



Ecological values within the area affected by the proposed Drury East Plan Change

PREPARED FOR:

Fulton Hogan Land Development

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EXECUTIVE SUMMARY

Fulton Hogan Land Development (FHLD) requests a Plan Change affecting approximately 187 hectares of land at Drury East (north and east of Drury township). The Plan Change extent is mostly bound by Fitzgerald Road, Drury Hills Road and Waihoehoe Road, but includes a small area north of Waihoehoe Road. Currently, the land is predominantly used for farming, with some rural lifestyle blocks. The Plan Change area is within the Hingaia Creek catchment and the overall topography of the area is gently undulating with several low ridgelines. The Ecology Company was retained to undertake a high level assessment of the ecological context and existing ecological values of the Plan Change area, in order to inform the Plan Change application to Auckland Council to rezone the area to enable urban development.

The Plan Change area is located in the Manukau Ecological District, which is characterised by very little remnant indigenous vegetation which is generally located in small, highly fragmented patches in the southern half of the district. The Plan Change area has been substantially modified for farming and other land uses and currently contains only a small (0.4ha) area of indigenous vegetation and some isolated mature trees near the corner of Waihoehoe Road and Drury Hills Road. The Plan Change area is located near several terrestrial Significant Ecological Areas (SEA_T) identified in the Auckland Unitary Plan, but does not include any SEA_T within its boundary. The majority of the vegetation within the Plan Change area comprises exotic pasture, crops and exotic and native trees associated with gardens and shelterbelts. There are no records of native geckos within the Plan Change area, but native copper skink (*Oligosoma aeneum*) have been recorded nearby. Similarly there are no records of native bats within the Plan Change area, but long-tailed bats (*Chalinolobus tuberculatus*) have been detected in low numbers within a few kilometres of the Plan Change area. Birds recorded nearby are generally those common native and exotic species typical of farmed areas and suburban gardens.

Three unnamed tributaries of Hingaia Stream traverse the Plan Change area and drain ultimately to the Manukau Harbour via Otuwairoa (Slippery Creek). There are no natural wetlands remaining within the Plan Change area, but several ponds have been created to provide water for livestock. The aquatic habitats are highly degraded and at the time of the site visits most of the stream beds were dry or nearly so. There are no records of native fish from within the site, but historic records show Hingaia Stream has good fish diversity, including eight species of native fish.

The Drury – Opāheke area generally lacks indigenous habitats and poses a barrier to ecological connectivity and function at the broader landscape scale. There is considerable potential to restore habitats within the Plan Change area as part of the Plan Change. Habitats which could be restored or created include wetlands, streams, forest and shrubland, as well as ecotones between habitats. We recommend retention and enhancement of the forest remnant, along with stream restoration and aquatic habitat enhancement (via instream works), weed and pest control, riparian planting and wetland creation in order to maximise the ecological benefits of the proposal and assist in restoring ecological function and connectivity at both the site and broader landscape scale.

1. INTRODUCTION

1.1 BACKGROUND

This report has been prepared to inform the Drury East Plan Change ('**the Plan Change**') on behalf of Fulton Hogan Land Development ('**FHLD**'). The approximate boundary of the Plan Change area is shown in Figure 1 below.

The Plan Change area is located within Drury East (north and east of Drury township) and has a land area of approximately 187 hectares. Drury East is contained by the Papakura urban area to the north, the Hunua foothills to the east, the Drury South Business zone to the south, and State Highway 1 to the west. FHLD has large landholdings within the Plan Change extent, which is mostly bound by Fitzgerald Road, Drury Hills Road and Waihoehoe Road, with a small area north of Waihoehoe Road. Currently, the sites are predominantly used for farming, with some rural lifestyle blocks.

Drury East has an extensive stream and flood plain network which connects headwater streams to Te Mānukanuka o Hoturoa (Manukau Harbour). The Plan Change area is within the Hingaia Creek catchment and is traversed by three main watercourses. The overall topography of the area is gently undulating with several low ridgelines.

The Plan Change area is currently zoned Future Urban under the Auckland Unitary Plan. FHLD are seeking to rezone the land for residential development, with a range of densities proposed across three zones (Town Housing and Apartment Buildings, Mixed Housing Urban and Mixed Housing Suburban). The proposed Plan Change provides for a small mixed use centre within the Plan Change area. New roading and servicing infrastructure is proposed to service the development. Once developed, it is anticipated that the Plan Change area could accommodate approximately 2800 dwellings.

1.2 PURPOSE AND SCOPE

FHLD engaged The Ecology Company in January 2019 to undertake an assessment of the ecological values of the Plan Change area to inform their Plan Change request to Auckland Council to allow the Plan Change area to be rezoned in order to enable urban development. FHLD requested a high level assessment of the existing ecology within the area to inform the Plan Change, specifically the scope of work included:

- Describe current ecological values of the Plan Change area including streams, vegetation and native fauna (noting limited access to some parts of the Plan Change area);
- Describe the ecological context of the wider Drury East area;
- Categorise the existing streams as permanent or intermittent in accordance with Auckland Council criteria. This task was limited by the very dry conditions at the time of the site visits;
- Identify priority areas for retention or protection within the affected area;
- Identify potential opportunities for enhancement or improvement of ecological linkages which could be included in the Plan Change.

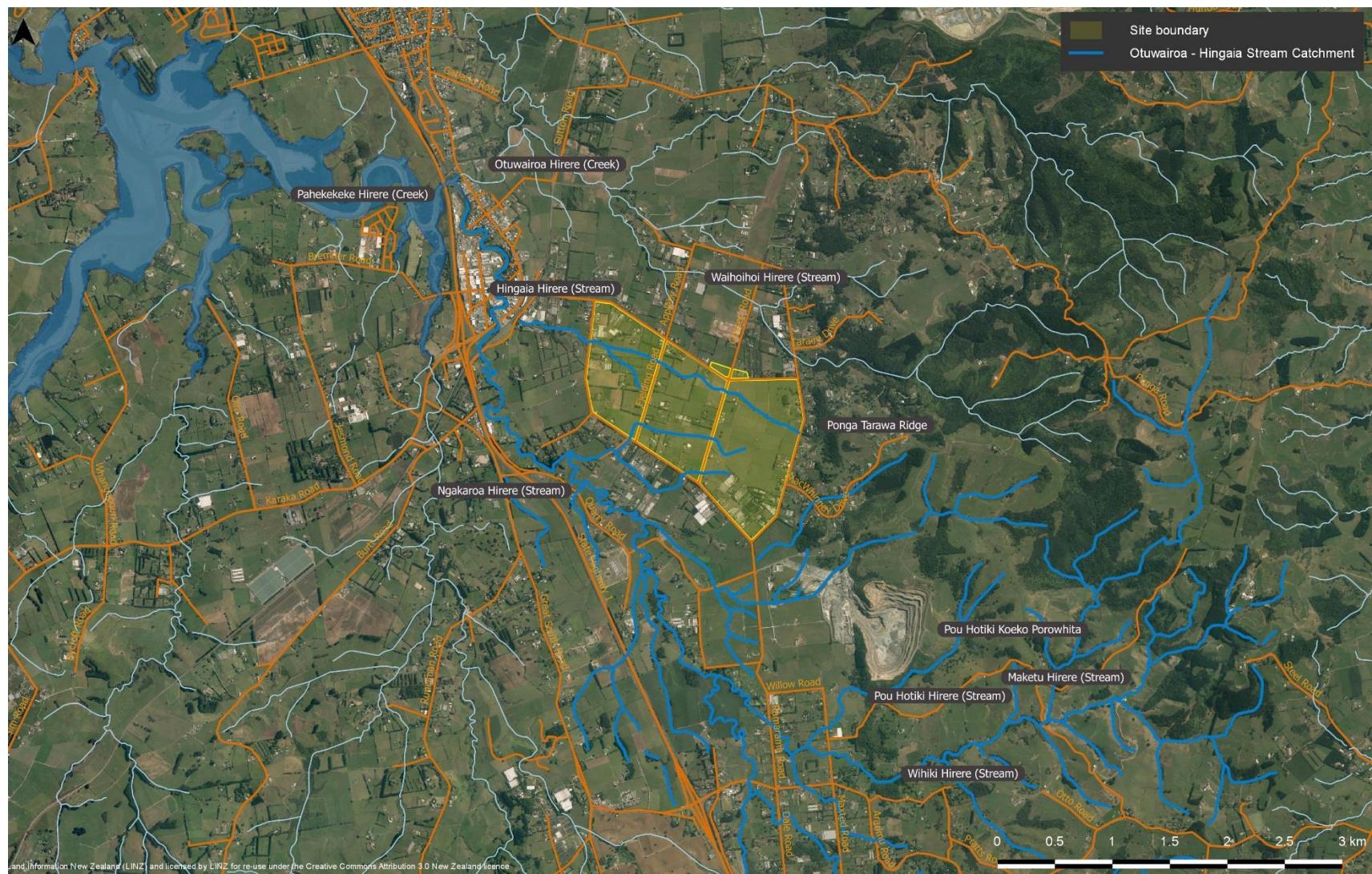


Figure 1: Approximate Location of the Proposed Drury East Plan Change Area

These matters are addressed in this report, which comprises seven sections as follows:

- **Section 1** (Introduction) describes the background of the proposal and the agreed scope of work.
- **Section 2** (Methods) describes the background literature used and the field work undertaken to inform this report.
- **Section 3** (Results) describes the findings of the literature search and field surveys in relation to terrestrial and aquatic ecological values.
- **Section 4** (Development Proposal) describes the proposed development and the anticipated effects.
- **Section 5** (Recommendations) provides recommended actions to maximise the positive ecological effects of the Plan Change and avoid, remedy or mitigate anticipated adverse effects on ecological values.
- **Section 6** (Conclusions) outlines our conclusions in relation to the proposal.
- **Section 7** (References) provides the references used in compiling this report.
- **The Appendices** provide reference material or summaries of data relevant to the findings and conclusions outlined in this report.

2. METHODS

2.1 DESKTOP METHODS

As part of gathering information about the Plan Change area, the following documents and databases were reviewed to assist in identifying the ecological values which were known or might be present at the Plan Change area:

- Herpetofauna Database for records of amphibians and lizards within 10km of the Plan Change area. The output from the Herpetofauna Database is discussed in Section 3.2.1.
- Auckland Council Bat records (B. Paris pers. comm. (2019)). The records from this Plan Change area are discussed in Section 3.2.1.
- eBird records within 10km of the Plan Change area. These records are also discussed in Section 3.2.1.
- Kane-Sanderson, P., Spyksma, A., Bennett, K., Lindgreen, M., Pertziger, F., Allen, J., Gasson, S and Canal, L (2018) Hingaia Stream Watercourse Assessment Report. 4Sight Consulting and Urban Solutions for Auckland Council.
- New Zealand Freshwater Fish Database for fish capture records in the Waihoihoi, Symonds and Hingaia Streams. The records from this database discussed in Section 3.2.2.
- Draft Drury – Opāheke Structure Plan Report (April 2019)
- Nathan, E. 2017. Ecology Assessment - Drury Structure Plan. Auckland Council.
- Auckland Unitary Plan (including the online maps).
- National Policy Statement for Freshwater Management (2014).
- National Policy Statement for Indigenous Biodiversity (proposed).
- Cultural Values Assessments from and consultation with Mana Whenua with respect to this proposal.

2.2 FIELD ASSESSMENT

The site walkovers which informed our description of the existing terrestrial and freshwater values took place on 14 February 2019 and 3 April 2019. The weather had been seasonally dry during autumn 2018 and summer and autumn 2018-2019 and ground water levels were generally low – very low.

Access was only available to parts of the Plan Change area and terrestrial plant, bird and mammal species encountered were recorded and where possible communities described.

Watercourses were classified in accordance with Auckland Unitary Plan criteria as provided in Appendix 1, following a review of existing information and in particular Kane-Sanderson *et al.* (2018) and the site visits carried out in February and April 2019. Aquatic habitats and aquatic flora were photographed and briefly described.

3. RESULTS

3.1 ECOLOGICAL CONTEXT

3.1.1 Terrestrial Ecology

The Plan Change area is located within the Manukau Ecological District which together with the Āwhitu and Hunua ecological districts forms the southernmost portion of the Auckland Ecological Region (McEwen 1987).

The Manukau Ecological District was characterised on the basis of geology and topography and encompasses Te Mānukanuka o Hoturoa (Manukau Harbour) as well as the low altitude flat to rolling land between the southern shores of the harbour and the north bank of the Waikato River. The Manukau Ecological District excludes the Āwhitu Peninsula (which comprises the Āwhitu Ecological District to the west) and is bordered to the east by the Hunua Ecological District and to the north by the Tāmaki and Waitākere ecological districts (McEwen 1987). In the south the ecological district boundary departs from the Waikato River near Tuakau, extending to the southeastern corner of the district, which is located west of Pokeno. From the southeastern corner the boundary extends north along the ridgeline which includes Opāheke, and Pukekiwiriki Pā and then travels east to include the Wairoa River mouth at Clevedon, before curving back to Brookby and north to approximately East Tāmaki before extending across to meet the northern shore of the harbour at Manurewa (McEwen 1987).

The Manukau Ecological District comprises around 62 500ha which experiences warm humid summers and mild winters with an annual rainfall of approximately 1100 – 1300 mm (McEwen 1987). Soils are generally well drained loam from old, strongly weathered volcanic ashes and vegetation has been highly modified by human activity particularly for farming and urbanisation (McEwen 1987).

Historically, lowland conifer-broadleaved forest was the most common vegetation type in the Manukau Ecological District, followed by podocarp-broadleaved rainforest, mixed kauri (*Agathis australis*) forest and kauri-hard beech (*Fuscospora truncata*) forest (Emmett *et al.* 2000). Modelling suggests that three forest types dominated across the Drury-Opāheke landscape including pūriri (*Vitex lucens*) forest, kahikatea (*Dacrydium dacrydioides*), pukatea (*Laurelia novae-zelandiae*) forest and taraire (*Beilschmiedia tarairi*), tawa (*B. tawa*), podocarp forest (Singers *et al.* 2017). Pūriri forest would have been located on the flattest and most fertile volcanic or alluvial soils. Kahikatea – pukatea forest would have formed corridors associated with the major streams and wettest lowland areas, with taraire, tawa podocarp forest occurring on slightly more elevated or otherwise more moderately fertile areas (Nathan 2017). All three types would likely have occurred within the Plan Change area, although most of the Plan Change area would have been occupied by pūriri forest, referred to by Singers *et al.* (2017) as forest type WF7.

In 2000 only c. 947ha (1.5%) of the Manukau Ecological District retained any indigenous vegetation cover. The remaining indigenous vegetation was sparse and highly fragmented with 296 fragments of forest, scrub or wetland, with the majority of sites (85%) less than 5ha in size (Emmett *et al.* 2000). The present isolation and scarcity of remnant vegetation patches within the district means that all areas of indigenous vegetation, no matter how small or modified, are important for contributing to the maintenance of biodiversity (Auckland Regional Council 2004). Nathan (2017) also identified a current lack of native vegetation within the wider Drury area of which the Plan Change area is a part, considering that the Drury – Opāheke area generally constitutes a ‘gap’ in ecological connectivity and a barrier to the movement of flora and fauna at the broader landscape scale.

Most fragments of indigenous vegetation remaining within the Manukau Ecological District are located south of Paerata and only 9% of the remaining indigenous vegetation lies within protected natural areas (Auckland Regional Council 2004). More than half of the protected vegetation comprises conservation covenants on private land (Auckland Regional Council 2004).

The Plan Change area is located near (<200m) several terrestrial Significant Ecological Areas (SEA_T) identified in the Auckland Unitary Plan located east of Drury Hills Road and approximately 1.8 – 2.5km south of two small SEA_Ts (SEA_T 77 at Ponga Road and SEA_T 545 at Sutton Road) as shown in Figure 2. These are both remnant fragments of kahikatea forest (Nathan 2017). These areas qualify

as SEA because they are representative and rare (i.e. they fulfil factors 1 and 2 of the Auckland Unitary Plan's ecological significance factors). Kahikatea forest is regarded as a "critically endangered" ecosystem type in the Auckland region (Singers *et al.* 2017).

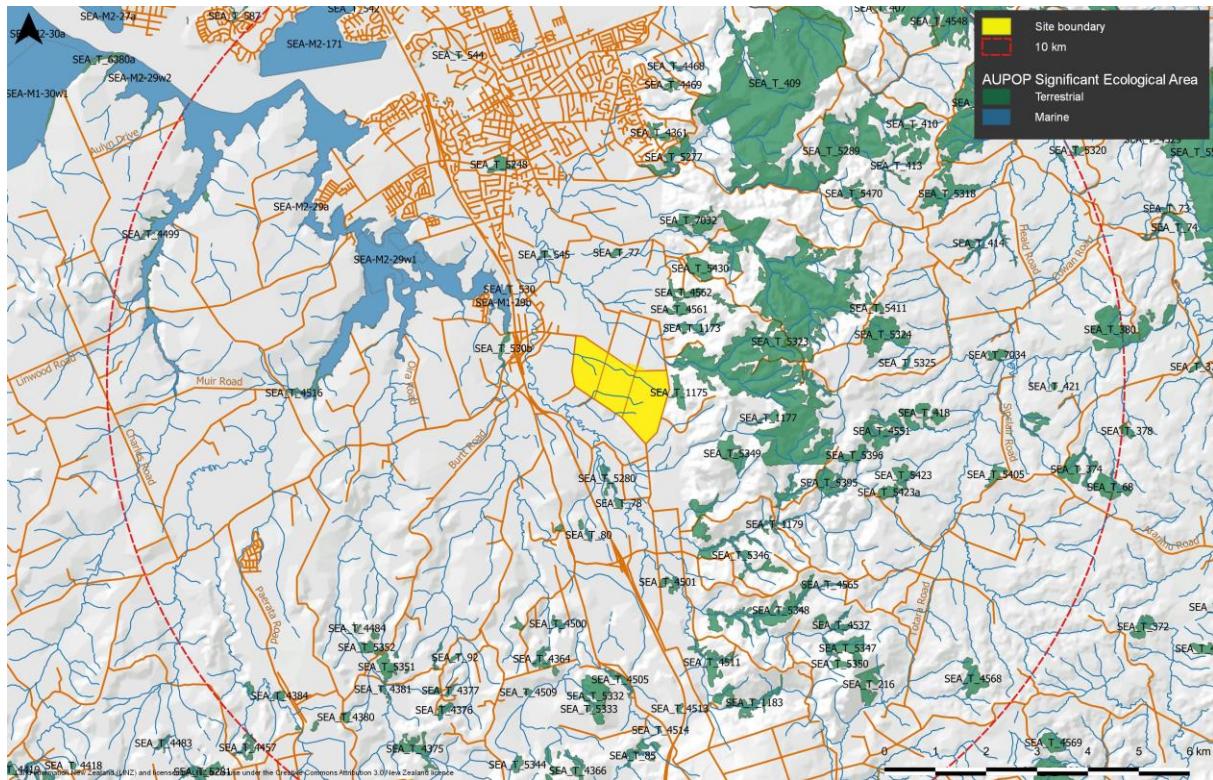


Figure 2: Significant Ecological Areas identified in the Auckland Unitary Plan in the vicinity of the proposed Drury East Plan Change Area

Restoration and protection of indigenous vegetation using a variety of mechanisms and restoring ecological linkages between natural areas were seen as priorities for the Manukau Ecological District by former Auckland Regional Council natural heritage staff in 2004 (Auckland Regional Council 2004). Nathan (2017) also identified that restoration of ecological values in the Drury – Opāheke structure plan area would bridge the gap he identified in ecological connectivity and is thus expected to yield ecological benefits of a larger scale and across a much larger area of the Auckland region.

Existing land use within the Plan Change area comprises mostly farming and lifestyle blocks. Three watercourses and at least six artificial ponds were identified within the site, along with one small remnant which appears to be indigenous forest and several isolated pūriri, totara and kahikatea trees nearby.

3.1.2 Aquatic Ecology

Because of the topography and elevation of the Plan Change area, original freshwater habitats in the area were characterised by low order, low energy watercourses connected to large wetland swamps and fens (Nathan 2017). These wetland areas functioned to attenuate water flows and acted as slow release water storage areas preventing downstream channel scouring, reducing sediment load and minimising flooding. Wetland areas would have harboured a variety of native terrestrial and aquatic flora and fauna, including a high diversity of native macroinvertebrates and fish species (Nathan 2017). They would also have been important food sources for nearby residents. Currently the freshwater habitats within the wider Drury – Opāheke structure plan area are highly modified with degraded habitat and compromised fauna values (Nathan 2017). Stream modifications include channelization and straightening, removal of riparian vegetation, installation of structures such as culverts and dams which affect fish passage and water quality, construction of ponds and pollution. These changes have resulted in low aquatic habitat diversity, low aquatic biodiversity and poor water quality.

Any original wetlands have been drained, filled or otherwise reclaimed, largely for agricultural purposes. These modifications have resulted in a near complete loss of wetland ecosystem types from the area along with the biota dependent on them. The ecosystem services provided by wetland systems including flow attenuation and water quality improvement have also been lost (Nathan 2017).

3.1.3 Coastal Ecology

The Plan Change area is not located immediately adjacent to the coast, however Te Mānukanuka o Hoturoa is the ultimate receiving environment for the streams which drain the site. The Manukau Harbour, together with the Firth of Thames, forms the most important wintering grounds for wading birds in the Southwest Pacific and is considered to be of international significance for wading birds (McEwen 1987). Accordingly parts of Pāhurehure Inlet and the adjoining estuary are mapped as Significant Ecological Areas (Marine) in the Auckland Unitary Plan. An important consideration of upstream developments surrounding the harbour should be the management of sediment and contaminant runoff so as to minimise effects on migratory and other wading birds feeding in the estuary. Coastal ecology is not considered further in this report.

3.2 ECOLOGICAL VALUES

3.2.1 Terrestrial Ecological Values

Indigenous Vegetation

The majority of the vegetation within the Plan Change area is exotic pasture, crops (maize at the time of the first site visit) and exotic trees and shrubs planted for shelter, amenity or as part of gardens. The only example of predominantly indigenous vegetation is a small area of forest located near the corner of Waihoehoe Road and Drury Hills Road as shown in Figure 3. This area is approximately 4,300m² (0.43ha) in extent and is surrounded to the north and west by a number of isolated mature pūriri, totara and kahikatea trees in the adjoining paddock. If all the nearby trees are included the area occupied by this vegetation is approximately 2.2ha (22 000m²).

This small remnant of vegetation is the only indigenous vegetation within the Plan Change area that is likely to have potential value as habitat for native species. These mature trees and the small forest remnant are not identified either as SEA or notable trees on the Auckland Council Unitary Plan maps. The nearest SEA is located approximately 220m east across Drury Hills Road (SEA_T 1175). The small size and isolation of this patch of vegetation from other areas of natural habitat in the wider area limits its ecological value, but there is the potential for enlarging the area and connecting it to other habitats via riparian or other plantings. Pūriri in particular is a reliable source of nectar and fruit for native species because it has flowers and ripe fruit throughout the year. In addition these are mature trees and have potential as habitats for other species of native fauna such as bats and lizards.



Figure 3: Remnant indigenous vegetation within the proposed Drury East Plan Change area

Herpetofauna (Frogs and Lizards)

The Amphibian and Reptile Database administered by the Department of Conservation was searched for records within a 10km radius of the approximate centre of the Plan Change area. There are no records from the Plan Change area itself, but several records from within the search area (shown in Figure 4). No native frogs have been recorded in the search area, although Australian frogs (*Litoria* spp.) do occur there. Similarly, there have been no records of native gecko, probably because of a lack of suitable habitat. Two species of skink have been recorded – the native copper skink (*Oligosoma aeneum*) and the exotic rainbow (or plague) skink (*Lampropholis delicata*). Copper skink occur throughout the North Island and on some offshore islands and are found in forest, shrublands, coastal areas, gardens and rough pasture. They live amongst leaf litter, under rocks, logs or other debris and in dense herbage (e.g. ungrazed grass). Copper skinks are regarded as “not threatened” (Hitchmough *et al.* 2015).

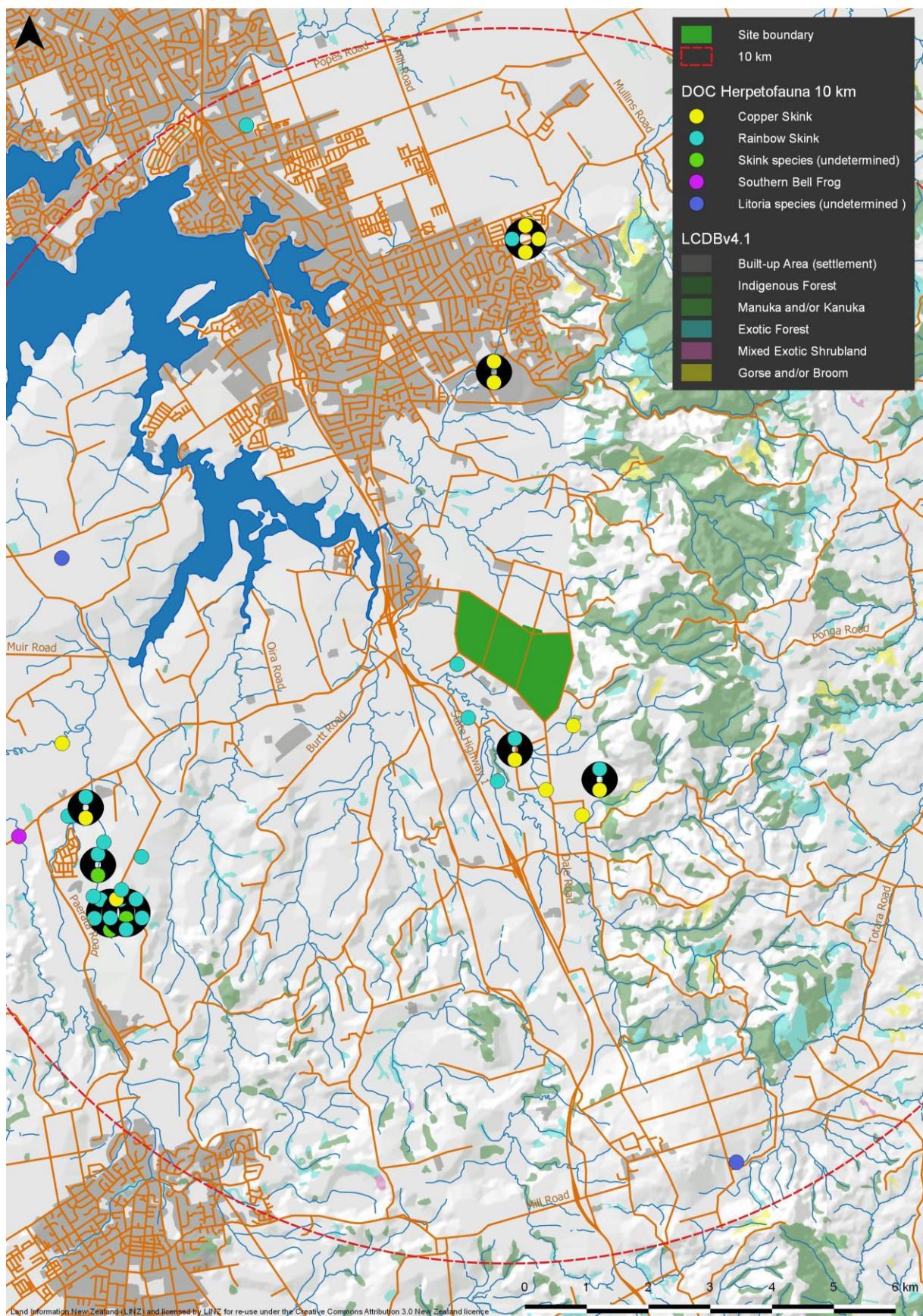


Figure 4: Database Records of frogs and lizards within approximately 10km of the Plan Change area

Pekapeka (Bats)

Pekapeka roost in cavities in mature trees and in the absence of suitable native trees will use exotic tree species or occasionally man-made structures such as bridges and buildings (O'Donnell 2005). Bats forage on the wing for flying invertebrates and often feed near streams and forest edges where invertebrate life is more abundant. Bat home ranges are large and bats can travel tens of kilometres in a night between their roosting and foraging sites. Home ranges include multiple roost sites and bats change roosts often.

Auckland Council bat records indicate the presence of long-tailed bats (*Chalinolobus tuberculatus*) at Ponga Road (approximately 3km north of the Plan Change area) in 2014. However, monitoring completed at Redhill along Hays Stream (approximately 4.7km north of the Plan Change area) in 2013 did not detect bats.

Other surveys by Auckland Council further east in the Hunua Ranges, Waharau and Tapapakanga Regional Parks, south at Mangatangi, north at Totara Park and Clevedon and west at Mauku, Puni and Patumahoe have detected bats, usually in low numbers except at forested sites to the east where numbers were higher. No surveys have been carried out within the structure plan area. Long-tailed bats are regarded as "Threatened (nationally critical)" (O'Donnell *et al.* 2017).

It is possible that long-tailed bats make use of some of the older trees or other habitat within the Plan Change area. The presence of bats in the vicinity indicates that more specific survey for bats is warranted prior to lodgement of any specific resource consent applications pertaining to the Plan Change area.

Birds

A search of the eBird database records within approximately 10km of the Plan Change area revealed records of 78 bird species (or unidentified types of birds), including 31 species of land bird, of which 15 species were introduced and 16 native. The native species of land bird recorded are shown in Table 1 and all birds recorded are provided in Appendix 2. Only three of the species of land birds recorded are of conservation interest (kārearea New Zealand falcon, kākā North Island kaka and mātātā North Island fernbird). Both kākā and kārearea populations are considered to be "recovering" whilst mātātā are "declining" (Robertson *et al.* 2017).

In total, the eBird database has 24,665 records of birds within the radius selected. Of those, one record is of mātātā, four of kārearea and seven of kākā. Thus the number of records for all three species represents a very tiny proportion (0.03% or less) of all bird records for the area. This rarity of records probably reflects the lack of suitable habitat in the wider area for mātātā and kākā, although kākā may visit the gardens and large trees within the Plan Change area seasonally, looking for nectar or other food. Kārearea range over large areas eating mostly small birds (including introduced birds). Kārearea are likely to be fly over the Plan Change area or visit on occasion, but the habitats within the Plan Change area are more likely to form part of a larger home range than core habitat.

As well as land based birds, other native species of water birds (shags, ducks, grebes and the like) and coastal birds (oystercatchers, dotterels, gulls and the like) were also recorded in the area. Nathan (2017) noted that the only records of nationally or regionally threatened bird species occurring in the wider Drury – Opāheke structure plan area were associated with the coastal end of Ngakoroa Stream (all records from SEA_T_530b). Water birds and coastal birds have been excluded here because the Plan Change area does not provide sufficient suitable habitat to support them continuously, even seasonally. As noted by Nathan (2017), some of these species are likely to visit the Plan Change area on occasion, including poaka (pied stilt, *Himantopus leucocephalus*), tarāpunga (red-billed gull, *Larus novaehollandiae scopulinus*) and karoro (Southern black-backed gulls *L. dominicanus*) and some are of conservation concern. These species would make temporary use of damp or disturbed pasture for feeding at certain times of the year. This type of habitat is present within the Plan Change area seasonally (e.g prior to crops being sown) and would be used at those times. Creation of wetland habitat within the Plan Change area would benefit water birds, and improvements to water quality downstream would benefit coastal birds in the longer term.

Table 1: Indigenous land-based birds known from within approximately 10km of the site

Scientific name	Common Name	Conservation Status
<i>Bowdleria punctata vealeae</i>	mātātā, North Island fernbird	At risk (declining)
<i>Chrysococcyx lucidus</i>	pīpīwharauroa, shining cuckoo	Not threatened
<i>Circus approximans</i>	kāhu, Australasian harrier	Not threatened
<i>Egretta novaehollandiae</i>	matuku, white-faced heron	Not threatened
<i>Falco novaeseelandiae</i>	kārearea, New Zealand falcon	At risk (recovering)
<i>Gerygone igata</i>	riroriro, grey warbler	Not threatened
<i>Hemiphaga novaeseelandiae</i>	kererū, kukupa, New Zealand pigeon	Not threatened
<i>Hirundo neoxena</i>	warou, welcome swallow	Not threatened
<i>Nestor meridionalis meridionalis</i>	kākā, North Island kaka	At risk (recovering)
<i>Ninox novaeseelandiae</i>	ruru, morepork	Not threatened
<i>Porphyrio melanotus</i>	pūkeko	Not threatened
<i>Prosthemadera novaeseelandiae</i>	tūī	Not threatened
<i>Rhipidura fuliginosa</i>	pīwakawaka, tīrairaka, fantail	Not threatened
<i>Tadorna variegata</i>	pūtangitangi, paradise shelduck	Not threatened
<i>Todiramphus sanctus</i>	kōtare, sacred kingfisher	Not threatened
<i>Zosterops lateralis</i>	tauhou, silveryeye, waxeye	Not threatened

3.2.2 Aquatic Ecological Values

Water Courses

The Plan Change area includes three streams which are all first order tributaries of Hingaia Stream. The Hingaia Stream is named for the chieftainess Hingaia and located mostly east of State Highway One, Drury as shown in Figure 1.

Approached from the south, the Hingaia Stream catchment begins just north of Bombay and extends east to Ararimu then north to Opāheke before turning west to the ridgeline known traditionally as Ponga Tarawa (near Drury Hills Road) and following the approximate line of Waihoe Hoe Road northwest to Drury township and the confluence with Otuwairoa (Slippery Creek). The western boundary approximately follows State Highway One until Ararimu Road, north of which three tributaries located between Great South Road and State Highway One flow northeast crossing under the highway to join the main stem of Hingaia Stream just east of the existing substation.

Hingaia Stream and its tributaries drain the southern and southwestern slopes of the peak known as Opāheke as well as the slopes of Pou Hotiki, Koeko Porowhita (Ballard's Cone), Te Maketu Pā and the area surrounding Pukekura Puna (spring) near Ramarama. The headwater streams which supply Hingaia Stream include Pou Hotiki Hīrere, Maketu Hīrere and Wihihī Hīrere as well as the three unnamed streams which drain the Plan Change area and one other unnamed tributary. Together these streams unite to form Hingaia Stream which flows north to enter Otuwairoa (Slippery Creek) near the State

Highway One Bridge over Otuwairoa. From there the Hingaia Stream discharges to Pāhekeheke Hīrere (Drury Stream) and the Pāhurehure Inlet of Te Mānukanuka o Hoturoa (Manukau Harbour).

The unnamed tributaries of Hingaia Stream within the Plan Change area have been inspected (where possible) and categorised according to the Auckland Council definitions. The stream classifications are shown in Figure 5, but it should be noted that this assessment was undertaken during unusually dry weather and not all sites could be accessed, thus there are some differences between this classification and Auckland Council's assessment of the streams. The stream classifications in Figure 5 have been used as the basis for other interrelated technical assessments and maps to support the plan change.



Figure 5: Stream categorisation of the tributaries of Hingaia Stream within the Plan Change area

As described in Section 3.1.2 above, the watercourses within the Plan Change area have been substantially altered by previous land uses. By way of example, typical current habitats along Stream 2 are shown in Plates 1 – 5 below. These plates show locations along the watercourse from upstream of Cossey Road to downstream of Fielding Road and clearly illustrate the lack of indigenous riparian cover, channelizing, the presence of aquatic weeds such as parrot's feather (*Myriophyllum aquaticum*), access to the channel by livestock at some locations and the lack of flow at the time of the site visit.



Plate 1: Stream 2 upstream of Cossey Road



Plate 2: Stream 2, downstream of Cossey Road



Plate 3: Stream 2 upstream of Fielding Road

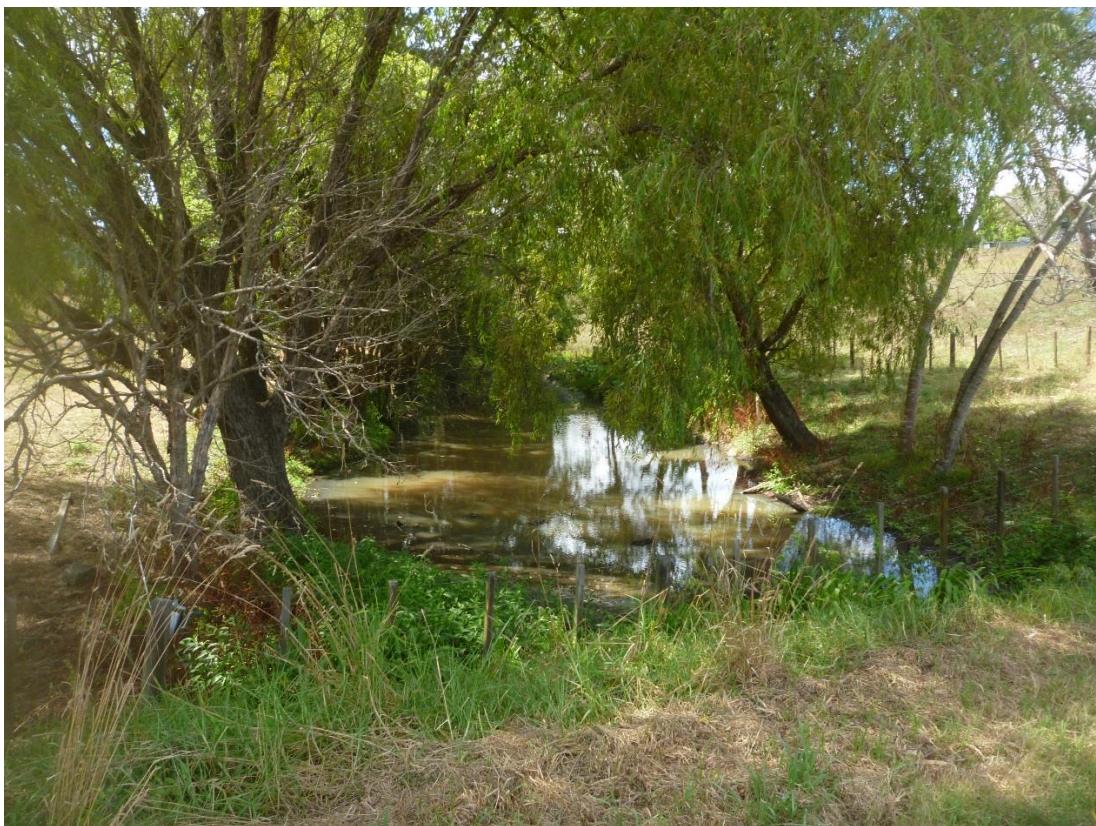


Plate 4: Stream 2 immediately upstream of Fielding Road



Plate 5: Stream 2 downstream of Fielding Road

Freshwater Fish

The search of the New Zealand Freshwater Fish Database revealed no fish have been recorded within the streams within the Plan Change area, but eight species of native fish (and no exotic species) have been recorded elsewhere in the headwaters of Hingaia Stream. These include:

- Longfin eel (*Anguilla dieffenbachii*)
- Shortfin eel (*Anguilla australis*)
- Common smelt (*Retropinna retropinna*)
- Torrentfish (*Cheimarrichthys fosteri*)
- Banded kokopu (*Galaxias fasciatus*)
- Redfin bully (*Gobiomorphus huttoni*)
- Cran's bully (*Gobiomorphus basalis*)
- Common bully (*Gobiomorphus cotidianus*).

None of these records has been obtained within the last five years. Kane-Sanderson *et al.* (2018) also noted the presence of the exotic pest fish gambusia (*Gambusia affinis*) within the catchment from surveys undertaken by Golder Associates in 2009. The location of records in the Freshwater Fish database is shown in Figure 6. Of these species recorded, longfin eel and common smelt are regarded as “At Risk (Declining)” and the other six species are regarded as “not threatened” (Dunn *et al.* 2018). The streams within the Plan Change area do not provide good habitat for any of these species at

present, although eels are likely to tolerate the present conditions. The permanent streams have the potential for restoration, which would improve aquatic habitat quality in the medium – long term.

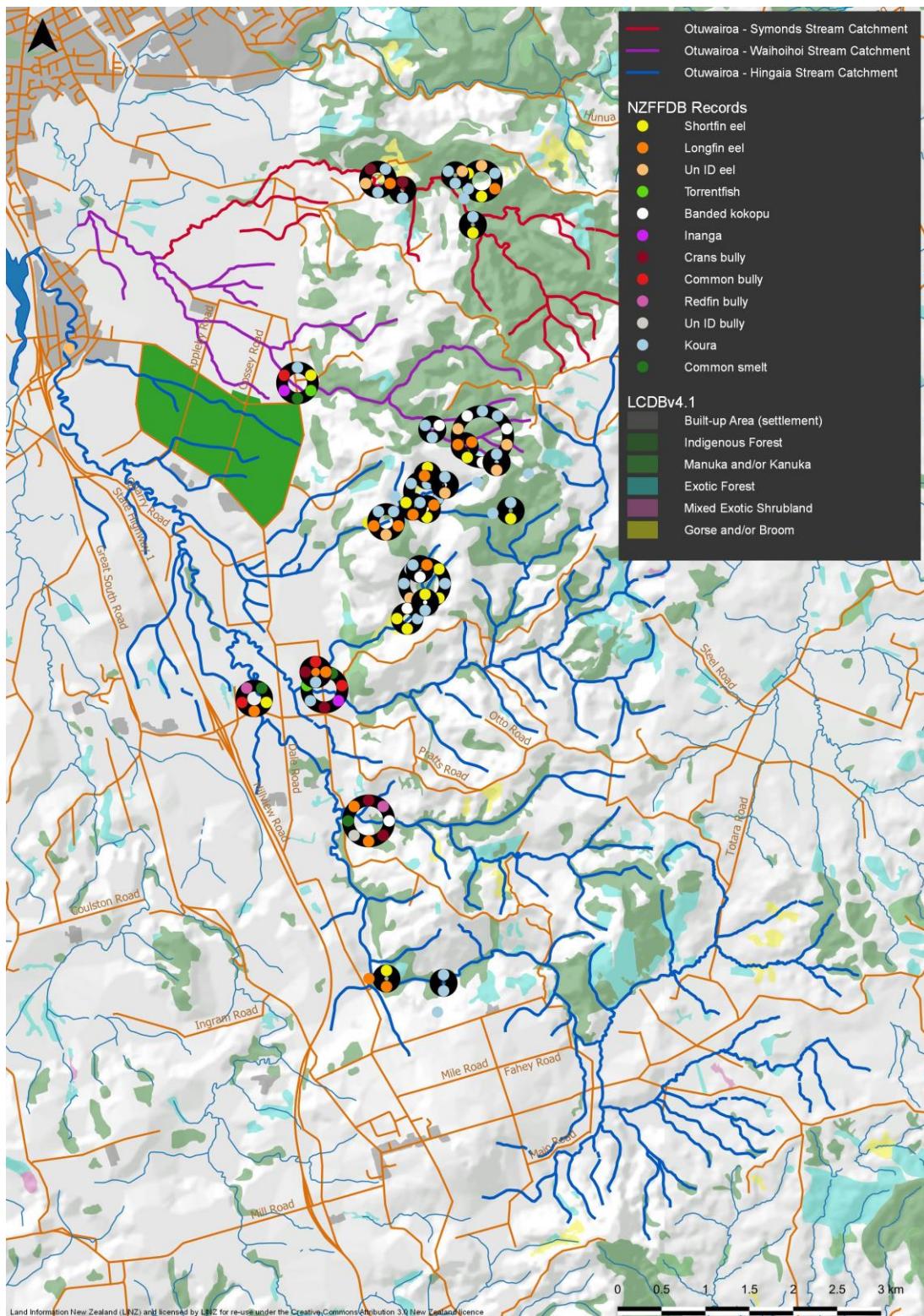


Figure 6: New Zealand Freshwater Fish Database Records for the Hingaia, Waihoihi and Symonds Streams sub catchments of the Otuwairoa catchment

4. DEVELOPMENT PROPOSAL

4.1 STREAM REMOVAL

The proposed master plan for the Plan Change area is shown in Figure 7. The proposal as shown in Figure 7 would involve the removal of approximately 655m of stream as follows:

- Approximately 188m of intermittent stream;
- Approximately 467m of permanent stream.

Roads, culverts and bridges also affect stream habitats by affecting the hydrology of the surrounding catchment and modifying the magnitude and direction of water movements as well as affecting sediment, nutrient and toxin inputs (Jones *et al.* 2000, Trombulak & Frissell, 2000), which in turn can affect aquatic biota.

Where adverse effects on waterways and/or loss of reaches of intermittent or permanent streams cannot be avoided, then that adverse effect needs to be mitigated or compensated for. The extent of such mitigation is normally calculated using the Environmental Compensation Ratio (ECR) as per the methodology outlined in Auckland Council Technical Report TR2011/009 (Storey *et al.* 2011).

The precise effects of the residential development on aquatic ecological values remain unknown and would be determined using the Environmental Compensation Ratio method (Storey *et al.* 2011) at the resource consents stage of the project when detailed design is available. Calculation of the ECR is based on Stream Ecological Valuations (SEV). The SEV uses a set of fourteen qualitative and quantitative variables to assess the integrity of stream ecological functions. The SEV assessment results in a comprehensive measure of the in-stream and riparian environment. This data is analysed using a series of formulae to derive an SEV score which ranges from 0 (no ecological value) to 1 (a pristine stream with maximum ecological value). The detailed SEV calculations would be undertaken as part of a future resource consent process in accordance with the provisions in E3 of the Auckland Unitary Plan.

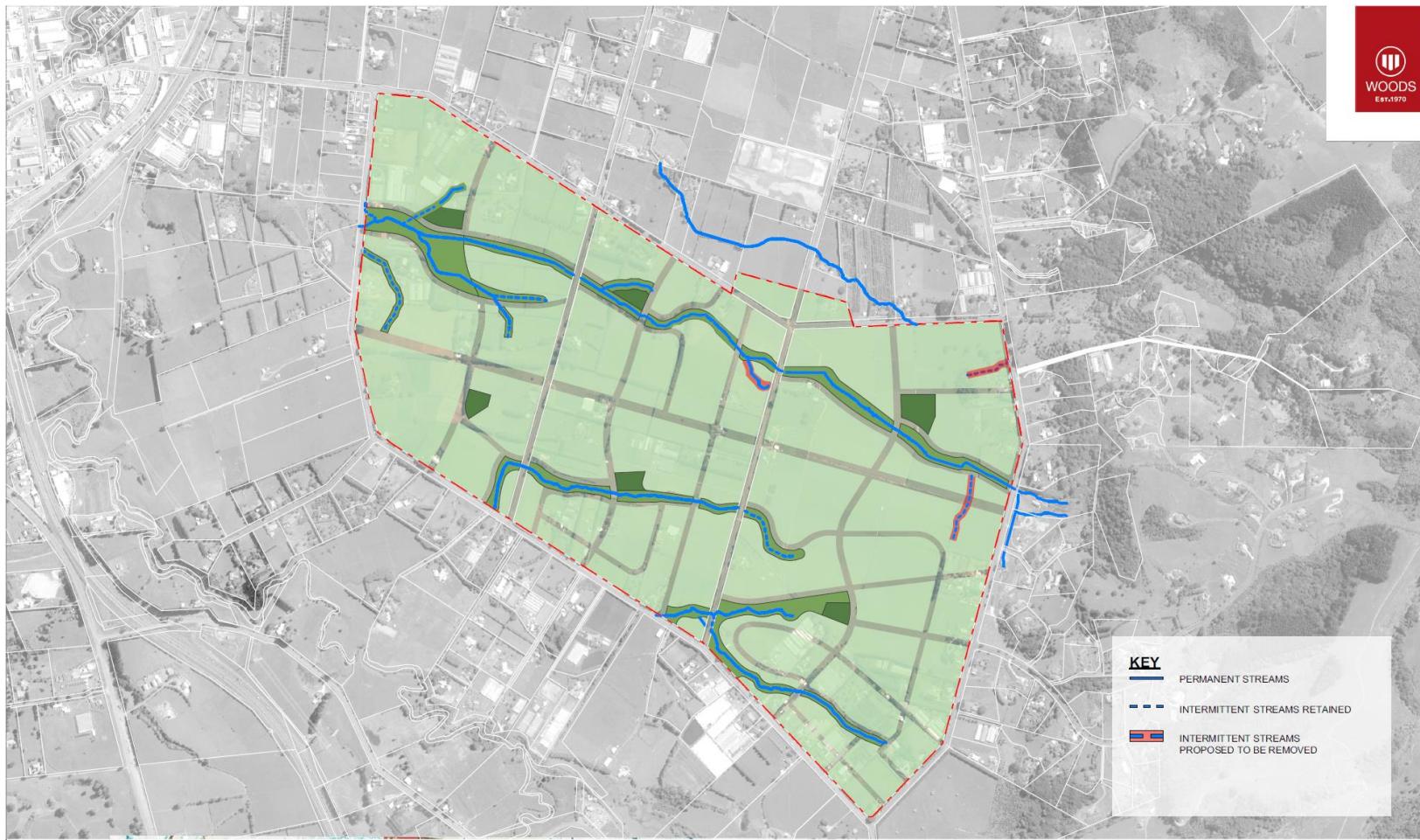


Figure 7: Proposed waterway network at Drury East

4.2 RIPARIAN PLANTING

We have recommended riparian planting of at least 10m each side of intermittent and permanent streams. Planted riparian margins must exclude walkways.

Riparian buffers of 10m either side of retained permanent and intermittent streams would require approximately 10.8ha of riparian planting across the site.

4.3 RESERVE AREAS

Figure 7 includes approximately 2.8ha of proposed parks, but does not include the proposed 2.2ha area which includes the existing forest remnant and surrounding mature trees in the northeast. The exact layout, location, purpose and desirability of reserve areas will need to be agreed with Auckland Council once more detailed design is to hand.

5. RECOMMENDATIONS

The ecological values of the Plan Change area are currently very limited, however there is considerable potential for the ecological values to be restored and enhanced across the Plan Change area as it is developed and for ecological connections to be restored across the wider area via the use of riparian and other plantings.

Section 3.7 of the Drury – Opāheke Structure Plan proposes a “blue – green network” to holistically address the rivers, floodplains, and coastal environments of the area (the “blue” aspects) and the areas of indigenous biodiversity, areas of ecological significance and the parks and reserves (the “green” aspects of the environment) and that proposal has been considered when formulating these recommendations. Ecological restoration of the site should involve:

- Retention of the existing area of indigenous vegetation near the intersection of Waihoehoe Road and Drury Hills Road (which is protected by a consent notice) and if practicable the isolated mature trees nearby. The isolated trees could form part of an open space reserve, but ideally planting would be used to connect the currently isolated trees to the existing stand and create a larger forest fragment which is geographically close to the existing SEA_T areas across Drury Hills Road and would be physically connected (via planting) to riparian areas downstream. As indicated above, the area affected including all the isolated trees and the small remnant covers approximately 2.2ha. Protection of these mature trees has a number of ecological benefits including maintaining a food source and nesting sites for local birds (particularly kererū and tūī), maintaining potential roost sites for long-tailed bats and providing a seed source for natural dispersal of locally adapted individuals elsewhere across the site. This area also includes a watercourse which would benefit from the proposal to establish forest around it and riparian planting would ecologically connect the remnant and stream with downstream vegetation and habitats improving ecological connectivity. The planting should be guided by a planting plan with the aim of restoring pūriri forest to the Plan Change area and make use of plants sourced from the Manukau Ecological District. Unfortunately, both the proposed corridors for the new Mill Road arterial route affect this area and utilisation of Corridor A in particular could result in the complete removal of the remaining forest remnant. Corridor B would bisect the area and would also likely result in vegetation removal. This matter will need to be addressed before the ecological potential of the forest remnant can be realised.
- Planting trees and other vegetation in riparian areas with the aim of increasing the current extent of forest and shrubland, protecting and buffering sensitive sites such as wetlands and forest, connecting habitats and creating a diversity of natural habitat types across the Plan Change area including kahikatea – pukatea forest and taraire – tawa – podocarp forest where appropriate. Creation of wetlands in low or poorly drained sites would also be of direct ecological benefit to local flora and fauna, including birdlife.
- Stream restoration with the aim of maintaining base flows, reducing flooding, improving water quality, reducing stream bank erosion, creating aquatic habitat, reducing water temperature fluctuations and improving fish passage and food sources for aquatic life. Actions to support this outcome would include removal of the existing ponds across the Plan Change area, creation of more natural wetlands at suitable locations (such as the reserve area near the confluence of Stream 1 and Stream 1B), reconfiguring the stream channel to create a variety of channel widths, depths and profiles and restore sinuosity, addition of wood and variably sized inorganic substrates to add to channel complexity and create refuges for fish and invertebrates, installation of fish passages where culverts and other stream crossings are created (if required), riparian planting of at least 10m each side of retained intermittent and permanent streams excluding walkways. The width of any plantings at particular locations could be varied to assist in providing habitat variation, including the creation of ecotones where appropriate.

Given the presence of native fish species elsewhere within the catchment, stream restoration of the type recommended would likely result in the recolonization of the headwater streams where habitats become suitable over the medium – long term. The presence of common native birds means these are also likely to expand across the Plan Change area as habitats improve and become suitable for them, particularly if pest control is maintained throughout the Plan Change area.

If implemented, these recommendations would result in an increase in the extent of native vegetation in the proposed plan change area and improve ecological connectivity and function. They would also buffer and connect habitats and improve water quality and aquatic habitat.

6. CONCLUSIONS

The ecological values at the Plan Change area have been adversely affected by previous land uses which have resulted in the removal of all the previously existing wetlands, almost all of the indigenous vegetation and the degradation of aquatic habitats in streams which have been dammed, diverted and channelized. There are no recognised sites of ecological significance within the affected area. The presence of a tiny (0.4ha) remnant of pūriri forest and three headwater tributaries of Hingaia Stream provide a basis upon which ecological restoration can be built.

Ecological restoration within the Plan Change area should include retention and augmentation of the remaining forest fragment (subject to the location of the proposed Mill Road arterial route), effective weed and pest control, creation of new wetlands at appropriate locations in order to attenuate flows and provide habitat as well as restoration of the streams via reconfiguring of the channels and addition of substrates to increase habitat complexity and provide refuges for fish and invertebrates. Fish passages should also be provided where required. It is most likely that there is sufficient stream habitat within the Plan Change area to be restored to compensate for the areas of stream to be lost. Riparian planting in accordance with a suitable planting plan would improve aquatic habitats, increase habitat diversity and provide ecological connection across the site for mobile species.

The Manukau Ecological District is characterised by a lack of indigenous habitats and the small to very small size and highly fragmented nature of what remains. There is good potential to increase the ecological value of the Drury East site in the medium to long term and contribute to improved local ecological diversity and connectivity by creating and restoring habitats in association with the existing forest remnant and the three headwater streams. These actions would also contribute to ecological connectivity in the wider area between the Hunua Ranges and Te Mānukanuka o Hoturoa in the medium – longer term.

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APPENDIX 1
Auckland Unitary Plan Stream Status Definitions

River or stream

A continually or intermittently flowing body of fresh water, excluding ephemeral streams, and includes a stream or modified watercourse; but does not include any artificial watercourse (including an irrigation canal, water supply race, canal for the supply of water for electricity power generation, and farm drainage canal except where it is a modified element of a natural drainage system).

Permanent river or stream

The continually flowing reaches of any river or stream.

Intermittent stream

Stream reaches that cease to flow for periods of the year because the bed is periodically above the water table. This category is defined by those stream reaches that do not meet the definition of permanent river or stream and meet at least three of the following criteria:

- (a) it has natural pools;
- (b) it has a well-defined channel, such that the bed and banks can be distinguished;
- (c) it contains surface water more than 48 hours after a rain event which results in stream flow;
- (d) rooted terrestrial vegetation is not established across the entire cross-sectional width of the channel;
- (e) organic debris resulting from flood can be seen on the floodplain; or
- (f) there is evidence of substrate sorting process, including scour and deposition.

Ephemeral stream

Stream reaches with a bed above the water table at all times, with water only flowing during and shortly after rain events. This category is defined as those stream reaches that do not meet the definition of permanent river or stream or intermittent stream.

Overland flow path

Low point in terrain, excluding a permanent watercourse or intermittent river or stream, where surface runoff will flow, with an upstream contributing catchment exceeding 4,000m².

Excludes the following areas:

- constructed depressions and pits within Special Purpose - Quarry Zone.

Artificial watercourse

Constructed watercourses that contain no natural portions from their confluence with a river or stream to their headwaters. Includes:

- canals that supply water to electricity power generation plants;
- farm drainage canals;
- irrigation canals; and
- water supply races.

Excludes:

- naturally occurring watercourses.

APPENDIX 2
EBird records within approximately 10km of the site

Ebird name		Scientific Name	Status	Number of Observations	Rank
African Dove	Collared-	<i>Streptopelia roseogrisea</i>		1	69=
Australasian Swamphen		<i>Porphyrio melanotus</i>		287	23
Australian Magpie		<i>Gymnorhina tibicen</i>		705	18
Australian Shoveler		<i>Spatula rhynchotis</i>		4	54=
Bar-tailed Godwit		<i>Limosa lapponica</i>		21	37
Black Swan		<i>Cygnus atratus</i>		7	48=
Black-billed Gull		<i>Chroicocephalus bulleri</i>		10	44=
Brown Teal		<i>Anas chlorotis</i>		2	63=
Buff-banded Rail		<i>Gallirallus philippensis</i>		6	51=
California Quail		<i>Callipepla californica</i>		139	26
Canada Goose		<i>Branta canadensis</i>		2	63=
Caspian Tern		<i>Hydroprogne caspia</i>		6	51=
Common Chaffinch		<i>Fringilla coelebs</i>		1298	8
Common Myna		<i>Acridotheres tristis</i>		1322	7
Common Redpoll		<i>Acanthis flammea</i>		1	69=
Cormorant sp.		<i>Phalacrocoracidae</i> sp.		1	69=
Domestic goose sp. (Domestic type)		<i>Anser</i> sp. (Domestic type)		2	63=
Dunnock		<i>Prunella modularis</i>		2	63=
Eastern Rosella		<i>Platycercus eximius</i>		1327	6
Eurasian Blackbird		<i>Turdus merula</i>		1569	1
Eurasian Skylark		<i>Alauda arvensis</i>		972	13
European Goldfinch		<i>Carduelis carduelis</i>		932	14
European Greenfinch		<i>Chloris chloris</i>		877	15
European Starling		<i>Sturnus vulgaris</i>		1294	9

Fernbird	<i>Megalurus punctatus</i>	1	69=
Franklin's Gull	<i>Leucophaeus pipixcan</i>	7	48=
Gray Gerygone	<i>Gerygone igata</i>	1338	5
Graylag Goose	<i>Anser anser</i>	15	42=
Great Cormorant	<i>Phalacrocorax carbo</i>	23	35
Great Egret	<i>Ardea alba</i>	3	62
House Sparrow	<i>Passer domesticus</i>	826	16
Hudsonian Godwit	<i>Limosa haemastica</i>	4	54=
Indian Peafowl	<i>Pavo cristatus</i>	2	63=
Kelp Gull	<i>Larus dominicanus</i>	47	31
Little Cormorant	Black <i>Phalacrocorax sulcirostris</i>	20	38
Little Egret	<i>Egretta garzetta</i>	1	69=
Little Pied Cormorant	<i>Microcarbo melanoleucus</i>	10	44=
Long-tailed Koel	<i>Urodynamis taitensis</i>	4	54=
Mallard	<i>Anas platyrhynchos</i>	76	28
Mallard	(Domestic type) <i>Anas platyrhynchos</i> (Domestic type)	4	54=
Mallard x Pacific Black Duck (hybrid)	<i>Anas platyrhynchos</i> x <i>superciliosa</i>	16	41
Masked Lapwing	<i>Vanellus miles</i>	623	20
New Zealand Falcon	<i>Falco novaeseelandiae</i>	4	54=
New Zealand Fantail	<i>Rhipidura fuliginosa</i>	1341	4
New Zealand Grebe	<i>Poliocephalus rufopectus</i>	26	33=
New Zealand Kaka	<i>Nestor meridionalis</i>	7	48=

New Zealand Pigeon	<i>Hemiphaga novaeseelandiae</i>	1083	11
Pacific Black Duck	<i>Anas superciliosa</i>	5	53
Paradise Shelduck	<i>Tadorna variegata</i>	57	29
passerine sp.	<i>Passeriformes</i> sp.	4	54=
Pied Cormorant	<i>Phalacrocorax varius</i>	15	42=
Pied Stilt	<i>Himantopus leucocephalus</i>	43	32
Pied x Black Stilt (hybrid)	<i>Himantopus leucocephalus</i> x <i>novaeseelandiae</i>	1	69=
Red Junglefowl (Domestic type)	<i>Gallus gallus</i> (Domestic type)	4	54=
Red Knot	<i>Calidris canutus</i>	8	46=
Red-billed Gull	<i>Chroicocephalus scopulinus</i>	26	33=
Red-breasted Dotterel	<i>Charadrius obscurus</i>	1	69=
Ring-necked Pheasant	<i>Phasianus colchicus</i>	663	19
Rock Pigeon	<i>Columba livia</i>	17	39=
Royal Spoonbill	<i>Platalea regia</i>	17	39=
Sacred Kingfisher	<i>Todiramphus sanctus</i>	1208	10
Shining Bronze-Cuckoo	<i>Chrysococcyx lucidus</i>	247	24
Silver-eye	<i>Zosterops lateralis</i>	1030	12
Song Thrush	<i>Turdus philomelos</i>	1391	3
South Island Oystercatcher	<i>Haematopus finschi</i>	22	36
Southern Boobook	<i>Ninox novaeseelandiae</i>	182	25
Spotless Crake	<i>Zapornia tabuensis</i>	1	69=
Spotted Dove	<i>Streptopelia chinensis</i>	453	22

Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	4	54=
Swamp Harrier	<i>Circus approximans</i>	777	17
Tui	<i>Prosthemadera novaeseelandiae</i>	1439	2
Variable Oystercatcher	<i>Haematopus unicolor</i>	8	46=
Welcome Swallow	<i>Hirundo neoxena</i>	597	21
White-faced Heron	<i>Egretta novaehollandiae</i>	48	30
White-fronted Tern	<i>Sterna striata</i>	2	63=
Wild Turkey	<i>Meleagris gallopavo</i>	1	69=
Wrybill	<i>Anarhynchus frontalis</i>	1	69=
Yellowhammer	<i>Emberiza citrinella</i>	125	27
Total observations	78 species or types	24665	

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