



**Freshwater Wetland
Ecological Effects
Assessment**

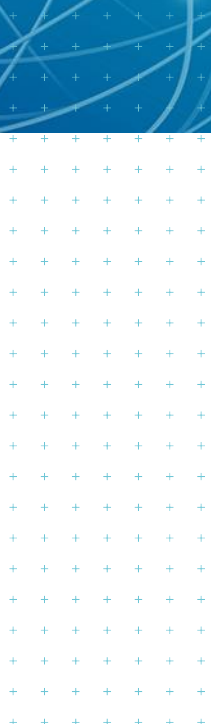
Beachlands South

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Table of contents

1	Introduction	1
1.1	Overview	1
1.2	Report scope	2
1.3	Statutory context	2
2	Methods	4
2.1	Desktop review	4
2.2	Field investigations	4
2.2.1	Overview	4
2.2.2	Wetland assessments	5
2.2.3	Fauna assessment	6
2.3	Assessment of ecological effects	6
2.3.1	Step one: Assigning ecological value	7
2.3.2	Step two: Assessing the magnitude of effects	7
2.3.3	Step three: Assessing the level of effects	7
2.3.4	Determining residual effects management requirements	8
3	Ecological Characteristics	9
3.1	Ecological context	9
3.2	Site description	9
3.2.1	Formosa Golf Resort site	9
3.2.2	620 Maraetai-Whitford Road	9
3.2.3	Other land parcels	10
4	Wetland Characteristics	11
4.1	Vegetation/habitat types	11
4.2	Wetland avifauna	12
4.3	Wetland invertebrates	14
5	Assessment of Ecological Effects	15
5.1	PPC Area Ecological values assessment (Step 1)	15
5.2	Magnitude of effects assessment (Step 2)	18
5.2.1	Overview of potential adverse effects	18
5.2.2	Overview of measures to avoid, remedy or mitigate effects	19
5.2.3	Magnitude of effects assessment after measures to avoid, remedy or mitigate	19
5.3	Level of effects (Step 3)	23
6	Proposed Residual Effects Measures	25
6.1	Proposed residual effects that will need to be addressed	25
6.2	Biodiversity offsetting and compensation	25
6.3	Overall approach for addressing residual effects	26
6.4	Proposed wetland compensation	27
7	Conclusion	29
8	Applicability	30
9	References	31

Executive summary

The Beachlands South Limited Partnership (BSLP) has applied for a Private Plan Change (PPC) across multiple contiguous properties in Beachlands, Auckland, totalling approximately 307 hectares of land.

The PPC area is located to the immediate south of the existing Beachlands Maraetai coastal town and is currently zoned Rural – Countryside Living under the Auckland Unitary Plan – operative in part (AUP-OP).

Through the associated Beachlands South Structure Plan (Structure Plan), the BSLP are seeking to rezone the land to a combination of Business (Mixed Use, Local Centre and Neighbourhood Centre), Open Space, various Residential zones and Future Urban zone.

Initially it is proposed to ‘Live Zone’ the northern portion of the Structure Plan area (the 170 ha Formosa Golf Course property) via a plan change and apply the Future Urban Zone to the remainder of the PPC area (Volume 2, Appendix A, Figure 1). The Future Urban Zone will be the subject of a further plan change application in due course.

This freshwater wetland ecology report assesses the appropriateness and adequacy of the existing statutory framework and proposed precinct provisions for addressing potential effects on freshwater wetland values both within the Live Zone and more broadly across the entire PPC area. To this end, the report includes¹:

- Determination of the extent of any National Policy Statement for Freshwater Management 2020 (NPS-FM) qualifying natural wetlands.
- A description of freshwater wetland values of the PPC area, based on desktop review and field surveys.
- An assessment of potential adverse effects on those freshwater wetland values within the Live Zone.
- Recommendations for addressing potential adverse effects within the Live Zone and the wider PPC/Structure Plan area.
- A conclusion on the appropriateness and adequacy of the proposed precinct provisions for addressing potential adverse effects within the Live Zone and the wider PPC/Structure Plan area.

This assessment included a desktop investigation as well as field surveys from December 2020 to September 2021. An assessment of ecological effects was then undertaken in accordance with the Environment Institute of Australia and New Zealand (‘EIANZ’) Ecological Impact Assessment Guidelines (‘EciAG’) (Roper-Lindsay et al., 2018).

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 address those residual adverse effects that could not be avoided, remedied or mitigated within the Live Zone and more broadly across the entire PPC area..

Historically, few if any natural wetlands would have been present within the PPC area. All wetlands currently present have either been constructed and therefore do not meet the definition of ‘natural wetland’ under the NES-FM, or have been induced through landscape modification (largely through the sedimentation of gullies). Notably, these induced wetlands are classified as ‘natural wetland’

¹ This work has been undertaken in accordance with our letter of engagement dated 11 December 2020.

under the NES-FM. In summary, all wetland types within the PPC area were assessed as being of moderate value due to the threat status of wetlands per se and habitat suitability for threatened species.

No 'natural'² wetlands are present within the Live Zone area and correspondingly, no effects on 'natural' wetlands are anticipated. However, the proposed change in land use within the Live Zone has the potential to result in a range of adverse effects on 'constructed' freshwater wetland ecological values. Potential adverse effects on constructed wetlands and associated wetland fauna within the Live Zone may include wetland habitat loss through vegetation clearance and drainage, wetland degradation through sedimentation or discharges that affect water quality, and general disturbance (e.g. noise, vibration, dust or lighting).

Measures to avoid, remedy or mitigate the loss of freshwater wetlands associated with the change in landuse activities in the Live Zone (and more broadly the PPC area) were developed through the optioneering and concept design phases of the project and have included:

- Site optimisation during the master-planning phase to avoid or minimise habitat loss of existing and potential high value habitat types and natural wetlands through the creation of the 88.7 ha EPAN.
- Avoidance of higher value wetlands (as well as stream and terrestrial biodiversity values) through the proposed 88.7 ha of Ecological Protected Area Network (EPAN) present within the Live Zone and wider PPC area.
- Inclusion of a minimum 10 m native vegetation buffer around all constructed and natural freshwater wetlands within the EPAN to mitigate the effects of disturbance relating to the proposed landuse change within the Live Zone (and FUZ in due course).
- Seasonal constraints on activities that affect constructed wetlands to avoid or minimise effects on wetland birds that are legally protected under the Wildlife Act 1953.

The proposed landuse change within the Live Zone (and wider PPC area) avoids the loss of any natural wetlands. However, the proposed landuse changes are expected to result in the loss of 2.09 ha of moderate value constructed wetlands that include wetland biodiversity values along with a range of indirect effects on constructed and natural wetlands through stormwater discharge and general disturbance. Specifically, after measures to avoid, remedy or mitigate adverse effects, the proposed land-use changes are expected to result in:

- 'High' residual effects for pūweto/spotless crane, pāteke/brown teal, and weweia/dabchick.
- 'Moderate' residual effects for constructed native-dominated wetlands, constructed exotic wetland and constructed open water wetlands,
- 'Very low' or 'Low' residual effects for all other natural wetlands and associated values.

To address these residual effects within both the Live Zone and Future Urban Zone (which will require a separate plan change application), it is proposed to undertake:

- The creation of approximately 5 ha of stormwater ponds that will provide benefits for wetland birds;
- 2.14 ha of native wetland enrichment planting and weed management within all exotic vegetated wetlands that are located within the proposed Ecological Protected Area Network (EPAN) (which is outside the proposed PPC development footprint).
- Wetland buffer plantings around the margins (10 m width) of the 3.32 ha of constructed and natural wetlands that are located within the 88.7 ha EPAN.

² As per legal opinion see Volume 2, Appendix C, Legal opinion on the definition of 'Natural' Wetland

- Control of mammalian predators within and surrounding wetlands in the EPAN as part of an integrated pest management programme that is intended to benefit wetland birds (in addition to terrestrial and coastal biodiversity values).

We conclude that if the proposed measures are undertaken, then all potential effects on wetlands and associated values within the Live Zone and also across the entire PPC/Structure Plan area can be adequately addressed. Net Gain outcomes for wetland biodiversity values are expected within 20 years of commencement of wetland restoration and enhancement activities.

Further to this, we consider that the proposed provisions and where applicable, future resource consent conditions and associated management plans will appropriately address adverse effects on wetlands associated with the proposed landuse change in the Live Zone and wider PPC area.

1 Introduction

1.1 Overview

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

The 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 Private Plan Change (PPC) process are listed in Table 1.1 below and include approximately 307 hectares of land (Volume 2, Appendix A, Figure 1).

The PPC area is currently zoned Rural – Countryside Living under the Auckland Unitary Plan – operative in part (AUP-OP) and the BSLP are seeking to rezone the land to a combination Business (Mixed Use, Local Centre and Neighbourhood Centre), Open Spaces, various Residential zones and Future Urban zone in a private plan change (PPC). The focus of this PPC has been to enable the urbanisation of the land whilst protecting and enhancing significant ecological values.

Initially it is proposed to ‘live’ zone the northern portion of the Structure Plan area via this PPC and apply the Future Urban Zone to the remainder of the site. The Future Urban Zone land will then be the subject of a further plan change application in future (Volume 2, Appendix A, Figure 1).

Table 1.1: Complete PPC/Structure Plan area (properties owned by the BSLP are shaded)

Address	Lot and DP number	Area (Hectares)
110 Jack Lachlan Drive Beachlands	LOT 2 DP 501271	170.48
620 Whitford-Maraetai Road	LOT 100 DP 504488	79.948
770 Whitford-Maraetai Road	LOT 10 DP 54105	6.87
758 Whitford-Maraetai Road	LOT 9 DP 54105	6.14
746 Whitford-Maraetai Road	LOT 8 DP 54105	5.80
740 Whitford-Maraetai Road	LOT 7 DP 54105	5.14
732 Whitford-Maraetai Road	LOT 6 DP 54105	5.09
722 Whitford-Maraetai Road	LOT 5 DP 54105	4.92
712 Whitford-Maraetai Road	LOT 4 DP 54105	4.75
702 Whitford-Maraetai Road	LOT 1 DP 208997	2.13
692 Whitford-Maraetai Road	LOT 1 DP 197719	1.77
682 Whitford-Maraetai Road	LOT 1 DP 187934	1.26
680 Whitford-Maraetai Road	LOT 26 DP 504488	12.81
Total		307.12

1.2 Report scope

This report characterises the freshwater wetland ecology values within the PPC area and immediate surrounds, and assesses the appropriateness of the existing statutory framework and proposed plan change provisions for addressing potential effects associated with the proposed land-use change. To this end, the report includes³:

- Determination of the extent of any National Policy Statement for Freshwater Management 2020 (NPS-FM) qualifying natural wetlands.
- A description of freshwater wetland values of the PPC site, based on desktop review and field surveys.
- An assessment of effects of the proposal on those freshwater wetland values.
- Recommendations to address potential adverse effects within the Structure Plan and PPC area and matters to be considered in the development of potential precinct provisions over the PPC area to guide and manage future development activities.
- A conclusion on the appropriateness and adequacy of the existing statutory framework and proposed precinct provisions for addressing potential effects associated with landuse change.

Coastal wetlands are located immediately adjacent to the proposed PPC area and the assessment of effects associated with the proposed landuse change and proposed effects management requirements will be addressed in the Marine Ecology Effects Assessment report.

This Freshwater Wetland Ecological Effects Assessment Report sits within 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
 - Terrestrial Ecology Effects Assessment
 - Wetland Ecology Effects Assessment (this report)
 - Stream Ecology Effects Assessment
 - Marine Ecology Effects Assessment
 - Biodiversity Compensation Modelling Report
- Volume 2: Appendices
 - Appendix A: Combined Ecology Tables and Figures
 - Appendix B: Terrestrial Ecology Tables and Figures
 - Appendix C: Wetland Ecology Tables and Figures
 - Appendix D: Stream Ecology Table and Figures
 - Appendix E: Coastal Marine Ecology Tables and Figures
 - Appendix F: Biodiversity Compensation Modelling Tables

1.3 Statutory context

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

³ This work has been undertaken in accordance with our letter of engagement dated 11 December 2020.

- Part 2 of the Resource Management Act 1991.
- The Resource Management (National Environmental Standards for Freshwater) Regulations 2020 (NES-FW). Notably, the PPC proposal does not involve any activity prohibited by Regulation 53 of the NES-FW in relation to natural wetlands.
- The NPS-FM. Policy 6 of the NPS-FM requires that *“There is no further loss of extent of natural inland wetlands, their values are protected, and their restoration is promoted.”*
- The AUP-OP.

The following non-statutory documents are also relevant:

- The Wetland Delineation Protocols (WDP) (Ministry for the Environment (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.
- Roper-Lindsay, J., Fuller S.A., Hooson, S., Sanders, M.D., Ussher, G.T. (2018). Ecological impact assessment Guidelines (EclAG). EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems. 2nd edition.
- 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 MfE and will supersede the proposed National Policy Statement on Indigenous Biodiversity notified in 2011.
- Maseyk, F., G.T. Ussher, G. Kessels, M. Christensen and M. Brown (2018). Biodiversity Offsetting under the Resource Management Act: A guidance document September 2018. Prepared for the Biodiversity Working Group on behalf of the BioManagers’ Group.

2 Methods

A desktop investigation and field surveys were undertaken to identify freshwater wetland characteristics and values within the proposed development as shown on the masterplan that would be enabled by the plan change (herein the 'development footprint'), the remainder of the site and immediate surrounds, using the methods described in Sections 2.1 to 2.3 below. An assessment of ecological effects was then undertaken in accordance with the EIANZ EciAG (Roper-Lindsay et al., 2018).

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 address those residual adverse effects associated with the proposed landuse change within the Live Zone and Future Urban Zones that could not be avoided, remedied or mitigated.

2.1 Desktop review

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.
- iNaturalist NZ database.

2.2 Field investigations

2.2.1 Overview

Field investigations were undertaken from December 2020 to April 2021 to characterise and map freshwater wetland values within the development footprint, the remainder of the site and immediate surrounds. These investigations included:

- Characterisation of wetland plant species dominance and composition including the application of Wetland Delineation Protocols (WDP; MfE 2020). Under the NPS-FM any assessment of the presence or extent of wetlands must have regard to the WDP (see Section 2.2.2 below for further detail on the WDP methodologies).
- Wetland biodiversity condition assessments associated with potential impacts such as browsing pressure and weed infestation.
- Habitat assessments for wetland birds and aquatic invertebrates with a focus on the presence or potential presence of nationally 'Threatened' or 'At Risk' species.
- Assessment of options and recommendations for effects avoidance and mitigation that would likely be required to address effects associated with the proposed landuse change.
- Assessment of options and recommendations for addressing any residual effects associated with the proposed landuse change that cannot be avoided or mitigated.

2.2.2 Wetland assessments

Between February 2020 and August 2021, all areas of potential wetlands ('natural' and 'constructed') were assessed in general accordance with the WDP (MfE, 2020) to determine the presence and extent of wetlands within the PPC area.

The WDP sets out the methods for classifying and delineating freshwater wetlands based on vegetation, soil and hydrological characteristics (which became available in late 2021). Specifically:

- The vegetation tool⁴ categorises hydrophytic vegetation (aquatic and wetland vegetation) and establishes tests to determine if abundance passes the threshold for a natural wetland. This applies three vegetation tests: the "rapid test", the "dominance test" and the "prevalence index".
- The hydric soils tool⁵ assists with identifying the presence of hydric soils by categorising and defining their features and providing a matrix of assessment methods.
- The hydrology tool⁶ provides an assessment methodology to determine the presence of a natural wetland based direct and indirect indicators of wetland hydrology.

While we applied the rapid test, dominance test and the prevalence index to assess areas of potential wetland, our assessment did not strictly follow the WDP in several respects, as described below.

While there is no doubt that the application of the WDP improves transparency, consistency and rigour in interpreting the presence and extent of wetlands, the WDP is open to subjectivity. For example the WDP relies on the use of 2 m x 2 m plots to quantify the composition and relative abundance of species. In our view, this will generally provide less accurate information than more coarse level quantification of relative abundance of plant species across the entire wetland. For instance, under the WDP, a decision on the presence of a wetland (up to 2ha) can potentially be based on results from a single "representative" 4m² plot, i.e. from assessing as little as 0.02 % of the wetland.

Given the above, our wetland assessment was not in strict accordance with the WDP (Volume 2, Appendix C, Figure 2). In summary, our assessment protocol was as follows:

- We first determined the suite of "potential" wetlands to be confirmed and delineated based on high-resolution drone aerial imagery.
- Within each "potential" wetland we determined in the field the composition and relative abundance of all species within each stratum (i.e. tree, sapling / shrub, herb) and within each different ecosystem type where there were multiple types within a single wetland. As stated above, this differed from the WDP because our assessments, i.e. the "rapid", "dominance test" and "prevalence index", for each wetland were based on the "potential" wetland as a whole rather than one or more "representative" plots.
- As per Step 2 of the WDP (Volume 2, Appendix C Figure 2) we applied the "rapid test". For this test to confirm the area as a wetland, all dominant species must be either completely dependent on wetland conditions (obligate – ("OBL")) or more commonly found in wetlands (facultative wetland species ("FAC-W")). In most cases, the presence of a wetland was confirmed through the "rapid test".

⁴ BR Clarkson A vegetation tool for wetland delineation in New Zealand: Landcare Research Contract Report LC1793 (Landcare Research, December 2013).

⁵ S Fraser, P Singleton, B Clarkson Hydric Soils – Field Identification Guide. Landcare Research Contract Report LC3233 (Landcare Research, June 2018).

⁶ Wetland delineation hydrology tool for Aotearoa New Zealand (MfE, July 2021).

- In accordance with Step 3 of the WDP (Volume 2, Appendix C, Figure 2), if a “potential” wetland did not pass the “rapid test” we undertook the “dominance test” and “prevalence index”.

Given that the wetlands within the PPC area were relatively easy to delineate and the size of the study area was considerable, the approach taken was considered to strike the best balance between accuracy, effort, and conservatism.

Following confirmation of ‘wetland’ status, further assessment was undertaken to confirm the status of the wetlands as ‘natural’, as defined under the NPS-FM⁷. Specifically, if it was apparent that the wetland would not be there “but for” earthworks and construction works carried out on the site, then it was constructed by artificial means on a plain and ordinary meaning of the NPS-FM definition (Volume 2; Appendix C, Legal Opinion on the definition of ‘Constructed’ wetland under the NPS-FM)). Natural wetlands for the purposes of the NPS-FM were then deemed to include all the wetlands on the site that were not constructed, irrespective of the degree of modification or inducement through anthropogenic land use activities.

2.2.3 Fauna assessment

To assess the presence, or potential presence of wetland avifauna, the following field assessments were undertaken:

- Mapping and descriptions of potential freshwater wetland avifauna habitat.
- Incidental observation of freshwater wetland avifauna.
- Surveys of constructed open water wetlands (freshwater only) with a Canon Powershot camera (40x zoom) and binoculars.
- Deployment of two Automatic Recording Devices (ARDs), ARD01 and ARD02, to investigate the presence of cryptic freshwater wetland bird species in brackish coastal wetland habitats (Volume 2, Appendix C, Figure 1).
 - ARD01 was deployed on early successional terrestrial vegetation adjacent to a brackish wetland on the coastal fringe, while ARD02 was deployed deep in saltmarsh vegetation. ARDs were set to record between one and a half hours before sunrise to two and a half hours after sunrise, and between one hour before sunset to three hours after sunset.
 - ARD01 recorded from 18 December to 25 December 2020, while ARD02 recorded from 18 December 2020 to 21 December 2020. A total of 80 hours (59.5 hours and 20.5 hours per recorder, respectively) of spectrogram data was analysed in the programme Raven (v. 2.0.1) to identify any terrestrial, coastal and wetland bird species.

Terrestrial and coastal avifauna, including field survey methods, are addressed in the Terrestrial and Marine Ecology Effects Assessment Reports.

2.3 Assessment of ecological effects

The assessment of ecological effects was undertaken in general accordance with the EciAG (Roper-Lindsay et al., 2018)⁸. These guidelines provide a systematic, consistent and transparent framework

⁷ ‘Natural wetland’ in the NPS-FM means a wetland (as defined in the Resource Management Act 1991) “that is not: (a) a wetland constructed by artificial means (unless it was constructed to offset impacts on, or restore, an existing or former natural wetland); or (b) a geothermal wetland; or (c) any area of improved pasture that, at the commencement date, is dominated by (that is more than 50% of) exotic pasture species and is subject to temporary rain-derived water pooling.”

⁸ Environment Institute of Australia and New Zealand Inc. (2018). Ecological Impact Assessment (EciAG). EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems. 2nd Edition.

for undertaking assessments of effects, while also providing for professional judgement and flexibility where appropriate.

As outlined in the following sections, the EciAG have been used to determine:

- **Step 1:** ‘Ecological value’ (refer to Tables 4-6, EciAG, 2018) of the PPC area.
- **Step 2:** The ‘Magnitude of Effect’ on the environment (refer to Tables 8-9, EciAG, 2018).
- **Step 3:** The overall ‘Level of Effect’ after recommended measures have been taken to further avoid, remedy or mitigate for effects (refer to Table 10, EciAG, 2018).

2.3.1 Step one: Assigning ecological value

‘Ecological values’ were assigned on a scale of ‘Negligible’ to ‘Very High’ based on species and habitat values, using criteria in the EciAG (Roper-Lindsay et al., 2018) (refer to Tables 4-6, EciAG, 2018). The ecological value assigned to habitat types is based on an assessment against four sub-criteria including ‘representativeness’, ‘rarity and distinctiveness’, ‘diversity and pattern’ and ‘ecological context’. The ecological values assigned to species that are known or likely to be present is based on the New Zealand Threat Classification Status (NZTCS; Townsend et al 2007) and corresponding threat classifications for each taxon (e.g., wetland birds, invertebrates and plants).

2.3.2 Step two: Assessing the magnitude of effects

The ‘Magnitude of Effect’ is a measure of the extent or scale of the effect of an activity and the degree of change that it will cause after measures to avoid, remedy or mitigate for effects have been applied.

The ‘Magnitude of Effect’ after measures to avoid, remedy or mitigate for effects, was scored on a scale of ‘Negligible’ to ‘Very High’ (refer to Tables 8-9, EciAG, 2018) and was generally assessed in terms of:

- Spatial scale of the effect.
- The relative permanence of the effect.
- The intensity of the effect within the impact footprint.
- Timing of the effect in respect of key ecological factors.
- Level of confidence in understanding the expected effect.

2.3.3 Step three: Assessing the level of effects

An overall ‘Level of Effect’ on each value (after measures to avoid, remedy or mitigate for effects) was identified for each activity or habitat/fauna type using a matrix approach. This approach combines the ecological values (described in Section 2.3.1 above) with the magnitude of effects (Section 2.3.2 above) resulting from the activity (refer to Table 10, EciAG, 2018, which is also set out below at Table 2.1).

The matrix describes an overall ‘Level of Effect’, after measures to avoid, remedy or mitigate effects, on a scale from ‘Very Low’ to ‘Very High’. The ‘Level of Effect’ is then used to guide the extent and nature of measures to demonstrably offset and/or compensate for these residual effects.

It is considered necessary to address any ‘Level of effect’ assessed as being ‘Moderate’ or higher through offsetting or compensation measures. However, any ‘Level of effect’ deemed to be ‘Very High’ (if applicable) may not comply with the ‘Limits to offsetting’ principle, and therefore cannot be offset.

Table 2.1: Criteria for describing overall levels of ecological effects (Step 3) Table 10, EciAG. If the overall level of effect is assessed as being 'Moderate' or greater (blue shade), this warrants measures to avoid, remedy and/or mitigate these effects.

Magnitude of effect	Ecological Value				
	Very high	High	Moderate	Low	Negligible
Very high	Very high	Very high	High	Moderate	Low
High	Very high	Very high	Moderate	Low	Very Low
Moderate	High	High	Moderate	Low	Very Low
Low	Moderate	Low	Low	Very low	Very Low
Negligible	Low	Very low	Very low	Very low	Very Low
Positive	Net gain	Net gain	Net gain	Net gain	Net gain

2.3.4 Determining residual effects management requirements

Determining the type and magnitude of wetland habitat and enhancement measures to address residual effects associated with the proposed PPC that cannot be avoided, remedied or mitigated will be guided by the application of a Biodiversity Compensation Model (BCM) (Baber et al. 2021a,b,c)(see the Biodiversity Compensation Modelling Report). These models provide additional objective transparency, process and justification for the overall compensation package (Baber *et al.* 2021). In summary, BCMS:

- Provide guidance on addressing all residual adverse effects associated with a project for which impacts or gains cannot feasibly be measured or quantified with adequate precision and for which residual effects management is deemed appropriate when assessed against the 'limits to offsetting' principle.
- Serve as a decision support tool that provides additional transparency and rigour to the process of addressing residual adverse effects on biodiversity through compensation measures at proposed habitat restoration/enhancement site(s).
- Provide guidance on whether Net Gain (NG) outcomes are expected to be achieved for specified biodiversity values. Expected NG outcomes are sought, rather than No Net Loss (NNL) outcomes, to provide more confidence that NNL will actually be achieved.
- Operate at the 'as close to offset as possible' end of the compensation continuum. This is termed 'biodiversity compensation' in the Draft NPS-IB.
- Operate across the full spectrum and scale of project optioneering and plan change or consent applications.
- Can be later used to verify offsetting based on real data that is collected after the commencement of habitat restoration and enhancement activities at proposed offset/compensation sites.

3 Ecological Characteristics

3.1 Ecological context

The site is located within the Hunua Ecological District (ED). Pre-human vegetation composition consisted of pōhutukawa, pūriri, broadleaved forest (WF4) on the coastal fringes with kauri, podocarp, broadleaved, beech forest (WF12) occurring across inland areas⁹. Large swathes of vegetation of the ED have been lost to agriculture, forestry and housing developments; however, relatively high indigenous forest cover remains, due in part to the protected Hunua Ranges, which comprise 250 km² of mature native forest, approximately 22 km south-east of the PPC site.

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 on both properties drain to Waikopua Creek and Coastal Marine receiving environment, which is an important wading bird area with areas identified as marine SEAs (refer to the Marine Ecological Assessment report).

3.2 Site description

The area investigated consisted of the entire 307 ha that made up the proposed PPC area (Volume 2; Appendix A; Figure 1).

Originally this area encompassed native forest along with associated streams. Few, if any, natural wetlands would have been present onsite as existing wetlands have either been constructed or have been induced through landscape modification (largely through the sedimentation of gullies).

Landuse change and modification has transformed 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 SEAs as identified in the AUP-OP. Freshwater wetlands onsite are almost exclusively dominated by ponds or highly modified exotic-vegetated wetlands, though several native-dominated wetlands are present.

3.2.1 Formosa Golf Resort site

Formosa Golf Resort (approximately 170 ha) consists of open grass fields maintained for golfing purposes, interspersed with rank grass and exotic forest. Patches of regenerating native bush occur, and mature native vegetation is present only on the coastal (western) edge of the course.

The Formosa golf course includes constructed golf-course ponds and small constructed vegetation wetlands, almost all of which are dominated by low stature exotic species.

A developed area of approximately 5 ha is present at the centre of the Formosa site consisting of buildings and carparks.

3.2.2 620 Maraetai-Whitford Road

620 Maraetai-Whitford Road (approximately 80 ha) is to the immediate south of the golf course and is dominated by pasture grass and currently used for farming. Exotic pine forestry occurs on the

⁹ Auckland Council GeoMaps. Ecosystems Potential Extent. Accessed on 24 May 2021 from <https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html>

western coastal edge, with rank grass and native vegetation also present. Native plantings have been undertaken along riparian margins of several streams.

This site includes a single constructed pond as well as several exotic-dominated low stature seepage and gully wetlands.

3.2.3 Other land parcels

Various other land parcels comprise around 57 ha, and comprise mostly of managed or rank grasslands, lifestyle housing with exotic and native forest fragments, and exotic dominated wetlands both constructed and natural.

4 Wetland Characteristics

4.1 Vegetation/habitat types

A total of 61 freshwater wetlands were present within the proposed PPC area (Volume 2, Appendix C; Figure 1) and immediate surrounds, totalling, 5.727 ha. These wetlands were classified into five distinct habitat types as described in Table 4.1 below.

Table 4.1: Habitat descriptions of freshwater wetlands present across the PPC site and in the immediate surrounds.

Wetland habitat type	Areal extent (Ha)	Habitat Characteristics
Wetlands interpreted as 'Constructed' under the NPS-FM, on the basis that they were constructed by artificial means as part of extensive earthworks that were undertaken over the entire golf course area in 1996 for golf-course development (see Volume 2, Appendix C, Legal opinion on the definition of 'Natural' Wetland).		
Constructed native wetlands	0.099 ha	Heavily modified constructed wetlands dominated by native marsh clubrush (<i>Bolboschoenus fluviatilis</i>)
Constructed exotic wetlands	1.475 ha	These wetlands were formed as a result of the golf course development, are all heavily modified and are mostly associated with overland flow paths, blocked drains/culverts or gullies. Most wetlands are heavily dominated by exotic species but native species such as <i>Carex secta</i> or <i>Juncus edgariae</i> may also be present.
Constructed open water wetlands	2.543 ha	These open water wetlands include amenity golf ponds or gully ponds constructed during the development of the golf course and periodically maintained. Their margins are generally dominated by exotic vegetation such as willow weed or mercer grass. However, some of these constructed ponds do include native plant species including raupō or several <i>Carex</i> species. Importantly, these wetlands may also include suitable habitat for 'Threatened' or 'At Risk' wetland birds (see Section 4.2 below).
Wetlands interpreted as 'Natural' under the NPS-FM (refer to the legal opinion, Volume 2, Appendix C, Legal opinion on the definition of 'Natural Wetland')		
WL10: Oioi, restiad rushland/reedland	0.344 ha	This wetland (wetland 62 - Volume 2; Appendix C; Figure 1), is located immediately adjacent to 620 Maraetai-Whitford Road between Terrestrial SEA-T-1140 and the adjacent Coastal Marine Area ¹⁰ . The wetland is dominated by native plant species, in particular <i>Carex geminata</i> , though exotic mercer grass is also a dominant species and invasive exotic species are also present, including grey willow and pampas. This wetland is also expected to support several 'At Risk' species including pūweto, koitareke and mioweka. The presence of the Nationally Critical matuku-hūrero cannot be ruled out. Historically this wetland would have been a saline/brackish coastal wetland. However, it has developed into a freshwater wetland through the creation of a bund with a perched culvert and the corresponding exclusion or near exclusion of seawater.
Exotic Wetlands	1.266 ha	These wetlands are all located outside the Live Zone but within the PPC area (Volume 2: Appendix C; Figure 1) and include both seepage

¹⁰ Two SEAs are located in forested gully systems at 620 Whitford-Maraetai Road: SEA_T_1140 and SEA_T_1141. These consist of both regenerating and native forest and are described in the Terrestrial Ecology report.

Wetland habitat type	Areal extent (Ha)	Habitat Characteristics
		wetlands dominated by <i>Juncus effusus</i> and gully wetlands dominated by mercer grass and willow weed.

4.2 Wetland avifauna

Overall based on habitat suitability, the PPC site was expected to support up to 19 native freshwater wetland bird species (Table 4.2 below), with a total of 8 native species observed during the site visits or through spectrogram (ARD) analysis.

Freshwater wetlands that included suitable habitat for nationally 'Threatened' or 'At Risk' species are presented in Volume 2, Appendix C, Figure 1). In broad terms:

- Constructed freshwater wetlands consisting of open water ponds with structurally complex wetland and terrestrial vegetation margins were considered suitable for dabbling ducks such as pāteke (brown teal).
- Freshwater or brackish wetlands with dense foliage were suitable for pūweto (spotless crane) and/or koitareke (marsh crane) and matuku-hūrepo (Australasian bittern).
- Other wetland habitat types that lacked open water and/or dense, complex wetland vegetation and/or terrestrial margins were considered less suitable for nationally 'Threatened' or 'At Risk' species but may constitute marginal habitat in some cases.

A full list of species is presented in Table 4.2 below. 'Threatened' or 'At Risk' species using or potentially using the freshwater habitats on the PPC site are presented in Table 4.3 below.

Table 4.2: Freshwater wetland avifauna observed on PPC site () or potentially present within the PPC site.**

Common name	Species name	Threat classification
Pāteke/brown teal**	<i>Anas chlorotis</i>	Threatened – Nationally Increasing
Tētē moroiti/Grey teal	<i>Anas gracilis</i>	Not Threatened
Mallard**	<i>Anas platyrhynchos</i>	Introduced
Kuruwhengi/Australasian shoveler**	<i>Anas rhynchos</i>	Not Threatened
Pāpera/Grey duck	<i>Anas superciliosa</i>	Threatened – Nationally Vulnerable
Grey duck x mallard hybrid**	<i>Anas superciliosa x A. platyrhynchos</i>	N/A
Pāpango/New Zealand scaup**	<i>Aythya novaeseelandiae</i>	Not Threatened
Matuku-hūrepo/ Australasian bittern	<i>Botaurus poiciloptilus</i>	Threatened – Nationally Critical
Canada goose**	<i>Branta canadensis</i>	Introduced
Kakīānau/Black swan**	<i>Cygnus atratus</i>	Not Threatened
Matuku moana/White-faced heron**	<i>Egretta novaehollandiae</i>	Not Threatened
Kawau/Black shag**	<i>Phalacrocorax carbo</i>	At Risk – Relict
Kawau paka/Little shag	<i>Phalacrocorax melanoleucos</i>	At Risk – Relict

Kāruhiruhi/Pied shag**	<i>Phalacrocorax varius</i>	At Risk - Recovering
Weweia/New Zealand dabchick**	<i>Poliiocephalus rufopectus</i>	Threatened – Nationally Increasing
Koitareke/marsh crake**	<i>Porzana pusilla</i>	At Risk – Declining
Pūweto/spotless crake**	<i>Porzana tabuensis</i>	At Risk – Declining
Pūtangitangi/Paradise shelduck**	<i>Tadorna variegata</i>	Not Threatened
Kōtare/sacred kingfisher**	<i>Todiramphus sanctus</i>	Not Threatened
Spur-winged plover**	<i>Vanellus miles</i>	Not Threatened

Spectrogram analysis resulted in identification of one recording of a pūweto on 20 December 2020, and one likely recording of a koitareke on 24 December 2020 (distant calls) (Table 4.3). No matuku-hūrepo calls were identified during spectrogram analysis.

Table 4.3: Nationally ‘Threatened’ and ‘At Risk’ freshwater wetland avifauna species present (*) or potentially present within the the PPC site permanently or intermittently.**

Common name	Species name	Threat classification ¹¹	Observation notes
Pāteke**	<i>Anas chlorotis</i>	Threatened – Nationally Increasing	A single pāteke identified at Wetland 16, resting on woody debris.
Pāpera	<i>Anas superciliosa</i>	Threatened – Nationally Vulnerable	Not identified on PPC site. Potentially intermittently present. Mallards abundant which interbreed with grey duck.
Matuku-hūrepo	<i>Botaurus poiciloptilus</i>	Threatened – Nationally Critical	Not identified. Marginal foraging habitat available.
Weweia**	<i>Poliiocephalus rufopectus</i>	Threatened – Nationally Increasing	A single New Zealand weweia foraging in open water on Wetland 34.
Koitareke**	<i>Porzana pusilla</i>	At Risk – Declining	Potential call on ARD01.
Pūweto**	<i>Porzana tabuensis</i>	At Risk – Declining	Pūweto calls at Wetland 7. Identified on ARD01.
Kāruhiruhi**	<i>Phalacrocorax varius</i>	At-Risk - Recovering	Observed in Wetland 17.
Kawau**	<i>Phalacrocorax carbo novaehollandiae</i>	At Risk – Relict	Observed in Wetland 17.

¹¹ Robertson, H. A., Baird, K., Dowding, J. E., Elliott, G. P., Hitchmough, R. A., Miskelly, C. M., McArthur, N., O’ Donnell, C. F. J., Sagar, P. M., Scofield, R. P. & Taylor, G. A. (2016). Conservation status of New Zealand birds. New Zealand Threat Classification Series 19. 27 p.

4.3 Wetland invertebrates

The presence of nationally 'Threatened' or 'At Risk' wetland invertebrates was considered unlikely based on a desktop review of available information and data but cannot be ruled out.

5 Assessment of Ecological Effects

The previous section described the freshwater wetland characteristics within the proposed PPC area and immediate surrounds. This section focuses on assessing the potential for adverse effects on wetlands associated with the proposed landuse change within the Live Zone, including consideration of the types of measures that should be undertaken to avoid, remedy or mitigate potential adverse effects within the Live Zone (which would also apply to the broader PPC area).

The assessment is based on the EclAG (Roper-Lindsay et al, 2018) as described in Section 2.3 above, which includes an ecological values assessment (Step 1) a magnitude of effects assessment (Step 2) and a level of effects assessment (Step 3).

5.1 PPC Area Ecological values assessment (Step 1)

The freshwater wetland values associated with each habitat type and associated species with the PPC area are assessed in Table 5.1 and Table 5.2 below.

In summary all wetland types were assessed as being of moderate value, due to the threat status of wetlands per se and habitat suitability for threatened species. The notable exception to this was Wetland 62 (Volume 2, Appendix C, Figure 1), which was located immediately adjacent to the proposed PPC area. This wetland was assessed as being of 'Very High value' because this wetland type was regionally threatened, included a diversity of native plants, played an important role in ecological connectivity between the coastal marine and terrestrial environment, and provided highly suitable habitat for several threatened species.

Table 5.1: Freshwater wetland values assessment: PPC Area and Immediate Surrounds

Ecological characteristic	Assessment of ecological value attributes based on EIANZ guidelines (Tables 4-6, EclAG)	Ecological value
'Constructed' Wetlands - Wetlands interpreted as 'Constructed' under the NPS-FM (ref legal opinion, Volume 2, Appendix C) on the basis that extensive earthworks were undertaken over the entire golf course area in 1996 for the purposes of golf-course development.		
Native constructed wetlands	<ul style="list-style-type: none"> Moderate value for representativeness because these wetlands are native dominated. Representativeness was not assessed as higher because these wetlands do not constitute a natural wetland ecosystem type, and would not have been historically present in this landscape. Moderate value for rarity and distinctiveness because only a small proportion of freshwater wetland habitats remain in the region and the ED. These wetlands are not expected to support any nationally 'Threatened' or 'At Risk' species. Low value for diversity and pattern because both native wetlands onsite include only a single native plant species (which is dominant), and would not support a high diversity of indigenous wetland birds or invertebrates, as these wetlands are very small. Low value for ecological context because while they have some value for buffering and ecological connectivity in the landscape, values are low due to their small size and/ or low indigenous diversity. <p>Two Moderate values and two Low values equates to an overall value assessment of Moderate.</p>	Moderate
Exotic constructed wetlands	<ul style="list-style-type: none"> Low value for representativeness because these wetlands are exotic dominated. Representativeness was not assessed as higher 	Moderate

Ecological characteristic	Assessment of ecological value attributes based on EIANZ guidelines (Tables 4-6, EclAG)	Ecological value
	<p>because these wetlands do not constitute a natural wetland ecosystem type and they would not have been historically present in this landscape.</p> <ul style="list-style-type: none"> • Moderate value for rarity and distinctiveness because only a small proportion of freshwater wetland habitats remain in the region and the ED. Also, a small proportion of these wetlands are known or likely to support the nationally 'At Risk' pūweto. • Moderate value for diversity and pattern. These wetlands are exotic dominated. However, collectively they do provide habitat for several native plant species, a small number of common and At Risk native wetland birds as well as common aquatic invertebrates adapted to seasonal hydroperiods (periods of inundation). • Low value for ecological context because while they have some value for buffering and ecological connectivity in the landscape, values are low due to their small size and/ or low indigenous diversity. <p>Two Moderate values and two Low values equates to an overall value assessment of Moderate.</p>	
Open water constructed wetlands	<ul style="list-style-type: none"> • Low value for representativeness because these wetlands do not constitute a natural wetland ecosystem type and would not have been present historically in this landscape. • Moderate value for rarity and distinctiveness because only a small proportion of freshwater wetland habitats remain in the region and the ED. Also, some of these wetlands and their surrounding wetland margins are known or likely to support nationally 'Threatened' or 'At Risk' wetland birds including weweia, pūweto and pāteke. • Moderate value for diversity and pattern. These wetlands are exotic dominated. However, collectively they do provide habitat for several native plant species, a small number of Threatened or 'At Risk' native wetland birds as well as common aquatic invertebrates. • Moderate value for ecological context because they are important for maintaining ecological connectivity in the landscape for aquatic invertebrates and wetland fauna. <p>Three Moderate values and one Low value equates to an overall value assessment of Moderate.</p>	Moderate
'Natural' Wetlands - Wetlands interpreted as 'Natural' under the NPS-FM (ref legal opinion Volume 2, Appendix C)		
Exotic wetlands	<ul style="list-style-type: none"> • Low value for representativeness because these wetlands are exotic dominated. Representativeness was not assessed as higher because these wetlands do not constitute a natural wetland ecosystem type, and would not have been present historically in this landscape. • Moderate value for rarity and distinctiveness because only a small proportion of freshwater wetland habitats remain in the region and the ED. Also, a small proportion of these wetlands are known or likely to support nationally 'Threatened' or 'At Risk' wetland birds including pūweto and pāteke. • Moderate value for diversity and pattern. These wetlands are exotic dominated. However, collectively they do provide habitat for several native plant species, a small number of common and 	Moderate

Ecological characteristic	Assessment of ecological value attributes based on EIANZ guidelines (Tables 4-6, EciAG)	Ecological value
	<p>'At Risk' native wetland birds. These wetlands are also expected to include common aquatic invertebrates adapted to seasonal hydroperiods (periods of inundation).</p> <ul style="list-style-type: none"> Low value for ecological context because while the wetlands have some value for buffering and ecological connectivity in the landscape, values are low due to their small size and/ or low indigenous diversity. <p>Two Moderate values and two Low values equates to an overall value assessment of Moderate.</p>	
<p>WL10: Oioi, restiad rushland/reedland (Wetland 62 immediately adjacent to PPC area)</p>	<ul style="list-style-type: none"> High value for representativeness because this wetland is indigenous dominated, and includes a high proportion of the species that would historically have been present. High value for rarity and distinctiveness because this ecosystem type is classified as a regionally 'Endangered' ecosystem type (Singers et al. 2018) with only a small proportion of these freshwater wetland ecosystem types remaining in the region and the ED. This wetland is also expected to provide suitable nesting and foraging habitat for several 'At Risk' wetland bird species including pūweto, koitareke and mioweka (banded rail). Occasional use by matuku-hūrepo also cannot be ruled out. High value for diversity and pattern. This wetland provides habitat for a high diversity of native plant and wetland bird species, and is also expected to include a diversity of common native aquatic invertebrates. High value for ecological context largely because this wetland provides and maintains critical ecological connectivity and sequencing between the coastal marine and freshwater stream/terrestrial environments within SEA_T_1141¹². <p>Four high values equates to an overall value assessment of Very High.</p>	<p>Very High</p>

Table 5.2: Ecological value assessment of indigenous freshwater wetland avifauna observed () or potential present within the PPC area.**

Maori name/English name	Threat classification	Ecological value (Tables 4-6, EciAG, 2018) ¹³
Pāteke (brown teal)**	Threatened – Nationally Increasing	High
Tētē moroiti (grey teal)	Not Threatened	Low
Kuruwhengi (Australasian shoveler)**	Not Threatened	Low
Pārera (grey duck)	Threatened – Nationally Vulnerable	Very High
Pāpango (New Zealand scaup)**	Not Threatened	Low

¹² Two SEAs are located in forested gully systems at 620 Whitford-Maraetai Road: SEA_T_1140 and SEA_T_1141. These consist of both regenerating and native forest and are described in the Terrestrial Ecology report.

¹³ Ecological value is directly related to the Department of Conservation threat status for birds (Robertson et al. 2017). However, the Threat Category classification system and threat status of some birds have now changed (Robertson et al. 2021). Of key importance a New Threat Category 'Threatened – Nationally Increasing' has been assigned. I consider the EciAG Ecological Value category that best aligns with this new category to be 'High'.

Maori name/English name	Threat classification	Ecological value (Tables 4-6, EclAG, 2018) ¹³
Matuku-hūrepo (Australasian bittern)	Threatened – Nationally Critical	Very High
Kakiāno (black swan)**	Not Threatened	Low
Matuku moana (White-faced heron)**	Not Threatened	Low
Kawau (Black shag)**	At Risk – Relict	Moderate
Kawau paka (Little shag)	At Risk – Relict	Moderate
Kāruhiruhi (Pied shag)**	At Risk - Recovering	Moderate
Weweia (dabchick)**	Threatened – Nationally Increasing	High
Koitareke (marsh crake)**	At Risk – Declining	High
Pūweto (spotless crake)**	At Risk – Declining	High
Pūtangitangi (Paradise shelduck)**	Not Threatened	Low
Kōtare (sacred kingfisher)**	Not Threatened	Low
Spur-winged plover**	Not Threatened	Low

5.2 Magnitude of effects assessment (Step 2)

The ‘Magnitude of Effects’ on freshwater wetland values within the Live Zone is assessed based on the extent, intensity, duration and timing of effects associated with the project after measures have been undertaken to further avoid, remedy or mitigate adverse effects.

An overview of the potential adverse effects associated with the landuse change in the Live Zone (Section 5.2.1 below) and corresponding measures to further avoid, remedy or mitigate effects area in the Live Zone and also the wider PPC area provided below (Section 5.2.2). This is followed by an assessment of the ‘Magnitude of Effects’ for each value that is associated with landuse change in the Live Zone (Section 5.2.3 below).

5.2.1 Overview of potential adverse effects

The proposed change in landuse within the Live Zone has the potential to result in a range of adverse effects on freshwater wetland ecological values. Potential adverse effects may include:

- Wetland habitat loss through vegetation clearance, earthworks and drainage.
- Wetland degradation through changes to hydrology, discharges¹⁴ that affect water quality and construction-related disturbance effects around wetland margins that may affect the quality of habitat for wetland species (e.g. noise, vibration, dust or lighting).

Potential long-term ongoing adverse effects associated with the change in landuse activity status within the Live Zone may include:

- Ongoing disturbance to wetlands and corresponding effects on the quality of wetland habitat for species due to the presence of infrastructure, housing and people in close proximity.
- Lost opportunities for creating wildlife corridors.

¹⁴ Discharge of water within a natural wetland as prohibited by Regulation 53 of the NES-FW is not proposed. Discharge points are expected to be at least 200 m from the wetland.

5.2.2 Overview of measures to avoid, remedy or mitigate effects

Measures to avoid the loss of natural wetlands associated with the change in landuse activities within the Live Zone (and wider PPC area) were undertaken through the optioneering and concept design phases of the PPC project and have included refining the configuration of the PPC project (e.g. designing the footprint to avoid all natural wetlands).

Potential adverse effects associated with the proposed landuse change in the Live Zone (and wider PPC area) will be further avoided, remedied or mitigated through:

- Site optimisation during the master-planning phase to avoid or minimise habitat loss of existing and potential high value habitat types and natural wetlands through the creation of the 88.7 ha EPAN.
- Inclusion of a minimum 10 m native vegetation buffer around all natural wetlands and within the EPAN to mitigate the effects of disturbance relating to the proposed landuse change.
- Seasonal constraints on vegetation clearance and earthworks that affect constructed wetlands to avoid or minimise effects on wetland birds that are legally protected under the Wildlife Act 1953. This includes avoidance of wetland loss:
 - outside of earthworks season (i.e., should not be undertaken from 1 May – 1 October) due to the need for erosion and sediment controls to be in place; and
 - during peak wetland bird breeding season to reduce harm to eggs or chicks (September – December inclusive).

Proposed precinct provisions identify freshwater wetlands and associated values within the EPAN and provide for their protection, restoration, enhancement and maintenance.

5.2.3 Magnitude of effects assessment after measures to avoid, remedy or mitigate

The magnitude of effects on freshwater wetland values within the Live Zone is based on the extent, intensity, duration and timing of effects associated with the PPC. Effects on freshwater wetland values are set out below and in turn the magnitude of effects on each of these values within the Live Zone are assessed after measures to avoid, remedy or mitigate effects.

The magnitude of effects categories in ascending order include 'negligible', 'low', 'moderate', 'high' or 'very high'. As set out in Table 5.3 below, in no instance was the magnitude of effects on wetland habitats and associated indigenous wetland fauna within the Live Zone assessed as 'Very High' or 'High'. This was largely because the wetland assessed as having very high value was well outside the Live Zone footprint, and potential effects on all natural wetlands were mitigated through the requirement in the PPC provisions to provide a 10 m native revegetation buffer within the EPAN, to protect those wetlands from PPC associated landuse change occurring outside the EPAN.

However, as detailed in Table 5.3 below, the proposed landuse changes within the Live Zone are expected to result in the loss of 2.09 ha of constructed wetlands, and to also include a range of indirect effects on constructed and natural wetlands through stormwater discharge and general disturbance. These activities are expected to generate a 'moderate' magnitude of effect after measures to avoid, remedy or mitigate for potential adverse effects on the following wetland types and associated wetland bird species:

- Constructed native wetland
- Constructed exotic wetland
- Open water wetlands
- Pāteke
- Weweia

- Pūweto

The magnitude of effects on all other freshwater wetland ecology values were assessed as 'Negligible' or 'Low'.

Table 5.3: 'Magnitude of Effects' freshwater wetland assessment.

Freshwater wetland habitat type	Project effects	Measures to avoid, remedy or mitigate effects	Magnitude of effect (Tables 8-9, EclAG, 2018)
Wetland classified as 'Constructed'			
Native vegetated wetland (<i>Bolboschoenus flavius</i>)	Total loss of this habitat within the Live Zone though the areal extent of loss per se is low (0.0445 ha). It is likely to constitute a moderate proportion of loss within the surrounding landscape and a negligible proportion of loss in the Ecological District.	None	Moderate
Exotic vegetated wetland	A high proportion of this habitat type is present within the Live Zone (0.487 ha out of a total of 1.475 ha present within the PPC area, equating to a loss of 33%). This is likely to constitute a low proportion of loss within the surrounding landscape and a negligible proportion of loss in the Ecological District.	Requirement in the plan change provisions to avoid vegetation clearance and/or earthworks leading to habitat loss and/or disturbance during peak wetland bird breeding season for wetlands that could potentially support wetland birds.	Moderate
Open water wetlands	A Very High proportion of this habitat type is present within the development footprint (1.558 ha out of a total of 2.5423 ha present within the PPC area, equating to a loss of 61.2%). This is likely to constitute a moderate proportion of loss within the surrounding landscape and a negligible proportion of loss in the Ecological District.	Requirement in the precinct provisions to avoid vegetation clearance and/or earthworks leading to habitat loss and/or disturbance during peak wetland bird breeding season for wetlands that could potentially support wetland birds.	Moderate

Freshwater wetland habitat type	Project effects	Measures to avoid, remedy or mitigate effects	Magnitude of effect (Tables 8-9, EciAG, 2018)
Wetland classified as 'Natural'			
Exotic vegetated wetlands	No effects associated with the proposed landuse change within the Live Zone are expected on natural exotic vegetated wetlands.	Requirement in the plan change provisions to include a 10 m wetland margin vegetated buffer around each wetland in the FUZ (and within the EPAN) to minimise effects related to disturbance and the degradation of surface water entering wetlands.	Negligible
Oioi, restiad rushland/reedland (WL10; Singers et al. 2017)	No effects associated with the proposed landuse change within the Live Zone are expected on the oioi, restiad rushland/reedland. This wetland is adjacent to but not within the PPC area.	Requirement in the plan change provisions to include best practice erosion and sediment controls and stormwater treatment. Requirement in the plan change provisions to include a 10 m buffer surrounding the terrestrial SEA which will further buffer the aquatic receiving environment from sedimentation.	Negligible
<u>Indigenous Wetland fauna</u>			
Pāteke/ brown teal	<ul style="list-style-type: none"> Habitat loss Potential harm to eggs or chicks General disturbance associated with the proximity to development 	<ul style="list-style-type: none"> Requirement in the precinct provisions to avoid effects on key habitats within the EPAN Requirement in the plan change provisions to avoid vegetation clearance and earthworks activities during peak breeding season when eggs and chicks are most likely to be present and provision of a 10 m mitigation vegetation buffer 	Moderate as a high proportion of habitat for pāteke will be impacted within the Live Zone and this constitutes a moderate proportion of available habitat in the surrounding landscape and a low proportion of the available habitat in the Ecological District.
Tētē moroiti/ grey teal			Low as tētē moroiti will be common in the surrounding landscape and within the Ecological District.
Kuruwhengi/ Australasian shoveler			Low as kuruwhengi will be common in the surrounding landscape and Ecological District.

Freshwater wetland habitat type	Project effects	Measures to avoid, remedy or mitigate effects	Magnitude of effect (Tables 8-9, EciAG, 2018)
Pārerā / grey duck		around wetland habitats to minimise disturbance-related effects	Negligible as pārerā is unlikely present onsite.
Pāpango / New Zealand scaup			Low as pāpango will be common in the surrounding landscape and Ecological District.
Matuku-hūrepo / Australasian bittern			Negligible as impacted habitats provide only marginal foraging habitat at best for matuku-hūrepo and this is a highly mobile species.
Kakīāno / black swan			Low as impacted habitat provides only marginal foraging habitat for kakīāno.
Matuku moana / white-faced heron			Low as impacted habitat provides only marginal foraging habitat for matuku moana.
Kawau / black shag			Low as impacted habitat provides only marginal foraging habitat for kawau.
Kawau paka / little shag			Low as impacted habitat provides only marginal foraging habitat for kawau paka.
Kāruhiruhi / pied shag			Low as impacted habitat provides only marginal foraging habitat for kāruhiruhi.
Weweia / dabchick			Moderate as a high proportion of habitat for weweia will be impacted within the Live Zone and this constitutes a moderate proportion of available habitat in the surrounding landscape and a low proportion of the available habitat in the Ecological District.
Koitareke / marsh crane			Low as a low proportion of habitat for koitareke will be impacted within the Live Zone and this constitutes a low proportion of available habitat in the surrounding landscape and a negligible proportion of the available

Freshwater wetland habitat type	Project effects	Measures to avoid, remedy or mitigate effects	Magnitude of effect (Tables 8-9, EciAG, 2018)
			habitat in the Ecological District.
Pūweto / spotless crane			Moderate as a moderate proportion of habitat for pūweto will be impacted within the Live Zone and this constitutes a moderate proportion of available habitat in the surrounding landscape and a low proportion of habitat in the Ecological District.
Pūtangitangi / paradise shelduck			Moderate as a moderate proportion of habitat for pūtangitangi will be impacted within the Live Zone and this constitutes a moderate proportion of available habitat in the surrounding landscape, and a low proportion of habitat in the Ecological District.
Kōtare / sacred kingfisher			Low as this constitutes a low proportion of available habitat for kōtare in the surrounding landscape and a negligible proportion of available habitat within the Ecological District.
Spur-winged plover			Low as this constitutes a low proportion of available habitat for spur-winged plover in the surrounding landscape and a negligible proportion of available habitat within the Ecological District.

5.3 Level of effects (Step 3)

Table 5.3 below sets out the potential 'Level of Effects' for each ecological value after measures required by plan change provisions to avoid, remedy or mitigate for effects have been considered. Recommendations for addressing residual effects that are 'Moderate' or higher are provided in Section 6.

The overall level of residual ecological effects on all wetland types within the Live Zone are expected to be 'Moderate' after the implementation of plan change provisions to avoid, remedy or mitigate effects are taken into account. However, effects on the oioi, restiad rushland/reedland wetland and natural exotic wetlands, neither of which are present in the Live Zone, are expected to be 'Low' and 'Very Low' respectively.

The overall level of effects on wetland birds ranges from 'Very Low' to 'High' with effects on pūweto pāteke and weweia assessed as 'High' after measures to avoid, remedy or mitigate effects, and effects on all other indigenous wetland birds assessed as 'Low' or 'Very Low'.

Recommendations for addressing residual effects associated with the proposed land-use changes within the Live Zone (and more broadly, the PPC area) are provided in Section 6 below. These measures include restoration and enhancement planting to address residual effects on wetland habitats and vegetation, and pest control to address residual effects on wetland fauna.

Table 5.4: Level of effects after measures to avoid, remedy or mitigate for effects

Ecological characteristic	Ecological value category	Magnitude of effects category	Level of effects category (Table 10, EciAG, 2018)
Wetland habitat type			
Constructed native wetland	Moderate	Moderate	Moderate
Constructed exotic wetland	Moderate	Moderate	Moderate
Constructed open water wetland	Moderate	Moderate	Moderate
Natural exotic wetland	Moderate	Negligible	Very low
Oioi, restiad rushland/reedland wetland	Very High	Negligible	Low
Wetland fauna			
Pāteke (brown teal)	High	Moderate	High
Tētē moroiti (grey teal)	Low	Low	Very Low
Kuruwhengi (Australasian shoveler)	Low	Low	Very Low
Pārera (grey duck)	Very High	Negligible	Low
Pāpango (New Zealand scaup)	Low	Low	Very Low
Matuku-hūrepo (Australasian bittern)	Very High	Negligible	Low
Kakīāno (black swan)	Low	Low	Very low
Matuku moana (White-faced heron)	Low	Low	Very Low
Kawau (black shag)	Moderate	Low	Low
Kawau paka (little shag)	Moderate	Low	Low
Kāruhiruhi (pied shag)	Moderate	Low	Low
Weweia (dabchick)	Moderate	Moderate	High
Koitareke (marsh crake)	High	Low	Low
Pūweto (spotless crake)	High	Moderate	High
Pūtangitangi (paradise shelduck)	Low	Moderate	Low
Kōtare (sacred kingfisher)	Low	Low	Very Low
Spur-winged plover	Low	Low	Very Low

6 Proposed Residual Effects Measures

This section sets out:

- An overview of the residual effects associated with land use change within the Live Zone and more broadly the PPC area that will need to be addressed through precinct provisions (Section 6.1);
- An overview of biodiversity offsetting and compensation definitions and principles (Section 6.2);
- The overall approach for addressing the residual effects associated with land use change within the Live Zone and the broader PPC area (Section 6.3); and
- The habitat restoration or enhancement measures that will be undertaken for the purpose of addressing residual effects on freshwater wetland ecology values within the Live Zone and the broader PPC area. (Section 6.4).

6.1 Proposed residual effects that will need to be addressed

As assessed in Section 5, the proposed land use change within the Live Zone area is expected to have residual adverse effects of 'Moderate' or higher (after measures to avoid, remedy or mitigate effects) on several wetland habitats and associated species. Specifically, the proposed land use change is expected to have:

- Potentially high level of residual effects on pūweto pāteke and weweia.
- Potentially moderate levels of residual effects on constructed native and exotic wetlands.

6.2 Biodiversity offsetting and compensation

Management of residual effects after measures to avoid, remedy or mitigate impacts fall to offsetting or compensation. As defined in Baber et al. (2021a) and Quinn et al. (2021):

“A biodiversity offset is a ‘measurable conservation outcome’ that meets certain principles and balances adverse residual effects, to a No Net Loss (NNL) or preferably Net Gain (NG) standard. While offsetting requires a measurable outcome that has been quantified through a robust and transparent process, biodiversity compensation does not necessarily need to be quantified and measurable. However, compensation measures under the principles of biodiversity compensation (as described below) are intended to achieve No Net Loss or preferably Net Gain outcomes where possible.”

Key biodiversity offsetting principles as set out in Appendix 8 of the AUP-OP, and Appendix 3 of the draft NPS-IB include the principles of:

- NNL or preferably NG outcomes.
- Adherence to the effects management hierarchy. Offset should only be contemplated after steps to avoid, remedy, or mitigate adverse effects have sequentially been exhausted, and thus applies only to residual biodiversity impacts. Compensation, as the least certain and most risky management of effects, should be considered as a last resort.
- Ecological equivalence, meaning the ecological values that benefit from the offsetting measures, are the same or similar to those being impacted.
- Additionality, meaning the gains in biodiversity must be above and beyond gains that would have occurred anyway in the absence of the offset or compensation.
- Long-term outcomes (preferably in perpetuity).

- Landscape context, whereby the biodiversity offset or compensation considers the landscape context of both the impact site and the offset site.
- Science and mātauranga Māori, whereby the design and implementation of a biodiversity offset must be a documented process informed by science, including an appropriate consideration of mātauranga Māori¹⁵.

Similarly, key biodiversity compensation principles are outlined in Appendix 4 of the NPS-IB. These biodiversity compensation principles generally follow the above offsetting principles, with the most notable difference relating to the scale of biodiversity compensation. Instead of the NNL or preferably NG outcomes required by offsetting, compensation requires the indigenous biodiversity values lost through the activity to be addressed by positive effects to indigenous biodiversity that are proportionate to the adverse effects.

6.3 Overall approach for addressing residual effects

The proposed residual effects management approach seeks to achieve NG outcomes after 20 years for the residual adverse effects on indigenous wetland biodiversity values within the Live Zone and more broadly the PPC area to inform the Structure Plan and PPC. This outcome can be achieved through native wetland and wetland margin planting, and a mammalian pest control programme to enhance existing wetland biodiversity values.

These proposed habitat restoration and enhancement measures are all forms of compensation and do not strictly meet the definition of offsetting, largely because at this stage of the process, the expected future gains associated with the proposed habitat restoration and enhancement activities cannot be quantified with adequate precision to constitute an offset (Baber et al. 2021). However, while biodiversity compensation does not require the same numerical rigour as offsetting, it is generally recognised that ecological outcomes are improved where offset principles are applied as a guideline when designing compensation packages.

As described in Section 2.3.4 above, the type and quantum of proposed compensation measures has been guided by the application of a Biodiversity Compensation Model (BCM) (Baber et al., 2021 a,b,c) (see the Biodiversity Compensation Model for detail). The locations of proposed management actions are presented in Volume 2, Appendix A; Figure 2.

The proposed compensation aligns with the principle of biodiversity offsetting in that restoration and enhancement outcomes:

- Adhere to the effects management hierarchy, i.e., in sequential order, the consideration of measures to avoid, remedy, mitigate, offset and compensation (as a last resort).
- Aim to achieve net gain outcomes as indicated through the use of a transparent biodiversity model as a decision support tool;
- Are ecologically equivalent ('like for like') in that habitat restoration and enhancement activities focus on generating Net Gains for wetland biodiversity values that are affected by the project activities;
- Are at least commensurate with the scale of adverse effects (but expected to generate Net Gain outcomes);
- Are additional and would not be otherwise undertaken;
- Are close as possible to the area of impact;
- Will result in long-term benefits for the affected biodiversity values;

¹⁵ This principle will be addressed primarily in the Cultural Impact Assessment and integrated into the residual effects management approach. Similarly, other inter-related principles and disciplines, e.g., stormwater management and landscape design will be built into the overall residual effects management package for ecology.

- Consider landscape context to optimise ecologically connectivity and buffering in the landscape.

6.4 Proposed wetland compensation

The biodiversity modelling (as detailed in the Biodiversity Compensation Modelling Report) suggests that to address the loss of constructed wetlands and their associated wetland bird values to an expected Net Gain standard within 20 years, will require the following habitat restoration and enhancement activities. These areas (with the exception of stormwater ponds), are shown in the PPC ecological compensation figure (Volume 2, Appendix A, Figure 2) and include:

- Approximately 5 ha of constructed stormwater wetlands that will address a number of residual adverse effects on the existing constructed wetlands and associated biodiversity values.
- Approximately 2.14 ha of native wetland enrichment planting, including a 20-year weed control programme within all exotic vegetation dominated wetlands that are within the EPAN.
- Wetland buffer plantings around the margins (10 m width) of all 3.32 ha of wetlands that are present within the EPAN including a 20-year weed control programme. This includes wetland buffer plantings within the EPAN around:
 - Approximately 2.14 ha of exotic vegetated wetlands (which will also receive native wetland enrichment planting).
 - Approximately 0.398 ha of native vegetated wetlands (which includes the 0.34 ha of oioi, restiad rushland/reedland wetland that is immediately adjacent to the PPC area (Wetland 62).
 - Approximately 0.785 ha of open water wetlands.
- Mammalian pest control across the 3.32 ha of wetlands that are present within the EPAN. This will be undertaken in conjunction with, and in addition to, the 88.7 ha pest control programme proposed across terrestrial and coastal sites with high ecological values.

The proposed wetland restoration and enhancement compensation actions will align with ecological best practice, namely:

- Native wetland revegetation will include the full suite of indigenous eco-sourced wetland plants that would be expected to occur in high value native dominated wetlands within the Ecological District.
- Wetland margin revegetation will include the full suite of indigenous eco-sourced wetland plants expected to occur in terrestrial habitats within the Ecological District.
- A proportion of already fallen (coarse woody debris) or felled exotic or native tree trunks and stumps shall be deployed within wetlands and wetland margins at revegetation sites to provide for native wetland biodiversity, e.g., terrestrial and aquatic invertebrates.
- All revegetation must be maintained and monitored annually for a period of 20 years with monitoring data evaluated to enable and inform adaptive management and to demonstrably verify that NG outcomes are being achieved.
- Maintenance shall include weed control, infill planting and control of mammalian browsers (if required).
- Long-term protection of wetlands will be further assured via encumbrances or covenants.
- Mammalian pest control will follow best practice and be undertaken for 35 years with a focus on reducing densities of rats, possums, mustelids and feral cats.
- A biodiversity outcome monitoring programme will be developed and implemented across impact sites and compensation sites to:

- Verify that expected NG outcomes have been achieved (i.e. that adverse effects on those values affected by the PPC project have been demonstrably offset or compensated for).
- Guide adaptive management response and contingency measures in the event that biodiversity gains are not tracking as expected. This programme will include baseline monitoring at the impact and compensation sites and will focus on vegetation characteristics and the relative abundance of birds.

In relation to natural inland wetlands as defined in the NPS-FM, we consider that the proposed measures meet the definition of ‘aquatic compensation’ in that document.

Overall, we consider it likely that all residual effects associated with a change in landuse activities enabled by the Plan Change will be adequately addressed through the proposed effects compensation measures and expect NG outcomes for wetland biodiversity. However, a wetland biodiversity monitoring programme would be necessary to verify that expected gains at the compensation sites are realised or to guide adaptive management actions where required.

7 Conclusion

In conclusion, we consider that all potential adverse effects on wetland ecology associated with the proposed landuse change within the Live Zone and wider PPC area can be addressed to an expected NG standard within 20 years.

The above outcomes for wetland ecology will be achieved firstly through the existing Auckland-wide provisions under the AUP and proposed precinct provisions developed for the proposed Beachlands South Precinct (as set out in the Planning Report that accompanies the PPC application). Secondly through subsequent resource consent processes, in which effects management measures will be enacted through consent conditions and associated management plans.

Through the creation of the 88.7 ha EPAN, we consider that the proposed precinct provisions set out in the planning report will:

- Ensure the protection of the most significant wetland ecology values onsite, which are located within the EPAN; and
- Provide for adequate wetland ecology mitigation and habitat restoration and enhancement opportunities that will be required at the resource consent application stage to address adverse effects associated with development.

8 Applicability

This report has been prepared for the exclusive use of our client, BSLP 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, BSLP, will submit this report as part of an application for a private plan change and that Auckland Council as the consenting authority will use this report for the purpose of assessing that application.

Tonkin & Taylor Ltd

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