REPORT

Tonkin+Taylor

Ecological Effects Assessment: Executive Overview

Prepared for
Beachlands South Limited Partnership
Prepared by
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Background

Beachlands South Limited Partnership (BSLP) is seeking a Private Plan Change (PPC) across multiple contiguous properties in Beachlands, Auckland, to expand the existing Beachlands Maraetai Coastal Town.

The proposed PPC area is bound by Jack Lachlan Drive to the north, the Pine Harbour Marina and ferry terminal directly to the northwest, a coastal edge and the coastal marine area along the west, Whitford-Maraetai Road to the east and rural-residential properties to the south (Volume 2; Appendix A, Figure 1).

The properties included in this PPC process and associated Beachlands South Structure Plan (herein 'Structure Plan') total approximately 307 ha and include the Formosa Golf Resort (approximately 170 ha), a farm at 620 Whitford-Maraetai Road (approximately 80 ha) and various smaller land parcels totalling approximately 57 ha.

The PPC area is currently zoned Rural – Countryside Living under the Auckland Unitary Plan – Operative in part (AUP-OP) and is located within the Whitford Precinct. Through the PPC, the BSLP is seeking to rezone the land to a combination of Business (Mixed Use, Local Centre and Neighbourhood Centre), Open Spaces, various Residential zones and Future Urban Zone. The PPC also proposes to apply the Beachlands South Precinct over the plan change area containing specific planning provisions for the management of future development activities within the PPC area following rezoning.

A key focus of the Structure Plan and PPC is to enable the urbanisation of the land whilst retaining, protecting and enhancing natural ecological features. To this end, the proposed PPC area includes an 88.7 ha Ecological Protected Area Network (EPAN) including the most significant existing and potential ecological values, which will be protected from development and ecologically enhanced.

Initially and via this plan change, it is proposed to 'Live Zone'[1] the northern portion of the PPC area (the 170 ha Formosa Golf Course) and to rezone the remaining development footprint within the southern portion of the PPC area as Future Urban Zone (Volume 2; Appendix A, Figure 1). This Future Urban Zone includes the proposed development footprint within the farm at 620 Whitford-Maraetai Road and various smaller land parcels included in the PPC along Whitford-Maraetai Road. The Future Urban Zone will be the subject of a further plan change application in due course.

Report Scope and Structure

The BSLP has requested that Tonkin & Taylor Ltd (T+T) prepare an ecological effects assessment (this document) to inform the development of the Structure Plan and the section 32 analysis that will support this PPC application[2]. The assessment of ecological effects includes:

- A description of ecological values of the PPC area and immediate surrounds, based on desktop review and field surveys.
- An assessment of ecological effects of the proposal on those ecological values affected by the proposed land use change focussing on the Live Zone (i.e. the area that is proposed to have live zoning applied to it).
- Recommendations for addressing potential adverse effects associated with land use change within the Live Zone and more broadly within the PPC area.

[1] Live Zone refers to the area that is proposed to have live zoning applied to it as shown on Volume 2; Appendix A, Figure 1.
[2] This work has been undertaken in accordance with our letter of engagement dated 11 December 2020

- An assessment of the appropriateness and adequacy of the proposed precinct provisions for addressing potential effects associated with land use change within the Live Zone and more broadly within the PPC area.

This report comprises a suite of ecological assessment reports and associated information as set out below:

- Volume 1: Ecology Technical Reports
  - Ecological Assessment of Effects Report: Executive Overview (this report)
  - Terrestrial Ecology Effects Assessment
  - Wetland Ecology Effects Assessment
  - Stream Ecology Effects Assessment
  - Coastal Marine Ecology Effects Assessment
  - Biodiversity Compensation Model Report
- Volume 2: Appendices
  - Appendix A: Integrated Ecology Tables and Figures
  - Appendix B: Terrestrial Ecology Tables and Figures
  - Appendix C: Freshwater Wetland Ecology Tables and Figures
  - Appendix D: Stream Ecology Table and Figures
  - Appendix E: Coastal Marine Ecology Tables and Figures
  - Appendix F: Biodiversity Compensation Model

Statutory Context

The statutory and planning documents that provide the framework for this assessment of ecological effects are detailed in the Section 32 Assessment of Environmental Effects for the proposal. In brief, these documents include:

- Part 2 of the Resource Management Act 1991.
- The Auckland Unitary Plan – Operative in part (AUP-OP).
- The New Zealand Coastal Policy Statement 2010 (NZCPS).
- The Resource Management (National Environmental Standards for Freshwater) Regulations 2020 (NES-FW).
- The National Policy Statement for Freshwater Management (NPS-FM).
- The Wildlife Act (1953).
- Conservation (Indigenous Freshwater Fish) Amendment Act 2019.
- The Marine and Coastal Area Act (Takutai Moana) 2011.
- The Hauraki Gulf Marine Part Act 2000.

The following non-statutory documents are also relevant:

- The Environment Institute of Australia and New Zealand (EIANZ) Ecological impact assessment Guidelines (EcIAG). EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems. 2nd edition (Roper Lindsay et al, 2018).
- The draft National Policy Statement for Indigenous Biodiversity (Draft NPS-IB) issued in November 2019. The Draft NPS-IB is currently being developed by the Ministry for the Environment (MfE) and will supersede the proposed National Policy Statement on Indigenous Biodiversity notified in 2011.

- Biodiversity Offsetting under the Resource Management Act: A guidance document, September 2018. Prepared for the Biodiversity Working Group on behalf of the BioManagers' Group (Maseyk et al, 2018).
- The Wetland Delineation Protocols (WDP) (MfE, 2020) which set out criteria for identifying and delineating wetlands. The NPS-FM requires regional councils to have regard to the WDP in cases of uncertainty or dispute about the existence or extent of a natural wetland.
- Auckland Unitary Plan Practice and Guidance note on River/ Stream Classification. RC 3.3.17 (V2) dated July 2021.
- Storey, R G, Neale, M W, Rowe, D K, Collier, K J, Hatton, C, Joy, M K, Maxted, J R, Moore, S, Parkyn, S M, Phillips, N and Quinn, J M (2011). Stream Ecological Valuation: a method for assessing the ecological function of Auckland streams. Auckland Council Technical Report 2011/009.
- Sea Change – Tai Timu Tai Pari (Hauraki Gulf Marine Spatial Plan).

Methods

Desktop investigations and field surveys were undertaken to identify ecological characteristics and values within the PPC area and immediate surrounds.

Relevant information and databases were reviewed to inform the methodology and approach to the ecological assessment and to determine the wider ecological context of the site. This included a review of the following available information:

- Indigenous terrestrial and wetland ecosystems of Auckland (Singers et al. 2017).
- AUP-OP geographic information system (GIS) layers:
  - Significant Ecological Areas (SEAs).
  - Ecosystem type layers.
  - Aerial imagery assessment of the SEAs and wider landscape to assess habitat suitability for wetland fauna.
- eBird database (https://ebird.org).
- Department of Conservation Bioweb database.
- Herpetofauna database.
- iNaturalist NZ database.
- New Zealand Freshwater fish data base.
- National Aquatic Biodiversity Information System (NABIS)(http://www.nabis.govt.nz/).
- Retrolens (online portal for historical aerial imagery).

Field surveys were undertaken to characterise the ecological values within the PPC area and inform the ecological assessment of effects associated with the Live Zone. Field investigations included:

- Terrestrial, wetland, freshwater stream and coastal marine habitat assessments and mapping to determine the extent and condition of habitat types, including the use of:
  - Singers et al (2017) for characterising terrestrial and wetland habitat types.
  - The WDP (MfE 2020) to determine the presence, extent and location of 'natural' and 'constructed' freshwater wetlands[3].

[3] 'Natural' and 'constructed' as defined by the National Policy Statement for Freshwater Management (Sept 2020), Ministry for the Environment.

  - The Auckland Unitary Plan Practice and Guidance note on River/ Stream Classification to classify watercourses and the SEV method to assess stream ecological function and value.
  - 'Intertidal and subtidal biota and habitats of the central Waitematā Harbour' to classify and determine the extent of coastal habitats.
- Fauna and vegetation surveys to determine the presence or likely presence of nationally 'Threatened', 'At Risk' or otherwise notable species, including:
  - Assessments of habitat suitability for threatened plants; long-tailed bats; forest, wetland and coastal birds; lizards; and terrestrial invertebrates.
  - Coastal bird visual surveys using spotting scopes across different tides.
  - Wetland bird observations, callback surveys and deployment of automatic recording devices.
  - Fish surveys using electric fishing and eDNA techniques and macroinvertebrate sampling.
  - Benthic infauna and epifauna surveys at mid and low tide sites in the marine receiving environment.

Ecological effects assessments were undertaken in accordance with:

- The EIANZ EcIAG (Roper-Lindsay et al., 2018).
- Adapted versions of the EIANZ EcIAG ecological values tables (Roper-Lindsay et al. 2018) developed specifically for coastal marine and freshwater ecology.

Measures to avoid, minimise, remedy and mitigate ecological effects associated with the proposed change in land-use activities were developed though the optioneering and concept design phases of the PPC. This included, for example, refining the configuration of the project (e.g. designing the development footprint to avoid important ecological values as much as possible) allowing for ecological buffers, stormwater management and fauna management. Further details are provided below and in the various ecology technical reports.

Compensation requirements were determined for those residual adverse effects associated with the proposed land use change that could not be avoided, remedied or mitigated, or offset. For terrestrial, wetland values and coastal bird values, biodiversity modelling (Baber et al. 2021 *a,b,c*) was used to assist in determining the type and magnitude of habitat restoration and enhancement measures that would likely be required to adequately address residual effects. For stream values, the SEV and Environmental Compensation Ratio (ECR) method was used to determine compensation requirements to address residual effects.

General Site Description

Originally the PPC area encompassed pōhutukawa, pūriri, broadleaved forest along the coast and gullies with kauri, podocarp, broadleaved, beech forest (WF12) occupying the slopes and higher ground. The PPC area would have also supported a forested stream network and few, if any, natural freshwater wetlands would have been present onsite.

Land use change and modification has transformed the majority of the PPC site into a golf course resort, farmland and lifestyle blocks that are dominated by managed rank or grassed pasture grasslands. Exotic pines have been planted between the golf course and 620 Whitford-Maraetai Road, as well as on the coastal margin of 620 Whitford-Maraetai Road. However, remnant mature indigenous forest is present in gullies and along the coastal fringe and includes three terrestrial SEAs as identified in the AUP-OP (as described below).

Freshwater wetlands within the Live Zone are 'constructed' and predominately made up of ponds or exotic-vegetated wetlands. However, native-dominated 'constructed'[4] wetlands are also present within the Live Zone, as are exotic-dominated, induced 'natural' wetlands in the FUZ. Additionally, a native dominated 'natural' freshwater wetland is located immediately adjacent to the FUZ on the coastal margin of 620 Whitford-Maraetai Road.

The landscape immediately to the east and south of the PPC site is dominated by farmland with native forest remnants along riparian margins and in gullies. A large housing block of approximately 300 ha occurs 100 m north of the PPC site and forms the main residential area of Beachlands. Catchments within the proposed PCC area drain to the Waikopua Creek and Whitford Embayment, which is an important wading bird area with areas identified as marine SEAs. The coastal area is also part of the Hauraki Gulf Marine Park and comprises three distinct tidal creeks (being Waikopua, Turanga and Maungamaungaroa Creeks) which are identified as being regionally and nationally significant (Schedule 4, AUP).

Ecological Characteristics and Values Associated with the PPC Area

Eleven terrestrial vegetation/habitat types are present within the proposed PPC area (refer to Table 1 and Figure 1 in Volume 2, Appendix B). Three terrestrial SEAs ranging in size from 0.8 ha to 11.1 ha are also present within the proposed PPC area. All terrestrial SEA vegetation and almost all of the native vegetation is located within the EPAN (as described below). These terrestrial habitat types include or are expected to include a range of native species, including species listed as nationally 'Threatened' or 'At Risk' as set out in Table 2.

A total of 61 freshwater wetlands (4.9 ha) were present within the proposed PPC area. These wetlands were classified into five distinct habitat types as described in Table 1 and include a range of native species, including wetland bird species listed as nationally 'Threatened' or 'At Risk' as set out in Table 2 (below) and Figure 1 in Volume 2, Appendix C, 1 for wetland locations and classifications.

Four main stream catchments are present within and/or adjacent to the Live Zone along with a number of smaller tributaries not connected to the larger stream catchments. All of the stream catchments are modified to some degree, either through the historic construction works on the golf course, creation of on-line ponds, culvert works, wastewater discharge or general land-use and riparian zone modification. Two fenced SEAs are located in forested gully systems on the 620 Whitford-Maraetai Road site within the FUZ. The largest stream catchment on that site coincides with the larger of the two SEAs and is a mostly unmodified watercourse. These streams include a range of native fauna, including fish species listed as nationally 'At Risk' as set out in Table 2 (below) and Figure 1 in Volume 2, Appendix D, for stream extents and classifications.

Coastal marine habitats adjacent to the PPC area comprise a matrix of shellbanks, intertidal mud and sandflats, sandstone reef, saltmarsh, seagrass beds and mangroves, all of which provide a range of ecosystem services. In particular, seagrass beds and firm muddy sand flats / cockle shell covered flats are highly productive as evidenced by the abundance and diversity of organisms located therein. The habitats are classified within marine SEAs, identifying these features as rich feeding grounds and important mid-tide roosts for many hundreds of a variety of international migratory and New Zealand endemic wading birds. The shellbanks also provide nesting habitat for the 'At Risk' northern New Zealand dotterel and variable oystercatcher. The coastal marine habitats include a range of native fauna, including bird species listed as nationally 'Threatened' or 'At Risk' as set out in Table 2 (below) and Figure 2 in Volume 2, Appendix E, marine habitat distributions.

[4] As defined in the National Policy Statement for Freshwater Management 2020. ("NPS–FM") (MfE, August 2020). Also see Defining 'natural wetlands' and 'natural inland wetlands' (MfE, September 2021).

Table 1 and Table 2 present a summary of the habitat types and fauna values respectively across the site and adjacent marine area, including threat status. Threat status has been considered in our assessment of the ecological value of habitats and fauna, in developing effects management measures and in our assessment of the magnitude and level of effects following the EIANZ EcIAG framework.

Table 1: Habitat descriptions with the 307 ha PPC area.

Vegetation type	Habitat extent (ha)	IUCN Threat Status/ SEA status
Terrestrial habitat types (aerial extent in ha)		
Tawa, kohekohe, rewarewa, hīnau, podocarp forest	4.5	Vulnerable/SEA_T_1141
Taraire, tawa, podocarp forest (WF9)	2.21	Endangered/SEA_T_1140 in part
Pōhutukawa, pūriri, broadleaved forest	0.5	Endangered/SEA_T_4556
Pōhutukawa treeland/flaxland/rockland	0.9	Vulnerable/SEA_T_4556
Kānuka forest (VS2)	4.5	Least Concern
Mānuka, kānuka scrub (VS3)	9.7	Least Concern/buffers SEA_T_1140
Broadleaved species scrub/forest (VS5)	0.03	Least Concern/SEA_T_4556
Native terrestrial plantings (PL)	1.7	Not Threatened
Exotic forest (EF)	14.8	Not Threatened
Exotic-dominated scrub (ES)	16.6	Not Threatened
Managed or rank grassland	ca 234	Not Threatened
Freshwater wetland habitat types (aerial extent in ha)		
Native wetland (constructed)	0.0445	Not threatened
Exotic wetland (constructed)	1.999	Not threatened
Open water wetlands (constructed)	1.855	Not threatened
WL10: Oioi, restiad rushland/reedland (natural)	0.344	Endangered
Exotic wetlands (natural)	0.955	Not threatened
Stream habitat (lineal m)		
Permanent stream	2,665	Not threatened
Intermittent stream	11,950	Not threatened
Coastal marine habitat		
Seagrass beds (intertidal and sub-tidal)	78.1	High value / At risk declining
Firm muddy sand flats / cockle shell covered flats	112.2	Very high value
Shell banks	0.8	Very high value
Sandstone reef	7.06	High value
Soft gloopy mud	8.7	Moderate value
Rock revetment	-	Low value
Saltmarsh	11.9	High value / Least concern
Mangroves / manawa (*Avicennia marina*)	45.9	Moderate value / Least concern

Table 2: Nationally 'Threatened' or 'At Risk' species that are known or assumed to be present within the PPC area or within the adjacent Coastal Marine Area (coastal birds only)**

Nationally 'Threatened' or 'At Risk' Species	Threat status
Plant species	
Pōhutukawa (*Metrosideros excelsa*)**	Threatened – Nationally Vulnerable
Kānuka (*Kunzea robusta*)**	Threatened – Nationally Vulnerable
Akatea (*Metrosideros excelsa*)**	Threatened – Nationally Vulnerable
Mānuka**	At Risk - Declining
Olearia angulata (planted)**	At Risk – Naturally Uncommon
Bat species	
Long-tailed bat (*Chalinolobus tuberculatus*)*	Threatened – Nationally Critical
Forest or grassland bird species	
New Zealand pipit (*Anthus novaeseelandiae*)**	At Risk – Declining
Kākā (*Nestor meridionalis*)	At Risk – Recovering
Long-tailed cuckoo (*Eudynamys taitensis*)	Threatened – Nationally Vulnerable
Wetland bird species	
Pāteke/brown teal *(Anas chlorotis)***	Threatened – Nationally Increasing
Pārera/Grey duck *(Anas superciliosa)*	Threatened – Nationally Vulnerable
Matuku-hūrepo/ Australasian bittern *(Botaurus poiciloptilus)*	Threatened – Nationally Critical
Kawau/Black shag *(Phalacrocorax carbo)***	At Risk – Relict
Kāruhiruhi/Pied shag (*Phalacrocorax varius)***	At Risk – Recovering
Weweia/New Zealand dabchick *(Poliocephalus rufopectus)***	Threatened – Nationally Increasing
Koitareke/marsh crake *(Porzana pusilla)***	At Risk - Declining
Pūweto/spotless crake *(Porzana tabuensis)***	At Risk - Declining
Coastal bird species (present within the adjacent CMA)	
Black-billed gull (*Larus bulleri*)	At Risk – Declining
Shore plover (*Thinornis novaeseelandiae*)	Threatened – Nationally Critical
Reef heron (*Egretta sacra*)	Threatened – Nationally Endangered
Banded dotterel (*Charadrius bicinctus*)	At Risk – Declining
Caspian tern (*Hydroprogne caspia*)	Threatened – Nationally Vulnerable
Lesser knot (*Calidrus canutus*)	At Risk – Declining
Wrybill (*Anarhynchus frontalis*)	Threatened – Nationally Increasing
Great knot (*Calidris tenuirostris*)	Vagrant (IUCN classification of 'Endangered)
Banded rail (*Gallirallus philippensis*)	At Risk – Declining

Nationally 'Threatened' or 'At Risk' Species	Threat status
Bar-tailed godwit (*Limosa lapponica*)	At Risk – Declining
Red-billed gull (*Larus novaeholandiae*)	At Risk – Declining
South Island pied oystercatcher (*Haematopus finschi*)	At Risk – Declining
White-fronted tern (*Sterna striata*)	At Risk – Declining
Black shag (*Phalacrocorax carbo*)	At Risk – Relict
Royal spoonbill (*Platalea regia*)	At Risk – Naturally Uncommon
Little black shag (*Phalacrocorax sulcirostris*)	At Risk – Naturally Uncommon
Northern New Zealand dotterel (*Charadrius obscurus*)	Threatened – Nationally Increasing
Pied shag (*Phalacrocorax varius*)	At Risk – Recovering
Variable oystercatcher (*Haematopus unicolor*)	At Risk – Recovering
Red-necked stint (*Calidris ruficollis*)	Migrant (IUCN classification of Near Threatened)
Ruddy turnstone (*Arenaria interpres*)	Migrant (IUCN classification of Near Threatened)
Pacific golden plover (*Pluvialis fulva*)	Migrant (IUCN threat classification of Least Concern)
Lizard species	
Ornate skink (*Oligosoma ornatum*)	At Risk – Declining
Elegant gecko (*Naultinus elegans*)	At Risk - Declining
Forest gecko (*Mokopirirakau granulatus*)	At Risk - Declining
Copper skink (*Oligosoma aenea*)	At Risk - Declining
Freshwater fish species	
Inanga (*Galaxias maculatus*)	At Risk - Declining
Giant kokopu (*Galaxias argenteus*)	At Risk - Declining
longfin eel (*Anguilla dieffenbachia*)	At Risk - Declining

** = confirmed as present within the PPC area.

Assessment of Ecological Effects Associated with the Live Zone

General overview

The Live Zone comprises the Formosa Golf Resort (approximately 170 ha), which currently consists of open grass fields maintained for golfing purposes, interspersed with rank grass and areas of exotic vegetation. However, small patches of regenerating native bush do occur, as does an SEA of mature native vegetation on the coastal (western) edge of the golf course. A developed area of approximately 5 ha is present at the centre of the golf course area consisting of buildings and carparks.

The proposed change in land use within the Live Zone has the potential to result in adverse effects on ecological values within the Live Zone and surrounding coastal marine receiving environment. In general terms, these effects may include:

- Terrestrial, wetland and stream habitat loss, fragmentation and degradation through earthworks and vegetation clearance.

- Direct mortality or injury to species that may be harmed during vegetation clearance or earthworks activities.
- Construction and operations related noise, vibrations, dust, or lighting effects.
- Ongoing disturbance effects, particularly on habitat margins/edges, through noise, dust and lighting associated with infrastructure and housing and the increased presence of people and introduced species in previously less accessible areas.
- Degradation of the aquatic (freshwater stream and coastal marine) receiving environment through sedimentation or stormwater or wastewater discharges that affect water quality.

Proposed measures to reduce the severity of adverse effects

Measures to avoid, remedy or mitigate adverse ecological effects associated with the proposed land use change within the Live Zone (and more broadly in relation to the PPC area) are addressed in the existing plan provisions and/or the proposed precinct provisions or will be addressed through future resource consents and include:

- Site optimisation during the master-planning phase to avoid or minimise habitat loss of existing and potential high value habitat types through the creation of the 88.7 ha EPAN (addressed through precinct provisions).
- Inclusion of a minimum 10 m native vegetation buffer around all high value terrestrial habitats and wetlands that are within the EPAN. The 10m vegetation buffer lies within the EPAN boundary and will minimise potential effects associated with the proposed landuse change within the Live Zone (addressed through precinct provisions).
- Seasonal constraints on earthworks or vegetation clearance activities to avoid or minimise effects on eggs or chicks during peak bird breeding season (in compliance with the Wildlife Act 1953) and to avoid important spawning and migration periods as appropriate.
- Salvage and relocation of lizards and fish and habitat features (e.g. downed logs) from the development area into suitable habitats within the EPAN.
- Sediment and erosion protection and stormwater and wastewater treatment to minimise adverse effects on water quality into the freshwater and coastal marine aquatic receiving environment.

Level of residual effects associated with the Live Zone

After efforts to avoid, remedy or mitigate effects on terrestrial ecology values, the proposed land use change within the Live Zone is expected to result in the loss of approximately 1.35 ha of exotic forest, 5.08 ha of exotic scrubland as well as large areas of rank and managed grasslands. Potential effects include habitat loss, harm to wildlife and general disturbance to remaining habitats. The residual 'Level of Effects' on terrestrial values that cannot be avoided, remedied or mitigated are assessed as:

- ''High' for the At Risk (declining) copper skink.
- 'No Effect or 'Very low' or 'Low' effects on all other terrestrial ecology values.

After efforts to avoid, remedy or mitigate effects on wetland values, the proposed land use changes within the Live Zone are expected to result in the loss of 2.09 ha of moderate value constructed wetlands and to also include a range of indirect effects on constructed and natural wetlands through stormwater discharge and general disturbance. Residual effects on wetland values are assessed as:

- 'High' for pūweto/spotless crake, pāteke/brown teal, and weweia/dabchick.

- ‘Moderate’ for constructed native-dominated wetlands, constructed exotic wetlands and constructed open water wetlands.
- ‘Very low’ or 'Low’ for all other natural wetlands and associated values.

For freshwater stream values, the proposed land use changes are expected to result in the loss of approximately 1,355 lineal metres (286.5 m^2) of ‘Low’ to ‘Moderate’ value intermittent stream habitat within the Live Zone, and temporary impacts on stream receiving environments through construction phases and permanent effects due to stormwater and wastewater management and discharges. Specifically, after measures to avoid, remedy or mitigate adverse effects, the proposed land-use changes are expected to result in:

- ‘Moderate’ to ‘High’ effects due to intermittent stream habitat reclamation.
- ‘Very low’ to ‘Low’ effects due to temporary construction related discharges, stormwater discharges and changes to hydrology, wastewater discharges and effects on native fish.

For coastal marine values, the proposed land use changes are expected to result in impacts on marine receiving environment habitats, including collective stressor effects associated with increased sediment, metal and nutrient discharges to the CMA. Construction phase and permanent effects, including an increase in human disturbance and potential for predation by domestic cats and dogs, are also expected to adversely impact on coastal bird species. Specifically, after measures to avoid, remedy or mitigate adverse effects, the proposed land-use changes are expected to result in:

- ‘Moderate’ effects on firm muddy sand flats / cockle shell covered flats and shell bank habitats.
- ‘‘Low’ effects on mangrove vegetation.
- ‘Very low’ to ‘High’ effects on wading bird species (‘High’ effects are expected for nesting wading birds through disturbance at existing nesting sites).
- ‘Very low’ or ‘Low’ residual effects for all other marine habitats and fauna values.

Measures to address residual effects within the Live Zone (and Future Urban Zone)

Biodiversity Compensation Models and SEV/ECR methods have been used to assist with determining the type and magnitude of proposed and available compensation to address potential residual effects within both the Live Zone and Future Urban Zone within the PPC area.

Biodiversity offsetting for effects on terrestrial and wetland biodiversity values was considered but ruled out because under offsetting:

- Impacts on exotic habitats would need to be addressed through replacement with those same exotic habitats (whereas compensation permits trading up through replacement of exotic habitats with restoration and habitat enhancement of native habitats);
- In most instances an effect cannot be demonstrably achieved with a reasonable degree of confidence at a plan chance (or resource consenting stage) when quantitative information at a proposed offset site is based on future predictions.

Based on the Biodiversity Compensation models and SEV/ECR methods it is predicted that Net Gain outcomes will be achieved within 20 years of commencement for all terrestrial, wetland, freshwater stream and coastal bird values. As required by precinct provisions, No Net Loss (and preferably Net Gain) outcomes will be verified through biodiversity outcome monitoring, which will also guide adaptive management/ contingency measures as required.

Compensation to address residual effects on freshwater wetland, terrestrial, freshwater stream and coastal biodiversity values will be required through the Auckland-wide and precinct provisions that include (see Volume 2: Appendix A, Figure 2):

- Habitat restoration and enhancement measures within the 88.7 ha EPAN, including:
  - 30.8 ha of terrestrial revegetation and habitat enhancement into all available terrestrial planting areas within the network to create additional habitat for terrestrial biodiversity;
  - Inclusion of a minimum 10 m native vegetation buffer around all high value terrestrial habitats and wetlands that are within the EPAN. The 10 m vegetation buffer lies within the EPAN boundary and will minimise potential effects associated with the proposed land use change within the Live Zone.
  - Approximately 2.14 ha of native wetland enrichment planting, including a 20-year weed control programme within all exotic vegetation dominated PPC area wetlands that are outside the proposed development footprint.
  - 8.8 ha of stream riparian planting to restore and enhance existing streams to address stream reclamation impacts within the Live Zone (impacts and offset for the FUZ to be determined at a later date); and
  - 88.7 ha of mammalian and invasive weed pest control for 35 years, which will further protect and enhance terrestrial and wetland biodiversity values.
- The creation of approximately 5 ha of stormwater ponds and associated wetland plant revegetation, which is expected to address adverse effects associated with the loss of constructed wetlands and associated wetland bird values.
- Habitat restoration and enhancement measures within the 'Very High' value 0.34 ha oioi, restiad rushland/reedland wetland to further enhance these values.
- Coastal bird nesting roosting and foraging habitat enhancement measures including:
  - The control of mammalian predators along the coastal margin adjacent to the proposed PPC coastal boundary (this pest control will be contiguous with pest control within the EPAN).
  - Enhancement of existing roost sites in the adjacent CMA through elevation and expansion of shell banks and invasive weed and mangrove management.
  - Enhancement and maintenance of high-quality coastal bird foraging habitat in the inter-tidal mud/sand flats in the adjacent CMA through selective mangrove management in recently colonised areas and areas that are expected to be colonised by mangroves in the future.

Conclusion

We conclude that if the above measures to address adverse ecological effects are enacted through the Auckland-wide and proposed precinct provisions and through subsequent resource consent conditions and associated management plans, then No Net Loss outcomes are expected within 20 years of commencement of these measures. We therefore consider the potential adverse effects associated with land use changes within the Live Zone (and more broadly the wider PPC area) can be adequately addressed.

Applicability

This report has been prepared for the exclusive use of our client Beachlands South Limited Partnership, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand and agree that our client will submit this report as part of an application for a private plan change and that Auckland Council as the territorial authority will use this report for the purpose of assessing that application.

Tonkin & Taylor Ltd

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