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Nelson Airport Designation Notice of Requirement

Ecological Assessment

Prepared for Nelson Airport Limited

18 August 2022

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Bibliographic reference for citation:
Boffa Miskell Limited 2022. *Nelson Airport Designation Notice of Requirement: Ecological Assessment*. Report prepared by Boffa Miskell Limited for Nelson Airport Limited.

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Status: Final	Revision / version: 2	Issue date: 18 August 2022

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Template revision: 20210624 0000
File ref: BM210724_001h_Nelson_airport_EcIA_20230225.docx

Cover photograph: Waimea Inlet alongside Nelson Golf Club, looking towards Maire Stream and Tahunanui in the distance, © Boffa Miskell, 2021

Executive summary

Nelson Airport Limited is intending to vary its designations to protect an ability to extend is main runway and is considering two options: a Northern Extension (Option A) and a Southern Extension (Option B).

Option A includes extending the main sealed runway into the adjacent (to the north) golf course land.

Option B includes extending the runway to the south across Jenkins Creek and into Waimea Inlet and to the north into the golf course land.

Boffa Miskell was engaged to carry out a high-level assessment to inform the Options Assessment of the Notice of Requirement (NOR) and identify the preferred option from an ecological perspective. This report is not intended to be a full ecological impact assessment.

The purpose of this report is to assess the ecological values within each of the two options, describe the likely ecological effects of the activity enabled by the designation, and provide recommendations on the preferred option from an ecological perspective.

At the completion of a consideration of the alternative sites, routes and methods by Nelson Airport Limited and its advisers, Boffa Miskell has also been tasked with providing recommendations based on the effects management hierarchy to avoid, minimize, remedy or mitigate adverse effects of the preferred option. Those matters will be contained in a separate report.

The ecological values assessment within this report is based on a desktop review and limited surveys of the avifauna and vegetation and terrestrial habitats present, with a focus on Option A, given the recorded statutory complexity associated with Option B as recorded in this report. No marine, freshwater or faunal surveys were carried out.

Option A: the vegetation and terrestrial habitats within Option A are highly modified and comprised of exotic plant species of generally negligible ecological value. The exception is the riparian vegetation of Maire Stream Tributary, which is of moderate ecological value. Maire Stream Tributary supports at least two indigenous freshwater fish species (longfin eel and banded kōkopu) and provides spawning habitat for īnanga. Constructed waterbodies occur within the golf course, and these may support freshwater fishes. The avifauna assemblage is dominated by introduced or native Not Threatened species. NZ pipit, red-billed gull and pied shag (all *At Risk*) were recorded on the golf course. In addition, a single bush falcon (*At Risk*) was recorded as an incidental observation while on the golf course site. In terms of the coastal habitat to the north of Option A, while providing habitat for coastal birds (including *Threatened* and *At Risk* species), the majority of this area is an off-lead dog area and as such the birds that were present were observed regularly being disturbed.

Option B: the vegetation and terrestrial habitats within Option B are also highly modified and dominated by exotic plant species of generally negligible

ecological value. The freshwater habitats within and adjacent to Option B include Jenkins Creek, Arapiki Stream and Poorman Valley Stream. These waterways support a number of indigenous freshwater fish species including *At Risk* and *Threatened* species, as well as spawning habitat for īnanga. Option B would include a c.3.6 ha reclamation of Waimea Inlet. While the ecological value of Waimea Inlet overall is high, the area of benthic habitat north and south of Monaco Peninsula is assessed as low. Moreover, this coastal marine area supports an avifauna assemblage of high ecological value, including a number of *At Risk* and *Threatened* species, and provides roosting, foraging, and nesting habitat. The Waimea Inlet is recognised as site of national and international importance for some coastal wading and shorebird species.

Options assessment: when considering the two options, Option A is preferred from an ecological perspective. This is because Option B will require reclamation of c.3.6 ha of coastal marine area (CMA) including loss of foraging habitats for *Threatened* and *At Risk* coastal avifauna species. Reclamation in the CMA is to be avoided unless there are no practical alternatives (Policy 10 of the New Zealand Coastal Policy Statement); and adverse effects of activities on *Threatened* and *At Risk* indigenous taxa must also be avoided (Policy 11(a)(i), New Zealand Coastal Policy Statement).

However, even within Option A, loss of īnanga spawning habitat and loss of freshwater length will need to be accounted for in any subsequent regional council consents for earthworks, water take and discharge (National Policy Statement for Freshwater Management, Policy 7).

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1.0 Introduction

Nelson Airport Limited (NAL) is seeking to give notice to the Nelson City Council (NCC) of its requirement for a designation to provide for the extension of its main runway to remove operational constraints experienced by existing aircraft and to support the potential operational needs of future aircraft types.

1.1 Scope

Boffa Miskell was engaged by NAL in August 2021 to carry out a high-level assessment to inform the Options Assessment of the NOR and identify the preferred option from an ecological perspective.

Section 171 (s171) of the Resource Management Act 1991 sets out the matters that need to be considered for this designation. The following s171 matters are of relevance to ecology:

- the effects on the environment of allowing the runway extension (and associated designation spatial area) (s171(1)).
- including a broad-level overview of such regarding respective statutory instruments (s171(1)(a)).
- a comparison (in terms of environmental effects) against alternative sites (s171(1)(b)).
- consideration of any positive effects on the environment to offset or compensate any adverse effects from the activity enabled by the designation (s171(1B)), or alternative conditions necessary to mitigate significant effects (s171(2)).

This high-level report is not intended to be a full Ecological Impact Assessment (EcIA) but is sufficient to inform the Options Assessment of the NOR by identifying the preferred expansion option from an ecological perspective.

This report:

- assesses, at a high level, the existing environment (Section 3.0) and ecological values (Section 4.0) within Option A (northern extension) and Option B (southern extension).
- describes the potential ecological effects of the activity enabled by Option A and Option B designation extensions (Section 5.0).
- provides high-level recommendations as to the comparative advantages (regarding ecology) between these two options and recommends the preferred option from an ecological perspective (Section 6.0).

Following this report, and at the conclusion of the multi-disciplinary consideration of alternative sites, routes and methods, Boffa Miskell will provide in a separate report based on the Option that will form the NOR. This subsequent report will provide recommendations:

- based on the effects management hierarchy to avoid, minimise, remedy or mitigate potential adverse effects of the preferred option.
- of any additional assessments or specialist surveys required to complete detailed EcIAs that may be required with any subsequent Outline Plan prepared under s176A of the

Resource Management Act to facilitate works otherwise authorised by the subsequent designation.

- of additional assessments or specialist surveys that would be required to complete detailed EcIAs to support future resource consent applications that are not anticipated to be provided for by the designation and subsequent Outline Plan process.

1.2 The options

Two options for airport extension are being considered: the Northern Runway (Option A) extension options; and the Southern Runway (Option B) extension options.

Option A (the Northern Options) includes extending the main runway length from 1,347 m to 1,510m. The proposed extension would extend the main sealed runway into the adjacent golf course land (Figure 1). A 240 m runway end safety area (RESA) will be created at each runway end, as required by Civil Aviation regulations pertaining to the extension of existing runways. The southern runway threshold would be realigned to accommodate the mandated RESA length and the main taxiway would be realigned with backtracking at the northern end to support the extended runway and mitigate noise effects for a number of dwellings adjacent to the extended runway.

Option B (the Southern Options) includes a runway extension of 163 m plus RESA, achieved by bridging across Jenkins Creek and on to NAL-owned land on Monaco Peninsula (Figure 1). As with Option A, a 240 m RESA would be created at each runway end. Option B would require reclamation of an additional c.3.6 ha in the Waimea Inlet to enable construction of the southern RESA, as well as provision of an alternative alignment of Point Road in a tunnel structure. The northern RESA would extend over the golf course land. The proposed crossing of Jenkins Creek would likely involve a bridge structure of at least 220 m in width. As above, formation of the runway would be a total length of 1,510 m. There would also be a clearway at the northern main runway end of c.275 m and a parallel taxiway extension (500 m) to the south.

Figure 1 captures this detail for the purpose of this assessment for both Option A and Option B.

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Data Sources:
- Cadastre: LINZ data service
- Designation: Airbiz

NELSON AIRPORT ECOLOGICAL ASSESSMENT

Designation Options

Date: 24 February 2023 | Revision: 1

Plan prepared for NAL by Boffa Miskell Limited

Project Manager: tanya.blakely@boffamiskell.co.nz | Drawn: BMc | Checked: TBl

Figure 1

2.0 Methodology

We used a combination of desktop review and site investigation to gather information on the existing ecological values within and adjacent to the proposed designation extension (Option A and Option B). This included a high-level assessment of the marine, freshwater, vegetation, and coastal and terrestrial avifauna values. Limited vegetation / botanical surveys and avifauna surveys were carried out; specialised surveys of other ecological matters (e.g., in-stream / aquatic or lizard communities) have not been completed as part of this work.

After the site visits and desktop review (described below), Boffa Miskell communicated its high-level options findings to NAL (in November 2021) and has subsequently prepared this report to accompany the NOR documents.

2.1 Desktop review

A desktop review was undertaken to gather information on the existing marine, freshwater, terrestrial vegetation, and coastal and terrestrial avifauna values within Option A and Option B.

The desktop review included:

- review of the two extension options (designation information received 10 August 2021).
- a desktop investigation to obtain existing information on ecological values in the vicinity of the proposed extension options, including:
    - readily available information within existing reports and literature on the ecological values in the vicinity of the airport and the Waimea Estuary.
    - data from the Ornithological Society of New Zealand's (OSNZ) atlas (Robertson et al., 2007) was collated from three 10 x 10 km grid squares (252, 598; 252, 599; 253, 599), which encompass Option A and Option B (refer to Figure 2).
    - the primary and secondary habitats[1] for each of the bird species recorded within the grid squares was obtained from Heather and Robertson (2015), along with each species' threat status according to the current New Zealand Threat Classification for avifauna (Robertson et al., 2017).
    - further literature and website searches were undertaken to obtain additional information regarding bird species known to occur within the surrounding habitats. This included the New Zealand Birds Online database, for which a species list was downloaded for Waimea Inlet (which identifies breeding species).
- GIS (spatial) databases and aerials, including:
    - Threatened Environment Classification (Walker et al., 2015).
    - ecological region and ecological district GIS layer.
    - waterways (river centre lines) shown on New Zealand Topographical Maps.
    - the NIWA-administered New Zealand Freshwater Fish database (NZFFD): this database holds records of freshwater fish distributions and occurrences based

[1] For the purpose of this report, primary habitat refers to the habitat that the species spends most of its time. Secondary habitats are other habitat types that the species may also use.

on previous surveys. The conservation status of fish species found in the NZFFD records was assessed based on the most recent conservation threat status for New Zealand's freshwater fishes (Dunn et al., 2018).

2.2 Site investigation

Dr Leigh Bull (Ornithologist, Senior Ecologist | Partner) and Scott Hooson (Ecologist | Senior Principal) visited areas within and adjacent to the proposed designation extension on 15 and 16 September 2021.

2.2.1 Vegetation and terrestrial habitats

A walk-through survey of Option A and Option B (as shown on Figure 1) was carried out to record the vegetation and habitats within these areas. During the survey:

- vegetation communities within Option A were classified using the classification system and naming conventions developed by (Atkinson, 1985) and mapped on hard copy maps.
- plant species[2] and their relative cover were recorded in each of the vegetation communities (a list of the plant species recorded during the site visit are provided in Tables A1a & A1b in Appendix 1).
- general notes were made on the structure and condition of the vegetation communities and habitats present.
- the suitability of terrestrial habitats for fauna was recorded.
- throughout the survey, photographs were taken, and a handheld Global Positioning System (GPS) was used to mark features of interest.

2.2.2 Avifauna

Targeted avifauna surveys included recording bird species present within the following habitats found within / adjacent to Option A and Option B:

- terrestrial habitats: 5-minute point counts were conducted at four sites (T1-T4, refer to Figure 3 for site locations and Appendix 2 for site photos); a total of four counts were undertaken at each site, comprising two in the morning and two in the afternoon. All birds seen and heard during each 5-minute period were recorded.
- coastal habitats: counts were undertaken at six sites (C1-C6; refer to Figure 3 for site locations and Appendix 2 for site photos); a total of four counts were undertaken at each site, comprising two during low tide and two during high tide. During each session, the coastal edge and adjacent water was scanned, and all coastal birds seen and heard were recorded.
- waterbodies: counts were undertaken at five sites (W1-W5; refer to Figure 3 for site locations and Appendix 2 for site photos); a total of four counts were undertaken at each site, comprising two in the morning and two in the afternoon. During each session,

[2] Although most exotic species were recorded, not all exotic grasses and herbs were recorded as this was not necessary for this assessment.

the waterbody and adjacent edge was scanned, and all waterbirds birds seen and heard were recorded.

In addition, any incidental observations of species of interest made outside of the targeted surveys, was recorded. Such observations could include *Threatened* or *At Risk* species, or large flocks of introduced species.

Weather conditions throughout the 2-day site visit were ideal for conducting avifauna surveys, with mild temperatures, light winds, and high cloud.

2.3 Limitations & data constraints

The following limitations and data constraints have been identified and taken into consideration for this assessment:

- limited vegetation / botanical surveys and avifauna surveys were carried out.
- specialised surveys of other ecological matters (e.g., in-stream, marine, lizard or invertebrate communities) have not been completed as part of this work.
- Drs Tanya Blakely (Freshwater) and Tommaso Alestra (Marine) did not visit the site.
- the vegetation / botanical survey was undertaken in early spring at a time when very few grasses and sedges were flowering. This made the accurate identification of some species difficult.
- OSNZ Atlas (1999-2004): the data were collected over a five-year period (1999-2004) by several people with varying levels of species identification skills. While the atlas grid square locations are fixed, there is no standardised method in terms of survey effort or coverage within each 10 km x 10 km grid square.
- seasonal variability: the data collected during the September 2021 site visit represents a snapshot of the species and habitat utilisation of the area at that time and does not account for temporal and seasonal variability that is likely to occur. As such, some avifauna species that potentially use habitats within the designation may not have been detected.
- cryptic bird surveys: while several data sources recorded cryptic marsh bird species within the wider area, surveys for these species were not conducted as part of this assessment.

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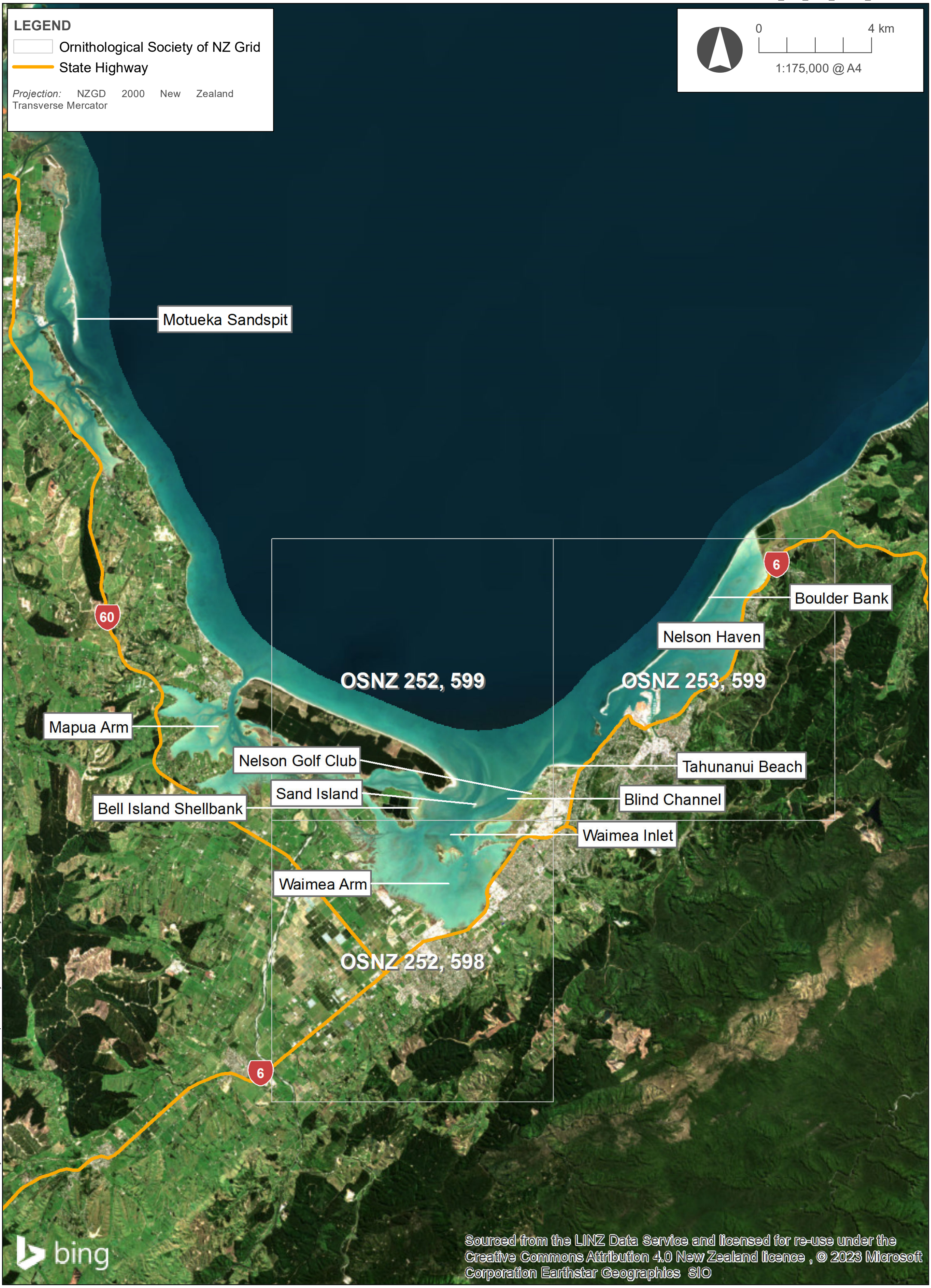

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Data Sources:
- Ornithological Grids: Ornithological Society of NZ

NELSON AIRPORT ECOLOGICAL ASSESSMENT

OSNZ Bird Atlas Grid Squares

Date: 05 October 2021 | Revision: 0

Plan prepared for NAL by Boffa Miskell Limited

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Figure 2

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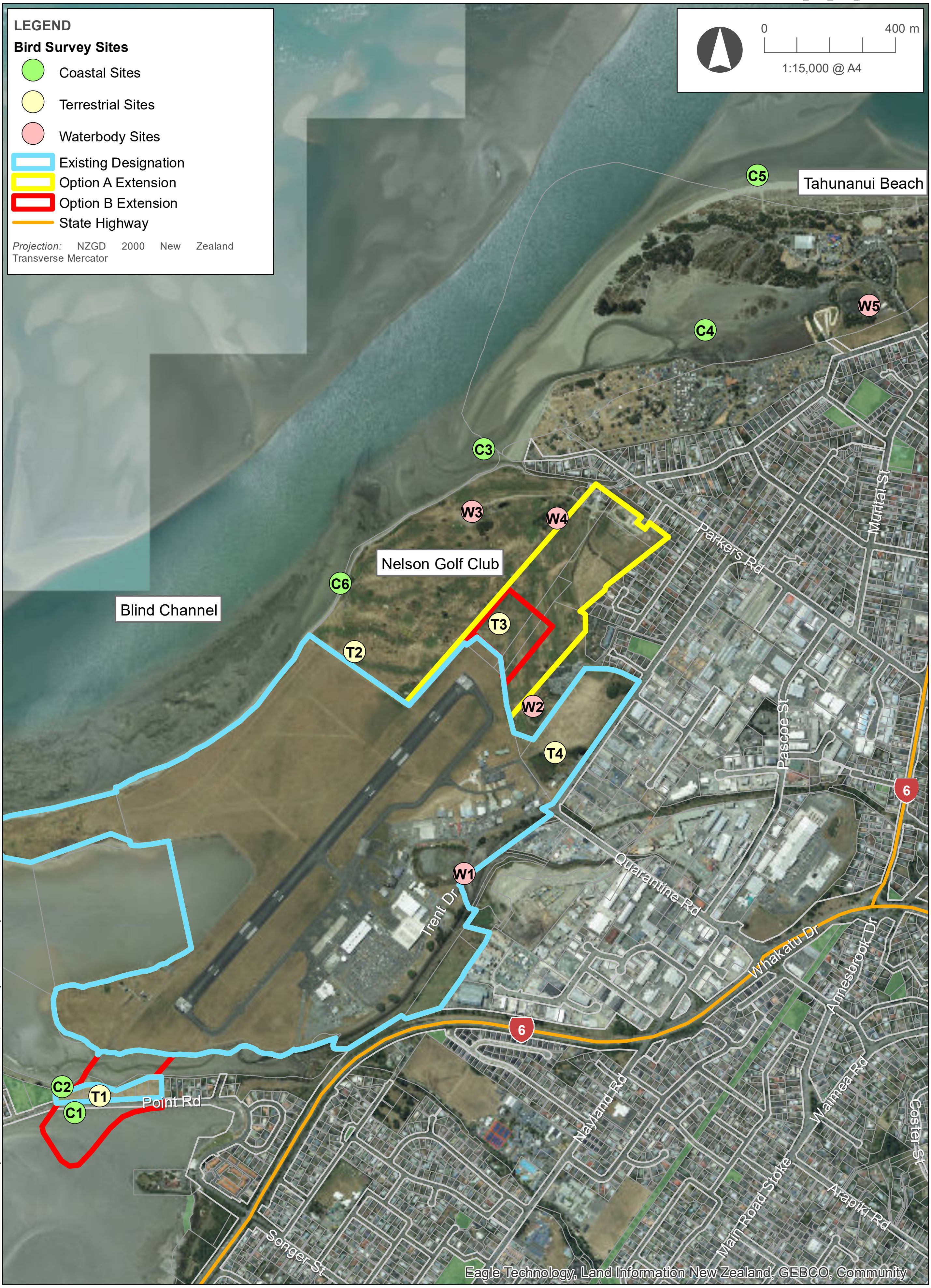

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Data Sources:
- Cadastre: LINZ data service
- Designation: Airbiz

NELSON AIRPORT ECOLOGICAL ASSESSMENT

Bird Survey Locations

Date: 24 February 2023 | Revision: 1

Plan prepared for NAL by Boffa Miskell Limited

Project Manager: tanya.blakely@boffamiskell.co.nz | Drawn: BMc | Checked: TBI

Figure 3

2.4 Assessing ecological values

In assessing ecological values of vegetation and terrestrial habitats, freshwater and avifauna, we have followed the terminology and methodology of Roper-Lindsay et al. (2018); and the criteria developed by Dr Sharon De Luca (Boffa Miskell Ltd, Marine Ecologist) for estuarine / marine environments[3].

This approach involves assessing various attributes (representative, rarity/distinctiveness, diversity and pattern, ecological context) and species known, or likely, to be present at a site or in an area.

3.0 Existing ecological environment

Nelson Airport lies to the south-west of the coastal city of Nelson and north-east of Richmond. The airport site is on low-lying (all at or below 5 m asl), reclaimed coastal land with adjacent Monaco Peninsula (to the south) and the Nelson Golf Club (to the north). The airport sits within the context of Waimea Inlet, with several waterways flowing through the adjacent landscape, including Maire Stream, Jenkins Creek and Poorman Valley Stream.

3.1 Ecological context

The airport is within the Motueka Ecological District (ED) in the Nelson Ecological Region. The Motueka ED is unusual in that it comprises two disjunct areas: the northern section of the ED incudes the lower valley floor of the Motueka River; the southern section includes the Wai-iti and Waimea Rivers. The ED lies mainly on alluvium, but also includes colluvium and beach deposits that make up the modern-day floodplains, fans, deltas, beach ridges and dunes that are typical of the ED. The topography of the ED is generally very flat to gently inclined, other than for steep terrace scarps. The Waimea section of the ED is dominated by floodplains with areas of low terrace and very minor areas of higher terrace inland. Barrier islands are comprised of sandy deposits that form beach rides and dunes. Soils are typically free-draining, other than for the clay-rich section of Waimea alluvium that lies between Appleby and Richmond. Sandy soils on coastal dunes are excessively well drained (McEwen, 1987; North, 2014).

Tall forests dominated by podocarps with some beech and hardwoods would originally have dominated most of the ED, with lowland totara, matai, and kahikatea with frequent black beech and some silver beech. Limited areas of inland swamp would have occurred along former channels and backwaters of the major rivers. Swamps would have been extensive in coastal and semi-coastal areas, grading into saltmarsh. A band of coastal scrub is likely to have occurred along the littoral margin and dune vegetation would have occurred locally (North, 2014).

[3] No regional or national guidelines or criteria have been developed to date in New Zealand, for the assessment of marine ecological values. The criteria used in this assessment have been developed by Dr Sharon De Luca, (Boffa Miskell Ltd, Marine Ecologist), to guide valuing estuarine environments and to provide a transparent and repeatable approach. This approach has been used and accepted in previous Board of Inquiry consenting processes, including for major roading projects for NZTA Projects: Pūhoi to Warkworth, Waterview Connection, Transmission Gully, Mackays to Peka Peka and East West Link.

Almost all the original indigenous vegetation cover has now been removed. Only very small remnants of podocarp forest and lowland hardwood forest survive where they occur on alluvial substrates. Coastal scrub, which is dominated by manuka is also very rare. Inland swamps have been drained, but some coastal freshwater wetlands remain. Saltmarshes are still reasonably extensive around the estuaries, and in particular, the Waimea and Motueka River deltas (North, 2014).

In terms of the Threatened Environment Classification 2012[4], the Project Site is within a land environment classified as having <10% indigenous cover left (J1.1b) (Walker et al., 2015).

3.2 Vegetation and terrestrial habitats

The following describes the vegetation and terrestrial habitats found within the Option A and Option B extensions; vegetation and terrestrial habitats found within the existing NAL Designation are excluded from these descriptions.

3.2.1 Option A extension

The vegetation and terrestrial habitats within Option A are almost entirely mown exotic grassland within the Nelson Golf Club (Figure 4).

Exceptions to this are:

- a built-up, largely unvegetated area at the northern end of Option A comprised of residential buildings, sheds and gravelled or sealed driveways and parking areas (this area is not described further).
- a highly modified area of exotic vegetation to the west of the northern end of the runway used to dump vegetation from the golf course.
- a tidal waterway called Maire Stream Tributary in the north-eastern part of Option A.

Each of these vegetation communities or habitats is described briefly below and their locations are shown Figure 4. The tidal waterway is also discussed in Section 3.3.1.1.

3.2.1.1 Exotic grassland

The mown exotic grassland on the golf course (Photo 1) is generally closely mown annual poa-browntop grassland on the fairways and mown (but taller) Chewings fescue-perennial ryegrass grassland in areas of rough; the composition of these grasslands is variable. Characteristic species recorded in exotic grassland within Option A were the grasses poa annua, browntop, Chewings fescue, perennial ryegrass as well as a wide range of exotic herbs including broad-leaved plantain, yarrow, white clover, catsear, dandelion, bellis daisy, chickweed, parsley piert, mouse ear chickweed, field speedwell and celery-leaved buttercup.

There are a small number of trees within the mown exotic grassland on the golf course within Option A. These trees have been planted for amenity purposes and include three strawberry trees, a single Eucalypt, a single laurel magnolia and a silver birch. All are exotic.

[4] The Threatened Environment Classification 2012 is a combination of three national databases: Land Environments of New Zealand, Land Cover Database (Version 4.0) and the Protected Areas Network. It shows how much indigenous vegetation remains within land environments, how much is legally protected, and how the past vegetation loss and legal protection are distributed across New Zealand's landscape.

3.2.1.2 Exotic vegetation west of the northern end of the runway

West of the northern end of the runway is an area used to dump vegetation from the golf course (Photo 2). This area has been highly modified by machinery and is comprised of cleared bare sandfield and piles of soil and green waste. Surrounding this area are patches of gorse, Scotch broom and tree lupin shrubland and rank exotic grassland with typical exotic herb species. There is a single young grey willow tree and a single young crack willow tree in an area of pooled water in an excavated pit.

3.2.1.3 Maire Stream Tributary

Maire Stream Tributary flows through the north-eastern part of Option A. The freshwater values of this waterway are described in Section 3.3.1.1. The riparian zone along this waterway supports indigenous dominated saltmarsh vegetation, comprised of frequent patches of glasswort, occasional patches of Caldwells clubrush, Batchelors button, and sea primrose; infrequent oioi, occasional sea rush and saltmarsh ribbonwood occur on the upper banks of the waterway (Photo 3). There were two plants of *Austrostipa stipoides* and an area of three-square near the upstream end of a short tributary of this waterway, which drained golf course land from the south (towards the airport) (Photo 4). The exotic herbs buck's horn plantain and sand spurrey occurred in infrequently inundated areas within the riparian zone. These saltmarsh communities were dominated by indigenous species. On the upper banks, a narrow band of rank exotic tall-fescue-cockfoot-prairie grass grassland with some Chewings fescue and a low diversity of exotic herbs occurred, with very infrequent exotic shrubs including gorse, Scotch broom and tree lucerne.

3.2.2 Option B extension

The only terrestrial vegetation and habitats within Option B are entirely exotic grassland, within in the RESA on the Nelson Golf Club land (Figure 4).

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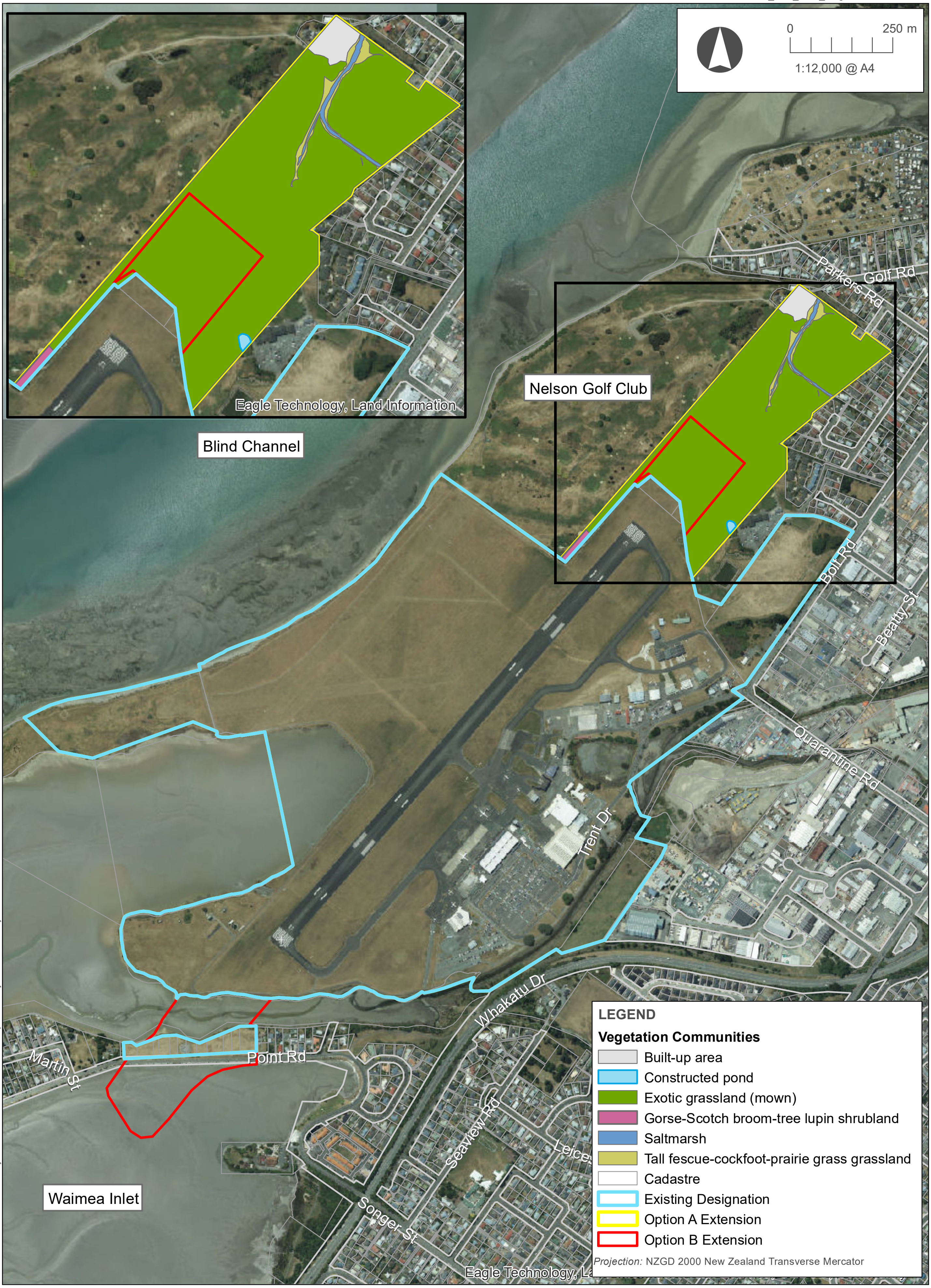

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Data Sources:
- Cadastre: LINZ data service
- Designation: Airbiz

NELSON AIRPORT ECOLOGICAL ASSESSMENT

Vegetation communities within Options A & B

Date: 24 February 2023 | Revision: 2

Plan prepared for NAL by Boffa Miskell Limited

Project Manager: tanya.blakely@boffamiskell.co.nz | Drawn: BMc | Checked: TBl

Figure 4

Photo 1: Mown exotic grassland on the golf course

Photo 2: Vegetation dumping area west of the northern end of the runway

Photo 3: Saltmarsh vegetation in Maire Stream Tributary

Photo 4: Saltmarsh vegetation in a short tributary of Maire Stream Tributary (to the south)

3.3 Freshwater

Waimea Inlet (discussed below in Section 3.4) receives freshwater inputs from 22 rivers and streams, which drain residential, industrial and rural catchments (Stevens et al., 2020).

There are numerous coastal waterways within the immediate surrounds of the existing airport and golf course, and Option A and Option B (Figure 5). The freshwater ecological values within the two options are described below. These values are entirely based on limited existing information; these were not surveyed during the site investigations.

3.3.1 Option A extension

The freshwater habitats within Option A include constructed waterbodies on the golf course, and the lower, tidal reaches of Maire Stream and Maire Stream Tributary (Figure 5).

The vegetation and avifauna values of these freshwater habitats are described in Section 3.2 and Section 3.5, respectively.

3.3.1.1 Maire Stream and Maire Stream Tributary

Maire Stream and Maire Stream Tributary flow in an easterly direction for approx. 3 km from Waimea Road, Bishopdale, to Blind Channel just south of Tāhunanui Beach. Maire Stream

Tributary sits within the Nelson Golf Club. These waterways drain residential areas (including a residential area under construction).

The lower reaches of these waterways are tidal; water or habitat quality is not routinely monitored by the Nelson City Council. While channelised and relatively modified due to urban development and golf course activities, there are recent (2012) records of banded kōkopu and longfin eel in the NZFFD, found upstream of State Highway 6 (SH6) / Tāhunanui Drive[5]. Banded kōkopu and longfin eel are endemic to (found only in) New Zealand. Banded kōkopu is one of the five migratory galaxiid species, spending most of its life in freshwater habitats; the juvenile stages of these five migratory galaxiid species return to freshwater after larvae rear in the marine environment. The returning fry are collectively referred to as whitebait. Longfin eel is a long-lived freshwater fish species, spending many decades in freshwater habitats before migrating to sea to spawn and complete its lifecycle. Maire Stream immediately upstream of the confluence with Maire Stream Tributary is also listed as potential īnanga spawning habitat[6] (Figure 5). Longfin eel and īnanga are *At Risk – Declining* species (Dunn et al., 2018).

Olley & Kroos (2014) comment that Maire Stream is notable for its extremely high numbers of banded kōkopu, and that it is probable that this species spawns in Maire Stream.

There are numerous human-made barriers (e.g., culverts) to fish passage in the lower reaches, as well as (natural barriers) bedrock waterfalls and shoots upstream of Annesbrook Drive (Olley & Kroos, 2014).

3.3.1.2 Constructed waterbodies

The values of the constructed waterbodies as habitats for freshwater fauna is unknown. These ponds are not thought to be connected to other freshwater habitats or the sea, so are unlikely to support populations of short-lived migratory freshwater fish; however, non-migratory species (such as upland bully) and long-lived species such as shortfin eels may be present. A part of one of these constructed ponds is within Option A, located immediately south of the Golf Club building. This pond, which has been constructed for amenity purposes, supports exotic dominated vegetation including water lilies within the pond and a dense band of irises around the margins. Exotic grasses and herbs, including creeping buttercup and creeping bent, and the rushes soft rush and jointed rush, were also present on the margins.

3.3.2 Option B extension

The freshwater habitats within and adjacent to Option B include Jenkins Creek and its tributaries, Arapiki Stream and Poorman Valley Stream (Figure 6). Option B extension also includes a RESA with the Nelson Golf Club land. This would include activities nearby, but not within Maire Stream Tributary (see Section 3.3.1.1).

Again, the vegetation values of these freshwater habitats are described in Section 3.2 and Section 3.5.

Jenkins Creek and Poorman Valley Stream originate approx. 7 km upstream (west) at Jenkins Hill, flowing east before converging and flowing south to Waimea Inlet. Arapiki Stream joins these waterways, originating approx. 2.5 km east and draining residential development. These three waterways converge and flow to Waimea Inlet between the existing airport boundary and Monaco Peninsula. The lower reaches of these waterways are tidal; water quality and

[5] https://nelsoncity.maps.arcgis.com/apps/webappviewer/index.html?id=0550cc5d9bb14f4788dead870edbe78a

[6] http://www.nelson.govt.nz/assets/Environment/Downloads/Water/freshwater-fish-monitoring/GIS-ENVIROMENT-PROGRAMMES-Fish-Species-Sightings-Stoke-Streams.pdf

macroinvertebrate and fish communities are routinely monitored by the Nelson City Council in Jenkins Creek and Poorman Valley Stream, but not Arapiki Stream.

3.3.2.1 Jenkins Creek

Jenkins Creek flows down the Enner Glynn Valley, through residential and industrial areas, being joined by Arapiki Stream and Poorman Valley Stream, and eventually flowing into the tidal reaches of Waimea Inlet.

Nelson City Council monitors one site in Jenkins Creek, at Pascoe Street. Water quality information collected includes *Escherichia coli*, water clarity and turbidity (measures of suspended fine sediments), and an array of nutrient parameters.

The 5-year median for *E. coli* is 425 n / 100 ml, putting it in the worst 25% of all sites monitored (www.lawa.org.nz). *E. coli* is a bacterium that is commonly found in the gut of animals and people and that naturally occurs in freshwater and is not usually harmful unless found in high concentrations. Of the other parameters regularly measured and reported by LAWA[7], clarity is good (best 50%), while turbidity (worst 50%), total nitrogen (worst 50%), ammoniacal nitrogen (worst 50%), dissolved reactive phosphorus (DRP) (worst 50%) and total phosphorus (worst 50%) are all indicative of poor water quality.

Nelson City Council monitors the macroinvertebrate community annually at this site, usually in November or December. Macroinvertebrates (e.g., freshwater insects, freshwater crayfish and mussels, snails and worms) can be extremely abundant in streams and are an important part of aquatic food webs and stream functioning. Macroinvertebrates vary widely in their tolerances to both physical and chemical conditions, and are therefore used regularly in biomonitoring, providing a long-term picture of the health of a waterway.

Using the macroinvertebrate community found in a stream / at a site, the Macroinvertebrate Community Index (MCI) can be calculated to give an overview of stream health. Higher scores indicate higher stream or ecological health.

MCI scores calculated over the last 9 years show Jenkins Creek is of “poor” to “fair” ecological health (www.lawa.org.nz).

Olley & Kroos (2014) describe the lower, tidal reaches of Jenkins Creek as degraded, with steep banks and poor water quality. Despite this, the NZFDD shows records of a number of fish species present in Jenkins Creek, including shortfin and longfin eel, kōaro, banded kōkopu, īnanga (all migratory galaxiid species), upland bully, common bully, and brown trout. Freshwater crayfish (kēkēwai) and freshwater shrimp are known to occur in the waterway.

Both species of eel, kōaro, banded kōkopu, and īnanga are obligate migratory species, requiring free access between freshwater and marine habitats to complete their lifecycles. Longfin eel, kōaro, īnanga and kēkēwai are classified as *At Risk – Declining* (Dunn et al., 2018). While species diversity of freshwater fish is lower than Poorman Valley Stream, Jenkins Creek is notable for some very large longfin eels, with some individuals greater than 1 m in length (Olley & Kroos, 2014).

The lower reaches of Jenkins Creek are listed as potential īnanga spawning habitat[6] (Figure 5).

3.3.2.2 Poorman Valley Stream

Nelson City Council monitors two sites in Poorman Valley Stream; one site is in the upper catchment, the other downstream near the confluence with Jenkins Creek.

[7] Land, Air Water Aotearoa (LAWA)

The 5-year median for *E. coli* is 92 n / 100 ml, putting it in the best 50% of all sites monitored (www.lawa.org.nz). Clarity (best 25%) and turbidity (best 50%) are good, while total nitrogen (worst 50%), nitrate nitrogen (worst 50%), DRP (worst 50%) are all indicative of poor water quality.

The annual macroinvertebrate community monitoring indicates “poor” to “fair” ecological health (based on the MCI scores) (www.lawa.org.nz).

There are a number of fish species present in Jenkins Creek, including shortfin and longfin eel, kōaro, banded kōkopu, giant kōkopu, and īnanga (all migratory galaxiid species), upland bully, common bully, redfin bully and giant bully, and brown trout. Freshwater crayfish (kēkēwai) and freshwater shrimp are known to occur in the waterway[6].

In addition to these species, Olley & Kroos (2014) also recorded yelloweye mullet and black flounder in the lower reaches; bluegill bully and lamprey (kanakana) are also found in the waterway.

Longfin eel, kōaro, īnanga, giant kōkopu, bluegill bully and giant bully, and kēkēwai are classified as *At Risk – Declining*; kanakana is *Threatened – Nationally Vulnerable* (Dunn et al., 2018).

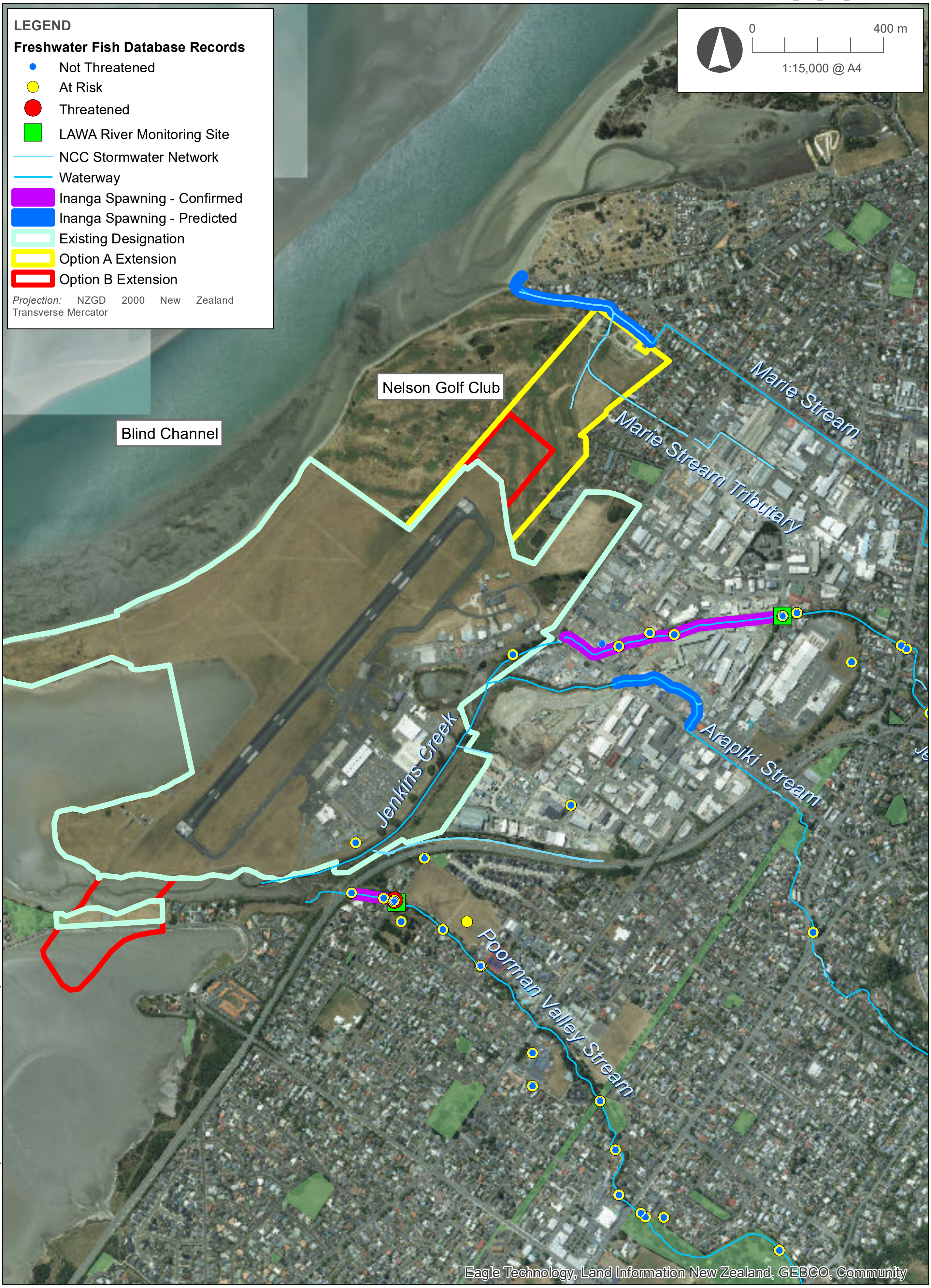
The fish community upstream of the quarry within the bush catchment beyond Marsden Valley Road is unknown, but may include kōaro, and possibly shortjaw kōkopu (Olley & Kroos, 2014). Shortjaw kōkopu is *Threatened – Nationally Vulnerable* (Dunn et al., 2018).

The lower reaches of Poorman Valley Stream are listed as potential īnanga spawning habitat (Figure 5).

3.3.2.3 Apariki Stream

Water or habitat quality, and the macroinvertebrate community are not routinely monitored by the Nelson City Council. However, there are recent records of freshwater fishes in the waterway, including shortfin eel, longfin eel, common bully, redfin bully and īnanga.

A substantial length of Arapiki Stream is culverted or piped and numerous fish passage barriers are present (Olley & Kroos, 2014).



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Data Sources:
- Fish records: NZ Freshwater Fish Database
- Cadastre: LINZ data service
- Waterways: NCC Top of the South online maps
- Designation: Airbiz

NELSON AIRPORT ECOLOGICAL ASSESSMENT

Freshwater Ecology

Date: 24 February 2023 | Revision: 2

Plan prepared for NAL by Boffa Miskell Limited

Project Manager: tanya.blakely@boffamiskell.co.nz | Drawn: BMc | Checked: TBI

Figure 5

3.4 Marine

Waimea Inlet is one of the largest estuaries in New Zealand, with an area of c.3,460 ha and an internal coastline of approximately 65 km. The Inlet is dotted by ten islands, which cover approximately 296 ha. It contains approximately 3,307 ha of intertidal area and c.150 ha of subtidal channels (Davidson & Moffat, 1990; Stevens & Robertson, 2014). The intertidal area consists of extensive sand and mud flats fringed by saltmarsh. The Inlet comprises two main intertidal basins, each with side arms and embayments. There are two entrances to the Inlet at opposite ends of Rabbit Island; the island forms a barrier between the Inlet and Tasman Bay. Due to its shallow configuration (mean depth 1-2m at high tide) and large tidal range (3.7 m during spring tides), most of the Waimea Inlet drains at low tide, with rapid flushing rates resulting in residence times shorter than one day (Robertson et al., 2002; Stevens & Robertson, 2014; Walls, 2006).

Waimea Inlet is listed in Schedule 25D of the Tasman Resource Management Plan (TRMP) as an area (Area 22) with nationally significant ecosystem values. These values include the Inlet's status as the largest barrier-enclosed estuary in the South Island. The Inlet is also described by the Department of Conservation (DOC) as a good representative example of a shallow estuary, a wetland type characteristic of New Zealand (Cromarty, 1996).

3.4.1 Wider context

3.4.1.1 Water quality

Waimea Inlet is seawater dominated and freshwater contributions are minor in comparison to the volume of the tidal component (Robertson et al., 2002). The main freshwater inflow to the Inlet is from Waimea River. Freshwater inputs carry nutrients, suspended solids and contaminants to the Inlet. Further sources of water contamination include the Bell Island wastewater treatment plant, stormwater outfalls and other forms of land runoff (Morrisey & Berthelsen, 2017).

Information about water quality in the Waimea Inlet is scarce because of the lack of an estuarine water quality monitoring program in the Nelson region. The available information indicates that the Inlet waters have a high-moderate enrichment status. This translates in moderate-to-high vulnerability to adverse ecological effects, such as macroalgal and phytoplankton blooms. However, such impacts seem to be largely prevented by the rapid tidal flushing (Gillespie & Berthelsen, 2017). The Waimea Inlet is considered moderately vulnerable to water contamination by toxicants from urban, industrial and agricultural runoff (Stevens & Robertson, 2017). Water clarity is poor because of the constant resuspension of muddy sediments (Stevens & Robertson, 2010).

3.4.1.2 Benthic habitat quality

Waimea Inlet is relatively muddy, with almost half of the intertidal sediments having >50% mud content (a very high proportion compared to other New Zealand estuaries; (Stevens et al., 2020; Stevens & Robertson, 2014). Muddy sediments are located in the inner areas of the central basins and in sheltered embayments of both the east and west arms. There was little change in the spatial extent of muddy areas between 1990 and 2020, indicating that mud accumulation is largely the result of historical catchment development, exacerbated by the presence of post-glacial silt deposits within the catchment (Stevens et al., 2020). Sand, gravel and shell ash are found under the mud, suggesting that the estuary would have been dominated by coarse sediments and shellfish prior to catchment development (Stevens & Robertson, 2011). Sand-dominated sediments are still widespread in the seaward side of the Inlet, which is better flushed by tidal exchanges (Stevens et al., 2020).

Muddy sediments are often associated with poor oxygenation and elevated concentrations of nutrients and organic matter. However, the available information shows that sediments in the Waimea Inlet have low-moderate levels of nutrient and organic enrichment and moderate oxygenation. Heavy metal contamination is also below concentrations considered harmful to aquatic life (Stevens & Robertson, 2014).

3.4.1.3 Aquatic life

Waimea Inlet marine ecosystem is characterized by a variety of habitat types, some of which are uncommon in estuarine contexts, and support a great diversity of marine/estuarine organisms. Sparse meadows of the seagrass *Zostera muelleri* (the only seagrass species in New Zealand and classified as *At Risk – Declining*; de Lange et al., 2018) cover about 2% of the intertidal area (approximately 64 ha) and are located near the well-flushed entrance channel and central basin of the eastern side of the Inlet. There has been a 60% decrease in the extent of seagrass meadows since 1990, most likely driven by poor water clarity and mud accumulation on the seabed (Stevens et al., 2020). Macroalgae (mostly the typical estuarine species *Gracilaria chilensis* and *Ulva* spp.) are scarcely abundant and rarely produce nuisance blooms (Stevens et al., 2020).

Salt marsh is a significant feature of the estuary and occupies 10% of the intertidal area (approximately 300 ha). Salt marsh is dominated by herbfield (primarily glasswort, *Sarcocornia quinqueflora*) and rushland (primarily searush, *Juncus kraussii*), with less extensive areas of tussockland, estuarine shrubs, sedgeland, and reedland. The most extensive areas of saltmarsh are located along the estuarine margins in proximity of the Waimea River, and at the head of the arms in the western side of the estuary. The current extent of salt marsh is a fraction of its original distribution, with historical and ongoing drainage, reclamation, margin development and channelization resulting in significant displacement of this habitat type. The available information shows a 21% reduction (approximately 74 ha) in salt marsh cover between 1946 and 2020, but the most extensive losses of coastal vegetation occurred before 1946 (Stevens et al., 2020; Stevens & Robertson, 2014).

The sediments of the Inlet host a range of over 100 species of benthic invertebrates. Infaunal communities are generally characterized by species that are both sensitive (e.g., cockles and pipis) and tolerant (e.g., polychaetes) to habitat degradation (i.e., increased mud concentrations). Infaunal communities have moderate abundance and diversity of species and their composition is consistent with other New Zealand estuaries (Stevens & Robertson, 2014; Walls, 2006). A large reduction in the abundance of species highly sensitive to mud/organic enrichment (e.g., pipis) has occurred between 2001 and 2014 (Stevens & Robertson, 2014). Remaining cockle and pipi beds are scattered around the eastern side of the Inlet.

While most of the Inlet is dominated by intertidal sand and mudflats, areas with high water flow close to the Inlet entrances support small pockets of biogenic habitats, including oyster/mussel reefs, tubeworm mounds and sponge gardens. Although relatively scarce, these habitats support a variety of other organisms and are uncommon estuary features.

Over 30 species of marine fish and 10 species of freshwater fish have been recorded in Waimea Inlet. Most marine fish move in an out of the Inlet depending on the state of the tide (e.g., kahawai, gurnard and snapper), but some spend their juvenile or adult life in the Inlet (e.g., grey mullet, sand flounder and sole). Waimea Inlet provides favourable habitat for young fish, which makes it an important nursery ground for snapper and rig (Davidson & Moffat, 1990; Walls, 2006). Many New Zealand freshwater fish species migrate between fresh and salt water at some stage of their life history, with estuaries such as Waimea Inlet providing an essential link in their life cycle.

3.4.2 Option A extension

Located in proximity of the main entrance of Waimea Inlet, the marine habitats adjacent to Option A are characterized by fast water flow, with benthic substrates dominated by sand and cobble fields. These habitats are likely to support diverse and abundant invertebrate communities. Dense seagrass meadows are present all along the coast west of the airport, while saltmarsh is absent. Artificial hard substrates (seawalls and revetments) are likely colonized by a small number of common estuarine species including limpets, barnacles and ephemeral green algae.

3.4.3 Option B extension

The benthic habitat north and south of the Monaco Peninsula, which would be permanently reclaimed as part of the southward airport expansion, is located within sheltered embayments and characterized by very high mud content (>90%; Stevens et al., 2020). Mud-dominated embayments are common across the Inlet. No information is available about infaunal communities around the Monaco Peninsula but, given the high mud content, the abundance and diversity of the animals living within the seabed is likely to be low, and sensitive species such as cockles and pipis are unlikely to be abundant. Seagrass and macroalgae are not present. Saltmarsh cover on the estuary margins is minimal and limited to herbfields. Artificial hard substrates (seawalls and revetments) are likely colonized by a small number of common estuarine species including limpets, barnacles and ephemeral green algae.

Surrounding the Monaco Peninsula are areas of faster water flow, characterized by sandy substrates and crossed by subtidal channels, which are known to support uncommon biogenic habitats such as sponge gardens and tube worm mounds, and are likely to allow the development of richer and more diverse infauna compared to sheltered embayment.

3.5 Avifauna

3.5.1 Wider context

A total of 90 bird species were recorded within the three OSNZ atlas squares which cover an area of 300 km^2 and encompass Option A and Option B (refer to Appendix 3 for species list which includes scientific names, threat classification and primary habitats). Those 90 species comprise 57 native species, 19 introduced, two colonisers, eight migrants and four vagrants. However, the area over which this data was collected incorporates a variety of habitat types, including coastal / oceanic, estuarine, freshwater, urban, farmland and forest (both native and exotic); which in part explains the high diversity of bird species. Therefore, not all of the 90 species recorded will occur within the airport designation or Option A or Option B extensions. Field work was carried out to confirm which of the 90 species do, or are likely to be, present.

Nelson Haven, Tahunanui Beach, Sand Island off Nelson Airport and Waimea Inlet are important areas for waders and coastal birdlife, a number of which are classified as *Threatened* or *At Risk*.

Nelson Haven is a large (1,600 ha) estuary, providing habitat for a diverse range of birdlife. A small number of variable oystercatcher (VOC; *At Risk – Recovering* (Robertson et al., 2017)) nest along the Boulder Bank, while banded dotterel (*Threatened – Nationally Vulnerable*) breed on adjacent areas. Gulls and white-fronted tern (WFT; *At Risk – Declining*) also breed on the Boulder Bank.

Waimea Inlet covers approximately 3,460 ha and comprises two major tidal areas, Mapua Arm and Waimea Arm (Owen & Sell, 1985). Owen & Sell (1985) recorded 75 bird species during their surveys of the Waimea Inlet, comprising 52 estuarine species on the tidal flats and saltmarsh, and 23 non-estuarine species at the inlet and on the immediate shoreline.

At mean low water, approximately 95% of the Waimea Inlet is exposed as intertidal mudflats and shellbeds, providing a wide expanse of intertidal zone on which estuarine birds feed (Owen & Sell, 1985). At high tide bird habitat reduces to a small group of islands varying in size and vegetative cover, and coastal high tide roosts.

Schuckhard & Melville (2013) reported that Tasman Bay hosted an average of about 12,000 birds (maximum 15,000) in summer (February), with the highest numbers recorded from Motueka Sandspit (about 5,000 on average; maximum of 7,500) and East Waimea Inlet (about 4,100 birds on average; maximum of 6,000). In terms of species composition in Tasman Bay, South Island pied oystercatcher (SIPO; *At Risk –Declining*) comprised 48% of all shorebirds during the summer (February) and 69% in winter (June), whereas in spring (November) bar-tailed godwit (*At Risk –Declining*) comprised about 63% of all shorebirds present (Schuckard & Melville, 2013). Schuckhard & Melville (2013) identified the East Waimea Inlet as being a site of international importance for VOC, SIPO and wrybill (*Threatened – Nationally Vulnerable*), and of national importance for red knot (*Threatened – Nationally Vulnerable*) and bar-tailed godwit.

Main high tide roosting sites within the Waimea Inlet include Bell Island Shellbank, Sand Island off Nelson Airport and Motueka Sandspit. Sand Island also supports breeding VOC, white-fronted tern, red-billed gull (*At Risk – Declining*) and black-billed gull (*Threatened – Nationally Critical*) (Schuckard & Melville, 2013).

The Waimea estuary also provides habitat for the *Threatened* white heron and Australasian bittern, and the *At Risk* banded rail (Owen & Sell, 1985).

3.5.2 Immediate surrounds

During the September 2021 avifauna surveys, coastal, freshwater and terrestrial habitats were surveyed in the immediate surrounds of Option A and Option B. A total of 32 species were recorded during those surveys, comprising one *Threatened* species (Caspian tern), eight *At Risk,* 12 native *Not Threatened*, and 11 *Introduced* species (Table 1). While the lowest species diversity was recorded during the coastal surveys (n=12) (Figure 6 and Figure 7), the highest proportion of *Threatened* and *At Risk* species was recorded in these coastal habitat types (Figure 8).

Table 1: Mean number of birds recorded over three surveys at each site in September 2021, separated by survey sites and habitat types. Threat classifications are based on Robertson et al. (2017).

Species	Threat classification	Coastal						Terrestrial				Waterbodies				
		C1	C2	C3	C4	C5	C6	T1	T2	T3	T4	W1	W2	W3	W4	W5
Caspian tern	Threatened					1	3									
Godwit	At Risk			3			36									
Little black shag	At Risk						1									
Pied shag	At Risk		1			1									1	
Pipit	At Risk									1						
Red-billed gull	At Risk	29	1	3	1	7	14								1	2
Royal spoonbill	At Risk	10	2													
VOC	At Risk	5	2	9		4	7									
SIPO	At Risk			14		18	19									
Black-backed gull	Not Threatened	2	2	2	3	3	4	1		1	1				4	3
Grey teal	Not Threatened														1	
Harrier	Not Threatened											1				
Kingfisher	Not Threatened	1	2		2			1		1		1				
Little shag	Not Threatened														1	1
Paradise shelduck	Not Threatened											2	2	1	2	2
Pied stilt	Not Threatened											4				
Pukeko	Not Threatened								1			2	3		3	
Silvereye	Not Threatened										3					
Spur-wing plover	Not Threatened		1													
Welcome swallow	Not Threatened								1	2		2	3	2	3	3
White-faced heron	Not Threatened	1	2		1	1	2					1				1
Blackbird	Introduced							1		2	2				1	
Chaffinch	Introduced							2		1	3					
Feral pigeon	Introduced											12				
Goldfinch	Introduced							2	2	3	3					
Greenfinch	Introduced							2	1	1	1					
House sparrow	Introduced							2	2		5				2	
Mallard	Introduced						2			1	1	1	3	6	4	
Skylark	Introduced							1	9	3	1				1	
Song thrush	Introduced								1							
Starling	Introduced								35	5	2					
Yellowhammer	Introduced									1	2					
Mean birds recorded per site		12	3	8	2	9	22	3	13	6	6	7	3	2	6	3

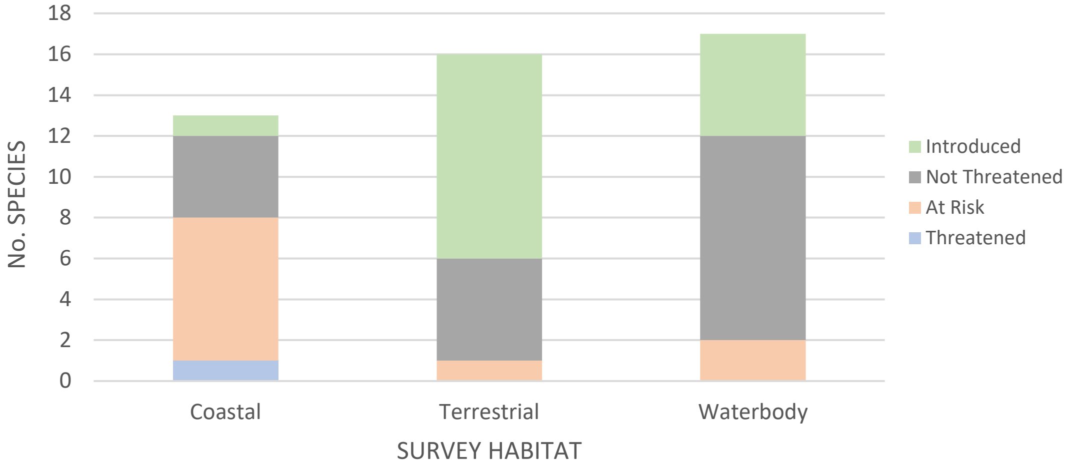

Figure 6: Avifauna species diversity and threat classification (Robertson et al. 2017) by habitat type as recorded during the September 2021 surveys.

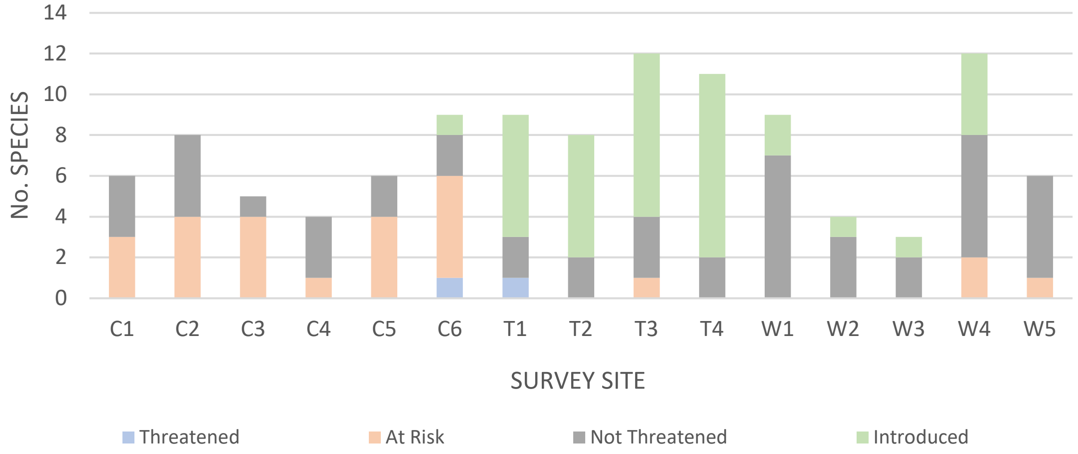

Figure 7: Number of species and their threat classification (Robertson et al. 2017) by survey site, as recorded during the September 2021 surveys. C = coastal, T = terrestrial, W = waterbody.

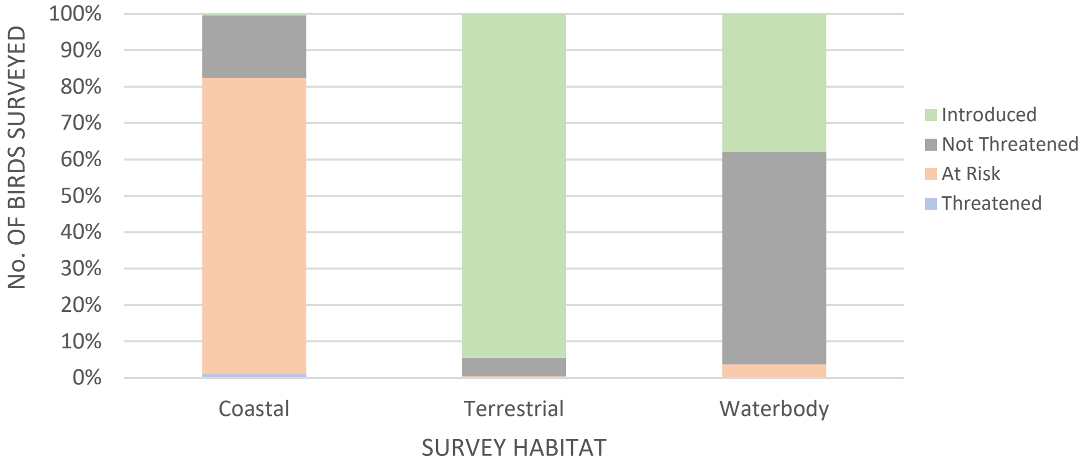

Figure 8: Proportion of birds recorded in different habitat types during the September 2021 according to Threat Classification (Robertson et al. 2017).

3.5.2.1 Option A

The habitat under the Option A footprint comprises primarily golf course and several constructed waterbodies. The data collected from the survey sites within the proposed designation envelope for Option A (W1-W4 and T2-T4) show an avifauna assemblage dominated by introduced or native *Not Threatened* species (refer to Table 1 and Figure 7). One *At Risk* species (NZ pipit) was recorded associated with the terrestrial sites on the golf course, while two (red-billed gull and pied shag) were recorded at the waterbodies on the golf course. In addition, a single bush falcon (*At Risk*) was recorded as an incidental observation while on the golf course site.

In terms of the coastal habitat to the north of Option A (sites C3-C5), while providing habitat for coastal birds (including *Threatened* and *At Risk* species), the majority of this area is an off-lead dog area and as such the birds that were present were observed regularly being disturbed. Of the coastal sites, C4 had the lowest species diversity (n=4) and the lowest mean birds (2) recorded per survey (Table 1). In comparison, site C6, which is immediately adjacent to the existing runway but outside of the off-lead dog area, recorded the highest mean number (22) of birds per survey for all sites (Table 1).

3.5.2.2 Option B

The habitat under the Option B footprint comprises primarily the coastal marine area (CMA), including a c.3.6 ha within Waimea Inlet that would be reclaimed to enable construction of the southern RESA.

The data collected from the coastal survey sites C1-C2 show a moderate species diversity relative to the other coastal sites (Figure 7), with approximately half the species recorded having an *At Risk* classification.

4.0 Ecological values

The following ecological values have been derived as described in Section 2.4 and are based on the existing environment information presented in Section 3.0.

4.1.1 Vegetation and terrestrial habitats

Most of the vegetation and terrestrial habitats within **Option A** are highly modified and comprised of exotic plant species.

- Exotic grassland within the golf course is of **Negligible** ecological value. It is entirely dominated by exotic species, is not representative of vegetation communities that would naturally be found in the ED, is not rare or distinctive and is of low value in terms of ecological context.
- The area used to dump spoil and vegetation to the west of the northern end of the runway is highly modified and dominated by exotic vegetation. It is of **Negligible** ecological value.
- The riparian vegetation and habitats associated with the tributary of Maire Stream are of Moderate ecological value (but also refer to Section 3.3 regarding ecological value for freshwater species). Maire Stream Tributary is channelised, but the vegetation

communities are indigenous dominated and moderately representative of intertidal saltmarsh communities in tidal waterways in the ED, although diversity is low. Although this feature does not provide important habitat for *Threatened* or *At Risk* terrestrial species, Maire Stream and its tributaries do support, and provide an ecological corridor for At Risk indigenous fishes. In addition, saltmarsh vegetation has been reduced to approximately 20% of its original extent in the ED (North, 2014).

The vegetation and terrestrial habitats within **Option B** are also highly modified and dominated by exotic plant species.

- Exotic grassland within the golf course is of **Negligible** ecological value. It is entirely dominated by exotic species, is not representative of vegetation communities that would naturally be found in the ED, is not rare or distinctive and is of low value in terms of ecological context.

4.1.2 Freshwater

Overall, the ecological values of Maire Stream, Maire Stream Tributary (within Option A), and Jenkins Creek, Arapiki Stream and Poorman Valley Stream (within / adjacent to Option B) are considered to be **High**. Despite the modified habitats, due to channelisation and piped sections, and degraded water quality due to a long history of urbanisation and industrial activity in the catchment, these waterways support *Threatened* and *At Risk* freshwater fish species.

The lower reaches of all of these waterways also provide (or potentially provide) īnanga spawning habitat, and possibly spawning habitat for other migratory galaxiid species (e.g., banded kōkopu, giant kōkopu).

The presence of īnanga is of particular importance. Īnanga is a diadromous (migratory) fish species indigenous to New Zealand. It is one of five of New Zealand's "whitebait" species and is listed as *At Risk – Declining* (Dunn et al., 2018). A major contributing factor to its conservation status is the degradation of spawning habitat associated with land-use change in lowland catchments (Hickford et al., 2010; Hickford & Schiel, 2011).

Īnanga spawn (lay their eggs) in riparian vegetation that is inundated during spring high tides and that occurs in tidal reaches, close to the upstream limit of salt-water intrusion. The same spawning sites may be used year after year, and it's therefore important to protect, enhance, and restore riparian areas (including appropriate vegetation) in critical spawning areas. In addition to peak spawning periods, adult inanga migrate along waterways to access spawning areas, with the peak migration period being November to March to coincide with peak spawning between March and June.

4.1.3 Marine

Any potential impact associated with the airport expansion should be assessed both at the scale of the construction footprint and at the scale of the whole Inlet, accounting for cumulative loss and modification of marine habitats.

Despite extensive historical habitat modification and ongoing ecological impacts linked to degraded habitat quality, the ecological value of the Waimea Inlet is assessed as **High**. This is because of its diversity of benthic habitats (which include meadows of the *At Risk – Declining* seagrass *Zostera muelleri* as well as biogenic habitats rare in estuarine contexts), its role as nursery and feeding grounds for many species of coastal fish, and also because it is a particularly representative example of a shallow estuary.

Given the extremely high mud content (>90%), and likely a depauperate infaunal community, and the absence of vegetation / macroalgae above the seabed, the ecological value of the benthic habitat that would be permanently reclaimed as part of Option B (i.e., the habitat immediately surrounding Monaco Peninsula) is assessed as **Low**.

Given the presence of sandy substrates and of subtidal channels that support uncommon biogenic habitats (and most likely a diverse infauna), the ecological value of marine habitats outside of the area proposed to be reclaimed under Option B (i.e., wider area surrounding Monaco Peninsula), which could be indirectly affected both during construction works and operation of the Option B extension, is assessed as **High**.

Given the presence of sand-cobble substrates (likely to support a diverse infauna) and dense seagrass meadows, the ecological value of the estuary area surrounding the golf course and the airport's western boundary, which may be indirectly affected both during construction and operation of the Option A extension, is assessed as **High**.

4.1.4 Avifauna

Overall, the avifauna assemblage associated with the coastal habitats is considered to be of **High** ecological value based on the number (n=7) of *At Risk* and *Threatened* species recorded during the September 2021 surveys (Figure 6), as well as previous surveys by others in the area (Owen & Sell, 1985; Schuckard & Melville, 2013). As noted earlier, the Waimea Inlet provides roosting, foraging and nesting habitat for a number of these species, and is recognised as being of national and international importance.

The terrestrial avifauna assemblage surveyed is considered to be of **Low** ecological value, predominantly comprising Introduced and Not Threatened species (Figure 7); the exceptions to this were the presence of NZ pipit and bush falcon (both *At Risk)* recorded on the golf course.

Similarly, the freshwater avifauna assemblage is considered to be of **Low** ecological value for the same reason (Figure 6). In terms of the two *At Risk* species (pied shag and red-billed gull) recorded at W4, both were flying over the site.

5.0 Potential ecological effects

The following sections assess the potential ecological effects of the activity enabled by the Option A and Option B designation extensions on the vegetation and terrestrial habitats, freshwater, marine and avifauna values.

We have not attempted to discuss all potential impacts in detail, instead focussing on the most likely potential effects that are expected for the activity enabled by the designation. Further, we have not assessed the magnitude or level of effects of these potential ecological effects.

It is also important to note that this assessment is based on desktop research and limited vegetation / botanical and avifauna field surveys within the Option A extension only. Field surveys of ecological values within Option B extension area were not undertaken (see Section 2.3 for further details).

5.1 Option A extension

5.1.1 Vegetation and habitats

5.1.1.1 Loss of terrestrial vegetation and habitats

Option A would require extending the main runway into the adjacent golf course, realigning the main taxiway with backtracking at the northern end to support the extended runway and re-aligning the southern runway to accommodate the RESA. This would result in the removal, sealing and permanent loss of the vegetation and habitats within these areas (Table 2).

Creating the RESA areas at each runway end would likely involve removing or disturbing the existing vegetation, filling and recontouring (where necessary) and then re-grassing the RESA.

Table 2. Area (in ha) of potential vegetation removal associated with Option A (based on a runway as shown Figure 1).

Vegetation Community	Ecological Value	Permanent vegetation removal	RESA (re-grassing)	Total
Built-up area	Negligible	0.00	0.20	**0.20**
Mown exotic grassland	Negligible	5.20	5.31	**10.51**
Saltmarsh	Moderate	0.13	0.04	**0.17**
Tall fescue-cockfoot-prairie grass grassland	Negligible	0.24	0.07	**0.32**
Total		**5.57**	**5.61**	**11.18**

Of the vegetation that would be removed or disturbed, 94% is exotic grassland of **Negligible** ecological value. While Option A would result in the permanent loss of the 5.31 ha of exotic grassland within the runway extension areas, the areas within the two RESA at either end of the runway would likely either remain in exotic grassland or be re-grassed (Figure 4).

The permanent removal of built-up areas and tall fescue-cockfoot-prairie grass grassland will not result in significant adverse effects. The loss of ecological functioning caused by removal of the tall fescue-cockfoot-prairie grass grassland on the riparian margins of Maire Stream Tributary is not relevant to this assessment as the freshwater and riparian habitat associated with this waterway would also be removed to create the runway extension and RESA.

There has been extensive loss of saltmarsh vegetation within the Motueka ED, including within Waimea Inlet (North, 2014) and there is now estimated to be 20% (200 ha) of the original area of saltmarsh vegetation remaining. Option A would require extending the runway and creating a RESA across a section of Maire Stream Tributary, which result in the loss of approximately 0.17 ha of indigenous dominated saltmarsh vegetation of **Moderate** ecological value. This equates to approximately 0.09% of this vegetation type in the ED.

Maire Stream Tributary is tidal and supports wetland vegetation (saltmarsh vegetation).

The potential effects on the freshwater ecology values of Maire Stream Tributary are assessed in Section 5.1.2.

5.1.1.2 Potential effects on lizards

Areas of rank (unmown) exotic grassland within Option A may provide habitat for indigenous skinks. We did not undertake surveys for lizards and the potential effects have not been assessed.

If construction works or infrastructure are being considered in areas of rank exotic grassland, lizard surveys are recommended to inform the need for managing potential effects on lizards[8].

5.1.1.3 Weed introduction and spread

Although there are numerous weedy species in the wider area, the terrestrial vegetation and habitats adjacent to the runway extensions and RESA areas where works would be required are generally of **Negligible** ecological value and are highly managed environments. For these reasons the potential effects of weed introduction and spread are unlikely to be of concern.

5.1.2 Freshwater

5.1.2.1 Loss of freshwater habitat

Option A will likely require extending the runway (and therefore tarmac) and creating a (likely grassed) RESA in within / across the current alignment of Maire Stream Tributary. This may result in the loss or piping of c.400 m of waterway.

In addition, in areas where there may not be direct effects of infilling or piping, new subsoil drainage and / or ground compaction may be required, and this could redirect shallow groundwater and result in changes in flow permanence of these waterways.

Maire Stream Tributary is of **High** ecological value as it supports indigenous freshwater fish species, including longfin eel (*At Risk*), banded kōkopu (*At Risk*) and probably provides spawning habitat for īnanga (*At Risk*).

This activity would need to be carefully considered and managed as part of the detailed design of an Option A extension.

5.1.2.2 Fish passage

Where there is not total loss of waterway (i.e., due to infilling), the construction and operation of the extended runway and RESA will likely require installing culverts to provide a safe crossing of Maire Stream Tributary.

Many of New Zealand's freshwater fish are migratory and, therefore, require unimpeded passage between the sea and freshwater habitats to complete their lifecycles. Even for non-migratory species, it's important that their movement within a waterway is not restricted or impeded.

Maire Stream Tributary supports migratory freshwater fishes, including At Risk species. In-stream structures, such as culverts, can disrupt or impede the free movement of fish along waterways.

5.1.2.2.1 Culvert length

Culvert length is an also important consideration as this could have significant effects on the freshwater ecology values within the designation. However, it is recognised that this will be a

[8] All indigenous lizards are protected under the Wildlife Act (1983).

matter for specific design, management and consideration should Option A be the preferred option for the purpose of the NOR.

There is a myriad of evidence to show that (amongst other factors) high velocities within culverts create barriers to the passage of fish species to and from the sea. A great deal of research has been conducted to determine either maximum tolerated velocities for New Zealand's freshwater fishes, or to develop specific structures to remedy barrel velocities in already constructed culverts.

However, the length of a culvert is not something that is often assessed, and the length of a culvert may be a significant factor determining whether a structure is, or is not, a barrier to fish and fauna passage. Some research suggests that culvert length may, in part, be due to low light levels inside the culverts, and that light conditions may affect the movement behaviour of at least some freshwater fish species. However, there remains a marked gap in scientific knowledge on whether the movement behaviour of freshwater fishes is influenced by light (i.e., light intensity).

The effect of darkness on migration of New Zealand's freshwater fish is an area of debate. However, the passage from light to dark, and vice versa, conditions encountered when entering and leaving culverts and piped networks may inhibit migration. Alternatively, if fish do continue to migrate through a dark piped network, they may need to pause to acclimate to the new conditions, which in turn may increase the amount of time a fish remains within the culvert, increasing fatigue and reducing passage (Boubée et al., 1999).

Regardless of the potential “darkness effect”, installation of culverts in waterways results in a total change of the habitat and can render that section of the stream uninhabitable for some species.

5.1.2.3 Inanga spawning habitat

The Conservation Act 1987 and the Freshwater Fisheries Regulations 1983 provide some protection relating to freshwater fish and freshwater habitats. With respect to īnanga and īnanga spawning habitat, it is an offence to disturb or damage spawning grounds, or to carry out an activity that makes these spawning sites less suitable for spawning, or that disturbs fish that are spawning within the area.

An Option A extension may include changes to freshwater habitats within an īnanga spawning zone, potentially making sites less suitable for spawning. Īnanga spawn in tidal reaches and within riparian vegetation that is inundated during spring high tides. The same spawning sites may be used year after year. The peak spawning period of inanga is March and June.

Īnanga is an *At Risk* freshwater fish species that spawns in riparian vegetation within tidal reaches of lowland waterways. One of the main reasons for the conservation status of inanga is the degradation and loss of spawning habitats as a result of land-use change (Hickford et al., 2010), which includes factors like changes to the tidal regime in waterways, loss or degradation of suitable riparian vegetation, and weed encroachment.

Piping of waterways and installations of culverts and other structures in an important consideration for fish passage (Section 5.1.2.2) and īnanga spawning habitats. Because īnanga spawn in riparian vegetation that is inundated during spring tides, close to the upstream limit of salt-water intrusion, the placement of structures in waterways (e.g., culverts, or sections of piped waterway) can prevent or change the extent of saltwater intrusion and affect zones that are critical for inanga spawning.

5.1.2.4 Increased impervious surfaces and contaminants

The construction of additional / extended airport runway and other sealed areas will result in additional impervious surfaces within the catchment. However, it's important to note that the increase in impervious surface area is probably very small, compared to existing condition.

Increases in the area of impervious surfaces can reduce natural flow paths (via infiltration) to waterways during rainfall events, resulting in 'flashy' flows. Contaminants and pollutants (e.g., sediments, heavy metals) from the surrounding urban environment also accumulate on these hard surfaces (e.g. roads, footpaths) and enter waterways during rainfall events. Both of these can have adverse effects on the ecology and health of waterways.

Contaminants, including petrochemicals (oil, fuels), heavy metals and fine sediments, build up during rainfall events and are transported by stormwater flows in waterways and other receiving environments.

5.1.2.5 Lighting effects

Ecological light pollution is the alteration of natural cycles of light and dark by artificial light sources, which has adverse effects on animals and ecosystems. Artificial lights can attract or repel organisms and can have far reaching effects for biota and ecosystems (Longcore & Rich, 2004). Artificial lights can increase predation, adversely affect migration behaviours, alter competition for food and habitat resources, reduce foraging time, and disrupt predator-prey relationships. Whilst understanding the ecological effects of light pollution on New Zealand's freshwater ecosystems and fauna is still in its infancy, it's likely that freshwater fishes and macroinvertebrates (including adult stages of aquatic insects) may be adversely affected by artificial lights.

For example, many of New Zealand's indigenous freshwater fishes and aquatic insects are nocturnal and artificial lights spilling into waterways may adversely affect behaviours, movement or migrations patterns, and foraging.

Aquatic insects have a winged adult stage, and it's this life stage that is most likely to be attracted to any lighting that may be included in the proposed road design. It is uncertain how lighting may impact fish migration and behaviour, particularly for nocturnal species. Terrestrial fauna, including birds and terrestrial invertebrates may also be impacted. Given the currently rural land use, there is currently very little lighting immediately adjacent to the waterways.

In New Zealand, aquatic insects emerge as adults for reproduction and to disperse throughout the year, however, there is a peak emergence period in the warmer months. There may be periods of the year when aquatic insects are more susceptible to lighting and this should be considered during the design phase, including in the context of existing night lighting in the surrounding urban environment.

While all new lighting could have an adverse effect on the ecology, LED lighting, which emits a "white" light, is of particular concern. Research into the differences between sodium vapour lamps and light-emitting diodes (LED) lighting is still in its infancy, LED lighting has been shown to have significant adverse effects on insect behaviour (Pawson & Bader, 2014).

However, there is already a high level of artificial lighting in the existing environment, and the additional lighting associated with Option A is expected to be unlikely to cause any additional adverse effects to the freshwater communities present.

5.1.2.6 Earthworks during construction

The construction of runway and RESA extension is likely to involve earthworks, vegetation clearance (see Section 5.1.1.1) and activities in waterways.

This has the potential to expose sediment, which can then be mobilised by rain and wind and enter adjacent waterways, resulting in increased suspended sediments and sedimentation of downstream habitats.

Suspended sediment can alter water chemistry (including lowering dissolved oxygen concentrations), increase turbidity and reduce light penetration and visual clarity downstream. Elevated turbidity can have adverse ecological effects, particularly if it is sustained for a long period of time. Increased turbidity levels can result in reduced photosynthesis and, therefore, affect growth of aquatic plants and algae (the food source of many macroinvertebrates). Feeding activity and foraging success can be reduced by elevated turbidity (Cavanagh et al., 2014), by both limiting abilities to detect prey and reducing availability of food. It can limit the ability of visually foraging fish to feed (e.g., trout) and result in avoidance behaviour of indigenous species such as banded kōkopu (Richardson et al., 2001). High loads of suspended sediments can also damage fish gills and make them more susceptible to disease, or even result in mortality (Rowe et al., 2009); macroinvertebrate communities can shift towards “sediment-tolerant” / burrowing taxa such as chironomids and aquatic worms, which is less suitable food for fish communities (Cavanagh et al., 2014).

If sediment is discharged to the river, it is likely to settle out on the riverbed downstream, which can clog the interstitial spaces between substrates, settle on macroinvertebrates (clogging gills) and smother food (algae and macroinvertebrate) resources. This deposited sediment is likely to stay in place until the next high flow event through the system. Because the waterways are spring fed, there is limited potential for flushing of these fine sediments from the system.

5.1.2.7 Mortality of fauna

If construction methods require works within or adjacent to the waterway, there is risk of mortality and disturbance of fish and other in-stream fauna and this needs to be considered and advice provided by a suitably qualified and experienced freshwater ecologist.

As discussed in Section 5.1.2.6, sediment discharge in waterways can result in smothering of macroinvertebrate and algae communities, clog fish gills, disrupt fish feeding behaviours and impede fish migration. In addition, any in-stream works (either of banks or in the river) could result in fish mortality through crushing and mechanical removal or disturbance of fish and other in-stream fauna.

5.1.2.8 Critical periods for fauna

In-stream works, and in particular temporary diversions or piping, also have the potential to interfere with migration and spawning of freshwater fishes. As discussed above, elevated turbidity levels have been found to result in avoidance behaviours in some fish species. Increased turbidity levels can also limit the ability of visually foraging fish to feed (e.g., trout), and high loads of suspended sediments can damage fish gills and make them more susceptible to disease, or even result in mortality (Rowe et al., 2009). Furthermore, construction noise and vibrations can affect both terrestrial and aquatic fauna behaviour, particularly if disturbance continues for an extended period of time.

It is, therefore, essential to avoid in-stream activities wherever possible, and especially during critical periods for fish migration and spawning.

The spawning and migration calendars, developed for New Zealand fish species, further guide the timing to avoid activities within and near waterways during other species’ critical periods (Appendix 4).

5.1.2.9 Introduction or spread of freshwater pests

Freshwater pests include (but are not limited to) aquatic plants, pest fish and the invasive alga didymo. These introduced species can cause enormous damage to our freshwater environments. The use of machines / vehicles in waterways can spread aquatic pests.

It will be essential to ensure all machinery, vehicles and equipment used during construction is free from aquatic pests.

5.1.3 Marine

The estuary area surrounding the golf course and the airport's western boundary, which is considered of **High** ecological value, could be temporarily affected by indirect effects occurring during construction, as well as operational effects once construction is completed, where not well managed.

5.1.3.1 Temporary habitat disturbance

During construction, temporary habitat disturbance may occur as a result of spills of sediment and other materials beyond the work footprint. Sediment runoffs form the construction site may result in increased suspended sediment loadings. This, in turn, would result in increased water turbidity, which may affect the marine organisms. Deposition of suspended sediment has the potential to cause habitat loss for benthic organisms and to smother filter feeding animals. Suspended sediments can also cause damage to fish eggs and disturbance to fish spawning grounds. Toxicological effects on marine life can arise from the discharge contaminants associated with the sediment into the marine environment.

These impacts can be avoided or minimized with best practice measures for erosion/sediment control and spill prevention/containment.

5.1.3.2 Operational effects

Once construction is completed, adverse effects on marine life may result from increased stormwater discharges into the Inlet.

These impacts can be minimized or prevented altogether planning for appropriate stormwater treatment as part of the airport expansion, and through best practice spill prevention and containment procedures.

5.1.4 Avifauna

5.1.4.1 Direct / permanent loss of habitat

The physical footprint of Option A comprises golf course and several constructed waterbodies. There will be no direct impact on the coastal environment.

No *Threatened* or *At Risk* species are known to breed within the proposed footprint. As noted earlier, red-billed gull and pied shag were the only *At Risk* species recorded during the waterbody surveys within the Option A footprint, both of which were observed flying over W4. Pipit and bush falcon, also *At Risk,* were recorded on the golf course site, however there is no breeding habitat available.

As such, the permanent loss of habitat resulting from the construction of this option likely relates to the loss of foraging and roosting habitat for a number of native Not Threatened and Introduced species.

5.1.4.2 Mortalities

The mobile nature of most avifauna species means that the potential for direct mortalities associated with construction activities are likely to be confined to birds that may be nesting or with young chicks. Given the lack of breeding habitat of *Threatened* or *At Risk* species under the proposed footprint, construction related mortalities are highly unlikely.

In terms of operational mortalities, it is possible bird strikes may occur as the extension of the runway will mean planes may land and take off closer to the northern estuaries and beaches than currently occurs. However, as noted above (Section 3.5.2.1), relatively fewer birds were recorded at those coastal sites.

5.1.4.3 Disturbance and displacement (effective habitat loss)

Disturbance activities could occur during both the construction and operational phases of the Project. Disturbance to avifauna may result in short- or long-term displacement, decreased feeding rates, unattended nests (leading to incubation failure and increased opportunities for predators), and energy and time costs (Borgmann, 2010; Bowles, 1995; Kaldor, 2019; Lord et al., 2001; Price, 2008; Walls, 1999).

The avifauna assemblage associated with the terrestrial, waterbody and coastal habitats are currently exposed to high levels of disturbance associated with the current land uses in the area; those being an existing airport / runway, golf course, recreational and dog-walking.

Thus, the construction and operation of Option A is unlikely to result in any significant disturbance or displacement to the avifauna assemblage present.

5.1.4.4 Food supply and foraging ability

If, during construction, runoff from the site is untreated prior to discharge to the receiving environment, there is the potential for adverse effects on marine water quality through increased suspended sediment and on marine invertebrates from the clogging of fine structures (such as gills) and smothering of benthic organisms (prey species) from deposited sediment. Impacts on benthic and fish communities can affect food supply for coastal and oceanic avifauna. In addition, increased water turbidity associated with construction activities can impact on the foraging ability of visual foragers to located prey items.

We assume that during construction best-practice erosion and sediment control measures will be used and that no impact on the marine environment associated with sediment discharges that may impact the food supply for coastal birds.

The presence of an operating airport / runway does not appear to impact foraging birds. As noted above, site C6 which is immediately adjacent to the existing runway recorded the highest mean number (22) of birds per survey for all sites. As such, there is unlikely to be any operational effects on the foraging ability of coastal birds associated with Option A.

5.1.4.5 Artificial lighting

Light-induced mortalities have been recorded for a number of seabirds, particularly petrels, whereby they are attracted to artificial light sources and either collide with structures or are vulnerable to predation when on land (Black, 2005; Deppe et al., 2017; Le Corre et al., 2002, 2003; Montevecchi, 2006; Reed et al., 1985; Rodríguez et al., 2012; Rodríguez & Rodríguez, 2009). Another potential effect of attraction to artificial lights is that birds are temporarily diverted towards the light(s) and away from other areas (e.g., breeding colonies). Incidences of attraction to artificial lights and strike have been attributed to low levels of moonlight and inclement weather resulting in poor visibility (Deppe et al., 2017; Poot et al., 2008; Reed et al., 1985; Rodríguez & Rodríguez, 2009).

As it is, there is already a high level of artificial lighting in the existing environment, and the additional lighting associated with Option A would be unlikely to cause any adverse effects to the avifauna assemblages present.

5.1.4.6 Pollution

Marine pollutants include hydrocarbons, heavy metals and hydrophobic persistent organic pollutants. The location of seabirds at or near the top of the marine food web makes them particularly sensitive to these pollutants (Burger & Gochfeld, 2002; Furness & Camphuysen, 1997). Some toxins can have a range of effects on seabirds, including affecting development, physiology and behaviour, reproductive performance and survival rates (Burger et al., 1992; Burger & Gochfeld, 1993; Finkelstein et al., 2006; Fry, 1995; Howarth et al., 1982).

We have assumed that stormwater run-off from the operating runway would not be directly discharged into the marine environment but would be treated in such a manner as to remove any contaminants before entering the CMA.

5.2 Option B extension

5.2.1 Vegetation and habitats

5.2.1.1 Loss of terrestrial vegetation and habitats

Option B would require extending the main runway within the existing designation and NAL-designated land on Monaco Peninsula and extending the runway at the northern end into the golf course. This would result in the removal, sealing and permanent loss of the vegetation and habitats within these areas (Table 3).

Table 3. Area (in ha) of potential vegetation removal associated with Option B (based on an 1,510 m runway as shown in Figure 1).

Vegetation Community	Ecological Value	Permanent vegetation removal (ha)
Exotic grassland (mown)	Negligible	1.78
Total		1.78

Because all of the terrestrial vegetation and habitats that would be removed are of **Negligible** ecological value no significant adverse effects on terrestrial vegetation or terrestrial habitats are anticipated.

5.2.1.2 Potential effects on lizards

The rank exotic grassland on NAL-designated land on Monaco Peninsula may provide habitat for indigenous skinks. We did not undertake surveys for lizards and the potential effects have not been assessed as this area is within the existing NAL Designation.

If Option B is further considered, lizard surveys are recommended to inform the need for managing potential effects on lizards[9].

[9] All indigenous lizards are protected under the Wildlife Act (1983).

5.2.1.3 Weed introduction and spread

There are numerous weedy species in the wider area and the vegetation and habitats adjacent to the Option B runway extensions and RESA. Areas where works would be required are generally of **Negligible** ecological value and are highly managed environments so the potential effects of weed introduction and spread are unlikely to be of concern.

5.2.2 Freshwater

5.2.2.1 Loss of freshwater habitat

The Option B extension is proposed to include bridging across Jenkins Creek (of c.200 m wide), to connect the existing airport runway with the NAL-designated land on Monaco Peninsula and to a c.3.6 ha reclamation in Waimea Inlet to enable construction of the southern RESA.

The potential effects of Option B extension on freshwater ecology are likely to be the same as some of the potential effects described in Option A above. Exceptions to this are that construction of a bridge is unlikely to result in the total loss of freshwater habitat and flow permanence, or substantive changes to fish passage.

5.2.2.2 Fish passage

The proposed bridging across Jenkins Creek is unlikely to adversely affect fish passage; bridges are generally considered the best structures for waterway crossings as far as ecological outcomes for maintaining fish passage. This is particularly important in the context of crossing Jenkins Creek, as this waterway and its tributaries (Poorman Valley Stream and Arapiki Stream) support a diverse freshwater fish community including numerous migratory and At Risk (and possibly Threatened) species.

5.2.2.3 Īnanga spawning habitat

The lower reach of Jenkins Creek is listed as potential īnanga spawning habitat, and the construction of a bridge could result in the loss of this critical habitat (see Section 5.1.2.3). This needs to be further assessed as part of resource consents that may be required in addition to the Outline Plan process.

5.2.2.4 Other potential effects

Other potential effects on freshwater ecology discussed under Option A are also relevant here (increased impervious surfaces and contaminants, lighting effects, mortality and disturbance of fauna during construction, and introduction or spread of freshwater pests); these potential effects are not repeated here, instead refer to Section 5.1.2 for detail.

5.2.3 Marine

The estuary area south of the Monaco Peninsula would be affected by permanent habitat reclamation and could also be impacted by indirect effects occurring both during the construction and operation of the runway. While the habitats within the proposed reclamation area are likely to be of Low ecological value[10], the surrounding estuary habitats are of High ecological value.

[10] Based solely on desktop information.

5.2.3.1 Direct / permanent loss of habitat

The c.3.6 ha reclamation associated with Option B would result in the permanent loss of soft sediment benthic habitat south of the Monaco Peninsula. A limited amount of artificial rocky benthic habitat provided by seawalls and revetments would also be removed.

5.2.3.2 Mortality of marine organisms

Sessile or slow-moving organisms within the area affected by reclamation are likely to suffer mortality, whereas mobile organisms (such as fish) would be able to leave, or avoid, the construction area. Macroalgae and sessile/slow-moving invertebrates (living both on top and within the seabed) would be the taxa most severely affected by mortality.

5.2.3.3 Temporary habitat disturbance

Physical disturbance: temporary benthic habitat disturbance would occur through excavation or use of the seabed (e.g., to accommodate machinery) beyond the footprint of the runway extension. Areas of seabed beyond the reclamation footprint may also be kept out of water for extended periods of time (i.e., beyond normal period of low-tide aerial exposure) e.g., using sheet piling to create a dry workspace. These effects can be reduced selecting the most appropriate construction methodology.

Noise and vibration: noise and vibration can have adverse effects on marine organisms, with the level of effect depending on degree and duration of the disturbance. Slow-moving organisms affected by noise and vibration may temporarily cease normal behaviour and could cease feeding, retract into shell, stop moving or hide. Mobile organisms (such as fish) may be able to leave the area in response to noise and vibration.

Resuspension of sediment contaminants: excavation of the seabed may resuspend contaminants (e.g., heavy metals) stored within the sediments and make them bioavailable, with the potential for toxicological effects on marine life. These impacts can be avoided or minimized with best practices for erosion and sediment control.

Sedimentation: disturbance of the seabed and runoffs form the construction site may result in increased suspended sediment loadings. This, in turn, would result in increased water turbidity, which may affect the marine flora. Deposition of suspended sediment has the potential to cause habitat loss for benthic organisms and to smother filter feeding animals. Suspended sediments can also cause damage to fish eggs and disturbance to fish spawning grounds. These impacts can be avoided or minimized with best practices for erosion and sediment control.

5.2.3.4 Operational effects

Once construction is completed, operational effects impacting marine life may include increased stormwater discharges into the Inlet. These impacts can be minimized or prevented altogether by planning for appropriate stormwater treatment as part of the airport expansion, and through best practice spill prevention and containment procedures.

5.2.4 Avifauna

5.2.4.1 Direct / permanent loss of habitat

The 3.6 ha reclamation associated with Option B will result in the permanent loss of foraging habitat for a number of *Threatened* and *At Risk* coastal avifauna species. However, there does not appear to be any breeding habitat available for these species within the Option B footprint.

5.2.4.2 Mortalities

As noted above, there does not appear to be any breeding habitat available for *Threatened* or *At Risk* species under the footprint, and as such mortalities during construction are unlikely. However, there is the potential for bird strike to occur during the operational phase.

5.2.4.3 Disturbance and displacement (effective habitat loss)

The avifauna assemblage associated coastal habitats within and adjacent to Option B are currently exposed to some level of disturbance associated with the existing airport / runway. Thus, the construction and operation of the Option B is unlikely to result in any significant disturbance or displacement to the avifauna assemblage present, particularly given the wider Waimea Inlet that is available to foraging and roosting birds.

5.2.4.4 Food supply and foraging ability

We assume that during construction best-practice erosion and sediment control measures will be used, however due to the nature of the construction being a reclamation, we have assumed that there may be some impact on the marine environment associated with sediment discharges that may impact the food supply for coastal birds in the immediate area.

The presence of an operating airport / runway does not appear to impact foraging birds. As such, we have assumed that foraging birds will habituate to the runway extension and that there will be no significant operational effect on the foraging ability of coastal birds associated with the Option B.

5.2.4.5 Artificial lighting

There is already a high level of artificial lighting in the existing environment, and the additional lighting associated with Option B would be unlikely to cause any adverse effects to the avifauna assemblages present.

5.2.4.6 Pollution

We have assumed that stormwater run-off from the operating runway would not be directed discharged into the marine environment but would be treated in such a manner as to remove any contaminants before entering the CMA.

5.3 Summary of potential effects

5.3.1 Option A extension

5.3.1.1 Vegetation and habitats

Option A is unlikely to result in any significant adverse effects on vegetation and terrestrial habitats because:

- Almost all of the existing areas, built-up areas, mown exotic grassland and tall fescue-cockfoot-prairie grass grassland are highly managed, modified areas of Negligible ecological value.
- A small area (approximately 0.09% of this vegetation type in the ED) of saltmarsh vegetation within the channelised Maire Stream Tributary would be removed.
- Areas within the proposed RESA are primarily exotic grassland and we understand that these areas would remain in exotic grassland or be re-grassed.

5.3.1.2 Freshwater

However, Option A may result in adverse effects on freshwater habitats because:

- Loss of freshwater habitat in Maire Stream Tributary, which supports freshwater fishes including At Risk species and provides critical spawning habitat for īnanga.
- Where the waterways are not infilled, but instead piped or culverted, barriers to fish passage could be created, which could severe connection between upstream reaches and the sea.
- Other effects on freshwaters include increased impervious surfaces and contaminant inputs, increased lighting, introduction of freshwater pests, and mortality or disturbance of freshwater fauna during construction.
- Potential effects on freshwater habitats and species would require management through avoidance or appropriate mitigation, which will need to be considered by future resource consent application processes.

5.3.1.3 Marine

Option A is unlikely to result in any significant adverse effects on marine habitats because:

- Indirect disturbance to surrounding estuary habitat during construction can be prevented or minimized with best practices for erosion/sediment control and spill prevention/containment.
- Any adverse effects on marine life resulting from increased stormwater discharges and oil spills into the Inlet once the runway is operational can be prevented or minimized with appropriate stormwater management and best practices for spill prevention/containment.

5.3.1.4 Avifauna

Option A is unlikely to result in any significant adverse effects on *Threatened* or *At Risk* species in the area due to:

- The footprint being contained within the existing golf course which provides habitat of low value for avifauna.
- The likely lack of breeding habitat for *Threatened* or *At Risk* species within and immediately adjacent to the footprint.
- The existing high level of disturbance to birds in the estuarine and coastal areas to the north associated with active recreational and off-lead dog areas.
- The existing levels of artificial lighting in the area.

5.3.2 Option B extension

5.3.2.1 Vegetation and habitats

Option B is unlikely to result in any significant adverse effects on vegetation and terrestrial habitats because:

- The terrestrial vegetation and habitats that will be lost are comprised of areas of highly modified exotic grassland that is of Negligible ecological value.

- However, the rank exotic grassland on NAL-designated land on Monaco Peninsula may provide habitat for indigenous skinks. If Option B is further considered, lizard surveys are recommended to inform the need for managing potential effects on lizards[11].

5.3.2.2 Freshwater

Option B may result in some adverse effects on freshwater habitats, including:

- Disturbance of riparian and in-stream habitats, and inanga spawning habitat.
- However, bridging (versus culverting) Jenkins Creek is not expected to create barriers to fish passage.
- Potential effects on freshwater habitats and species may require management through avoidance or appropriate mitigation, which will need to be considered by future resource consent application processes.

5.3.2.3 Marine

Option B will cause permanent loss (reclamation) of 3.6 ha of estuary benthic habitat. In addition, it may result in:

- Indirect disturbance to surrounding estuary habitat during construction (which could be reduced selecting the most appropriate construction methodology and following best practices for erosion/sediment control and spill prevention/containment).
- Adverse effects on marine life resulting from increased stormwater discharges and oil spills into the Inlet once the runway is operational. These effects can be prevented or minimized with appropriate stormwater management and best practices for spill prevention/containment.

5.3.2.4 Avifauna

- Option B will result in the loss of c.3.6 ha of habitat within the Waimea Inlet. While this effect is likely to be confined to the loss of foraging, rather than roosting or nesting, habitat, we note that this is the permanent loss of habitat for a number of *Threatened* or *At Risk* species.

6.0 Options assessment

Overall, **Option A** is the recommended option as far as impacts on ecological values are concerned, based on the above information and in consideration of the following.

- Option A would likely result in the loss of a substantially larger area of vegetation and terrestrial habitats than Option B. However, vegetation and habitats likely impacted by both options are largely exotic and of Negligible ecological value (but also note importance of spawning habitat for freshwater fauna).
- However, the indigenous-dominated saltmarsh vegetation in the riparian margin of Maire Stream Tributary would be impacted by Option A. This saltmarsh vegetation is wetland, and the potential loss / effects on this may need to be considered in the

[11] We did not undertake surveys for lizards. All indigenous lizards are protected under the Wildlife Act (1983).

context of the requirements of the National Environmental Standards for Freshwater (NES-F).

- Reclamation of land in the CMA is to be avoided unless there are no practical alternatives according to Policy 10 of the NZCPS. Further, the NES-F wetland provisions apply to natural wetlands in the CMA[12], so consideration of the activity against the NZCPS and the NES-F is recommended. Option A does not include reclamation within the CMA. Reclamation of land in the CMA is proposed as part of the Option B extension.

- Policy 11(a)(i) of the NZCPS requires the avoidance of adverse effects of activities on indigenous taxa that are listed as *Threatened* or *At Risk* in the New Zealand Threat Classification System lists. As identified above (Section 5.3.2.4), there are a number of such avifauna species that may be impacted through Option B, primarily associated with the permanent loss of foraging habitat. The potential for adverse effects on *Threatened* and *At Risk* species is substantially reduced with Option A.

- We also consider that potential construction and operational effects on the marine environment associated with Option A would not pose significant ecological concerns if appropriately managed.

- However, both Option A and Option B extensions may result in loss or degradation of freshwater habitats, including for *At Risk* (and possibly *Threatened*) species, and spawning habitat.

- The loss of river extent and values should be avoided, where practicable (Policy 7 of the National Policy Statement for Freshwater Management (NPS-FM), unless the Regional Council is satisfied that there is a functional need for the activity in that location; and the effects of the activity are managed in accordance with the effects management hierarchy (as outlined in section 3.24 of the NPS-FM). Further, habitats of indigenous freshwater species should be protected according to Policy 9 of the NPS-FM.

- The NES-F regulations also stipulate design criteria and rules around ensuring continued fish passage. The potential to use a bridge (rather than culverting) to cross Jenkins Creek (Option B) may avoid adverse effects on fish passage. In comparison, Option A may result in piping / culverting, which should not adversely affect fish passage where appropriately designed, installed and maintained.

- Option A may require infilling of waterways, which should be avoided as a first principle (NPS-FM, Policy 7). These waterways may also provide habitat for inanga spawning. Loss of inanga spawning habitat and loss of Maire Stream Tributary (as a result of Option A), which provides habitat for *At Risk* freshwater fishes, should be further considered during any Outline Plan of works.

[12] In November 2021, the High Court held in Minister of Conservation v Mangawhai Harbour Restoration Society Incorporated that the NES-F wetland provisions apply to natural wetlands in the CMA.

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Appendix 1: Plant species lists

Note: while most exotic species were recorded, not all exotic grasses and herbs were recorded and are listed here as this was not necessary for this assessment.

Table A1a. Indigenous and exotic vascular plant species recorded within Option A (sorted by common name).

Common name	Scientific name	Threat Status	Growth Form
Indigenous species			
Batchelors button	*Cotula coronopifolia*	Not Threatened	Dicot Herb
Cabbage tree	*Cordyline australis*	Not Threatened	Tree
Caldwells clubrush	*Bolboschoenus caldwellii*	Not Threatened	Grass
Coastal immorality grass	*Austrostipa stipoides*	Not Threatened	Grass
Dwarf montia	*Montia fontana subsp. chondrosperma**	Not Threatened	Dicot Herb
Glasswort	*Salicornia quinqueflora*	Not Threatened	Dicot Herb
Jointed wire rush	*Apodasmia similis*	Not Threatened	Grass
Kānuka	*Kunzea species*	Threatened - Nationally Vulnerable (planted)	Tree
Karamu	*Coprosma robusta*	Not Threatened	Tree
Karo	*Pittosporum crassifolium*	Not Threatened, non-local	Tree
Large-leaved kōwhai	*Sophora tetraptera*	Not Threatened, non-local (planted)	Tree
Leafless rush	*Juncus australis*	Not Threatened	Grass
Raupō	*Typha orientalis*	Not Threatened	Grass
Salt marsh ribbonwood	*Plagianthus divaricatus*	Not Threatened	Shrub
Sea primrose	*Samolus repens*	Not Threatened	Dicot Herb
Sea rush	*Juncus kraussii*	Not Threatened	Grass
Slender clubrush	*Isolepis cernua*	Not Threatened	Grass
Three-square	*Schoenoplectus pungens*	Not Threatened	Grass
Unidentified rush sp.	*Juncus species*	Not Threatened	Grass

Common name	Scientific name	Threat Status	Growth Form
Exotic species			
Annual poa	*Poa annua**		Grass
Bellis daisy	*Bellis perennis**		Dicot Herb
Black nightshade	*Solanum nigrum**		Low Shrub
Blackberry	*Rubus fruticosus**		Low Shrub
Blackwood	*Acacia melanoxylon**		Tree
Broad-leaved dock	*Rumex obtusifolius**		Dicot Herb
Broad-leaved flea-bane	*Erigeron sumatrensis**		Dicot Herb
Broad-leaved plantain	*Plantago major**		Dicot Herb
Buck's horn plantain	*Plantago coronopus**		Dicot Herb
Bull bay	*Magnolia grandiflora**		Tree
Catsear	*Hypochaeris radicata**		Dicot Herb
Celery-leaved buttercup	*Ranunculus sceleratus**		Dicot Herb
Cheatgrass	*Bromus tectorum**		Grass
Chewings fescue	*Festuca rubra**		Grass
Chickweed	*Stellaria media**		Dicot Herb
Cleavers	*Galium aparine**		Dicot Herb
Clover species	*Trifolium species**		Dicot Herb
Cocksfoot	*Dactylis glomerata**		Grass
Convolvulus	*Convolvulus arvensis**		Dicot Herb
Cotoneaster	*Cotoneaster species**		Shrub
Couch	*Elytrigia repens**		Grass
Crack willow	*Salix xfragilis**		Tree
Creeping bent	*Agrostis stolonifera**		Grass
Creeping buttercup	*Ranunculus repens**		Dicot Herb
Curled dock	*Rumex crispus**		Dicot Herb
Dandelion	*Taraxacum officinale**		Dicot Herb
Eucalyptus species	*Eucalyptus species**		Tree
Fennel	*Foeniculum vulgare**		Dicot Herb
Field speedwell	*Veronica arvensis**		Dicot Herb
Gorse	*Ulex europaeus**		Shrub
Grey willow	*Salix cinerea**		Tree
Hawksbeard	*Crepis capillaris**		Dicot Herb
Ivy	*Hedera helix**		Dicot Herb

Common name	Scientific name	Threat Status	Growth Form
Jointed rush	*Juncus articulatus**		Grass
Leafless rush	*Juncus effusus**		Grass
Loquat	*Eriobotrya japonica**		Tree
Mallow species	*Malva species**		Dicot Herb
Montpellier broom	*Genista monspessulana**		Shrub
Mouse-ear chickweed	*Cerastium fontanum**		Dicot Herb
Onion grass	*Romulea rosea**		Grass
Oxtongue	*Helminthotheca echioides**		Dicot Herb
Pampas grass	*Cortaderia selloana**		Grass
Parsley piert	*Aphanes arvensis**		Dicot Herb
Perennial rye grass	*Lolium perenne**		Grass
Plum species	*Prunus species**		Tree
Prairie grass	*Bromus catharticus**		Grass
Red hot polka	*Kniphofia uvaria**		Dicot Herb
Sand spurrey	*Spergularia rubra**		Dicot Herb
Scotch broom	*Cytisus scoparius**		Shrub
Small-leaved wireweed	*Polygonum arenastrum**		Dicot Herb
Smooth catsear	*Hypochaeris glabra**		Dicot Herb
Spurrey	*Spergula arvensis**		Dicot Herb
Strawberry tree	*Arbutus unedo**		Tree
Sweet vernal	*Anthoxanthum odoratum**		Grass
Toad rush	*Juncus bufonius**		Grass
Tree lucerne	*Chamaecytisus palmensis**		Tree
Tree lupin	*Lupinus arboreus**		Shrub
Vetch	*Vicia sativa**		Dicot Herb
Water lily species*	*Water lily species**		Dicot Herb
Wild carrot	*Daucus carota**		Dicot Herb
Yarrow	*Achillea millefolium**		Dicot Herb
Yellow flag iris	*Iris pseudacorus**		Grass

Table A1b. Indigenous and exotic vascular plant species recorded on Monaco Peninsula within the Option B extension (sorted by common name).

Common name	Scientific name	Threat Status	Growth Form
Indigenous species			
Bracken	*Pteridium esculentum*	Not Threatened	Fern
Coastal immorality grass	*Austrostipa stipoides*	Not Threatened	Grass
Glasswort	*Salicornia quinqueflora*	Not Threatened	Dicot Herb
Lowland flax	*Phormium tenax*	Not Threatened (planted)	Grass
Mikimiki	*Coprosma propinqua*	Not Threatened (planted)	Tree
Salt marsh ribbonwood	*Plagianthus divaricatus*	Not Threatened (planted)	Shrub
Scrub pōhuehue	*Muehlenbeckia complexa*	Not Threatened (planted)	Climber/Vine
Taupata	*Coprosma repens*	Not Threatened (planted)	Tree
Wharariki	*Phormium cookianum*	Not Threatened (planted)	Grass
Exotic species			
Bay tree	*Laurus nobilis**		Tree
Blackberry	*Rubus fruticosus**		Low Shrub
Blackwood	*Acacia melanoxylon**		Tree
Broad-leaved dock	*Rumex obtusifolius**		Dicot Herb
Broad-leaved plantain	*Plantago major**		Dicot Herb
Browntop	*Agrostis capillaris**		Grass
Catsear	*Hypochaeris radicata**		Dicot Herb
Chewings fescue	*Festuca rubra**		Grass
Clover species	*Trifolium species**		Dicot Herb
Cocksfoot	*Dactylis glomerata**		Grass
Fennel	*Foeniculum vulgare**		Dicot Herb
Gorse	*Ulex europaeus**		Shrub
Ice plant	*Carpobrotus edulis**		Dicot Herb
Mallow species	*Malva species**		Dicot Herb
Narrow-leaved plantain	Plantago lanceolata*		Dicot Herb
Pampas grass	*Cortaderia selloana**		Grass
Periwinkle	*Vinca major**		Dicot Herb
Prairie grass	*Bromus catharticus**		Grass
Scotch broom	*Cytisus scoparius**		Shrub
Sheeps sorrel	*Rumex acetosella**		Dicot Herb

Common name	Scientific name	Threat Status	Growth Form
Sweet vernal	*Anthoxanthum odoratum**		Grass
Tree lucerne	*Chamaecytisus palmensis**		Tree
Tree lupin	*Lupinus arboreus**		Shrub
Vetch	*Vicia sativa**		Dicot Herb
Yarrow	*Achillea millefolium**		Dicot Herb
Yucca	*Yucca species**		Low Shrub

Appendix 2: Avifauna survey location photos

Representative photos of each avifauna survey site are provided below; refer to Figure 3 for locations of each of these sites.

Photo 5: Avifauna survey site C1

Photo 6: Avifauna survey site C2

Photo 7: Avifauna survey site C3

Photo 8: Avifauna survey site C4

Photo 9: Avifauna survey site C5

Photo 10: Avifauna survey site C6

Photo 11: Avifauna survey site T1

Photo 12: Avifauna survey site T2

Photo 13: Avifauna survey site T3

Photo 14: Avifauna survey site T4

Photo 15: Avifauna survey site W1

Photo 16: Avifauna survey site W2

Photo 17: Avifauna survey site W3

Photo 18: Avifauna survey site W4

Photo 19: Avifauna survey site W5

Appendix 3: Avifauna species & habitat list

The following table lists all the avifauna species recorded within the OSNZ 2004 atlas squares encompassing the Nelson airport and surrounding environment (Figure 2), and during the September site visit (Figure 3).

Names written in red indicate species identified by New Zealand Birds Online[13] as breeding within Waimea Inlet.

Information regarding primary and secondary habitat associations[14] was obtained for each species from Heather & Robertson (2015), along with each species' New Zealand threat status[15] according to Robertson et al. (2017).

[13] https://nzbirdsonline.org.nz/?q=location-search&field_location_term_id=284&field_location_term_value=Waimea%20Inlet

[14] For the purpose of this report, primary habitat refers to the habitat in which the species spends most of its time. Secondary habitats are other habitat types which the species may also utilise.

[15] With qualifiers: CD=conservation dependent; De=designated; DP=data poor; IE=island endemic; Inc=increasing; OL=one location; RF=recruitment failure; RR=range restricted; SO=secure overseas; Sp=sparse; St=stable; TO=threatened overseas.

SPECIES		CONSERVATION STATUS		HABITAT								SOURCE			
				Native forest	Exotic Forest	Scrub / shrubland	Farmland / open country	Freshwater / wetlands	Coastal / Estuary	Oceanic	Urban/Residential	2520, 5980	2520, 5990	2530, 5990	Sept 2021 site visit
Bellbird	*Anthornis m. melanura*	Not Threatened	Not Threatened									✓	✓	✓	
Brown creeper	*Mohoua novaeseelandiae*	Not Threatened	Not Threatened										✓		
Bush falcon	*Falco novaeseelandiae* "bush"	At Risk	Recovering [DP]									✓		✓	
Kea	*Nestor notabilis*	Threatened	Nationally Endangered[RR]									✓			
Kereru	*Hemiphaga novaeseelandiae*	Not Threatened	Not Threatened[CD Inc]									✓		✓	
Kingfisher	*Todiramphus sanctus vagans*	Not Threatened	Not Threatened									✓	✓	✓	✓
Morepork	*Ninox n. novaeseelandiae*	Not Threatened	Not Threatened									✓		✓	
Tomtit	*Petroica macrocephala*	Not Threatened	Not Threatened									✓	✓		
Shining cuckoo	*Chrysococcyx l. lucidus*	Not Threatened	Not Threatened[DP]									✓	✓	✓	
NZ fantail	*Rhipidura fuliginosa*	Not Threatened	Not Threatened[EF]									✓	✓	✓	
South Island kaka	*Nestor m. meridionalis*	Threatened	Nationally Vulnerable[CD PD RF]									✓			
South Island robin	*Petroica australis australis*	Not Threatened	Not Threatened[CD]									✓			
Tui	*Prosthemadera n. novaeseelandiae*	Not Threatened	Not Threatened[Inc]									✓	✓	✓	
Blackbird	*Turdus merula*	Introduced	Introduced & Naturalised[SO]									✓	✓	✓	✓
California quail	*Callipepla californica*	Introduced	Introduced & Naturalised[SO]									✓	✓	✓	
Cirl bunting	*Emberiza cirlus*	Introduced	Introduced & Naturalised[SO]									✓	✓	✓	
Grey warbler	*Gerygone igata*	Not Threatened	Not Threatened									✓	✓	✓	
Pheasant	*Phasianus colchicus*	Introduced	Introduced & Naturalised[SO]									✓	✓	✓	
Silvereye	*Zosterops lateralis lateralis*	Not Threatened	Not Threatened[SO]									✓	✓	✓	✓
Canada goose	*Branta canadensis*	Introduced	Introduced & Naturalised[SO]									✓	✓	✓	
Cattle egret	*Ardea ibis coromanda*	Migrant	Migrant[SO]									✓	✓		
Chaffinch	*Fringilla coelebs*	Introduced	Introduced & Naturalised[SO]									✓	✓	✓	✓
Dunnock	*Prunella modularis*	Introduced	Introduced & Naturalised[SO]									✓	✓	✓	
Goldfinch	*Carduelis carduelis*	Introduced	Introduced & Naturalised[SO]									✓	✓	✓	✓
Greenfinch	*Carduelis chloris*	Introduced	Introduced & Naturalised[SO]									✓	✓	✓	✓
House sparrow	*Passer domesticus*	Introduced	Introduced & Naturalised[SO]									✓	✓	✓	✓
Little owl	*Athene noctua*	Introduced	Introduced & Naturalised[SO]									✓			

SPECIES		CONSERVATION STATUS		HABITAT								SOURCE			
				Native forest	Exotic Forest	Scrub / shrubland	Farmland / open country	Freshwater / wetlands	Coastal / Estuary	Oceanic	Urban/Residential	2520, 5980	2520, 5990	2530, 5990	Sept 2021 site visit
Magpie	*Gymnorhina tibicen*	Introduced	Introduced & Naturalised[SO]									✓		✓	
NZ pipit	*Anthus n. novaeseelandiae*	At Risk	Declining									✓	✓	✓	✓
Redpoll	*Carduelis flammea*	Introduced	Introduced & Naturalised[SO]									✓	✓	✓	
Skylark	*Alauda arvensis*	Introduced	Introduced & Naturalised[SO]									✓	✓	✓	✓
Song thrush	*Turdus philomelos*	Introduced	Introduced & Naturalised[SO]									✓	✓	✓	✓
Spur-winged plover	*Vanellus miles novaehollandiae*	Not Threatened	Not Threatened[SO]									✓	✓	✓	✓
Starling	*Sturnus vulgaris*	Introduced	Introduced & Naturalised[SO]									✓	✓	✓	✓
Swamp harrier	*Circus approximans*	Not Threatened	Not Threatened[SO]									✓	✓	✓	✓
Welcome swallow	*Hirundo n. neoxena*	Not Threatened	Not Threatened[SO ST]									✓	✓	✓	✓
Yellowhammer	*Emberiza citrinella*	Introduced	Introduced & Naturalised[SO]											✓	✓
Australian coot	*Fulica atra australis*	Coloniser	Coloniser[Inc SO]											✓	
Black shag	*Phalacrocorax carbo novaehollandiae*	At Risk	Naturally Uncommon[SO Sp]									✓	✓	✓	
Black swan	*Cygnus atratus*	Not Threatened	Not Threatened[SO]									✓	✓	✓	
Black-billed gull	*Larus bulleri*	Threatened	Nationally Critical[RF DP]									✓	✓	✓	
Black-fronted dotterel	*Charadrius melanops*	Coloniser	Coloniser[SO Sp]									✓			
Black-fronted tern	*Chlidonias albostriatus*	Threatened	Nationally Endangered[CD, DP, RF, Sp]									✓	✓	✓	
Grey duck	*Anas s. superciliosa*	Threatened	Nationally Critical[SO DP]									✓	✓	✓	
Grey teal	*Anas gracilis*	Not Threatened	Not Threatened[Inc SO]									✓	✓	✓	✓
Little black shag	*Phalacrocorax sulcirostris*	At Risk	Naturally Uncommon[RR]									✓	✓	✓	✓
Little shag	*Phalacrocorax melanoleucos brevirostris*	Not Threatened	Not Threatened[Inc]									✓	✓	✓	✓
Mallard	*Anas platyrhynchos*	Introduced	Introduced & Naturalised[SO]									✓	✓	✓	✓
South Island pied oystercatcher	*Haematopus finschi*	At Risk	Declining									✓	✓	✓	✓
NZ scaup	*Aythya novaeseelandiae*	Not Threatened	Not Threatened[Inc]									✓			
NZ shoveler	*Anas rhynchotis variegata*	Not Threatened	Not Threatened									✓	✓	✓	
Paradise shelduck	*Tadorna variegata*	Not Threatened	Not Threatened									✓	✓	✓	✓
Pied shag	*Phalacrocorax varius varius*	At Risk	Recovering									✓	✓	✓	✓
Pied stilt	*Himantopus h. leucocephalus*	Not Threatened	Not Threatened[SO]									✓	✓	✓	✓

SPECIES		CONSERVATION STATUS		HABITAT								SOURCE			
				Native forest	Exotic Forest	Scrub / shrubland	Farmland / open country	Freshwater / wetlands	Coastal / Estuary	Oceanic	Urban/Residential	2520, 5980	2520, 5990	2530, 5990	Sept 2021 site visit
Pukeko	*Porphyrio m. melanotus*	Not Threatened	Not Threatened[Inc SO]									✓	✓	✓	✓
White heron	*Ardea modesta*	Threatened	Nationally Critical[OL SO St]									✓	✓	✓	
White-winged black tern	*Chlidonias leucopterus*	Migrant	Migrant[SO]									✓	✓		
Asiatic black-tailed godwit	*Limosa limosa melanuroides*	Vagrant	Vagrant[SO]									✓			
Banded dotterel	*Charadrius bicinctus bicinctus*	Threatened	Nationally Vulnerable[DP]									✓	✓	✓	
Banded rail	*Gallirallus philippensis assimilis*	At Risk	Declining[DP RR]									✓	✓	✓	
Black-backed gull	*Larus d. dominicanus*	Not Threatened	Not Threatened[SO]									✓	✓	✓	✓
Caspian tern	*Hydroprogne caspia*	Threatened	Nationally Vulnerable[SO Sp]									✓	✓	✓	✓
Eastern bar-tailed godwit	*Limosa lapponica baueri*	At Risk	Declining[TO]									✓	✓	✓	✓
Eastern curlew	*Numenius madagascariensis*	Migrant	Migrant[SO]											✓	
Eastern little tern	*Sternula albifrons sinensis*	Migrant	Migrant[SO]									✓	✓		
Lesser knot	*Calidris canutus rogersi*	Threatened	Nationally Vulnerable[TO]									✓	✓	✓	
Little egret	*Egretta garzetta immaculata*	Vagrant	Vagrant[SO]										✓		
Northern NZ dotterel	*Charadrius obscurus aquilonius*	At Risk	Recovering[CD]									✓			
Pacific golden plover	*Pluvialis fulva*	Migrant	Migrant[SO]									✓	✓		
Red-billed gull	*Larus novaehollandiae scopulinus*	At Risk	Declining									✓	✓	✓	✓
Red-necked stint	*Calidris ruficollis*	Migrant	Migrant[SO]											✓	
Reef heron	*Egretta sacra sacra*	Threatened	Nationally Endangered[DP SO Sp]										✓		
Royal spoonbill	*Platalea regia*	At Risk	Naturally Uncommon[Inc RR SO Sp]									✓	✓	✓	✓
Siberian tattler	*Tringa brevipes*	Vagrant	Vagrant[SO]									✓			
Spotted shag	*Stictocarbo p. punctatus*	Not Threatened	Not Threatened									✓	✓	✓	
Terek sandpiper	*Tringa cinerea*	Vagrant	Vagrant[SO]									✓			
Turnstone	*Arenaria interpres*	Migrant	Migrant[SO]									✓	✓	✓	
Variable oystercatcher	*Haematopus unicolor*	At Risk	Recovering											✓	✓
White-faced heron	*Egretta novaehollandiae*	Not Threatened	Not Threatened[SO]									✓	✓	✓	✓
White-fronted tern	*Sterna s. striata*	At Risk	Declining[DP]									✓	✓	✓	
Wrybill	*Anarhynchus frontalis*	Threatened	Nationally Vulnerable[RR DP]									✓	✓	✓	

SPECIES		CONSERVATION STATUS		HABITAT								SOURCE			
				Native forest	Exotic Forest	Scrub / shrubland	Farmland / open country	Freshwater / wetlands	Coastal / Estuary	Oceanic	Urban/Residential	2520, 5980	2520, 5990	2530, 5990	Sept 2021 site visit
Arctic skua	*Stercorarius parasiticus*	Migrant	Migrant[SO]										✓	✓	
Australasian gannet	*Morus serrator*	Not Threatened	Not Threatened[De Inc SO]									✓	✓	✓	
Brown skua	*Catharacta antarctica lonnbergi*	At Risk	Naturally Uncommon[Sp]										✓		
Flesh-footed shearwater	*Puffinus carneipes*	Threatened	Nationally Vulnerable[RR TO]											✓	
Fluttering shearwater	*Puffinus gavia*	At Risk	Relict[RR]										✓	✓	
NZ white-capped mollymawk	*Thalassarche cauta steadi*	At Risk	Declining[EF RR]											✓	
Sooty shearwater	*Puffinus griseus*	At Risk	Declining[SO]											✓	
Southern blue penguin	*Eudyptula minor minor*	At Risk	Declining[DP]											✓	
Rock pigeon	*Columba livia*	Introduced	Introduced & Naturalised[SO]									✓	✓	✓	✓

Appendix 4: Critical periods for freshwater fishes

Table A4.1. Freshwater fish spawning calendar, taken from NIWA (2015).

Key: Peak | Range | Larvae/Fry/Juveniles present | non migrant * | present •

Functional Group	Species	Conservation Status	Summer D	Summer J	Summer F	Autumn M	Autumn A	Autumn M	Winter J	Winter J	Winter A	Spring S	Spring O	Spring N	All	North Island NL	North Island CNI	North Island EC	North Island HB	North Island SNI	South Island NM	South Island WC	South Island CAN	South Island OS
Bullies (fast flow) and Torrentfish	Bluegill bully	•													•									
	Redfin bully	•													•									
	Torrentfish	•													•									
Bullies (slow flow)	Common bully	o													•									
	Crans bully	o														•	•	•	•	•				
	Giant bully	o													•									
	Tarndale bully*	□																			•			
	Upland bully*	o													•									
Eels	Longfin eel	•													•									
	Shortfin eel	o													•									
Inanga and smelt	Common smelt	o													•									
	Inanga	•													•									
	Stokells smelt	□																					•	
Lamprey	Lamprey	+													•									
Large Galaxiids	Banded kokopu	o													•									
	Giant kokopu	•														•	•	•		•	•	•	•	•
	Koaro	•													•									
	Shortjaw kokopu	+														•	•	•		•	•	•		•
Mudfish*	Black mudfish	•														•	•							
	Brown mudfish	•															•					•		
	Canterbury mudfish	•																					•	
	Northland mudfish	+														•								
Non-Migratory Galaxiids*	Alpine galaxias	□																					•	•
	Bignose galaxias	+																					•	
	Canterbury galaxias	•																			•		•	•
	Dusky galaxias	++																						•
	Dwarf galaxias	•															•		•	•	•	•	•	
	Eldons galaxias	++																						•
	Taieri flathead galaxias	+																						•
	Gollum galaxias	+																						•
	Upland longjaw galaxias	+																					•	
	Lowland longjaw galaxias	+++																					•	•
	Roundhead galaxias	++																						•
	Dwarf inanga	•														•								
Salmonid Sportfish	Atlantic salmon	Δ																						•
	Brook Char	Δ															•						•	•
	Brown trout	Δ															•	•	•	•	•	•	•	•
	Chinook salmon	Δ																				•	•	•
	Mackinaw*	Δ																					•	
	Rainbow trout	Δ													•									
	Sockeye salmon	Δ																					•	•

o Not Threatened • At Risk Declining □ At Risk Naturally Uncommon + Threatened Nationally vulnerable ++ Threatened Nationally Endangered

+++ Threatened Nationally Critical Δ Sportsfish

Table A4.2. Freshwater fish migration calendar, taken from NIWA (2015).

Key: Peak (P) | Range (R) | Lower river * | Present •

Functional Group	Conservation				Summer			Autumn			Winter			Spring				North Island					South Island			
	Species	Status	Direction	Life stage	D	J	F	M	A	M	J	J	A	S	O	N	All	NL	CNI	EC	HB	SNI	NM	WC	CAN	OS
Bullies (fast flow) & Torrentfish	Bluegill bully	•	upstream	juvenile	R	R	R	R								R	•									
			down	larvae	R	R	R	R						R	R	R										
	Redfin bully	•	upstream	juvenile	R	R	R	R								R	•									
			down	larvae	R	R	R							R	R	R										
	Torrentfish	•	upstream	juvenile					R	P	P	P	P	R	R	R	•									
			down	larvae*	R	R	P	P	P	P	R															
Bullies (slow flow)	Common bully	o	upstream	juvenile	R	R	R	R									•									
			down	larvae*	R	R	R	R						R	P	P										
	Giant bully	o	upstream	juvenile	R	R	R	R									•									
			down	larvae*	R	R	R	R						R	R	R										
Eels	Longfin eel	•	to estuary	glass eel								R	P	P	P	R	•									
			upstream	juvenile	P	P	P	P	R							R										
			down	adult				R	R	R																
	Shortfin eel	o	to estuary	glass eel	R								R	P	P	P	•									
			upstream	juvenile	P	P	P	P	R							R										
			down	adult			R	R	R	R																
Inanga and smelt	Common smelt	o	upstream	juvenile									R	P	P	R	•									
			down	larvae*		R	R	R	P	P	P	R	R													
	Inanga	•	upstream	juvenile						R	R	R	P	P	P	P	•									
			down	larvae*	R	R	R	P	P	P	P	P	R		R	R										
	Stokells smelt	□	upstream	adult*	P	R	R	R							R	P									•	
			down	larvae*	R	P	P	R						R	R	R										
Lamprey	Lamprey	+	upstream	adult					R	R	R	R	P	R	R	R	•									
			down	juvenile	R	R	R	R	R	R	R	R	R	R	R	R										
Large Galaxiids	Banded kokopu	o	upstream	juvenile	R								R	P	P	R	•									
			down	larvae				R	R	R	P	P	R	R												
	Giant kokopu	•	upstream	juvenile	R										R	P		•	•	•		•	•	•	•	•
			down	larvae						R	P	P	R	R												
	Koaro	•	upstream	juvenile										P	P	R	•									
			down	larvae						P	P	R	R	R												
	Shortjaw kokopu	+	upstream	juvenile										R	R	R		•	•	•		•	•	•		•
			down	larvae						R	P	P	R													
Salmonid Sportfish	Atlantic salmon	Δ	upstream	adult	R	R	R	R	R	R																•
			down	juvenile						R	R	R	R													
	Brook Char	Δ	upstream	adult	R	R	R	R	R	R									•						•	•
			down	juvenile						R	R	R	R													
	Brown trout	Δ	upstream	adult	R	R	R	P	P	P									•	•	•	•	•	•	•	•
			down	juvenile	R	R	R	R	R	R	R	R	R	R	R	R										
	Chinook salmon	Δ	upstream	adult	R	R	R	R	P	P	R													•	•	•
			down	juvenile						R	R	R	P	P	R											
	Rainbow trout	Δ	upstream	adult						R	P	P	R	R			•									
			down	juvenile	R	R	R	R	R	R	R	R	R	R	R	R										
	Sockeye salmon	Δ	upstream	adult				P																	•	•
			down	juvenile					R	P	R															

o Not Threatened • At Risk Declining □ At Risk Naturally Uncommon + Threatened Nationally vulnerable ++ Threatened Nationally Endangered

+++ Threatened Nationally Critical Δ Sportsfish

About Boffa Miskell

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

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Memorandum

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Attention:	Simon Barr, Nelson Airport Limited
Date:	8 February 2023
From:	Dr Tanya Blakely (Freshwater), Scott Hooson (Terrestrial Vegetation and Habitats), Dr Tommaso Alestra (Marine), Dr Leigh Bull (Avifauna)
Message Ref:	Multi-criteria analysis for Ecology
Project No:	BM210724 – Nelson Airport Ecology

This memorandum is an addendum to the Nelson Airport Designation Notice of Requirement, Ecological Assessment (“Ecological Assessment)” report provided to Nelson Airport Limited on 18 August 2022.

We present details of the vegetation and habitats, freshwater, marine and avifauna ecological values and score each of the options (Option A and Option B) against the potential effects on these ecological values. This is intended to inform the broader multi-criteria analysis (MCA) for the project, which will be used to identify the preferred option, from an RMA perspective, in terms of runway extension across all the relevant disciplines.

The options assessed are Option 1 – Northern extension and Option 2 – Southern extension and are described in Section 1.2 and Figure 1 of the Ecological Assessment report.

Methodology

For the purposes of inputting into the overall MCA, ratings had to be applied to each of the ecological criterion using the scoring system of +3 (significant positive effect) to 0 (neutral / change) to -3 (significant adverse effect) (shown in Table 1).

Table 1. Overall MCA scoring from -3 (significant adverse effect) to +3 (significant positive effect).

Effects / Outcome criteria	Scoring
Significant adverse effect / substantial negative effect on the project outcome	-3
Moderate / Major adverse effect	-2
Minor adverse effect	-1
Neutral / no change	0
Minor positive effect	1
Moderate / Major positive effect	2
Significant positive effect / achievement of project outcome.	3

To follow a robust and repeatable process, we used the Environment Institute of Australia and New Zealand (EIANZ) Ecological Impact Assessment (EcIA) guidelines (Roper-Lindsay et al., 2018) to assess the ecological values (Table 2, Table 3, Table 4, Table 5) and the magnitude of potential effect (Table 6) to determine an overall level of effect (Table 7) for terrestrial vegetation and habitats, freshwater, marine and avifauna assemblages (terrestrial, freshwater and coastal).

The level of effect was then applied to the MCA scoring as shown in Table 8.

Table 2. Matters to be considered when assigning ecological value to terrestrial vegetation / habitats / communities, or a freshwater site or area (Roper-Lindsay et al., 2018).

MATTERS	ATTRIBUTES TO BE CONSIDERED - TERRESTRIAL	ATTRIBUTES TO BE CONSIDERED - FRESHWATER
Representative-ness	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 for the habitat type	- Extent to which site / catchment is typical or characteristic - Stream order - Permanent, intermittent, or ephemeral waterway - Catchment size - Standing water characteristics
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	- Supporting nationally or locally (within relevant Ecological District) Threatened, At Risk or uncommon species - National distribution limits - Endemism - Distinctive ecological features - Type of lake / pond / wetland / spring
Diversity and pattern	- Level of natural diversity, abundance and distribution - Biodiversity reflecting underlying diversity - Biogeographical considerations – pattern, complexity - Temporal considerations, considerations of lifecycles, daily or seasonal cycles of habitat availability and utilisation	- Level of natural diversity - Diversity metrics - Complexity of community - Biogeographical considerations – pattern, complexity, size, shape
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 (from "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	- Stream order - Instream habitat - Riparian habitat - Local environmental conditions and influences, site history and development - Intactness, health and resilience of populations and communities - Contribution to ecological networks, linkages, pathways - Role in ecosystem functioning – high level, proxies

Table 3. Scoring for sites or areas combining values for four matters in Table 2 (Roper-Lindsay et al., 2018).

VALUE	DESCRIPTION
Very High	Area rates High for 3 or all of the four assessment matters listed in Table 2 and Table 3. Likely to be nationally important and recognised as such.
High	Area rates High for 2 of the assessment matters, Moderate and Low for the remainder; or Area rates High for 1 of the assessment maters, Moderate for the remainder. Likely to be regionally important and recognised as such.
Moderate	Area rates High for one matter, Moderate and Low for the remainder; or Area rates Moderate for 2 or more assessment matters Low or Very Low for the remainder. Likely to be important at the level of the Ecological District.
Low	Area rates Low or Very Low for majority of assessment matters and Moderate for one. Limited ecological value other than as local habitat for tolerant native species.
Very Low / Negligible	Area rates Very Low for 3 matters and Moderate, Low or Very Low for remainder.

Table 4. Matters to be considered when assigning ecological value to a marine site or area, based on criteria developed by Dr Sharon De Luca (Boffa Miskell Ltd, Marine Ecologist) for estuarine / marine environments[1].

VALUE	CHARACTERISITCS
Very High	- Benthic invertebrate community typically has very high diversity, species richness and abundance for the habitat type. - Benthic invertebrate community contains dominated taxa that are sensitive to organic enrichment and mud. - Marine sediments typically comprise <25% smaller grain sizes. - Surface sediment oxygenated with no anoxic sediment present. - Contaminant concentrations in surface sediment significantly below ANZG DGV effects threshold concentrations. - Invasive opportunistic and disturbance tolerant species absent. - Native estuarine vegetation sequences intact and provides significant habitat for native fauna. - Habitat unmodified.
High	- Benthic invertebrate community typically has high diversity, species richness and abundance for the habitat type. - Benthic invertebrate community contains many taxa that are sensitive to organic enrichment and mud. - Marine sediments typically comprise <50% silt and clay grain sizes. - Surface sediment oxygenated. - Contaminant concentrations in surface sediment significantly below ANZG DGV effects threshold concentrations. - Invasive opportunistic and/or disturbance tolerant species largely absent. - Estuarine vegetation dominated by native species. - Habitat largely unmodified.
Moderate	- Benthic invertebrate community typically has moderate species richness, diversity and abundance for the habitat type. - Benthic invertebrate community has both (organic enrichment and mud) tolerant and sensitive taxa present. - Marine sediments typically comprise less than 50-70% silt and clay grain sizes. - Shallow depth of oxygenated surface sediment. - Contaminant concentrations in surface sediment generally below ANZG DGV effects threshold concentrations. - Few invasive opportunistic and/or disturbance tolerant species present. - Estuarine vegetation a mixture of native and exotic species. - Habitat modification limited.

[1] No regional or national guidelines or criteria have been developed to date in New Zealand, for the assessment of marine ecological values. The criteria used in this assessment have been developed by Dr Sharon De Luca to guide valuing estuarine and marine environments and to provide a transparent and repeatable approach. This approach has been used and accepted in previous Board of Inquiry consenting processes, including for major roading projects for Waka Kotahi NZTA projects.

VALUE	CHARACTERISITCS
Low	- Benthic invertebrate community degraded with low species richness, diversity and abundance for the habitat type. - Benthic invertebrate community dominated by organic enrichment tolerant and mud tolerant organisms with few/no sensitive taxa present. - Marine sediments dominated by silt and clay grain sizes (>70%). - Surface sediment predominantly anoxic (lacking oxygen). - Elevated contaminant concentrations in surface sediment, above ANZG DGV effects threshold concentrations. - Invasive, opportunistic and/or disturbance-tolerant species dominant. - Estuarine vegetation dominated by exotic species. - Habitat highly modified.
Very Low	- Benthic invertebrate community degraded with very low species richness, diversity and abundance for the habitat type. - Benthic invertebrate community dominated by organic enrichment tolerant and mud tolerant organisms with no sensitive taxa present. - Marine sediments dominated by silt and clay grain sizes (>85%). - Surface sediment anoxic (lacking oxygen). - Elevated contaminant concentrations in surface sediment, above ANZG Default Guideline Values (DGV) effects threshold concentrations2. - Invasive, opportunistic and disturbance tolerant species highly dominant. - Native estuarine vegetation absent. - Habitat extremely modified.

Table 5. Assigning ecological value to species from Roper-Lindsay et al., (2018).

VALUE	SPECIES
Very High	*Nationally Threatened* (Nationally Critical, Nationally Endangered, Nationally Vulnerable, Nationally Increasing[3]) species found in the ZOI[4] either permanently or seasonally.
High	Species listed as *At Risk – Declining* found in the ZOI either permanently or seasonally.
Moderate	Species listed as any other category of *At Risk* (Recovering, Relict, Naturally Uncommon) found in the ZOI either permanently or seasonally; or Locally (ED) uncommon or distinctive species.
Low	Nationally and locally common indigenous species.
Very Low / Negligible	Exotic species, including pests, species having recreational value.

When assigning ecological value to species, we used the following threat classifications:

- Plants: de Lange et al. (2018)
- Birds: Robertson et al. (2021)[5]
- Freshwater fish: Dunn et al. (2018)

[2] ANZG (2018) Australian and New Zealand Guidelines for Freshwater and Marine Water Quality (replaced previous ANZECC guidelines).

[3] Nationally Increasing is category that was devised by DOC (Michel, 2021) in 2021 to resolve a problem that would arise if the population of a taxon assessed as At Risk Recovering A should stabilise. Threatened – Nationally Increasing is assigned to "Small population that have experienced a previous decline (or for which it is uncertain whether it has experienced a previous decline) and that is forecast to increase >10% over the next 10 years or 3 generations, whichever is longer" (Rolfe et al. 2021). Thus, while such a threat category is not identified in Roper-Lindsay et al. (2018), we have included it along with all other *Threatened* classifications in to the Very High ecological value category.

[4] Roper-Lindsay et al. (2018) define the Zone of Influence (ZOI) as "*the areas/resources that may be affected by the biophysical changes caused by the proposed project and associated activities."*

[5] The Ecological Assessment used Robertson et al., (2017) rather than Robertson et al., (2021). The threat classification for some species has changed, such as bush falcon, which increased from *At Risk* to *Threatened*. This has implications for assigning the ecological value.

Table 6. Criteria for describing magnitude of effect from Roper-Lindsay et al., (2018).

MAGNITUDE	DESCRIPTION
Very High	Total loss of, or very major alteration, to key elements/ features of the baseline conditions such that the post development character/ composition/ attributes will be fundamentally changed and may be lost from the site altogether; AND/OR ***Loss[6] 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[6] 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 post-development character, composition and/or attributes will be partially changed; AND/OR ***Loss[6] of a moderate proportion of the known population or range of the element / feature.***
Low	Minor shift away from 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/patterns; AND/OR ***Having a minor effect on the known population or range of the element / feature.***
Negligible	Very slight change from existing baseline condition. Change barely distinguishable, approximating to the "no change" situation; AND/OR ***Having a negligible effect on the known population or range of the element / feature.***

When assigning magnitude of effect, we used the criteria and descriptions from Roper-Lindsay et al. (2018) (as shown in Table 6). We assessed the magnitude of effect for each component of ecology at the following scales.

- Vegetation and habitats: Motueka Ecological District scale
- Freshwater: Waimea Inlet scale, including both Waimea and Māpua arms
- Marine: Waimea Inlet scale, including both Waimea and Māpua arms
- Avifauna: Waimea Inlet scale, including both Waimea and Māpua arms; this includes the coastal and estuarine environment to the south of a line drawn from Port Nelson to Māpua.

We have also taken both a species (for avifauna) and habitat focus and applied the criteria or proportion thresholds below, at the scale(s) noted above, to assist with determining the magnitude of effect:

- Very High: >50% of the population[7] affected or habitat lost.
- High: 20-50% of the population[7] affected or habitat lost.
- Moderate: 10-20% of the population[7] affected or habitat lost.
- Low: 1-10% of the population[7] affected or habitat lost.
- Negligible: <1% of the population[7] affected or habitat lost.

Table 7. Matrix of level of effect modified from Roper-Lindsay et al., (2018).

LEVEL OF EFFECT		Ecological &/or Conservation Value				
		Very High	**High**	**Moderate**	**Low**	**Very Low / Negligible**
Magnitude	**Very High**	Very High	Very High	Very 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
	Very Low / Negligible	Low	Very Low	Very Low	Very Low	Very Low
	Positive	Net gain	Net gain	Net gain	Net gain	Net gain

[6] In the context of mobile fauna, the term "loss" can include displacement from an area.

[7] For avifauna, this relates to the scale of the local population, that being the Waimea Inlet as defined above.

Table 8. The EIANZ EcIA level of effect (from Table 7) and MCA scores (Table 1).

EIANZ EcIA LEVEL OF EFFECT	EFFECTS / OUTCOME CRITERIA	SCORING
Very High – High	Significant adverse effect / substantial negative effect on the project outcome	-3
Moderate	Moderate / Major adverse effect	-2
Low	Minor adverse effect	-1
Very Low / Negligible	Neutral / no change	0
Net gain: Low	Minor positive effect	1
Net gain: Moderate	Moderate / Major positive effect	2
Net gain: High – Very High	Significant positive effect / achievement of project outcome	3

Limitations and assumptions

As noted in Section 2.3 of the Ecological Assessment, the following limitations and data constraints were identified and taken into consideration for this MCA assessment:

- Limited vegetation / botanical surveys and avifauna surveys were carried out by Scott Hooson and Dr Leigh Bull, respectively.
- Specialised surveys of other ecological matters (e.g., in-stream, marine, lizard or invertebrate communities) have not been completed as part of this work.
- Drs Tanya Blakely (Freshwater) and Tommaso Alestra (Marine) did not visit the site and freshwater and marine assessments are based on readily available desktop information.
- The vegetation / botanical survey was undertaken in early spring at a time when very few grasses and sedges were flowering. This made the accurate identification of some species difficult.
- OSNZ Atlas (1999-2004): the data were collected over a five-year period (1999-2004) by several people with varying levels of species identification skills. While the atlas grid square locations are fixed, there is no standardised method in terms of survey effort or coverage within each 10 km x 10 km grid square.
- Seasonal variability: the data collected during the September 2021 site visit represents a snapshot of the species and habitat utilisation of the area at that time and does not account for temporal and seasonal variability that is likely to occur. As such, some avifauna species that potentially use habitats within the designation may not have been detected.
- Cryptic bird surveys: while several data sources recorded cryptic marsh bird species within the wider area, surveys for these species were not conducted as part of this assessment.

We have also considered the following assumptions for this MCA assessment:

- We have taken a conservative approach to deal with uncertainty due to the limitations noted above (and in the Ecological Assessment), whereby the highest possible effect has been used when scoring potential effects.
- Individual potential effects (for species, different habitat types, etc) have been assessed, and from this we have taken the highest possible effect for each area of ecology and used this for the MCA process.
- As Nelson Airport already holds existing designations and an operational runway, the focus of this MCA assessment for ecology is on changes associated with the proposed Option A and Option B extensions – i.e., any new activities that the extended designation would provide for. For example, while habitat suitable for lizards (e.g., skink) was noted within the survey area (i.e., rank grass north of Quarantine Road; land on Monaco Peninsula), these areas fall within the existing NRMP DAA1 Designation and so effects on lizards have not been considered in our MCA assessment.

- Similarly, the small shallow water wetland in the eastern corner of the golf course beside Bolt Road has not been considered in this assessment as it is located within the existing NRMP DAA1 Designation.

- Cryptic marsh bird species (e.g., banded rail) have been reported present and breed within the wider area, however, surveys for these species were not conducted as part of this assessment. In accordance with a conservative approach, we have assumed that the saltmarsh vegetation along Tāhunanui Estuary to the north and Jenkins Creek to the south of the Airport may provide breeding habitat for banded rail.

- We have assumed that foraging shorebirds are distributed evenly over the intertidal habitat of Waimea Inlet.

- We have assumed that NZ pipit and bush falcon are not breeding within habitats of the golf course, as no breeding habitat is available.

- The assessment has been done <u>without mitigation</u>, but the following base mitigation has been considered:

    - We have assumed that robust erosion and sediment control measures and best practice site management will minimize the release of sediment and contaminants into the freshwater and marine environments during construction.
    - We have assumed that stormwater runoff from the operating runway would be treated prior to being discharged to the freshwater and / or marine environment, to avoid or minimise contaminants (sediment, pollutants) entering the coastal marine area.
    - Option B – the southern extension option – proposes to include a bridged crossing over Jenkins Creek, rather than a piped / culverted crossing. This would be a bridge structure of at least 220 m in width.
    - Our assessment assumes a 3.6 ha reclamation of inlet seabed to the south of Monaco Peninsula for the southern option (Option B). While we assume that piles will be required within the bed of Jenkins Creek and the surrounding Waimea Inlet (north of Monaco Peninsula), to support the bridge structure, in the absence of detailed information we have not assessed reclamation and occupancy in the estuary bed because of these piles.

Results

Table 9. Ecological effects assessment of Option A and Option B, without mitigation, following Roper-Lindsay et al. (2018).

Ecological Criteria	Option A – Northern Extension Option – without mitigation		Option B – Southern Extension Option – without mitigation	
Vegetation and habitats	-1	Minor adverse effects expected, due to loss of 0.17 ha of indigenous dominated saltmarsh vegetation along Maire Stream Tributary. This saltmarsh habitat is a natural wetland. Rank exotic grassland habitats within eastern areas may provide habitat for skinks requiring surveys and management, if works are required in this area. However, these areas of habitat are within the existing NRMP DAA1 Designation so potential effects of the northern extension option on skinks have not been included in the MCA assessment. Ecological value: a small area of indigenous dominated saltmarsh vegetation along Maire Stream Tributary is of **Moderate** ecological value; all other vegetation and terrestrial habitats within the northern extension are of **Negligible** ecological value. Magnitude of effect: the loss of saltmarsh vegetation equates to approximately 0.09% of this vegetation type in the ecological district, but a greater loss at the scale of the feature. The loss of other vegetation and terrestrial habitats will have a negligible magnitude of effect. Overall, the magnitude of effect has been assessed as a **Low** magnitude / minor shift (saltmarsh) to **Negligible** magnitude / very slight change (all other) from the existing baseline condition. Level of effect: **Low (-1)** (saltmarsh) to **Very Low (0)** (all other)	0	Negligible adverse effects on vegetation and terrestrial habitats because all of the southern extension (not already designated as NAL-land) is entirely exotic grassland of Negligible Ecological Value. Land on Monaco Peninsula may provide habitat for skinks requiring surveys and management, if works are required in this area. However, Monaco Peninsula is within the existing NRMP DAA1 Designation, so potential effects of the southern extension option on skinks have not been included in the MCA assessment. Ecological value: all vegetation and terrestrial habitats within the southern extension are of **Negligible** ecological value. Magnitude of effect: the loss of these will result in a **Negligible** magnitude of effect / very slight change from existing baseline condition. Level of effect: **Very Low (0)**

Ecological Criteria	Option A – Northern Extension Option – without mitigation		Option B – Southern Extension Option – without mitigation	
Freshwater	-1	Minor adverse effect due to loss of c.475 m[8] of freshwater habitat of Marie Stream Tributary, which likely supports At Risk freshwater fish species and may be inanga spawning habitat. Potential minor adverse effect due to loss of ecological connection with the upstream 500 m of Maire Stream Tributary. Ecological value: Maire Stream Tributary (c.1000 m total length of stream, with c.475 m within the Option A footprint), although modified (channelised with sub-optimal water and habitat quality) likely supports numerous *At Risk* freshwater fish species and may provide spawning habitat for inanga – High ecological value. Magnitude of effect: piping or infilling of Maire Stream Tributary will result in the loss of c.475 m of freshwater habitat, which is c.0.7-1.4% of remaining coastal stream reaches (i.e., lower reaches of waterways within 1.5 km of the coast) at the Waimea Inlet scale; and c.7.7-16.2% habitat loss at the project scale. Due to loss of freshwater habitat, potential inanga spawning habitat, and an increase in impervious surfaces and contaminant inputs. Additionally, potential loss of ecological connectivity to a further c.500 m of upstream freshwater habitat, which may affect persistence of upstream populations of freshwater fishes. Equates to a Low magnitude of effect at the Waimea Inlet scale. At the project scale, the level of effect would be Low-High (loss of 7.7%-16.2% freshwater habitat). Level of effect: Low (-1)	0	Negligible adverse effects on freshwater ecology, due to only minimal disturbance of riparian and in-stream habitats expected given bridging of Jenkins Creek. Ecological connectivity along Jenkins Creek expected to remain approximately similar to current state. Ecological value: Jenkins Creek supports numerous *At Risk* freshwater fish species, and inanga spawning habitat (upstream / outside of the airport's existing designation) – High ecological value. Magnitude of effect: bridging of Jenkins Creek may result in disturbance of riparian and in-stream habitats but the potential to create barriers to fish passage at the coastal interface is limited considering a bridge is proposed. Equates to a Negligible magnitude of effect. Level of effect: Very Low (0)
Marine	0	No change to the existing effects on marine ecology, assuming that discharges of sediment and contaminants into the CMA during both construction and operation of the runaway are avoided or minimised. Ecological value: the estuary area surrounding the golf course supports seagrass meadows and has sand-cobble substrates likely to support diverse infauna – High ecological value.	-2	Moderate adverse effect on marine ecology due to reclamation of 3.6 ha of estuary habitat. Direct disturbance during construction and permanent loss of estuary habitat. Ecological value: • The estuary area immediately surrounding Monaco Peninsula has high mud content. The seabed is not covered by vegetation / macroalgae No information is available about infaunal communities around the Monaco Peninsula, but sites with similar mud content

[8] The value of c.475 m is based on the most recent spatial data and mapping, which replaces the previous estimated length of c.400 m discussed in the Ecology Assessment dated 18 August 2022. This update to the approx. length of Maire Stream within Option A footprint, from c.400 m to c.475 m does not change the magnitude of effect.

Ecological Criteria	Option A – Northern Extension Option – <u>without</u> mitigation		Option B – Southern Extension Option – <u>without</u> mitigation	
		<u>Magnitude of effect</u>: temporary indirect adverse effects during construction (sediment inputs) and operational effects (stormwater discharges) once the runway is completed. Equates to a **Very Low / Negligible** magnitude of effect. <u>Level of effect</u>: **Very Low (0)**		elsewhere in the inlet have been shown to have moderate levels of macrofauna abundance, diversity and richness. Similarly, although no information is available about the level of sediment contamination around the Monaco Peninsula, sites with similar mud content have been shown to have benthic contaminant concentrations generally below guideline levels – **Low-Moderate** ecological value. • However, the wider Waimea Inlet presents a diversity of benthic habitats (which include meadows of the At Risk – Declining seagrass *Zostera muelleri* as well as rare biogenic habitats in estuarine contexts such as sponge gardens) and is an important nursery and feeding ground for many species of coastal fish – **High** ecological value. <u>Magnitude of effect:</u> permanent habitat loss of 3.6 ha of intertidal habitat of moderate ecological value due to reclamation, plus additional loss of habitat due to piles for bridging Jenkins Creek, as well as indirect effects during construction (e.g., temporary excavation of the seabed and sediment inputs). • At the scale of the Project: loss of intertidal habitat from c.20 ha of similar intertidal habitat across the two embayments north and south of Monaco Peninsula, equates to 18% of habitat lost. This equates to a **Moderate** magnitude of effect. • At the scale of the Waimea Inlet: loss of intertidal habitat from c.2,800 ha of similar intertidal habitat of the Inlet, equates to 0.13% of habitat lost. Taking cumulative effects due to ongoing modification and loss of marine habitats, this equates to a **Moderate** magnitude of effect. <u>Level of effect</u>: **Moderate (-2)** at the project scale; **Moderate (-2)** at the Waimea Inlet scale
Avifauna	-1	Minor adverse effects on avifauna species due to permanent loss of foraging and roosting habitats and increased disturbance of coastal species. <u>Ecological value</u>: • Terrestrial avifauna largely comprised of native *Not Threatened* (**Low** ecological value) and *Introduced* species (**Very Low** ecological value); but New Zealand pipit are	-2	Moderate adverse effect due to reclamation of 3.6 ha of estuary habitat, which provides foraging habitat for *Threatened* and *At Risk* coastal avifauna species, as well as permanent loss of foraging and roosting habitat for various terrestrial species. <u>Ecological value</u>: • Terrestrial avifauna largely comprised of native *Not Threatened* (**Low** ecological value) and *Introduced* species (**Very Low** ecological value); but New Zealand pipit are classified as *At Risk* (**High**

Ecological Criteria		Option A – Northern Extension Option – <u>without</u> mitigation		Option B – Southern Extension Option – <u>without</u> mitigation
		classified as *At Risk* (**High** ecological value) and bush falcon as *Threatened* (**Very High** ecological value). • Freshwater avifauna included *At Risk* species (**High** ecological value). • Coastal habitats support numerous *Threatened* (**Very High**) and *At Risk* species (**High** ecological value). <u>Magnitude of effect</u>: At the scale of the Waimea Inlet: • Terrestrial: permanent loss of foraging and roosting for terrestrial native *Not Threatened* and *Introduced* species, as well as for NZ pipit and bush falcon – **Negligible** magnitude of effect. • Freshwater: no breeding habitat for freshwater species within the extension footprint, and species recorded were traversing the site – **Negligible** magnitude of effect • Coastal: no direct loss impact on coastal environment, but potential additional disturbance of coastal avifauna communities that are already subject to high levels of disturbance from current activities – **Negligible** magnitude of effect. <u>Level of effect</u>: • Terrestrial: **Very Low** (0) for *Not Threatened* and *Introduced* species; **Very Low** (0) for NZ pipit; **Low** (-1) for bush falcon. • Freshwater: **Very Low** (0) • Coastal: **Very Low** (0) to **Low** (-1)		ecological value) and bush falcon as *Threatened* (**Very High** ecological value). • Coastal habitats support numerous *Threatened* (**Very High**) and *At Risk* species (**High** ecological value). <u>Magnitude of effect</u>: At the scale of the Waimea Inlet: • Terrestrial: permanent loss of foraging and roosting for terrestrial native *Not Threatened* and *Introduced* species, as well as for NZ pipit and bush falcon – **Negligible** magnitude of effect. • Coastal: permanent loss of foraging habitat for a number of *Threatened* and *At Risk* species, but there does not appear to be breeding habitat available for these species within Option B footprint. If banded rail are breeding in Jenkins Creek saltmarsh habitat, they would be subject to a higher level of disturbance than currently exposed to – **Low** magnitude of effect. <u>Level of effect</u>: • Terrestrial: **Very Low** (0) for *Not Threatened* and *Introduced* species; **Very Low** (0) for NZ pipit; **Low** (-1) for bush falcon. • Coastal: **Moderate** (-2) to **Low** (-1)

In summary, the MCA scoring analysis identifies that without mitigation, Option A has minor adverse effects on vegetation and habitats, freshwater ecology and avifauna species, and no change to effects on marine ecology. Conversely, without mitigation, Option B has moderate adverse effects on marine ecology and avifauna species, and negligible to no adverse effects on vegetation and habitats or freshwater ecology. Option A is the recommended option as far as impacts on overall ecological values are concerned.

Option B would require reclamation of c.3.6 ha of land in the coastal marine area (CMA), plus some additional land in the CMA due to piles for bridging across Jenkins Creek. This would have associated moderate adverse effects on marine ecology values due to reclamation, and on coastal avifauna species due to permanent loss of foraging habitat for a number of *Threatened* and *At Risk* species.

Conversely, Option A, the preferred option from an ecological perspective, would have greater losses of vegetation and terrestrial habitat compared to Option B. However, the values represented by such terrestrial habitat is largely exotic and of Negligible ecological value. Option A has minor adverse effects on freshwater ecology due to loss of c.475 m (and up to 1000 m) of Maire Stream Tributary, which likely supports *At Risk* freshwater fish species and may provide inanga spawning habitat. However, this assumes that Maire Stream Tributary would be piped or infilled, and effects management options such as realignment of the waterway and recreation of inanga spawning habitat have not been considered (i.e., the assessment is without mitigation). No adverse effects on marine ecology are expected with Option A, based on the assumption that robust construction erosion and stormwater control and operational stormwater treatment will be put in place. Minor adverse effects on avifauna species are anticipated, due to permanent loss of foraging and roosting habitats for terrestrial and freshwater species, and increased disturbance of *At Risk* and *Threatened* coastal species.