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**272 and 278 Clevedon-Kawakawa Road,
Ecology Report**

For: Stratford Properties Ltd

Ecological Effects and Restoration Opportunities

September 2019

REPORT INFORMATION AND QUALITY CONTROL

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1 INTRODUCTION

Stratford Properties Limited is proposing to rezone and subdivide a large rural site, with clusters of countryside living development to be located on the property outside of areas that are subject to periodic flooding. The site is located at 272 and 278 Clevedon-Kawakawa Road, Clevedon, and situated between Clevedon-Kawakawa Road and the estuarine lower reaches of the Wairoa River. A large wetland feature is also encompassed by the northern site boundary. The margins of the Wairoa River (outside the property boundary) are subject to a Significant Ecological Area overlay under the Auckland Unitary Plan (SEA-T-5361).

The statutory approval process that is being adopted for this project involves a private plan change request to rezone part of the land at 272 and 278 Clevedon-Kawakawa Road and the land at 274 Clevedon-Kawakawa Road from Rural – Rural Coastal to Rural – Countryside Living and to extend the Clevedon Sub Precinct C over this land and a subsequent resource consent application for the subdivision of 278 Clevedon-Kawakawa Road to create 11 countryside living lots, a shared access and amenity lot, a balance farm lot and a balance lot to be amalgamated with 272 Clevedon-Kawakawa Road. The resource consent application is being prepared on the basis that the plan change request will be approved prior to this application being considered.

The resource consent application is therefore being made on the basis that the land area at 278 Clevedon Kawakawa Road to be used for countryside living activities is zoned Rural Countryside Living and the Clevedon Sub Precinct C applies to this land.

This ecological assessment, including opportunities for ecological management and enhancement, is therefore based on the subsequent subdivision and development of the land that will be enabled through the approval of the plan change request, which is the proposal as detailed in the resource consent application.

For this purpose, an ecological assessment of the vegetation and habitats within the wider property, and throughout the area proposed for development was undertaken. This was to identify the key features and habitat values of the vegetation and terrestrial fauna potentially affected by the proposal. The assessment was also completed to identify potential restoration and enhancement opportunities within the site. Several areas have been considered and described as options for enhancement (Section 6).

The purpose of this report is to describe the existing ecological values of the property and site, with a view to identifying the magnitude of both the potential ecological effects associated with the proposal, and to outline a suite of restoration and enhancement opportunities on site.

2 SITE DESCRIPTION

For the purposes of this ecological assessment, the site is referred to as the property to be developed at 278 Clevedon-Kawakawa Road. The site is located approximately 2 km to the north-east of Clevedon, a rural town in Auckland (Franklin ward), approximately 4 km to the south-west of the Tamaki Strait, an arm of the Hauraki Gulf (Figure 1). The northern boundary of the site is situated along the tidally influenced Wairoa River which flows into the Strait. The margins of the Wairoa River at the site are subject to a Significant Ecological Area overlay under the Auckland Unitary Plan (SEA-T-5361, Figure 1).

The site is in the Manukau Ecological District (Auckland Ecological Region), which was historically characterised by large areas of podocarp-broadleaved forests featuring predominantly kauri, puriri and taraire; and wetlands and kahikatea swamps featuring on alluvial terraces and flats (ARC 2004). Mangroves are a feature of the lower Wairoa River (McEwen 1987).

The area proposed for development comprises of several grazed paddocks currently stocked, and a number of artificial drains maintained to reduce the impact of regular flooding from the Wairoa River. An unnamed tributary of the Wairoa River is a feature of the northern part of the site (not directly affected by the proposed development) and is fenced off to prevent stock access.

Soil types at the site comprise predominantly of deep, poorly drained, silty loam over clay characteristic of the ED's gleyed alluvial soils and peats on river flats and swamps (McEwen 1987).

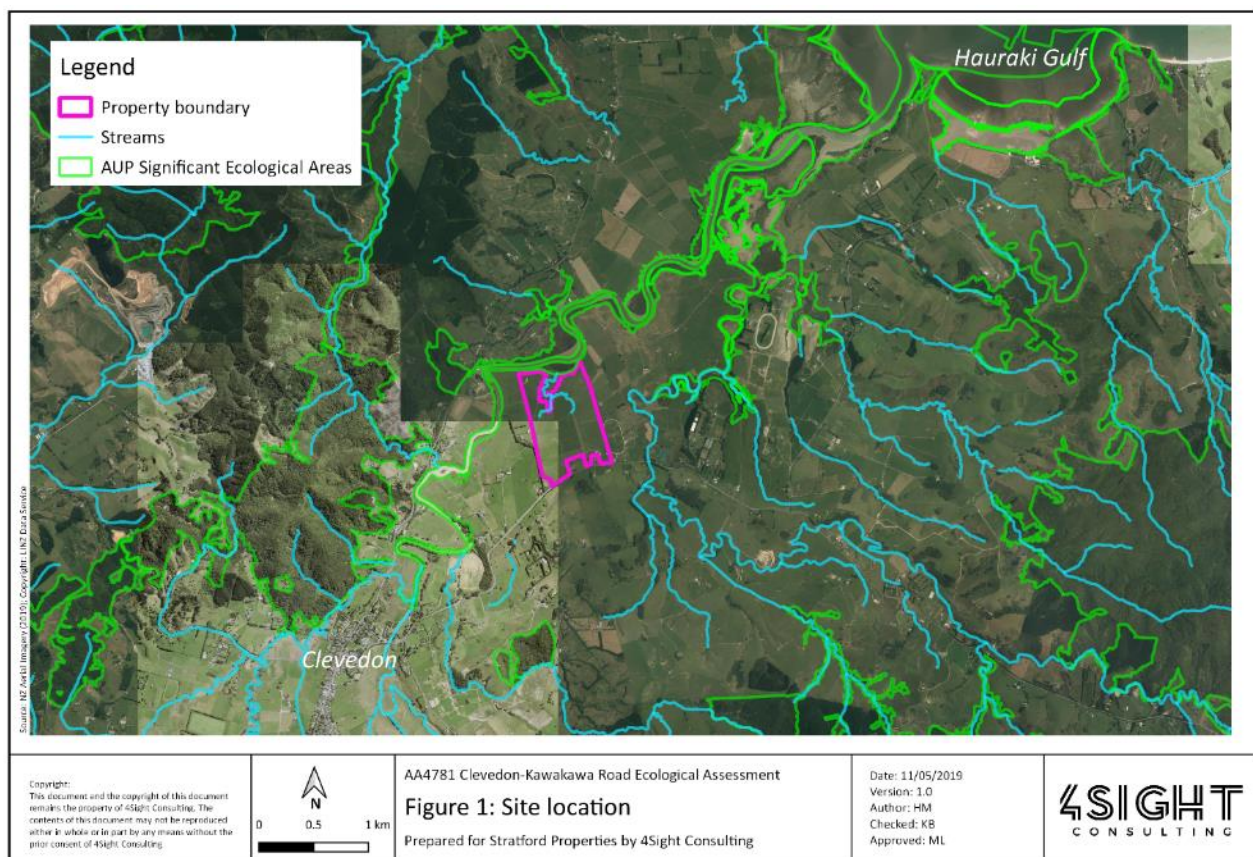


Figure 1 Site location

3 METHODOLOGY

3.1 Desktop assessment

Prior to the site visit a desktop assessment of the site was undertaken. The review of relevant background literature and databases conducted to understand the ecological values within the site and surrounding areas included:

- Relevant planning maps, including geospatial information on Significant Ecological Areas in the AUP;
- Land Environments New Zealand (LENZ) Land Cover Database New Zealand 2012;
- NZ Herpetofauna Atlas database published by the Department for Conservation;
- New Zealand Freshwater Fish database (NZFFDB) administered by NIWA; and
- NZ Plant Conservation Network (NZPCN) plant distribution database.

3.2 Site survey

Following a preliminary desktop assessment, the terrestrial and aquatic habitat characteristics of the site and surrounding area were surveyed by during a site visit on 1 May 2019. To assess ecological values and habitat potentially affected by the proposed works, a walkover of the whole site was conducted.

Site photos are presented in Appendix A:.

3.2.1 Terrestrial habitats

During the site visit, indigenous and exotic plant species and communities were recorded, and a qualitative assessment of vegetation habitats was conducted. The assessment included, but was not limited to, areas of vegetation on site immediately adjacent to, and generally surrounding the works footprint. The survey focused on the botanical and ecological value of identified plant communities.

3.2.2 Aquatic habitats

Qualitative instream and riparian margin assessments were undertaken. Characteristics of freshwater habitats were recorded during the site visit. These included flow levels and paths, and stream morphology (i.e. width, depth and stream bank characteristics). Observations of riparian vegetation type and composition were made at the site.

Any limitations to fish passage were assessed at the location of two culverts on the northern boundary of the site.

Waterways were mapped and presented as geospatial information (Figure 2).

3.3 Assessment of ecological effects

The assessment of ecological effects informed by the Ecological Impact Assessment (EclA) guidelines of the Environment Institute of Australia and New Zealand (EIANZ 2018). An outline of the proposed development is included by way of a scheme plan and landscape plan attached in Appendix B:.

Ecological significance criteria provided by the AUP, D9: Significant Ecological Areas Overlay were used to guide the assessment (Auckland Council 2013).

The following steps were used for this assessment:

1. Ecological values are assigned a level on a scale of Low, Moderate, High or Very High based on assessing the values of species, communities and habitats identified against criteria set out in the EclA guidelines.
2. The magnitude of effect of the site works on ecological values is evaluated as either No Effect, Negligible, Low, Moderate, High or Very High. The 'Magnitude of Effect' is based on:
 - The scale of the unmitigated effect per se (i.e. the earthworks, impacts on hydrology, impacts on wetland vegetation);
 - The proportion of habitat loss versus local availability;

- The expected duration of effect (e.g. permanent versus temporary); and
 - The intensity of the effect (i.e. the extent to which habitat loss within the site is complete or partial).
3. The overall level of effect in the absence of mitigation is determined using a matrix that is based on the ecological values and the magnitude of effects on these values in the absence of any efforts to avoid, remedy or mitigate for potential effects. Level of effect categories include No Ecological Effect, Very Low, Low, Moderate, Moderate/High, High and Very High.

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

4 RESULTS

4.1 Desktop assessment

The margins of the Wairoa River at the site (northern boundary) are subject to a terrestrial Significant Ecological Area overlay under the Auckland Unitary Plan (SEA-T-5361, Figure 1).

Land Environments New Zealand (LENZ) classifies this area as the second highest LENZ threat category (Threatened Environments Class 2, 10-20% indigenous cover left) The LENZ classification recognises that indigenous biodiversity in these environments has been severely reduced and remaining habitats are sparsely distributed in the landscape (Walker et al., 2015).

4.2 Vegetation

The site is situated within the Manukau Ecological District (ED) of the Auckland Ecological Region. While the historical vegetation cover of this alluvial floodplain is likely to have been dominated by wetlands and kahikatea (*Dacrycarpus dacrydioides*) swamp, the landscape is now modified through artificial drainage to facilitate agricultural land use activities.

The site of the proposed countryside living development comprises of grazed paddocks that are characterised by common pasture grass and herbaceous species. Sparse patches of indigenous vegetation such as *Juncus* and *Carex* species are present on the riparian margins of artificial drainage channels, which are regularly maintained (excavated) by the landowner. The drains also feature at times dense cover of *Isolepis prolifera*, an indigenous grass-like herbaceous plant that grows mostly in open, freshwater wetland systems throughout New Zealand and can become an aggressive weed in farm drains.

Beyond the immediate area proposed for countryside living development, the wider site features riparian vegetation of similar composition along the tributary of the Wairoa River (Figure 2), which includes a stand of poplar trees at the southern extent. Further downstream, the tributary flows into the Wairoa River in an estuarine system dominated by mangroves, with *Juncus* species also present.

4.3 Terrestrial fauna

Several bird species commonly associated with open farmland were observed during the site visit. Species observed included fantail (*Rhipidura fuliginosa* – Not Threatened, Robertson et al. 2016), paradise shelduck (*Tadorna variegata* – Not Threatened), and welcome swallow (*Hirundo neoxena*, Not Threatened).

No lizards were observed during the site visit. The grazed, modified nature of the site and lack of mature vegetation or other suitable habitat or refugia means it is unlikely that lizard species are present at the site. Some apparently suitable habitat for lizards is present adjacent to the tributary of the Wairoa River, where several mature trees including dead logs can be found. This habitat is located within an area subject to periodic flooding. The proposed development will not encroach on this habitat.

While long-tailed bats (*Chalinolobus tuberculata* – Threatened, Nationally Critical; O'Donnell et al. 2018) are known to be present in the nearby Hunua Ranges (Lindsay et al. 2009) and are potentially occasionally present at the site as it may provide foraging habitat, there is no suitably roosting habitat present on site, and no suitable habitat (including foraging or commuting habitat) is provided by the area designated for the development.

No notable bird, bat or lizard habitat is provided by the features of the proposed residential development.

4.4 Freshwater habitat

Aquatic habitat present in the proposed development area is limited to artificial farm drainage channels, modified flow paths and small seep zones. None of these systems were found to have water present at the time the site assessment was undertaken (early May 2019).

Further to the north of the wider site, the drainage system links to a tributary of the Wairoa River. The tributary is characterised by an open, meandering channel of an average width of c.2-3 m (Figure 2). The stream is soft-bottomed

and impacted by fine sediment depositions. Riparian vegetation is sparse and comprises weed species (including rank grasses) alongside indigenous *Carex* and *Juncus* species.

Two culverts are present at the site (Figure 2). Culvert A is approximately of 60 cm diameter, perched by c.1-2 m (at low tide) and overhanging by c.1 m (photos in Appendix A:). This culvert features a flap gate installed by Auckland Council for flood control (to reduce the impact of tidally linked flooding of the upstream paddock and residential areas). Culvert B links the tributary to the downstream, estuarine ecosystem. Culvert B is approximately of 20 cm diameter and links the downstream estuarine system to a degraded wetland area that is currently utilised for grazing. At the time of observation, at low tide, this culvert was not perched, and it appears likely that it is regularly overtopped during high tide levels.

A range of freshwater fish species have been recorded at the Wairoa River and its tributaries (Crow 2017; presented in Table 1). It is possible that a small subset of these species is present in the tributary; however, the nature of the culvert and flood gate (Culvert A) appear to impede fish passage at present.

Photos are presented in Appendix A:.

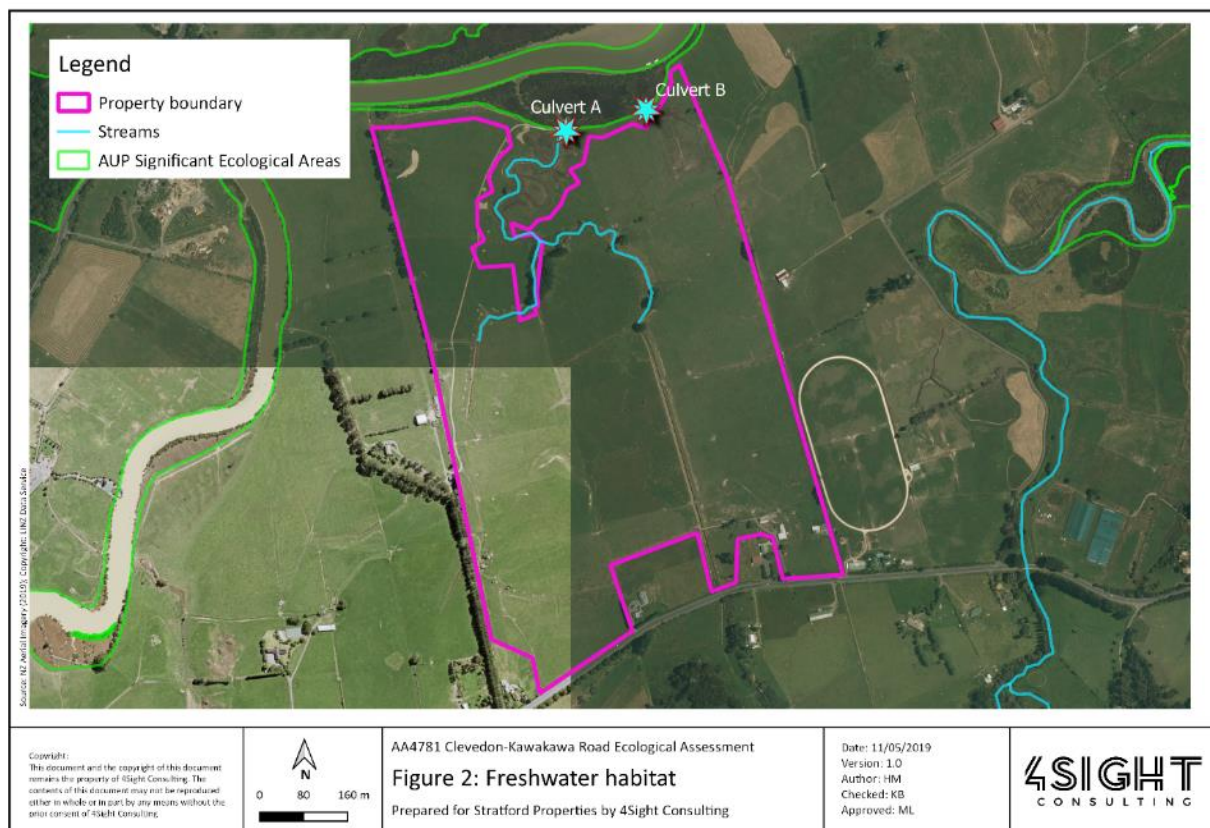


Figure 2 Freshwater habitats

Table 1 NZFFDB¹ records for the Wairoa River and tributaries in the vicinity (c.3 km radius) of the site

Common name	Scientific Name	Threat Status*
Shortfin eel	<i>Anguilla australis</i>	Not Threatened
Longfin eel	<i>Anguilla dieffenbachii</i>	At Risk - Declining
Australian longfin eel	<i>Anguilla reinhardtii</i>	Non-resident native
Torrentfish	<i>Cheimarrichthys fosteri</i>	At Risk – Declining
Inanga	<i>Galaxias maculatus</i>	At Risk - Declining
Unidentified bully	<i>Gobiomorphus</i> sp.	Unknown
Common bully	<i>Gobiomorphus cotidianus</i>	Not Threatened
Giant bully	<i>Gobiomorphus gobioides</i>	At Risk - Declining
Common smelt	<i>Retropinna retropinna</i>	Not Threatened
Yelloweye mullet	<i>Aldrichetta forsteri</i>	Not Threatened
Estuarine triplefin	<i>Grahamina</i> sp.	Not Threatened
Goldfish	<i>Carassius auratus</i>	Introduced and naturalised

* Dunn et al. 2018

4.5 Animal pest species

No mammalian pest sign (i.e. scat or tracks) was observed within the site during the survey. However, it is likely that possums, rats, mice, mustelids, hedgehogs and feral cats are present within the site and surrounding area.

¹ New Zealand Freshwater Fish Database published by NIWA (Crow 2017)

5 ASSESSMENT OF ECOLOGICAL EFFECTS

The following sections detail an Ecological Impact Assessment in general accordance with EIANZ Ecological Impact Assessment guidelines (EIANZ, 2018). This approach considers the ecological values of the site and assesses the level of effects the development is likely to have on the ecological features and values.

5.1 Ecological values

Ecological values present at the development site have been assessed as **Negligible** based on the highly modified nature of the site comprising currently grazed pasture and predominantly exotic species, with infrequent, fragmented patches of common indigenous *Juncus* species present.

The ecological features and values of the site are discussed below against the key criteria used to determine the significance of terrestrial ecosystems (EIANZ, 2018; AUP, Schedule 3).

5.1.1 Representativeness

The extent to which the area is typical or characteristic. Size.

The area comprises modified, grazed pasture areas dominated by exotic pasture species, including grasses and herbaceous species. Fragmented patches of common indigenous *Juncus* species are present in the seep zones of limited extent and are infrequent. The total area proposed for development is approximately 8 ha of exotic pasture, not all of which will be impacted, with areas remaining in pasture in between residential houses (Appendix B:).

The vegetation onsite is considered to have a negligible value regarding ecological representativeness.

5.1.2 Rarity/Distinctiveness

Amount of habitat or vegetation remaining. Supporting nationally or locally threatened, at risk or uncommon species. Regional or national distribution limits. Endemism. Distinctive ecological features. Natural rarity.

The habitat of the development area is limited to grazed pasture, dry artificial drainage channels and dry seep zones. No nationally or locally threatened, at risk or uncommon species are supported by the area, and no distinctive ecological features are present.

The habitat on site is considered to have a negligible value regarding ecological rarity and/or distinctiveness.

5.1.3 Diversity and Pattern

Level of natural diversity. Biodiversity reflecting underlying diversity.

Due to the modified, exotic nature of the ecosystem, it is considered to have a negligible value with respect to ecological diversity and pattern.

5.1.4 Ecological Context

Contribution to network, buffer, linkage, pathways. Role in ecosystem functioning. Important fauna habitat.

The habitat on site is linked to a riparian Significant Ecological Area (SEA-T-5361), which is located c. 500 m downstream of the proposed development area.

While the area of development is linked to this system via a drainage channel, it only provides limited ecosystem services functions including carbon sequestration, filtration of contaminants and flood control.

Based on these functions, the habitat is of low value regarding ecological context.

5.1.5 Overall Ecological Value

Overall, the ecological value of the terrestrial vegetation and habitats within the site is assessed as **Negligible**.

5.2 Ecological effects

The proposed works associated with the subdivision and development of the site that will be enabled by the proposed plan change as detailed in the resource consent application include:

- Earthworks to form an elevated access road from Clevedon–Kawakawa Road to the housing development areas;
- The development of roadside swales to capture and treat runoff from the access road, before discharge to ground;
- Following development, stormwater from impervious surfaces will be captured and detained in on-site tanks, with overflows discharged to land, and wastewater will be treated by onsite systems and disposed to land.

In summary, the proposed works include earthworks and construction of a cluster of residential houses in two locations on the southern half of the property. A scheme plan and landscape plan outlining the proposed development and planned restoration planting are attached in Appendix B:.

In general terms, impacts associated with the proposed countryside living development are expected to be limited to potential sedimentation or contamination of receiving aquatic environments, as described in more detail below.

5.2.1 Sediment discharges associated with development

There is the potential for sediment discharges to downstream receiving environments during the construction period. Overland flow paths and farm drainage channels are present within or immediately surrounding the development area and drain towards the Wairoa River and adjacent Significant Ecological Areas.

However, earthworks associated with the development are expected to be limited in extent, and largely associated with development of the elevated accessway to the northern housing cluster. Provided appropriate sediment and erosion control measures are utilised during the construction phase and earthworks are undertaken during periods of low rainfall, the low gradient nature of the surrounding catchment and the scale of the works will mean the scale and temporal effects of these risks to receiving environments will be very low.

5.2.2 Positive effects

As outlined in Section 6, there are a number of enhancement opportunities on site that could provide positive ecological outcomes associated with the proposed development. These opportunities include planting of a kahikatea grove within the flood plain between the two housing clusters, riparian restoration of the tributary of the Wairoa River, the enhancement of potential inanga spawning habitat immediately upstream of the Wairoa River riparian area, and possible improvements to fish passage (Figure 3).

5.3 Magnitude of effects

We have considered the spatial scale of the ecological effects associated with the proposal at a local and district scale, determining the local effects in relation to the earthworks and housing development within c.8 ha of currently grazed pasture. This approach is consistent with the EIANZ guidelines and is recommended as an appropriate scale when considering the loss of terrestrial and freshwater vegetation and habitats.

The impacts associated with the earthworks and housing development are expected to be limited to the potential for sediment discharges to downstream aquatic receiving environments. However, these effects can be effectively managed and minimised using appropriate erosion and sediment control measures.

Overall, the effects of the proposed development were assessed to likely result in a **Low** magnitude of effect based on a minor alteration to one or more key elements/features of the existing baseline conditions. Effects are expected to be localised to a small area.

There is also the potential for positive effects as part of the proposal. Positive effects could be achieved through the implementation of enhancement opportunities elsewhere on site, including wetland and riparian margin restoration, inanga spawning habitat creation and improvement of fish passage at two culverts.

5.4 Overall level of effect

The ecological value for the site is **Negligible** and the magnitude of the effect associated with the proposed dwelling construction is **Low**.

Based on the matrix presented in Table 2, the overall ecological impact is **Very Low**.

If some or all of the enhancement opportunities outlined in Section 6 are implemented, the overall ecological impact could result in a **Net Gain**.

Table 2 Criteria for describing level of effects (based on the EIANZ 2018 guidelines (Table 10)).

Table 10. Criteria for describing level of effects (Adapted from Regini (2000) and Boffa Miskell (2011))

Ecological Value ► Magnitude ▼	Very high	High	Moderate	Low	Negligible
Very high	Very high	Very high	High	Moderate	Low
High	Very high	Very high	Moderate	Low	Very low
Moderate	High	High	Moderate	Low	Very low
Low	Moderate	Low	Low	Very low	Very low
Negligible	Low	Very Low	Very low	Very low	Very low
Positive	Net gain	Net gain	Net gain	Net gain	Net gain

6 ENHANCEMENT OPPORTUNITIES

While the overall impact of ecological effects associated with the proposed countryside living development have been assessed to be **Very Low**, several enhancement opportunities have been identified on site that could result in an overall Net Gain in ecological values as a result of the proposal.

Suggested areas that are suitable for enhancement are described below. Key enhancement opportunities include wetland and riparian restoration, creation and protection of potential inanga spawning habitats, and fish passage improvements.

A map of the areas suitable for enhancement and restoration is presented in Figure 3.

6.1 Enhancement opportunity area A

This enhancement opportunity location comprises an area of approximately 2 ha currently dominated by exotic grazed pasture (Figure 3). A minor artificial drainage channel runs alongside its northern boundary (Appendix A; Photo 2). As part of the proposed development, an opportunity exists to backfill this channel, thereby allowing natural, occasional flooding of this area. The enhancement opportunity comprises the low-lying flood plain on either side of the access drive between the two proposed housing clusters. Stormwater from the proposed accessway treatment swale will discharge to this area. The enhancement area is located within the wider, periodically inundated, Wairoa River flood plain.

Our recommendation is to re-establish a kahikatea-dominated alluvial floodplain wetland/forest system. Restoration planting will be required as part of this.

Associated benefits expected for this area include re-establishment of natural vegetation cover, attenuation of flood events, increased biodiversity values, and increased habitat for wetland and terrestrial bird species.

Suitable plant species for this enhancement area are outlined in Table 3.

Table 3: Suitable plant species for Enhancement Opportunity Area A

Common name	Scientific name	Plant type
Flax/harakeke	<i>Phormium tenax</i>	
Kahikatea	<i>Dacrycarpus dacrydioides</i>	Tree
Kōwhai	<i>Sophora microphylla</i>	Tree
Māpou	<i>Myrsine australis</i>	Tree
Purei	<i>Carex virgata</i>	Sedge
Purei	<i>Carex secta</i>	Sedge
Swamp coprosma	<i>Coprosma propinqua</i>	Shrub
Toetoe	<i>Austroderia fulvida</i>	Sedge

6.2 Enhancement opportunity area B

This enhancement opportunity location comprises an area of approximately 2.2 ha located alongside the meandering tributary of the Wairoa River (Figure 3). It is currently characterised by a fenced off, narrow riparian margin dominated by rank grasses and some indigenous sedges (Appendix A:). The proposed enhancement area is partially located within the development site and partially within land in public ownership.



Figure 3 Suggested enhancement and restoration areas

6.2.1 Riparian plantings

Our recommendation is to widen the fenced area of the riparian margin in some places (Figure 3), and establish plantings of suitable indigenous species (Table 4) to enhance riparian and instream habitat through shading and complexity. Nutrient filtering and flood attenuation are expected benefits.

Further associated benefits include the creation of habitat for bird species, alongside terrestrial and freshwater invertebrates that restore the food web of the riparian and stream habitats.

Table 4: Suitable plant species for Enhancement Opportunity Area B

Common name	Scientific name	Plant type
Cabbage tree/ tī kouka	<i>Cordyline australis</i>	Tree
Flax/harakeke	<i>Phormium tenax</i>	
Giant sedge	<i>Gahnia xanthocarpa</i>	Sedge
Karamū	<i>Coprosma robusta</i>	Shrub
Kōwhai	<i>Sophora microphylla</i>	Tree
Māhoe	<i>Melicytus ramiflorus</i>	Tree
Māpou	<i>Myrsine australis</i>	Tree
Purei	<i>Carex virgata</i>	Sedge
Purei	<i>Carex secta</i>	Sedge
Swamp coprosma	<i>Coprosma propinqua</i>	Shrub
Toetoe	<i>Austroderia fulvida</i>	Sedge

While some of this area is located outside the official property boundary, we understand that there is an agreement in place with Auckland Council for the landowner to utilise some of the area officially owned by Council in exchange for fencing of the waterway (Doug Sheeran, *pers. comm.*). While landowner approval would be required for enhancement within areas outside the development property, it is likely that restoration in this area will be acceptable as part of this agreement.

6.2.2 Fish passage

Fish passage into this tributary is currently severely restricted by the presence of a flap gate installed to control tidal flooding of the upstream areas (Culvert A in Figure 3; photos in Appendix A:). There is an opportunity to upgrade the culvert and flap gate with a 'fish friendly' floodgate, in accordance with the recommendations of the New Zealand Fish Passage Guidelines (Franklin et al. 2018). Such floodgates include simple modifications that keep the floodgate open for extended periods, increasing opportunities for indigenous migratory fish (such as inanga) to move past the floodgate barrier, while still maintaining the flood protection values of the floodgate.

Since this culvert is located on council land, any modifications to the culvert will require agreement and inputs from Auckland Council.

6.3 Enhancement opportunity area C

This enhancement opportunity location comprises an area of approximately 2.5 ha, a wetland area situated upstream of the riparian margins of the Wairoa River (Figure 3). As a less productive and often water-logged area of the property, we recommend that this area is permanently fenced off from stock and enhanced through suitable plantings (Table 5).

Associated benefits expected as part of this restoration opportunity include the creation of brackish/freshwater transitional wetland habitat, enhancement of stream habitat, flood attenuation, filtration of nutrient runoff and other

contaminants, the improvement of fish passage and the creation of potential inanga spawning habitat (see 6.3.1 and 6.3.2 below).

Table 5: Suitable plant species for Enhancement Opportunity Area C

Common name	Scientific name	Plant type
Cabbage tree/ tī kouka	<i>Cordyline australis</i>	Tree
Flax/harakeke	<i>Phormium tenax</i>	
Giant sedge	<i>Gahnia xanthocarpa</i>	Sedge
Jointed wire rush	<i>Apodasmia similis</i>	Sedge
Kahikatea	<i>Dacrycarpus dacrydioides</i>	Tree
Kōwhai	<i>Sophora microphylla</i>	Tree
Purei	<i>Carex virgata</i>	Sedge
Purei	<i>Carex secta</i>	Sedge
Toetoe	<i>Austroderia fulvida</i>	Sedge

6.3.1 Fish passage

Fish passage into this upstream is currently somewhat impeded by the presence of small, narrow culvert and vehicle ford linking the tidal mangrove area to the upstream wetland areas (Culvert B in Figure 3; photos in Appendix A:). We recommend that the culvert is upgraded in accordance with the recommendations of the New Zealand Fish Passage Guidelines (Franklin et al. 2018) to ensure permanent fish passage is provided for. Integration of a larger culvert with a suitable farm track crossing is recommended to remove the ford and minimise impacts of vehicle movements on the stream.

6.3.2 Inanga spawning habitat

The combination of fencing, improved fish passage and planting is designed to create an area of potential inanga spawning habitat. Inanga prefer relatively slow flowing habitat, including pools, slow runs and backwaters. They spawn in autumn, using riparian vegetation of areas with estuarine influence, using areas that are flooded by spring tides, allowing the larvae to be washed out to sea to complete their diadromous life cycle (Richardson & Taylor 2002).

Riparian vegetation, woody debris associated with vegetation, and macrophytes all provide cover for inanga. Pastoral grasses, toetoe, flax, and watercress can also create suitable habitat. Eliminating stock access is critical to the restoration of inanga spawning habitat.

6.4 Weed and pest animal control

Pest plants (weeds) affect the long-term survival of native plants and plant communities by smothering, shading or otherwise competing with indigenous plants. Furthermore, weeds can take over habitat required by seedlings thus restricting regeneration. Indigenous plantings are often invaded by weeds but in a planting of well-selected, rapid growing, closely planted plants, maintenance and weed control over three to five years is long enough to achieve a continuous canopy that will keep out many of the weeds.

Introduced animal pests and stock may gradually degrade habitat through direct trampling and through removal of, or damage to, vegetation. These forms of degradation may accelerate soil erosion directly or may damage the habitat of indigenous organisms. We recommend all restoration areas should be subject to pest animal control for a minimum timeframe of 5 years, targeting key animal pest species such as possums, rabbits, rats and mustelids. All enhancement areas should be appropriately fenced to prevent grazing stock access.

In addition to providing benefit to indigenous bird species, controlling pests will improve the success of plantings and enhance natural regeneration opportunities for indigenous plants.

7 SUMMARY

The site is situated within the Manukau Ecological District (ED) of the Auckland Ecological Region. While the historical vegetation cover of this alluvial floodplain is likely to have been dominated by wetlands and kahikatea swamp forest, the landscape is now modified through artificial drainage to facilitate agricultural land use activities. The site of the proposed residential development comprises of several grazed paddocks that are characterised by common pasture grass and herbaceous species.

Ecological values present at the development site have been assessed as **Negligible** based on the modified nature of the site comprising currently grazed pasture and predominantly exotic species, with infrequent, fragmented patches of common indigenous *juncus* species present. Overall, the effects of the proposed development on ecological values were assessed to likely result in a **Low** magnitude of effect based on a minor alteration to one or more key elements/features of the existing baseline conditions. Effects are expected to be localised to a small area. The overall ecological impact was assessed to be **Very Low**.

There is also the potential for positive effects as part of the proposal. Positive ecological benefits could be gained through the implementation of enhancement opportunities elsewhere on site, including wetland and riparian margin restoration, inanga spawning habitat creation and improvement of fish passage at two culverts.

If enhancement opportunities outlined in Section 6 are implemented, the overall ecological impact is expected to result in a **Net Gain**.

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Appendix A:

Site Photos



Photo 1 Site overview – current land use of area proposed for development



Photo 2 Drainage system in area proposed for development



Photo 3 Unnamed tributary of Wairoa River



Photo 4 Mangrove ecosystem downstream (outside of development site)



Photo 5 Culvert A (outside of development site)



Photo 6 Culvert B (outside of development site)



Photo 7 Upstream of Culvert B



Photo 8 Potential restoration opportunity A



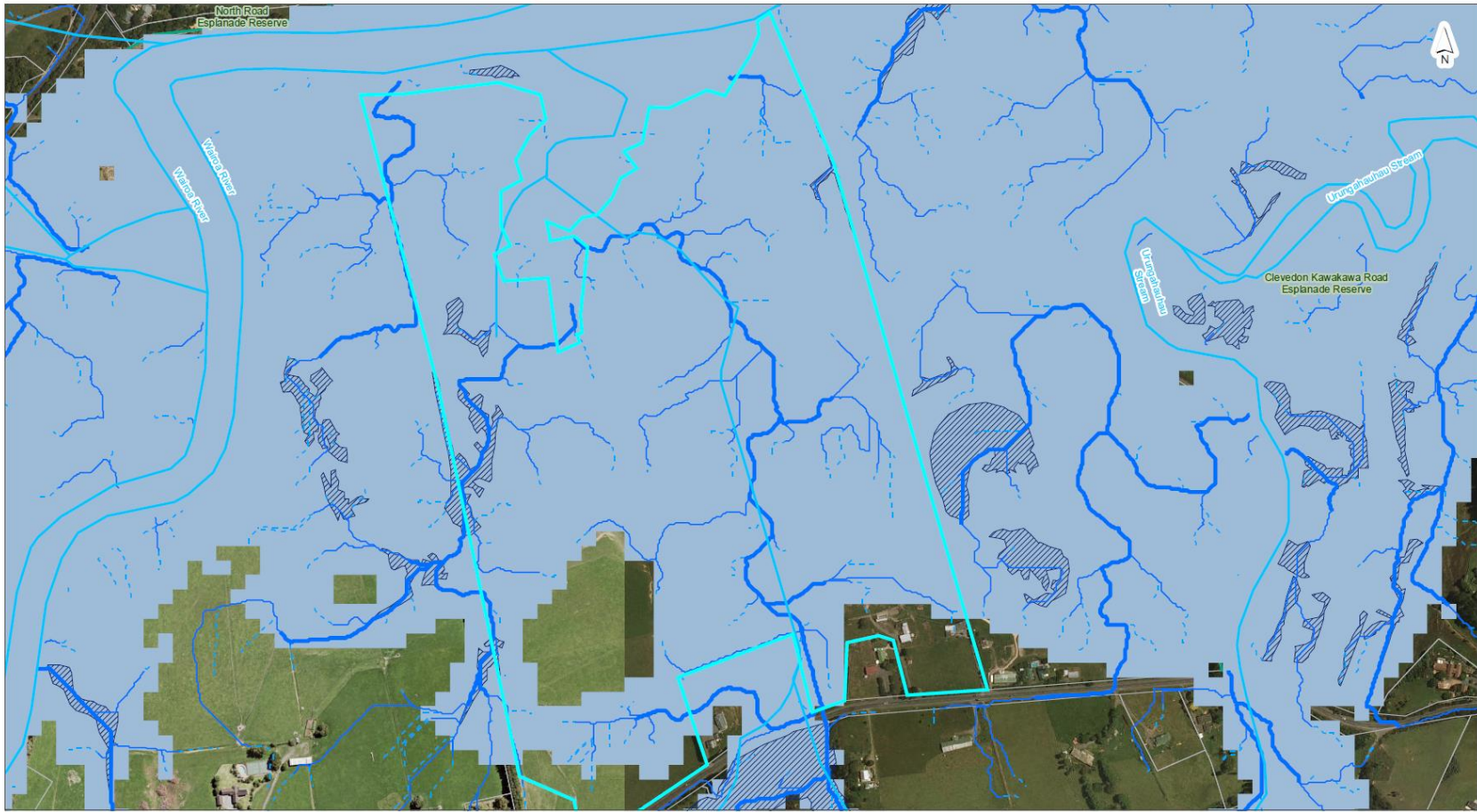
Photo 9 Potential restoration opportunity B



Photo 10 Potential restoration opportunity C

Appendix B:

Maps and Plans



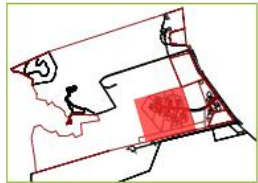
DISCLAIMER:
 This map/plan is illustrative only and all information should be independently verified on site before taking any action. Copyright Auckland Council. Land Parcel Boundary information from LINZ (Crown Copyright Reserved). Whilst due care has been taken, Auckland Council gives no warranty as to the accuracy and plan completeness of any information on this map/plan and accepts no liability for any error, omission or use of the information.
 Height datum: Auckland 1946.



0 50 100 150
 Meters
 Scale @ A3
 = 1:5,000
 Date Printed:
 17/10/2018

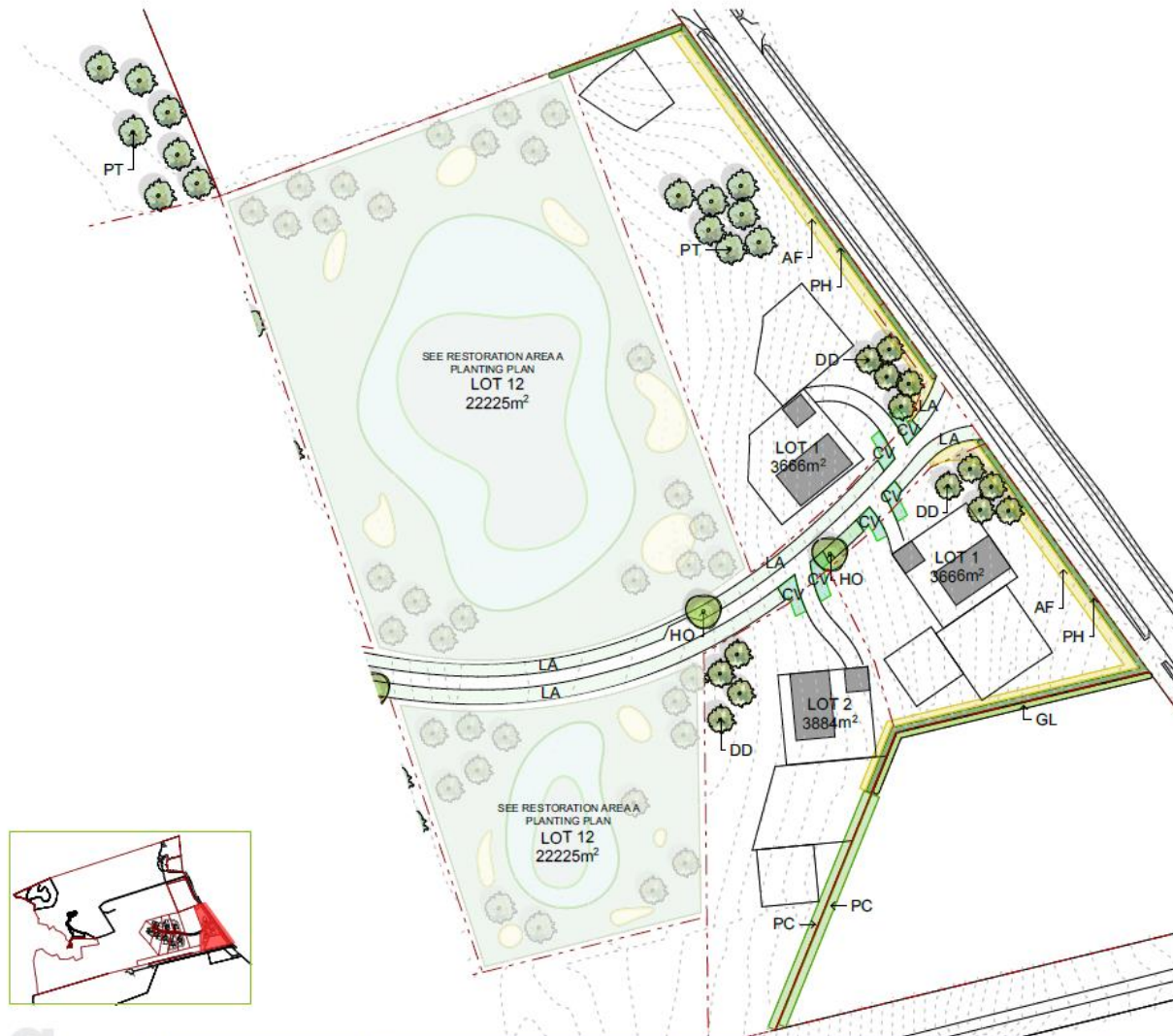




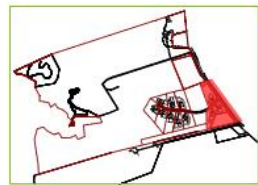


Code	Name	Common Name	PB	Spacing	Quantity
PT	<i>Podocarpus taenioides</i> 'Blue'	subspiral blue	SB	Marked	44
DD	<i>Dezycaepus decrydoides</i>	Hardybeak	SB	Marked	23
HO	<i>Quercus ilex</i>	Holly oak	SB	Marked	8
CV	<i>Carex virgate</i>	carex	S	600mm	1000
LA	Lawn Grass				





Code	Name	Common Name	PH	Spacing	Quantity
DD	Dacrydium decrytoides	Kahikatea	80	Marked	13
PH	Phormium tenax	Manuka	80	Marked	14
CV	Carex lasiocarpa	Manuka	80	Marked	15
GL	Glaucium littorale	Manuka	40	1000mm	81
AF	Austrocladia fulvida	Manuka	5	800mm	126
CV	Carex virgata	Manuka	5	800mm	876
HO	Quercus ilex	Manuka	5	1000mm	320
PC	Phormium cookianum	Manuka	5	1000mm	220
LA	Lawn areas	Manuka	5	1000mm	220





Code	Name	Common Name	PIB	Spacing	Quantity
DD	<i>Drycaepus dryobolus</i>	Tapirake	DB	Marked	20
AF	<i>Austrodia fulvida</i>	Leak	0 DL	1500mm	445
AF	<i>Austrodia spicata</i>	Leak	0 DL	800mm	4150
CV	<i>Carex virgate</i>	Leak	0 DL	800mm	11400
PH	<i>Phormium tenax</i>	Hamburua	0 DL	1000mm	7700

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Drycaepus dryobolus



Austrodia fulvida



Carex virgate

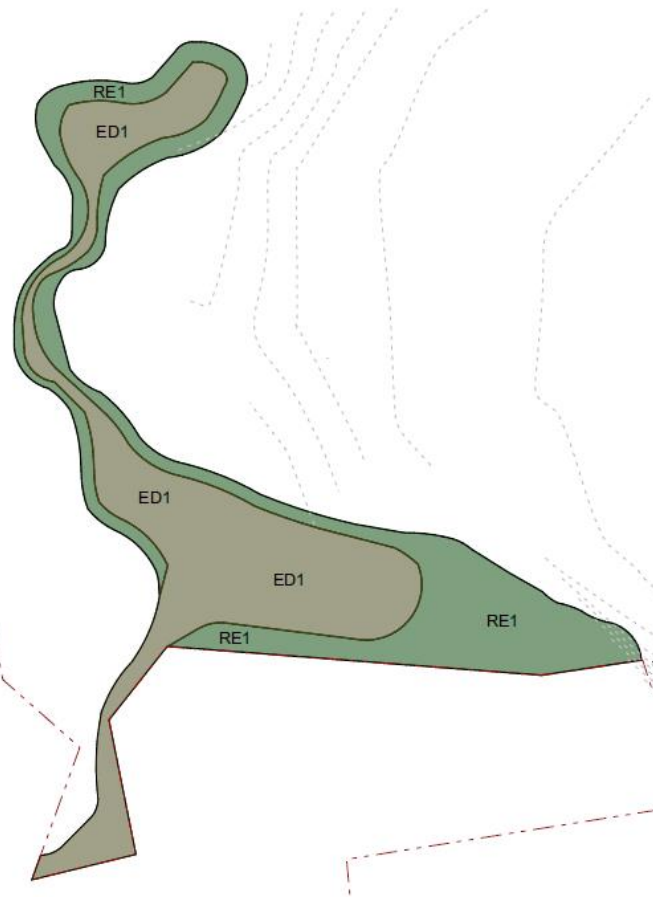


Phormium tenax



Apodasmia similis





Code	Name	Common Name	PL	Spacing	Quantity
Stream Edge Zone					
ED1	Carex lasiocarpa 20%	carex	0 RL	1800mm	2750
ED1	Coprosma robusta 20%	koparua	0 RL	1800mm	764
ED1	Coprosma propinqua 20%	koparua	0 RL	1800mm	764
ED1	Carex sarothamnos 20%	gladi-leaf	0 RL	1900mm	340
Stream Reserve Zone					
RE1	Austroderia foliolata 15%	swale	0 RL	1800mm	424
RE1	Cordyline australis 10%	flax	1 RL	4000mm	21
RE1	Carex virgata 10%	carex	0 RL	1800mm	469
RE1	Mitrasacis australis 10%	mitras	1 RL	2000mm	13
RE1	Melicope ramiflora 5%	rahiwa	1 RL	1900mm	17
RE1	Phormium tenax 40%	harakeke	0 RL	1800mm	1333
RE1	Sophora microphylla 5%	whakarua	1 RL	4000mm	10

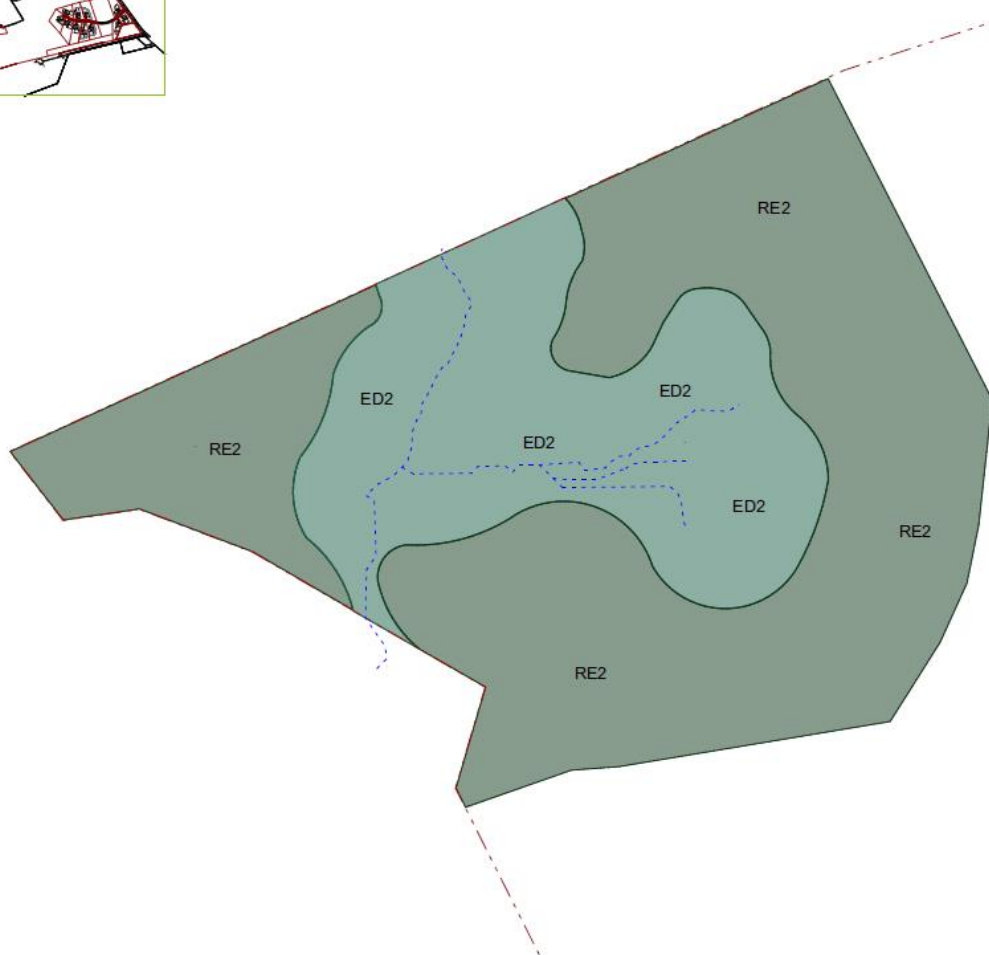
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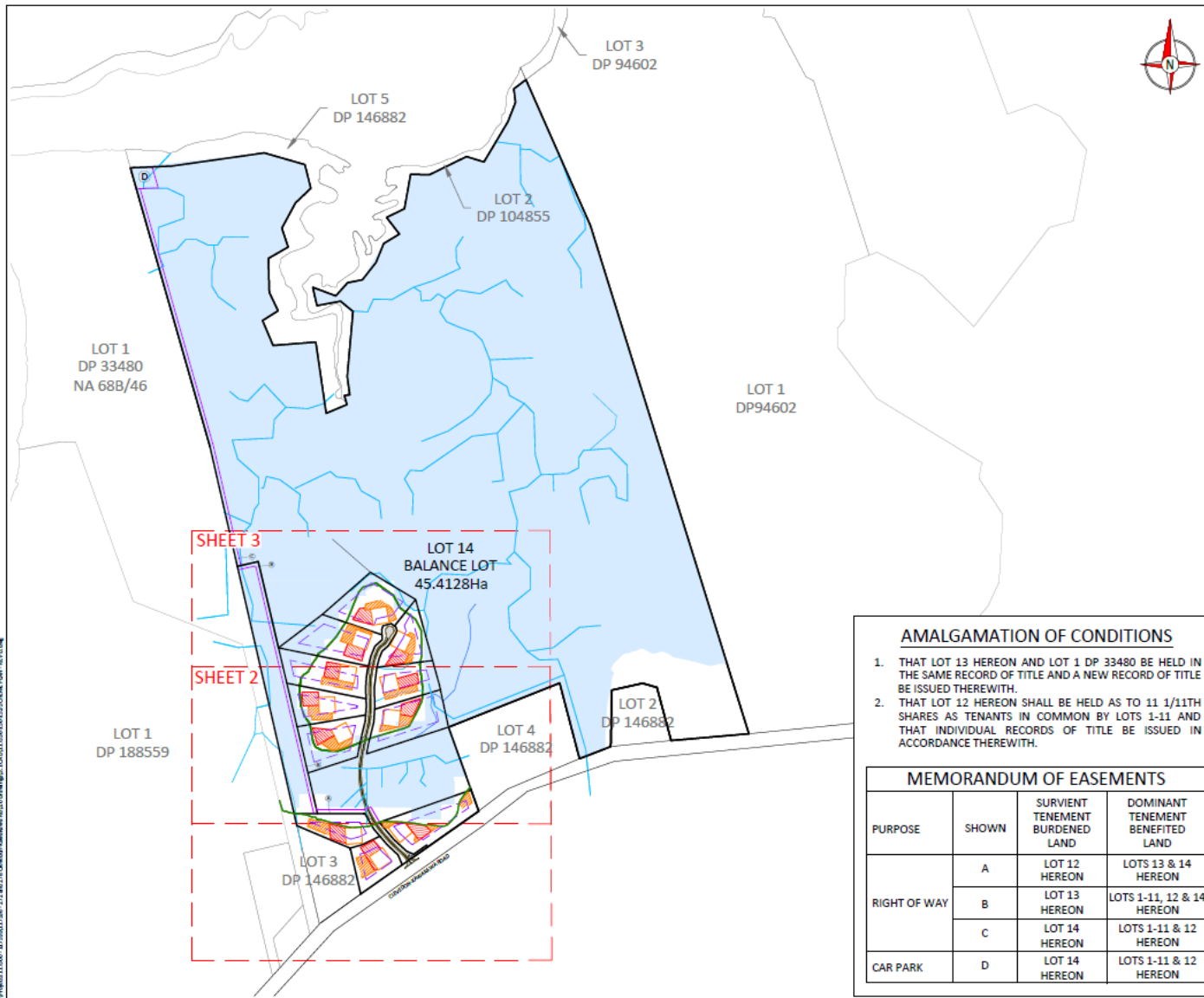


Code	Name	Common Name	PL	Spacing	Quantity
	Stream Edge Zone				
ED2	<i>Alchornea arifolia</i> 20%	oia	0.5L	600mm	4887
ED2	<i>Carex virgata</i> 20%	paue	0.5L	1000mm	1762
ED2	<i>Carex acuta</i> 20%	paue	0.5L	500mm	10813
ED2	<i>Lythrum salicifolium</i> 30%	paui wetige	0.5L	1000mm	1186
	Stream Reserve Zone				
RE2	<i>Acrostichum furcoides</i> 20%	tuwaka	0.5L	1000mm	1977
RE2	<i>Cordyline australis</i> 10%	koropua	0.5L	4000mm	111
RE2	<i>Decasporus decrydioides</i> 20%	karuhaka	0.5L	4000mm	89
RE2	<i>Phormium tenax</i> 40%	karamea	0.5L	1000mm	326
RE2	<i>Sophora microphylla</i> 10%	ohaua	0.5L	4000mm	111

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Drawing Plotted: 10/4/2019 8:26 AM



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- NOTES:**
- COORDINATES ARE IN TERMS OF MOUNT EDEN CIRCUIT, GEODETIC 2000.
ORIGIN: CE43 AE2M
mN 788335.92
mE 425775.36
 - LEVELS ARE IN TERMS OF AUCKLAND VERTICAL DATUM 1946.
ORIGIN OF LEVELS: CE43 (GEOCODE AE2M)
RL: 17.27m
 - CONTOUR INTERVAL
- MAJOR 1.00m
- MINOR 0.50m
 - FOR RESOURCE CONSENT PURPOSES ONLY.
 - AREAS AND MEASUREMENTS ARE SUBJECT TO SURVEY.

- LEGEND:**
- WW PRIMARY DISPOSAL AREA (Red hatched)
 - WW RESERVE DISPOSAL AREA (Orange hatched)
 - BUILDING PLATFORM (Orange outline)
 - EASEMENT (Purple outline)
 - 12.0m SETBACK (Dashed purple line)
 - OVERLAND FLOW PATH (Blue line)
 - GIS FLOOD PLAIN (Light blue)
 - 4.4m FLOOD LEVEL (Green dashed line)

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DRAWING TITLE:
PROPOSED SUBDIVISION OF LOT 1 DP 146882 SCHEME PLAN - SHEET 1/3

CLIENT NAME:
STRATFORD PROPERTIES LIMITED

CLIENT DETAILS:
276&278 CLEVEDON-KAWAKAWA ROAD
CLEVEDON

RESOURCE CONSENT

REV	DESCRIPTION	BY	DATE
1	ORIGINAL ISSUE	BC	14/06/10
2	BORDERS ADJUSTED AND NEW AREAS	EW	29/05/19
3	BORDERS ADJUSTED AND NEW AREAS	EW	04/05/19
4	PRIMARY DISPOSAL AMENDED	EW	02/10/19

SURVEYED	PG	19/12/10
DESIGNED	EW	15/05/19
DRAWN	PL	15/05/19
APPROVED		

SCALE (A3) 1:5000 SCALE MM
0 50 100 150 200 250m

DRAWING REFERENCE 117536-150 **KEY** D

AMALGAMATION OF CONDITIONS

- THAT LOT 13 HEREON AND LOT 1 DP 33480 BE HELD IN THE SAME RECORD OF TITLE AND A NEW RECORD OF TITLE BE ISSUED THEREWITH.
- THAT LOT 12 HEREON SHALL BE HELD AS TO 11 1/11TH SHARES AS TENANTS IN COMMON BY LOTS 1-11 AND THAT INDIVIDUAL RECORDS OF TITLE BE ISSUED IN ACCORDANCE THEREWITH.

MEMORANDUM OF EASEMENTS

PURPOSE	SHOWN	SURVIENT TENEMENT BURDENED LAND	DOMINANT TENEMENT BENEFITED LAND
RIGHT OF WAY	A	LOT 12 HEREON	LOTS 13 & 14 HEREON
	B	LOT 13 HEREON	LOTS 1-11, 12 & 14 HEREON
	C	LOT 14 HEREON	LOTS 1-11 & 12 HEREON
CAR PARK	D	LOT 14 HEREON	LOTS 1-11 & 12 HEREON

117536-150-01 11/04/2019 11:38:27 276 & 278 Clevedon-Kawakawa Road Auckland 1013 0800 SURVEY www.landsurvey.co.nz

