- Existing vegetation clearance;
- Earthworks;
- Stream in-filling and temporary damming and diversion;
- New channel design and construction;
- Erosion and sediment control measures;
- Landscaping.

The assessment of ecological effects has been undertaken in accordance with the EIANZ guidelines (Roper-Lindsay et al., 2018). Level of effects are assessed as the product of the magnitude (determined according to the duration of effects, the degree of change that will be caused and the extent of potential impact), and the ecological values impacted. The key effects assessed, and associated magnitude are described in detail below.

Construction phase ecological effects include:

- Loss and modification of in-stream habitat;
- Loss of existing vegetation cover;
- Potential injury and/or mortality of native freshwater species;
- Reduction in stream ecological function from possible sediment discharge and stream bed disturbance;
- Temporary disturbance to avifauna;
- Potential injury and/or mortality of lizards.

Operational phase ecological effects include:

- In-stream enhancement;
- Enhancement via riparian plantings.

5.1 Magnitude of Effects

5.1.1 Loss and modification of in-stream habitat

The regrading of the Site and realignment of a section of stream will result in the permanent modification of approximately 130 m (~90 m permanent; ~40 m intermittent) of degraded stream habitat. Flows from the degraded stream will be diverted to a new stream channel of approximately 195m. The new stream is designed to provide a naturalised channel (meandering with in-stream habitat features) with riparian planting (ave. of 10m width either side of the channel). To maintain the drainage pathway, the new reach will be established before the existing watercourse is in-filled. The ecological function of the impact reach will not be immediately replaced by the realigned stream, until the realigned stream is colonised by macroinvertebrates, macrophytes and fish. This is expected to take between five to ten years.

These effects are localised to the scale of the reach with no ecological disturbance to the downstream environments (i.e. Oakley Creek) or the broader catchment expected. The works are expected to have localised effects on the Foodstuff stream between the existing and new confluence point, through a minor change in flow pattern from this channel removal, however is not expected to have any effect on the Foodstuffs stream functionality. The short-term loss of stream ecological function is assessed as a **Moderate** magnitude of effect.

5.1.2 Loss of existing vegetation cover

Vegetation of low ecological value (predominantly weedy exotic herbaceous species) is present across the Site, some of which is in the riparian yard of the streams on site. The removal of this vegetation cover is considered a **Negligible** magnitude of effect, as it is of low ecological value and the realignment and Foodstuff stream improvements are expected to result in enhanced ecological and increased indigenous vegetation value within the riparian zone through plantings.

The vegetation does, however, provide several ecosystem services such as poor-quality bird and skink habitat, and sediment control. These functions will be temporarily lost but will be improved in the long-term through riparian revegetation along new and existing stream alignments at the Site.

5.1.3 Potential injury and/or mortality of native freshwater species

These works will disrupt any native freshwater species inhabiting the stream reach to be infilled. The works have the potential to cause injury or mortality of any native species present, most likely shortfin eel, either directly through in-filling of the stream reach if fish salvage is not undertaken, or indirectly from habitat degradation near the confluence with Foodstuffs Stream if sediment discharges from the in-stream works are not managed. Despite the limited range of fish species present in the affected reach at the time of survey, if unmanaged, risk of harm is possible. This should also be contextualised in this location for aquatic fauna to relocate to connected waterways – and hence the magnitude of effect is expected to be **Low**.

This can be further mitigated by undertaking a fish salvage and relocating any aquatic organisms downstream into the Foodstuffs stream.

5.1.4 Reduction in stream ecological function from possible sediment discharge and stream bed disturbance (Foodstuffs Stream)

In-stream works, including the placement of boulders and riprap to stabilise the channel and construction that disturbs the stream banks has the potential to cause adverse effects on habitat quality and aquatic life in the Foodstuffs stream and downstream environment. Sediment laden water runoff during bulk earthworks may also result in reduced ecological health of this stream channel, by reducing water clarity, light attenuation, smother benthic organisms upon settling, and may reduce visibility for fish and cause harm to fish gills.

There is already substantial silt and sand sediment present in the reach and although these works will improve the overall habitat quality of the stream, the overall magnitude of effect of this activity is considered **Moderate** without appropriate management precautions implemented.

5.1.5 Temporary Disturbance of avifauna

The construction activities within the Site are likely to result in temporary disturbance to avifauna and loss of the pūkeko nesting habitat observed at the Site. Due to their highly mobile nature, it is likely that direct impacts on birds on-site will be largely avoided as they are expected to disperse to other habitats during the period of vegetation clearance, although the pūkeko nesting habitat present may be adversely affected depending on the timing of the work. Overall, the magnitude of this effect is expected to be **Low**.

5.1.6 Potential injury and/or mortality of lizards

The vegetation clearance (despite being mostly exotic herbaceous weeds) and earthworks on the Site have the potential to cause injury and/or mortality of native copper skink (At Risk – Declining conservation status). There are areas with rank grass and building debris piles present within the site which have a high likelihood of providing lizard habitat.

There is high likelihood that a large Copper Skink population is present based on suitable habitat and connectivity to nearby populations. As all native fauna is protected under the Wildlife Act, measures to avoid

injury/mortality are required and a lizard management plan has been recommended to address these issues. The magnitude of this effect is expected to be **High** with appropriate management precautions implemented.

5.1.7 In-stream enhancement

In-stream enhancement to the existing Foodstuffs stream and through the realigned stream design as part of these works are expected to provide multiple benefits; namely ecological, amenity and stormwater management. Enhanced in-stream habitat will be provided by increasing sinuosity and in-stream habitat heterogeneity through the inclusion of boulders to create riffles. Shading and organic leaf litter from planted riparian vegetation will improve in-stream water quality and habitat for freshwater fauna through temperature control, organic nutrient inputs, and increased habitat diversity. An indicative landscape plan for the realignment can be viewed in Beca (2022) May Road Development Resource Consent Drawing 3126366-CA-7201.

SEV scores can range between 0 and 1, with a score of 1 indicating high, unimpacted ecological function and 0 indicating limited ecological function. Based on the SEV compensation potential score for the realignment (mean 0.445) compared to its current score (0.246), the works have the potential to have a small enhancement to hydraulic function, a large enhancement to biogeochemical function and habitat provision, and a small enhancement to biodiversity (refer to Table 3 for a summary for current and potential SEV values).

Therefore, the magnitude of effect is **Positive**, as there is expected to be a net gain in ecological value over a medium time scale as in-stream fauna colonises the realigned stream and the surrounding riparian vegetation becomes established.

5.1.8 Enhancement via riparian plantings

The riparian area surrounding the new realigned stream and the existing Foodstuffs stream channel running along the northeast boundary will be enhanced with native plantings with coconut matting to allow plant establishment in the soil as part of the works on the Site. These will be specified in a planting plan. As this work will provide comprehensive native plantings in the riparian area which are not currently present around the existing and realigned streams, this will result in both terrestrial and freshwater habitat enhancement, including increased indigenous dominance and a riparian buffer to reduce runoff and erosion, and enhance shading. The realigned stream channel generally has 10 m width or more of planted riparian margin free of buildings, development, and impervious area on both banks. The existing Foodstuffs stream will have approximately 3 m width of planted riparian margin on the left bank (note the right bank is outside the Site boundary) but beyond that currently is and will remain impervious area. This has been considered in the full site assessment of effects.

Overall, the enhancement through riparian planting is a **Positive** magnitude of effect.

Table 6. Summary of potential unmitigated ecological effects during these works.

Impact	Ecological component	Ecological Value (habitat or species)	Magnitude of Effect	Current Level of Effect (unmitigated)
Loss and modification of in-stream habitat	Impact Reach	Low	Moderate	Low
Loss of existing vegetation cover	Vegetation	Negligible	Negligible	Very Low
Potential injury and/or mortality of native freshwater species	Impact Reach, Foodstuffs Stream, Freshwater Fauna	Low	Low	Very Low
Reduction in stream ecological function from possible sediment discharge and stream bed disturbance	Impact Reach, Foodstuffs Stream	Low	Moderate	Low

Temporary disturbance to birds	Birds	Low	Low	Very Low
Potential injury and/or mortality of lizards	Lizards	High	High	Very High
In-stream enhancement	Foodstuffs Stream	Low	Positive	Net Gain
Enhancement via riparian plantings	Vegetation, Foodstuffs Stream	Negligible, Low	Positive	Net Gain

6 Proposed Effects Management

The key ecological effects requiring management occur during the construction phase of the project. Ecological input into design and proposed activities have sought to raise issues early to assist where possible to avoid, remedy and minimise adverse effects and maximise ecological benefits. The potential adverse ecological effects detailed in Section 6 can be minimised or managed through best practice environmental management as outlined below.

6.1 Avoidance

Due to historic degradation, ecological features and values are of low ecological value with the exception of herpetofauna, and did not necessitate complete avoidance in context of the potential benefits of the project, in particular with respect to the restoration potential of the site.

6.2 Minimisation

6.2.1 Native Fish Salvage and Management Plan

Prior to in-stream works proceeding we recommend that the impact reach be isolated (using stop-nets) and fish present in this section be caught and translocated to a suitable aquatic habitat (preferably the Foodstuffs stream).

It is recommended that a Native Fish Management Plan is developed and implemented to minimise any potential impacts to native fish within the stream reach to be infilled. This management plan should outline the procedures to salvage and safely relocate the native fish out of the impacted reach prior to instream works being undertaken, along with appropriate timeframes for fish salvage associated with the staging of construction. This will likely involve isolating the impact reach using stop-nets and a combination of trapping, slow dewatering and sorting through dewatered materials to capture and safely relocate fish outside of the works zone. The stop-nets should be retained within the stream until the works are completed, to ensure that no fish re-enter this section of the stream.

6.2.2 Erosion and Sediment Control Plan

To sufficiently and appropriately manage the potential discharge of sediment laden water through the stream infilling for best practice environmental management, it is recommended all management measures in the Beca (2022a) Erosion and Sediment Control Plan (ESCP) are implemented in accordance with the Auckland Council Guideline GD05.

6.2.3 Lizard management

Native lizards are protected under the Wildlife Act 1953 and construction activities have the potential to impact native skink species. Due to the high likelihood of copper skink being present and the presence of suitable habitat, a lizard management plan is recommended. This will need to be developed and implemented by a DOC-permitted lizard ecologist (herpetologist), and prior to the start of works, adverse effects on native skinks present at the Site will need to be mitigated by relocating them to protected, suitable habitat.

The lizard salvage and relocation should be undertaken by an experienced herpetologist, outside of winter months and in accordance with Department of Conservation Wildlife Authority requirements. A lizard release site will need to be secured and should be under pest control both prior to, and following relocation. The release site should also be monitored for lizard presence, abundance, and habitat suitability outside of winter months.

6.2.4 Timing of Works

Avifauna

Although the Site has low bird ecological value, construction activities are likely to result in a temporary loss of pūkeko nesting habitat and disturbance to other birds. Due to their highly mobile nature, it is likely that direct impacts on adult birds on-site will be largely avoided as they are expected to disperse to other habitats during the period of vegetation clearance. Possible disturbance or harm can be reduced further by undertaking construction works in close proximity to watercourses outside of the pūkeko nesting season (August – November).

Fish

Stream dewatering should be undertaken during months when the intermittent section of the stream is expected to be dry to reduce potential adverse effects on fish. Freshwater fauna salvage work should ideally be completed within one summer/autumn season, preferably between December and May which is the optimum time for capturing native freshwater fish (Joy et al., 2013).

Lizards

Any lizard survey and/or salvage should take place outside of winter months when lizards are most active, and in accordance with Department of Conservation Wildlife Authority requirements.

Instream works

In-stream works should be undertaken during low stream flow conditions over the dry summer period. March – April would be the best time of year for the stream diversion to be put in place and would simultaneously avoid adverse effects on birds during the nesting season.

The new channel should be constructed before diverting flows. If the stream realignment and enhancement is to be staged due to construction necessity and the full required length is unable to be achieved immediately, a combined offset (via new stream realignment and enhancement) and compensation (riparian planting) approach may be used.

6.3 Biodiversity offset

6.3.1 Stream offset

The diversion of an approximately 130 m section of stream habitat (~90 m permanent, ~40 m intermittent), whilst degraded, has the potential to negatively impact the overall ecological value of the Site. However, to compensate for this impact and allow for water transport capacity to be maintained, the realigned channel on the Site with enhanced in-stream and riparian habitat features will improve the ecological and habitat functionality and value of the freshwater environment within the Site (refer to Beca (2022) Landscape Plan 3126366-CA-7201.for design). This design includes in-stream habitat features to create a suitable, improved habitat to facilitate aquatic recolonisation, utilisation, and allows for fish passage.

Environmental Compensation Ratio (ECR) was calculated to be 1.28:1 (Storey et al., 2011) (refer Appendix B). This requires 166 m of stream to be created to reasonably offset the loss 130 m of the Impact Reach. The realigned stream is proposed to be approximately 195 m in length which will result in a total gain of approximately 65 m of stream length, which is greater than the minimum length required for compensation based on the ECR.

Assuming this is implemented as per the design specifications, this will achieve no net loss, and a net gain of ecological value on the Site over a medium-to-long term time scale. The realignment will be like for like

offsetting and result in increased, additional stream length, and improved value of freshwater and riparian areas (refer Beca (2022) Landscape Plan 3126366-CA-7100).

The realigned stream will be enhanced relative to the existing channel through the creation of meander, and addition of boulders and pinned logged maintaining natural substrates to increase habitat diversity for fauna and geomorphic heterogeneity. The facilitation of natural in-stream habitat through design will provide additional refugia not previously present for aquatic fauna and allow overall habitat quality and quantity enhancements.

6.3.2 Riparian Planting

Riparian planting using a heterogenous mix of native species typical of the Tāmaki ecological district should be undertaken along the new stream channel and along the Foodstuffs stream to restore the riparian margins of these streams. Riparian revegetation has the potential to: create more diverse and stable stream food webs, enhance habitat diversity, improve temperature regulation for in-stream biota, provide organic matter inputs, improve soil infiltration capacity, reduce long-term bank erosion, and reduce sediment and nutrient concentrations (Davies-Colley et al., 2009; McKergow et al., 2016). A riparian buffer width of 10 metres from the stream edge is recommended to meet restorative functions (Collins et al., 2013) and align with riparian setbacks as required in the AUP:OP.

6.4 Overall Level of Effects

Table 7. Overall level of ecological effects with effect management implemented.

Impact	Ecological component	Ecological Value (habitat or species)	Effects management	Revised Magnitude of Effect	Revised Level of Effect
Loss and modification of in-stream habitat	Impact Reach	Low	Stream offset, Riparian planting	Low	**Very Low**
Loss of existing vegetation cover	Vegetation	Negligible	N/A	Negligible	**Very Low**
Potential injury and/or mortality of native freshwater species	Impact Reach, Foodstuffs Stream, Freshwater Fauna	Low	Native Fish Salvage and Management plan	Low	**Very Low**
Reduction in stream ecological function from possible sediment discharge and stream bed disturbance	Impact Reach, Foodstuffs Stream	Low	Erosion and Sediment Control Plan	Low	**Very Low**
Temporary disturbance to birds	Birds	Low	Bird management	Negligible	**Very Low**
Potential injury and/or mortality of lizards	Lizards	High	Lizard management	Low	**Low**
In-stream enhancement of May Road Stream	Foodstuffs Stream	Low	N/A	Positive	**Net Gain**
Enhancement via riparian plantings	Vegetation, Foodstuffs Stream	Negligible, Low	N/A	Positive	**Net Gain**

7 Conclusions and Recommendations

The Site is highly modified and consists of poor-quality freshwater and terrestrial habitat. Regardless, some effects of the redevelopment works, particularly in the watercourses, need to be managed. Fauna management and habitat replacement considerations will need to be addressed to develop the Site as proposed. Many potential effects occur during the construction phase which can be minimised by timing and the staging of the development.

Through the proposed effects management outlined in this report, the overall effects of the proposed works are considered to be **Very Low.** Once the stream realignment and associated planting is complete, it is expected that there will be a **Net Gain** in ecological values at the Site within a 5-10 year period.

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9 Limitations

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A

Appendix A – Ecological Impact Assessment Guidelines

Ecological Impact Assessment Guidelines

Assigning Ecological Value

The freshwater habitat features were assessed considering each of the attributes in Table A 1, and terrestrial habitat features were assessed considering attributes in Table A 2. Features of interest were subjectively given a rating on a scale of 'Very Low' to 'High' for each attribute and assigned a value in accordance with the description provided in Table A 3.

Table A 1. Attributes that may be considered when assigning ecological value to a freshwater site or area (adapted from Roper-Lindsay et al., 2018).

Value	Explanation	Characteristics
Very High	A reference quality watercourse in condition close to its pre-human condition with the expected assemblages of flora and fauna and no contributions of contaminants from human induced activities including agriculture. Negligible degradation e.g., stream within a native forest catchment	Benthic invertebrate community typically has high diversity, species richness and abundance. Benthic invertebrate community contains many taxa that are sensitive to organic enrichment and settled sediments. Benthic community typically with no single dominant species or group of species. MCI scores typically 120 or greater. EPT richness and proportion of overall benthic invertebrate community typically high. SEV scores high, typically >0.8. Fish communities typically diverse and abundant. Riparian vegetation typically with a well-established closed canopy. Stream channel and morphology natural. Stream banks natural typically with limited erosion. Habitat natural and unmodified.
High	A watercourse with high ecological or conservation value but which has been modified through loss of riparian vegetation, fish barriers, and stock access or similar, to the extent it is no longer reference quality. Slight to moderate degradation e.g., exotic forest or mixed forest/agriculture catchment.	Benthic invertebrate community typically has high diversity, species richness and abundance. Benthic invertebrate community contains many taxa that are sensitive to organic enrichment and settled sediments. Benthic community typically with no single dominant species or group of species. MCI scores typically 80-100 or greater. EPT richness and proportion of overall benthic invertebrate community typically moderate to high. SEV scores moderate to high, typically 0.6-0.8. Fish communities typically diverse and abundant. Riparian vegetation typically with a well-established closed canopy. No pest or invasive fish (excluding trout and salmon) species present. Stream channel and morphology natural. Stream banks natural typically with limited erosion. Habitat largely unmodified.
Moderate	A watercourse which contains fragments of its former values but has a high proportion of tolerant fauna, obvious water quality issues and/or sedimentation issues. Moderate to high	Benthic invertebrate community typically has low diversity, species richness and abundance.

Value	Explanation	Characteristics
	degradation e.g., high-intensity agriculture catchment.	Benthic invertebrate community dominated by taxa that are not sensitive to organic enrichment and settled sediments. Benthic community typically with dominant species or group of species. MCI scores typically 40-80. EPT richness and proportion of overall benthic invertebrate community typically low. SEV scores moderate, typically 0.4-0.6. Fish communities typically moderate diversity of only 3-4 species. Pest or invasive fish species (excluding trout and salmon) may be present. Stream channel and morphology typically modified (e.g., channelised) Stream banks may be modified or managed and may be highly engineered and/or evidence of significant erosion. Riparian vegetation may have a well-established closed canopy. Habitat modified.
Low	A highly modified watercourse with poor diversity and abundance of aquatic fauna and significant water quality issues. Very high degradation e.g., modified urban stream	Benthic invertebrate community typically has low diversity, species richness and abundance. Benthic invertebrate community dominated by taxa that are not sensitive to organic enrichment and settled sediments. Benthic community typically with dominant species or group of species. MCI scores typically 60 or lower. EPT richness and proportion of overall benthic invertebrate community typically low or zero. SEV scores low to moderate, typically less than 0.4. Fish communities typically low diversity of only 1-2 species. Pest or invasive fish (excluding trout and salmon) species present. Stream channel and morphology typically modified (e.g. channelised). Stream banks often highly modified or managed and maybe highly engineered and/or evidence of significant erosion. Riparian vegetation typically without a well-established closed canopy. Habitat highly modified.

Table A 2. Attributes to be considered when assigning ecological value or importance to a site or area of vegetation/ habitat/community (Roper-Lindsay et al., 2018).

Matters	Topics for which criteria are needed
Representativeness	Criteria for representative vegetation and aquatic habitats: Typical structure and composition Indigenous species dominate Expected species and tiers are present Thresholds may need to be lowered where all examples of a type are strongly modified Criteria for representative species and species assemblages: Species assemblages that are typical of the habitat Indigenous species that occur in most of the guilds expected of the habitat type
Rarity/distinctiveness	Criteria for rare/ distinctive vegetation and habitats: Naturally uncommon, or induced scarcity Amount of habitat or vegetation remaining Distinctive ecological features National priority for protection Criteria for rare/ distinctive species or species assemblages: Habitat supporting nationally Threatened or At Risk species, or locally uncommon species Regional or national distribution limits of species or communities Unusual species or assemblages Endemism
Diversity and Pattern	Level of natural diversity, abundance, and distribution Biodiversity reflecting underlying diversity Biogeographical considerations, considerations of lifecycles, daily or seasonal cycles of habitat availability and utilization
Ecological context	Site history, and local environmental conditions which have influenced the development of habitats and communities The essential characteristics that determine an ecosystem's integrity, form, functioning, and resilience (form "intrinsic value" as defined in RMA) Size, shape and buffering Condition and sensitivity to change Contribution of the site to ecological networks, linkages, pathways and the protection and exchange of genetic material Species role in ecosystem functioning – high level, key species identification, habitat as proxy

Table A 3. Rating system for assessing ecological value of a freshwater or terrestrial system (Roper-Lindsay et al. 2018).

Value	Description
Negligible	Feature rates Very Low for at least three assessment attributes and Low to Moderate for the remaining attribute(s).
Low	Feature rates Very Low to Low for most assessment attributes and moderate for one. Limited ecological value other than providing habitat for introduced or tolerant indigenous species.
Moderate	Feature rates High for one assessment attribute and Low to Moderate for the remainder, OR the project area rates Moderate for at least two attributes and Very Low to Low for the rest. Likely to be important at the level of the Ecological District.
High	Feature rates High for at least two assessment attributes and Low to Moderate for the remainder, OR the project area rates High for one attribute and Moderate for the rest. Likely to be regionally important.
Very High	Feature rates High for at least three assessment attributes. Likely to be nationally important.

Species

The EIANZ provides a method for assigning value (Table A 4) to species for the purposes of assessing actual and potential effects of activities.

Table A 4. Criteria for assigning ecological values to species.

Ecological Value	Species
Very High	Threatened (Nationally Critical, Nationally Endangered, Nationally Vulnerable)
High	At Risk (Declining, Recovering, Relict, Naturally Uncommon)
Medium	Locally uncommon/rare, not nationally threatened or at risk
Low	Not threatened nationally, common locally

Assigning Magnitude of Impacts

The magnitude of impacts is determined by the scale (temporal and spatial) of potential impacts identified and the degree of ecological change that is expected to occur as a result of the proposed activity (Roper-Lindsay et al. 2018).

Based on the assessor's knowledge and experience, the magnitude of identified impacts on the ecological values within the project area and zone of influence were assessed and rated on a scale of 'Very High' to 'Negligible' based on the description provided in Table A 5.

Table A 5. Summary of the criteria for describing the magnitude of effect (Roper-Lindsay et al., 2018).

Magnitude	Description
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

Assessment also considered the temporal scale at which potential impacts were likely to occur:

- Permanent (>25 years).
- Long-term (15-25 years).
- Medium-term (5-15 years).
- Short-term (0-5 years).
- Temporary (during construction)

Assessing the Overall Level of Effects

The overall level of effect on each ecological feature identified within the zone of influence were determined by considering the and the Value of impacted ecological habitat and species, and the Magnitude of impacts identified above (Roper-Lindsay *et al*. 2018).

Results from the assessment of ecological value and the magnitude of identified impacts were used to determine the level or extent of the overall impacts on identified ecological features within the project area and zone of influence using the matrix below.

Table A 6.Matrix combining magnitude and value for determining the level of ecological impacts (Roper-Lindsay et al. 2018).

Effect Level		Ecological and/or Conservation Value				
		Very High	**High**	**Moderate**	**Low**	**Negligible**
	Very High	Very High	Very High	High	Moderate	Low
Magnitude	**High**	Very High	Very High	Moderate	Low	Very Low
	Moderate	High	High	Moderate	Low	Very Low
	Low	Moderate	Low	Low	Very Low	Very Low
	Negligible	Low	Very Low	Very Low	Very Low	Very Low
	Positive	Net Gain	Net Gain	Net Gain	Net Gain	Net Gain

Results from the matrix were used to determine the type of responses that may be required to mitigate potential direct and indirect impacts within the project area and within the zone of influence, considering the following guidelines (Roper-Lindsay *et al*. 2018):

- A ‘Low’ or ‘Very Low’ level of impact is not normally of concern, though design should take measures to minimise potential effects.
- A ‘Moderate’ to ‘High’ level of impact indicates a level of impact that qualifies careful assessment on a case-by-case basis. Such activities could be managed through avoidance (revised design) or appropriate mitigation. Where avoidance is not possible, no net loss of biodiversity values would be appropriate.

A ‘Very High’ level of impact is unlikely to be acceptable on ecological grounds alone and should be avoided. Where avoidance is not possible, a net gain in biodiversity values may be appropriate.

B

Appendix B – Detailed SEV Results and Reference Site Descriptions

Table B.1. Stream ecological valuation results for the impact reach at May Road. This worksheet calculates the final scores for each function, the sum of all scores (ranging between 0 and 14), and the overall mean SEV score (ranging between 0 and 1), for each site. The final scores are located at the bottom of the table. Reference site values derived from other studies are also presented.

Variable (code)	May Road Current	May Road Potential	Compensation Potential
Vchann	0.10	0.10	0.50
Vlining	0.80	0.80	0.90
Vpipe	1.00	0.30	0.30
=	**0.33**	**0.10**	**0.19**
Vbank	0.00	0.30	0.30
Vrough	0.51	0.60	0.60
=	**0.00**	**0.18**	**0.18**
Vbarr	1.00	1.00	1.00
=	**1.00**	**1.00**	**1.00**
Vchanshape	0.20	0.20	0.60
Vlining	0.80	0.80	0.90
=	**0.60**	**0.60**	**0.80**
Hydraulic function mean score	**0.48**	**0.47**	**0.54**
Vshade	0.02	0.60	0.50
=	**0.02**	**0.60**	**0.50**
Vdod	0.20	0.60	0.60
=	**0.20**	**0.60**	**0.60**
Vripar	0.05	0.50	0.50
Vdecid	1.00	1.00	1.00
=	**0.05**	**0.50**	**0.50**
Vmacro	0.71	0.90	0.90
Vretain	0.20	0.20	0.60
=	**0.20**	**0.20**	**0.60**
Vsurf	0.48	0.51	0.33
Vripfilt	0.38	0.62	0.62
=	**0.43**	**0.57**	**0.48**
Biogeochemical function mean score	**0.18**	**0.49**	**0.54**
Vgalspwn	0.00	0.00	0.00
Vgalqual	0.00	0.25	0.25
Vgobspwn	0.20	0.20	1.00
=	**0.10**	**0.10**	**0.50**
Vphyshab	0.33	0.56	0.56
Vwatqual	0.01	0.18	0.15
Vimperv	0.10	0.10	0.10
=	**0.19**	**0.35**	**0.34**
Habitat provision function mean score	**0.15**	**0.23**	**0.42**
Vfish	0.17	0.17	0.17
=	**0.17**	**0.17**	**0.17**
Vmci	0.45	NA	NA
Vept	0.00	NA	NA
Vinvert	0.12	NA	NA
=	**0.19**	**0.19**	**0.19**
Vripcond	0.21	0.27	0.27

Vripconn	0.90	0.59	0.65
=	**0.19**	**0.16**	**0.18**
Biodiversity function mean score	**0.18**	**0.17**	**0.18**
Overall mean SEV score (maximum value 1)	**0.262**	**0.379**	**0.445**

Table B.2. River environment classification values for sample reaches and reference streams (MfE, 2010)

Category	Impact Reach	Reference 1 (Oakley Creek)	Reference 2 (Omaru Creek)	Reference 3 (Avondale Stream)
Order	1	3	2	1-2
Source of flow	Low-Elevation	Low-Elevation	Low-Elevation	Low-Elevation
Geology	Miscellaneous	Miscellaneous	Miscellaneous	Miscellaneous
Land cover	Urban	Urban	Urban	Urban
Climate	Warm-Wet	Warm-Wet	Warm-Dry	Warm-Wet

.

C

Appendix C – Macroinvertebrate Community Index Results from EIA

Table D.1. Macroinvertebrate community indices for Impact reach. Macroinvertebrate samples were processed by EIA Ltd.

Taxa	MCI score	MCI-sb score	Abundance
True Fly Chironomus	1	3.4	20
True Fly Polypedilum	3	8	1
Crustacea Ostracoda	3	1.9	1000
MITES	5	5.2	1
OLIGOCHAETES	1	3.8	1000
NEMERTEANS	3	1.8	5
Bug Anisops	5	2.2	3
Number of Taxa			7
EPT Value			0
Number of Individuals			2030
% EPT (taxa number)			0
Sum of recorded scores			26.3
SBMCI Value			75.14
Sum of abundance load			5796.8
SQMCI-sb Value			2.86

D

Appendix D – Fish Survey Results

Table E.1. Fish species recorded in Gee Minnow Traps within the impact reach.

Trap	Species	Length	Abundance
1	*Gambusia affinis*	30mm	2
1	Back swimmer (*Anisops*)	20mm	3
2	*Gambusia affinis*	30-40mm	11
3	*Anguilla australis*	500mm	1
3	*Gambusia affinis*	30mm	8
4	*Anguilla australis*	200mm	1
4	*Gambusia affinis*	30mm	3
5	*Anguilla australis*	250mm	1
5	*Gambusia affinis*	40mm	3
6	*Gambusia affinis*	30-50mm	9
7	Nil	-	-
8	Nil	-	-

E

Appendix E – Multi Species eDNA Test Results from Wilderlab Ltd

Table F.1. Multi species eDNA assay results for the impact reach at May road. Samples processed by Wilderlab Ltd.

Scientific name	Rank	Common name	May road (abundance)
Gambusia affinis	species	Mosquitofish	29971
Cairina moschata	species	Muscovy duck	10236
Potamothrix bavaricus	species		7385
Anas platyrhynchos	species	Mallard duck	4243
Porphyrio melanotus	species	Pukeko; Australasian swamphen	3252
Hydra vulgaris	species	Hydra	1818
Ilyodrilus templetoni	species	Aquatic worm	1553
Anguilla australis	species	Shortfin eel	1478
Aulodrilus pluriseta	species		1179
Limnodrilus hoffmeisteri	species	Redworm	1047
Homo sapiens	species	Human	430
Chironomus tepperi	species		379
Lumbriculus variegatus	species	Blackworm; California blackworm	334
Chaetogaster diaphanus	species		209
Neotoxoptera formosana	species	Onion aphid	191
Limnodrilus hoffmeisteri complex lineage VIII	subspecies		186
Tubifex tubifex	species	Sludge worm	147
Paratanytarsus grimmii	species	Parthenogenetic cosmopolitan chironomid	112
Supraphorura furcifera	species	Springtail	112
Deroceras invadens	species	Slug	106
Chaetogaster diastrophus	species		94
Chironomus cloacalis	species		91
Bothrioneurum vejdovskyanum	species		53
Corynoneura scutellata	species	Non-biting midge	41
Cornu aspersum	species	Garden snail	40
Orthonychiurus folsomi	species	Springtail	40
Prostoma eilhardi	species		39
Paracyclops fimbriatus	species	Copepod	15
Arcitalitrus dorrieni	species		14
Kumanoa faroensis	species		10
Eiseniella tetraedra	species		10
Megascolex laingii	species		7
Chydorus sphaericus	species		7
Bos taurus	species	Cattle	6
Rhynchodemus sylvaticus	species		6
Spumella lacusvadosi	species	Freshwater golden-brown alga; Chrysomonad	6
Psychoda cinerea	species	Moth flies	5
Gallus gallus	species	Chicken	5
Potamopyrgus antipodarum	species	Mud Snail	5

Limnodrilus hoffmeisteri complex lineage X	subspecies		3
Ilyodrilus	genus		2224
Potamopyrgus	genus	Mud snails	727
Dero	genus		327
Nais	genus		51
Pristina	genus		29
Chamaedrilus	genus		28
Limnophyes	genus	Non-biting midge	26
Limnodrilus	genus		9
Tubificinae	subfamily		418
Naididae	family		353
Naidinae	subfamily		66
Chironomidae	family		48
Aphididae	family		14
Anatidae	family	Ducks/Geese/Swan	6
cellular organisms	no rank		6246
Metazoa	kingdom		5140
Arthropoda	phylum		500
Galloanserae	superorder		116
Insecta	class	Insects	102
unclassified Limnophyes	no rank		48
Hemiptera	order		47
Lepidoptera	order		31
Actinopteri	class		21
Ditrysia	no rank		11
Chordata	phylum		10
Annelida	phylum		6
Mammalia	class		5

F

Appendix F – Wetland Delineation Letter

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22 December 2020

May 1 Limited
c/o Awatere Limited
PO Box 37-635
Parnell
Auckland 1151
New Zealand

Attention: Richard Stilwell (May 1 Limited),
Hamish Gard (TSA)
Copy: Dale Paice (Beca)

Dear Richard,

May Road Wetland Classification

1 Background and Scope

May 1 Limited is considering redevelopment of their May Road properties in Mount Roskill (the Site). They are working with Watercare Services Limited who own the land to the northwest to develop an integrated stormwater and earthworks approach across the site boundaries. The proposed future development includes using engineered fill to create platforms raised above the 1% AEP floodplain. To compensate, other areas are to be cut to create additional floodplain storage.

Beca Limited (Beca) have been commissioned by May 1 Ltd to undertake a wetland identification and delineation at 105 May Road, Mount Roskill to determine whether any natural wetlands (under the National Policy Statement for Freshwater) are present at the site.

An assessment of three low-lying areas to the north-west of 105 May Road were conducted to confirm the presence, or not, of a wetland to help inform the future redevelopment of the Site

The location of the site is displayed below in Figure 1. The proposed earthworks footprint and post-development contours are shown in Figure 2.

Figure 1: Site Plan

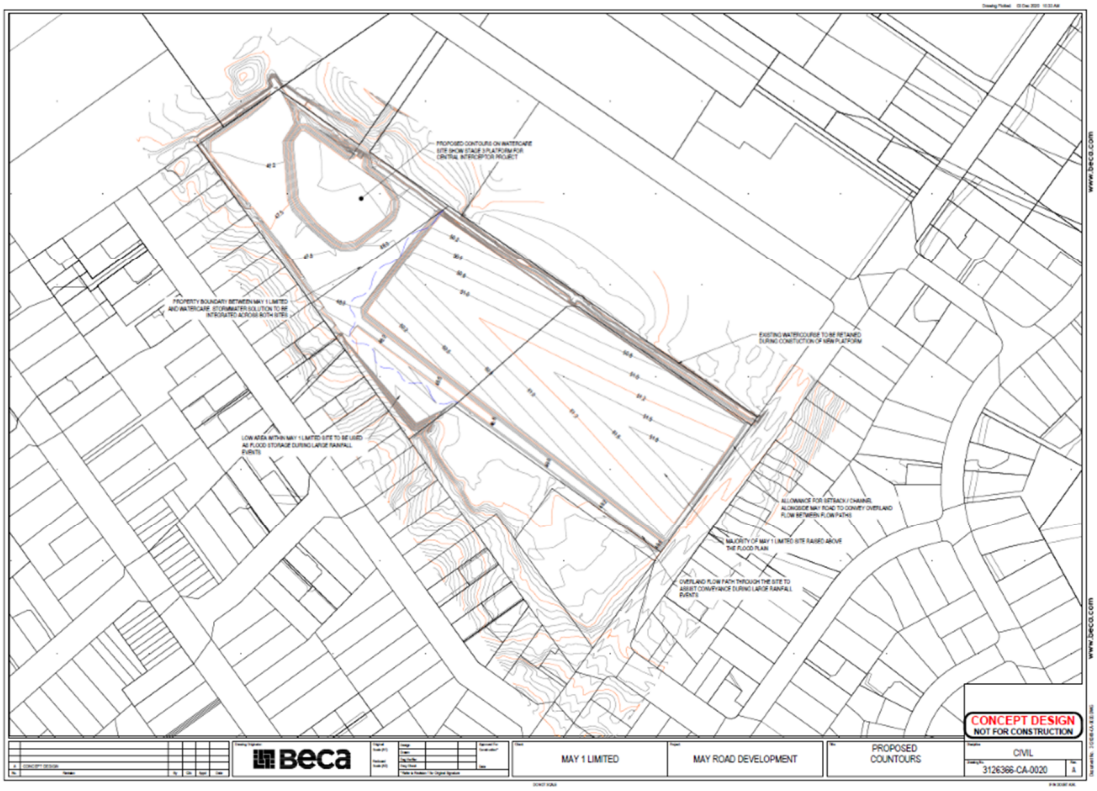

Figure 2: Proposed contours post-development.

2 Site location

The Site is located on May Road in the suburb of Mount Roskill and encompasses the parcels of 105 (Legal Description SEC 2 SO 4685230), 105a-109a (Legal Description Lot 1 DP 586970, and 119 May Road (Legal Description Lot 3 DP 40979). The Site is located to the north west of Mount Roskill, it is typically flat between elevations of 49 and 51 mRL, and rises gently to the west, with a low-lying area in the north-western corner of the 105 property.

A north-west aligned drainage channel follows the north-eastern boundary of the Site, before discharging to a culvert in the Watercare site. A second perpendicular drain follows the boundary between 105 and 105a-109a May Road.

Several large warehouse and smaller shed structures are present on the 105a-109a May Road lots with various stockpiles of wood, refuse, and soil fill, while 105 and 119 May Road are predominately vacant. 105 May Road is currently being leased and serves as the location of the contractor's site offices as part of Watercare's Central Interceptor project.

The site is located within Tāmaki ecological district (McEwen, 1987). Historically, the site would have been covered with lowland broadleaf forest with abundant taraire and pūriri that would have would have supported a diverse range of invertebrates, amphibians, reptiles, birds and bats (Singers et al., 2017). Presently, the site is surrounded by industrial, residential and commercial land use.

3 Methodology

3.1 Defining wetlands

The Resource Management Act 1991 (RMA) defines a wetland 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".*

Exclusions to define which wetlands may be considered 'natural wetlands' are then outlined in the National Policy Statement for Fresh Water Management (2020) [NPS-FM]. A natural wetland refers to a wetland that is not:

a) A wetland constructed by artificial means (unless it was constructed to offset impacts on, or restore, an existing or former natural wetland); or

b) A geothermal wetland; or

c) Any area of improved pasture that, at the commencement date, is dominated by (that is more than 50% of) exotic pasture species and is subject to temporary rain-derived water pooling.

3.2 Wetland classification

The US Wetland Delineation System for Regulatory Purposes (Environmental Laboratory 1987, and US Army Corps of Engineers updates) sets out specific guidance for what constitutes a wetland. This protocol has been adapted for New Zealand conditions by Landcare Research in the Wetland Delineation Protocols[1]

[1] Wetland delineation protocols Contract Report: LC3354, B. Clarkson (2018) Manaaki Whenua – Landcare Research.

which are incorporated by reference into the NPS FM 2020. Three criteria (vegetation, soils, and hydrology) are used to identify and delineate the extent of wetlands. The following general diagnostic environmental characteristics are used[2]:

1. **Vegetation**. The prevalent vegetation consists of macrophytes that are typically adapted to areas having saturated soil conditions which includes obligate (OBL), facultative wetland (FACW), or facultative (FAC) species. It is not necessary that a wetland is dominated by indigenous species, but it is required that the wetland is **not** dominated by exotic **pasture** species.
2. **Soil.** Soils are present and have been classified as hydric, or they possess characteristics that are associated with reducing soil conditions (e.g. peat, or anaerobic mottling or colour, anaerobic smell).
3. **Hydrology**. The area is inundated either permanently or periodically, or the soil is saturated to the surface at some time during the growing season of the prevalent vegetation.

A desktop and field assessment of ecology, hydrology, wetland and catchment characteristics was undertaken to classify the putative wetland (e.g. human-induced or naturally occurring) in accordance with the Landcare Research wetland delineation tool (Figure 3). The process to determine if an area is classified as a wetland is to undertake both the Dominance Test and Prevalence Index (PI). The PI is a weighted average that incorporates species abundance measures with the wetland indicator status ratings of the species present[3]. The PI score reflects the wetland affinity of the species present. A PI of <3 indicates hydrophytic (wetland) vegetation.

If both tests are met, the area is considered to have wetland vegetation. If neither is met, the area does not have wetland vegetation. For the prevalence test Wentworth[3] cautioned that in the USA vegetation assessment alone was not accurate between Prevalence Index values 2.5 to 3.5.

If a potential wetland meets the Dominance Test and/or Prevalence Index then a further assessment needs to be made as to whether the area is dominated by species that are on the New Zealand Grassland Association lists as pasture or forage species[4]. If more than 50% of the area within the plot is dominated by these pasture or forage species then the area is considered to be pasture. If it is less than that then the area should be considered a wetland.

---

[2] Environmental Laboratory 1987. Corps of Engineers Wetlands Delineation Manual Technical Report Y-87-1, US Army Engineer Waterways Experiment Station, Vicksburg, Mississippi. Retrieved from https://www.lrh.usace.army.mil/Portals/38/docs/USACE%2087%20Wetland%20Delineation%20Manual.pdf

[3] Wentworth T.P., Thompson G.P., and Kologiski RI 1988: Designation of wetlands by weighted averages of vegetation data: preliminary evaluation. Water Resources Bulletin 24(2): 389–396.

[4] Stewart, A., Kerr, G., Lissaman, W., & Rowarth, J. (2014). Pasture and Forage Plants for New Zealand. Grassland Research and Practice Series No. 8, Fourth Edition.

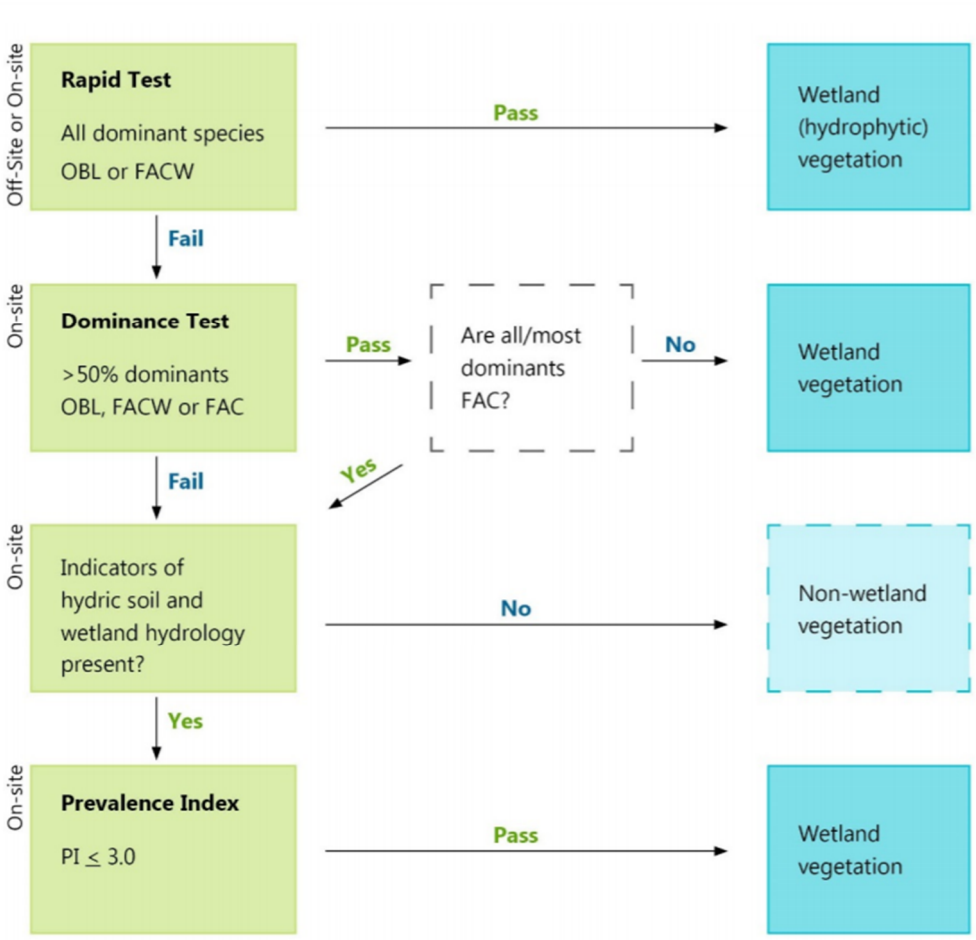

Figure 3. Landcare Research hydrophytic (wetland) vegetation delineation tool. Wetland indicator status abbreviations: FAC = facultative; FACW = facultative wetland; OBL = obligate wetland.

Further information is provided by the predicted historic extent of wetlands which have been mapped based on soil types, soil drainage and topography[5], although the geospatial layer is limited by a minimum resolution of 0.05 hectares and the exclusion of ephemeral wetlands, saltmarsh, and shallow water wetlands. Historical imagery is also valuable to understand whether the wetland was historically present or has formed or disappeared as a result of human intervention (i.e. due to earthworks, drainage etc).

The wetland assessment was based on the following information:

- Site visit undertaken on the 17th December 2020. Three areas were assessed (see Figure 4 for locations)
- Auckland Council Geospatial layers including, contours, catchment and hydrology layers etc.
- Google Earth and LINZ aerial photography

[5] Ausseil, A-GE, Gerbeaux, P, Chadderton, WL, Stephens, T, Brown, DJ, and Leathwick, J 2008: Wetland ecosystems of national importance for biodiversity: Criteria, methods and candidate list of nationally important inland wetlands. Landcare Research Contract Report LC0708/158 for the Department of Conservation.

- Historical aerial photography accessed through Retrolens.nz and the National Library Photographic Archive.
- Manaaki Whenua soil information from S-map
- Ministry for the Environment predicted wetland extent layer[6]

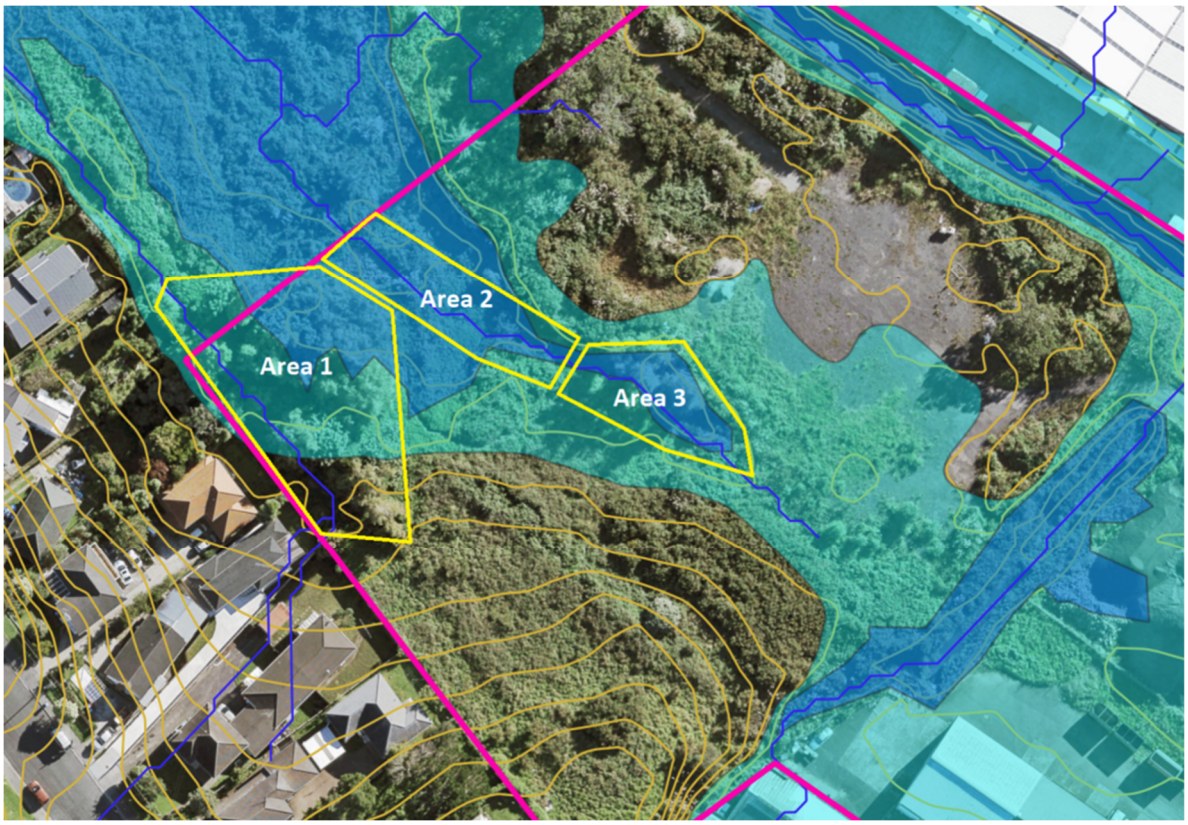

Figure 4. Areas assessed at 105 May Road.

4 Wetland classification

4.1 Vegetation

Vegetation at the site consists predominantly of weedy exotic herbaceous species. Dominant species within the potential wetland areas include: soft rush, bindweed, creeping buttercup, willow, birdsfoot trefoil, umbrella sedge, waterpepper, coral tree, nasturtium, and veldt grass. A complete list of species present is included in Tables 1-3.

[6] https://data.mfe.govt.nz/layer/52677-prediction-of-wetlands-before-humans-arrived/



Figure 5. Areas assessed from left: Area 1, Area 2, Area 3.

Table 1. Species recorded within Area 1. Dominant species are shown in bold. Wetland indicator status abbreviations: FAC = facultative; FACW = facultative wetland; OBL = obligate wetland; FACU = usually in non-wetlands; NA = not applicable (not typically found in wetlands).

Species	Common name	Stratum	Nativity	Pasture species	Wetland indicator status
Erythrina xsykesii	**Coral tree**	**tree**	**exotic**	**N**	**NA**
Salix matsudana	**Tortured willow**	**tree**	**native**	**N**	**FACW**
Salix babylonica	**Weeping willow**	**tree**	**exotic**	**N**	**FACW**
Ligustrum sinense	Chinese privet	tree	exotic	N	FACU
Ligustrum lucidium	Large-leaved privet	tree	exotic	N	NA
Populus spp.	Poplar	tree, sapling	exotic	N	NA
Coprosma robusta	Karamu	sapling	native	N	FACU
Solanum mauritianum	Wooly nightshade	sapling	exotic	N	NA
Quercus robur	Oak	sapling	exotic	N	NA
Pittosporum crassifolium	Karo	sapling	native	N	NA
Iris pseudacorus	Yellow flag iris	herb	exotic	N	OBL
Convolvulus spp.	**Bindweed**	**herb**	**exotic**	**N**	**NA**
Ranunculus repens	**Creeping buttercup**	**herb**	**exotic**	**N**	**FAC**
Persicaria hydropiper	Waterpepper	herb	exotic	N	FACW
Tropaeolum majus	**Nasturtium**	**herb**	**exotic**	**N**	**NA**
Crocosmia x crocosmiiflora	Montbretia	herb	exotic	N	NA
Impatiens sodenii	Shrub basalm	herb	exotic	N	NA
Leycesteria formosa	Himalayan honeysuckle	herb	exotic	N	NA
Cyperus eragrosti	Umbrella sedge	herb	exotic	N	FACW
Plantago major	Broad-leaved plantain	herb	exotic	N	FACU
Rumex conglomeratus	Clustered dock	herb	exotic	N	FAC

Species	Common name	Stratum	Nativity	Pasture species	Wetland indicator status
Vinca minor	Myrtle	herb	exotic	N	NA
Vicia sativa	Common vetch	herb	exotic	N	NA
Ehrharta erecta	**Veldt grass**	**herb**	**exotic**	**N**	**NA**
Juncus effusus	Soft rush	herb	exotic	N	FACW
Zantedeschia aethiopica	Arum lily	herb	exotic	N	FAC
Hedychium gardnerianum	Wild ginger	herb	exotic	N	NA
Dactylis glomerata	Orchard grass	herb	exotic	Y	FACU
Hedera helix	Common ivy	Herb	exotic	N	NA

Table 2. Species recorded within Area 2. Dominant species are shown in bold. Wetland indicator status abbreviations: FAC = facultative; FACW = facultative wetland; OBL = obligate wetland; FACU = usually in non-wetlands; NA = not applicable (not typically found in wetlands).

Species	Common name	Stratum	Nativity	Pasture species	Wetland indicator status
Juncus effusus	**Soft rush**	**herb**	**exotic**	**N**	**FACW**
Ranunculus repens	**Creeping buttercup**	**herb**	**exotic**	**N**	**FAC**
Rumex obtusifolius	Broad-leaved dock	herb	exotic	N	FAC
Convolvulus spp.	**Bindweed**	**herb**	**exotic**	**N**	**NA**
Daucus carota	Wild carrot	herb	exotic	N	NA
Elminthotheca echioides	Oxtongue	herb	exotic	N	NA
Cyperus eragrosti	**Umbrella sedge**	**herb**	**exotic**	**N**	**FACW**
Lotus corniculatus	**Bird's-foot trefoil**	**herb**	**exotic**	**Y**	**FACU**
Paspalum distichum	Mercer grass	herb	exotic	N	FACW
Holcus lanatus	Yorkshire fog	herb	exotic	Y	FAC
Rumex conglomeratus	Clustered dock	herb	exotic	N	FAC
Persicaria hydropiper	**Waterpepper**	**herb**	**exotic**	**N**	**FACW**
Vicia sativa	Common vetch	herb	exotic	N	NA

Table 3. Species recorded within Area 3. Dominant species are shown in bold. Wetland indicator status abbreviations: FAC = facultative; FACW = facultative wetland; OBL = obligate wetland; FACU = usually in non-wetlands; NA = not applicable (not typically found in wetlands).

Species	Common name	Stratum	Nativity	Pasture species	Wetland indicator status
Rubus fruticosus	Blackberry	shrub	exotic	N	FAC
Ehrharta erecta	**Veldt grass**	**herb**	**exotic**	**N**	**NA**
Plantago lanceolata	Narrow-leaved plantain	herb	exotic	Y	FACU
Paspalum distichum	Mercer grass	herb	exotic	N	FACW
Persicaria hydropiper	**Waterpepper**	**herb**	**exotic**	**N**	**FACW**

Species	Common name	Stratum	Nativity	Pasture species	Wetland indicator status
Crocosmia x crocosmiiflora	Montbretia	herb	exotic	N	NA
Juncus effusus	Soft rush	herb	exotic	N	FACW
Ranunculus repens	Creeping buttercup	herb	exotic	N	FAC
Cyperus eragrosti	Umbrella sedge	herb	exotic	N	FACW
Lotus corniculatus	Bird's-foot trefoil	herb	exotic	Y	FACU
Vinca minor	Myrtle	herb	exotic	N	NA
Coprosma robusta	Karamu	sapling	native	N	FACU
Cordyline australis	Ti kouka	tree	native	N	FACW
Salix matsudana	**Tortured willow**	**tree**	**exotic**	**N**	**FACW**

Vegetation at the site is generally highly modified and few native species are present. Areas 1 and 2 have ≥50% of dominant species that are facultative wetland (FACW) or facultative (FAC) species, while Area 1 has the only obligate (OBL) wetland species found at the site. The prevalence index for these two areas is >3.0, indicating typical hydrophytic vegetation is **not** present (Table 4). Area 3 consists of no obligate wetland species, however >50% of dominant species are FACW or FAC and the prevalence index for this area was <3.0 (2.84) indicating hydric vegetation is present (Table 4).

Table 4. Prevalence index for the three areas assessed at 105 May Road.

	Area 1		Area 2		Area 3	
	Total % cover of:	Score	Total % cover of:	Score	Total % cover of:	Score
OBL species	7	7	0	0	0	0
FACW species	43	86	45	90	84.5	169
FAC species	35	105	30	90	6.5	19.5
FACU species	26	104	15	60	9	36
NA species	135	675	18	90	25	125
Column totals:	246	977	100	340	123	349.5
	Prevalence index: 3.97		Prevalence index: 3.4		Prevalence index: 2.84	

4.2 Soil

Geotechnical investigations[7] found that the majority of the site was underlain by Holocene alluvium of the Tauranga Group consisting of clayey silts, soft to firm peat, and soft to stiff organic silt material. This recent material was on top of a relatively thin AVF – Ash layer likely derived from nearby Mount Roskill, which consists of firm to very stiff sandy silts, with varying content of gravel. Below this was older Tauranga Group material of the Puketoka Formation consisting of stiff to very still sandy silts, and firm to stiff clayey silts,

[7] Beca, 2020. Geotechnical Interpretive Report – May Road Development. Prepared for May 1 Ltd.

overlying East Coast Bays formation soils and rock. Basalt rock material was only identified in discrete locations along the north eastern boundary of the Site and was generally encountered at shallow (~2.0-4.7m) depth. Fill material was encountered across the Site associated with the existing structures present on the Site.

The present of peat and organic material confirms hydric soils are present at the site, although may be covered with fill in some areas.

4.3 Hydrology

Area 1 is situated where an intermittent watercourse flows along the south-western edge of the site from a public stormwater outlet at 33 Marion Avenue. Area 2 is located in a low-lying overland flow path, and Area C is a small low, lying depression to the south-east of Area B.

The stream flowing through Area 1 had water in it during the site visit but the remainder of all areas were dry underfoot. No ponding was apparent in Area 2 or 3 at the time of the site visit; however, during a previous site visit undertaken during September, shallow ponding was present in Area 3 (see Figure 7).

The site is situated within a natural, low-lying area, however the topography of the site has been altered and made uneven by earthworks and deposition of fill. Constructed drainage channels run along the north-eastern perimeter of the site, western perimeter and through the centre of the site. The construction of these drains is likely to have lowered the water table below the root zone of vegetation and caused the area to drain more rapidly following inundation. Land use change in the surrounding area and an increase in impervious surface would also have increased surface runoff, resulting in greater flood flows and more frequent flooding. Groundwater levels at the site ranged from 1.21-1.25m on the 6th November 2020[8].

[8] Beca, 2020. Land Contamination Assessment – May Road Development. Prepared for May 1 Ltd.

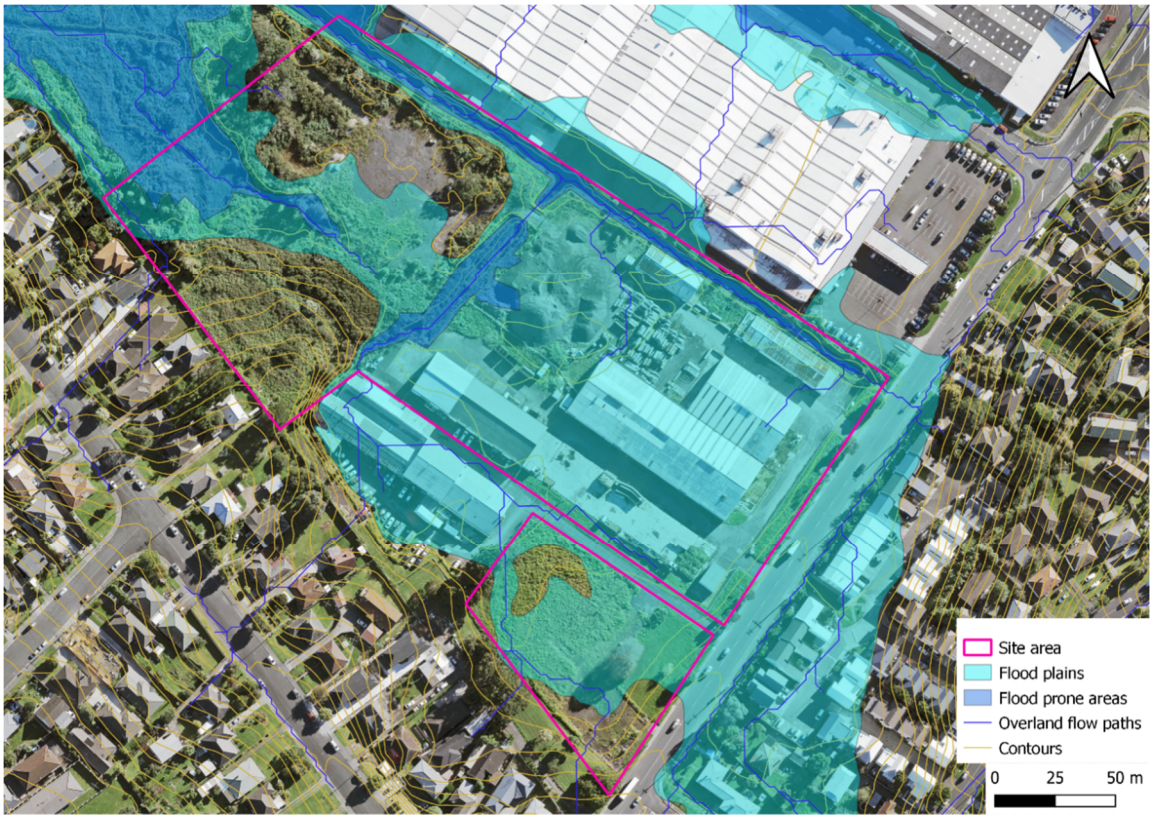

Figure 6. Hydrological features of the site (Source: Auckland Council Geomaps, Dec 2020).

Figure 7. Photograph of Area 3 taken on 29th September 2020.

4.4 Historical status

According to the Ministry for the Environment pre-human wetland extent geospatial layer[9], the site was not historically a wetland, although this layer is limited by a minimum resolution of 0.05 hectares and the exclusion of ephemeral wetlands.

Aerial photographs of the site and surrounding area were obtained for the years 1940-2001 (Source: Retrolens.nz, National Library Photographic Archive, and AC GIS Viewer). The aerials show that the site was historically converted to pasture, and then various structures constructed and demolished (Figures 8 – 12). Historical unknown filling is also noted to have occurred[10]. As previously noted, land use activities have modified the sites topography and interrupted natural flow regimes. **Potential** wetland vegetation is intermittently present to the north-east of 105 May Road (where Watercare contractor offices are currently located). However, there is no evidence that it was present prior to anthropogenic modification.

Of particular interest is the historical aerial photograph from 1981 which shows that the drainage channel that ran across the site diagonally was infilled and a flat earthworks platform created to the north of the site (Fig. 11). The creation of the depression where the potential wetland in Area 3 is now located is evident in this photo (circled in Fig. 11).

[9] https://data.mfe.govt.nz/layer/52677-prediction-of-wetlands-before-humans-arrived/

[10] Beca, 2020. Land Contamination Assessment – May Road Development. Prepared for May 1 Ltd.

Figure 8. Aerial photograph of the site from 1940 (Auckland Council GIS Viewer).

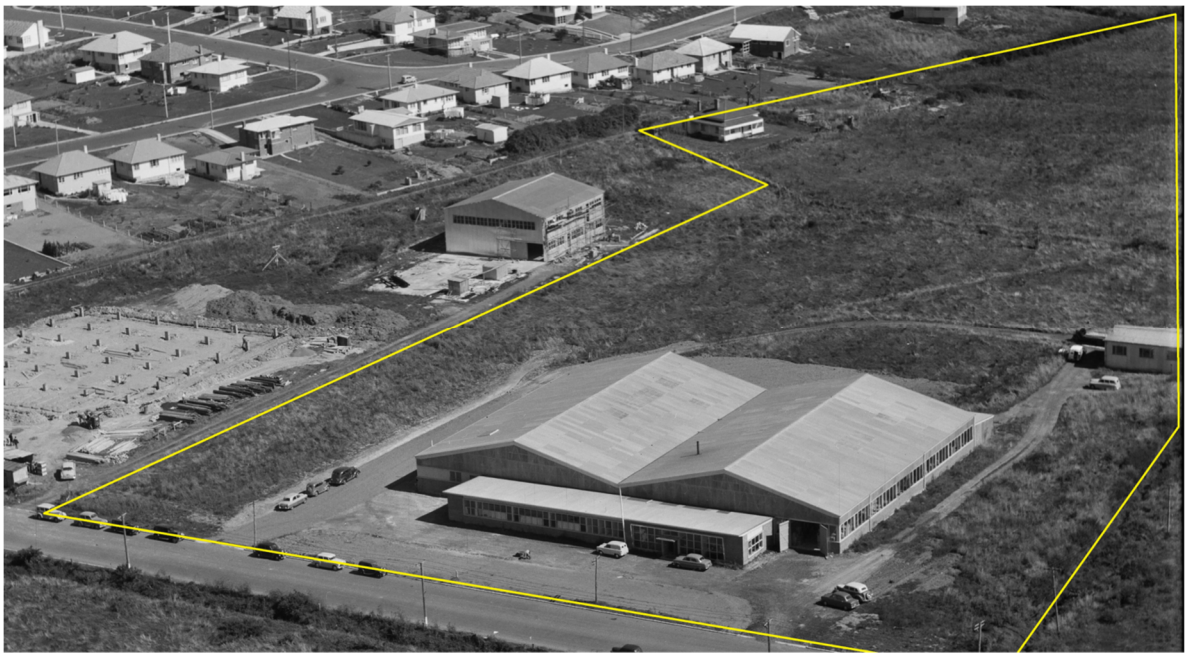

Figure 9. Photograph of the site from 1957 (National Library Photographic Archive).

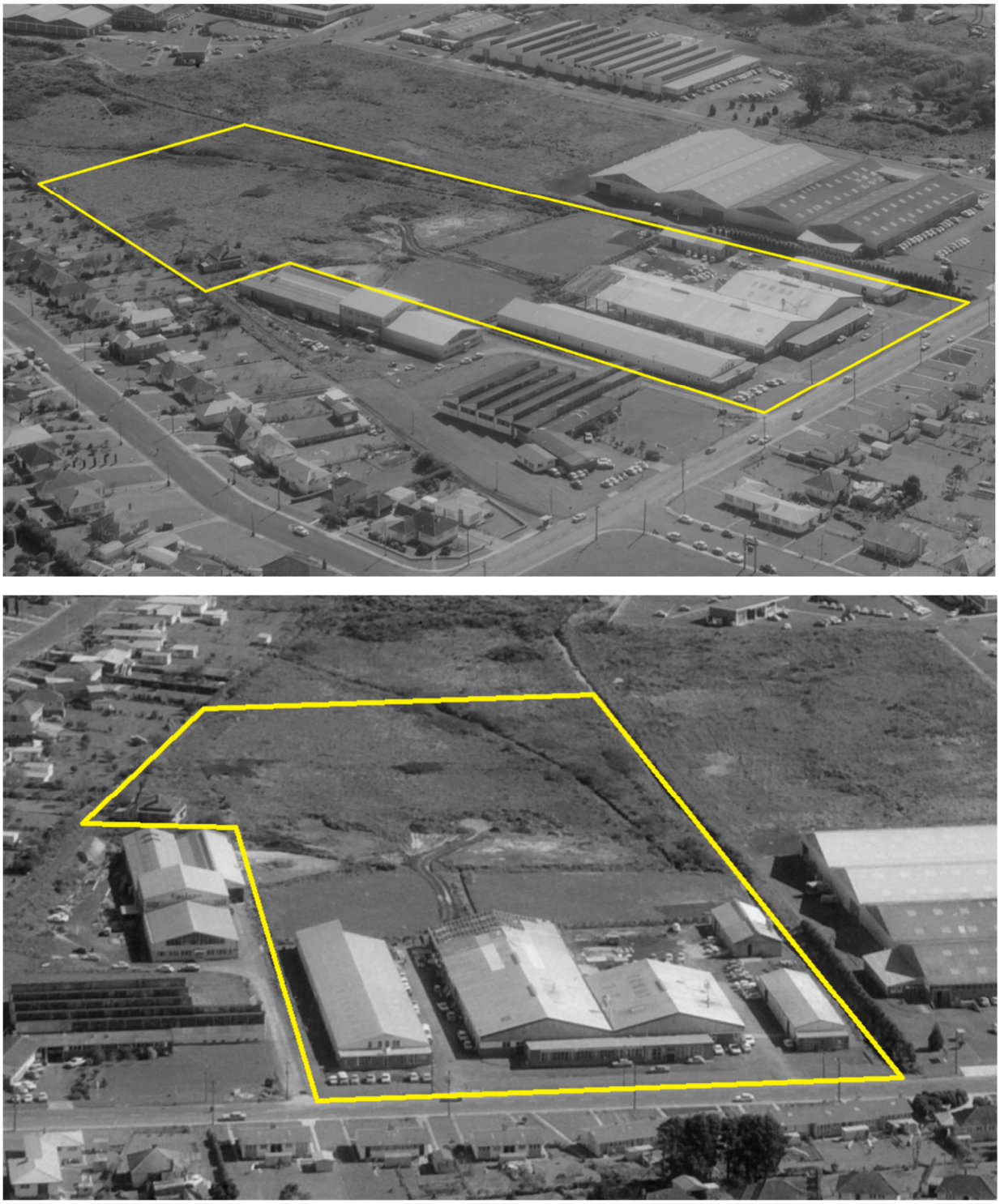

Figure 10. Aerial photographs from 1967 (National Library Photographic Archive).

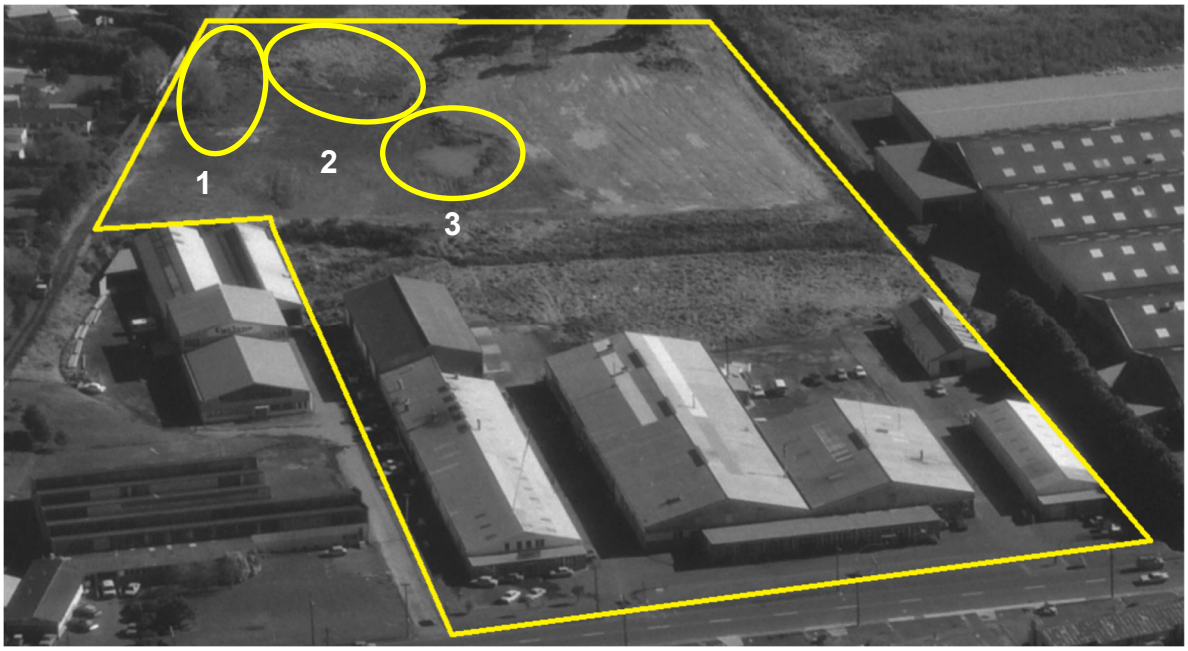

Figure 11. Aerial photograph from 1981 (National Library Photographic Archive). Areas assessed as part of this wetland classification are circled. From left: Area 1, Area 2, Area 3.

Figure 12. Aerial photograph from 2001 (Auckland Council GIS Viewer).

5 Conclusion

The site has been subject to extensive anthropogenic modification. This includes: vegetation clearance, grazing, placement of fill material and non-woody debris over potential hydric soils, construction of drainage systems, and land-use change in the surrounding landscape. There is evidence that hydric soils were present prior to these alterations, but there is no evidence that wetland hydrology or hydric vegetation were historically present.

Currently, the surrounding catchment includes a large amount of impervious surface that will have increased the amount of surface water runoff the Site receives while constructed drainage channels will have lowered the water table of the Site. As such, the hydrology of the Site has been considerably modified.

Areas 1 and 2 were not assessed as currently having hydric vegetation typical of a wetland and are therefore classified as non-wetlands. In contrast, Area 3 is assessed as having hydric vegetation, although the prevalence index value does fall within the range in which results can be inaccurate[11]. Area 3 is a localised depression that is the result of anthropogenic modification and earthworks. Surface water runoff collects here on top of impermeable fill and clay soils, but the presence of water does not have an overriding influence on the characteristics of the vegetation. The area is assessed as having a non-wetland hydrology. That is, “although the soil may be inundated or saturated by surface water or ground water periodically during the growing season of the prevalent vegetation, the average annual duration of inundation or soil saturation does not preclude the occurrence of plant species typically adapted for life in aerobic soil conditions”[12].

In summary, the three areas assessed do not meet all three diagnostic criteria of hydrophytic vegetation, hydric soils, and wetland hydrology are therefore are not considered to be natural wetlands (Table 5). Due to the highly modified nature of the site, nor are they considered to have high restoration potential. Area 3 retains some surface water and has some facultative wetland vegetation, but this is considered to be the indirect result of earthworks modifying the topography of the site.

Table 5. Summary of wetland assessment according to diagnostic criteria.

Criteria	Area 1	Area 2	Area 3
Hydric vegetation	No	No	Yes
Hydric soils*	Yes	Yes	Yes
Wetland hydrology	No	No	No
More than 50% pasture species?	No	No	No

[11] Wentworth T.P., Thompson G.P., and Kologiski RI 1988: Designation of wetlands by weighted averages of vegetation data: preliminary evaluation. Water Resources Bulletin 24(2): 389–396.

[12] Environmental Laboratory 1987. Corps of Engineers Wetlands Delineation Manual Technical Report Y-87-1, US Army Engineer Waterways Experiment Station, Vicksburg, Mississippi. Retrieved from https://www.lrh.usace.army.mil/Portals/38/docs/USACE%2087%20Wetland%20Delineation%20Manual.pdf

Human-induced or constructed by artificial means?	Indirectly	Indirectly	Indirectly
Natural wetland?	No	No	No
Classification	Non-wetland	Non-wetland	Non-wetland

* Soil was not investigated during the site visit to contaminated land risks. Soil data is taken from geotechnical investigations at the site and not necessarily specific to each area.

Yours sincerely,

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