



Wairau Blue Green Network FTA

Preliminary Ecology Assessment

Prepared for Auckland Council Healthy Waters and Flood Resilience
Prepared by Beca Limited

6 November 2025



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1 Introduction

Auckland Council's Healthy Waters and Flood Resilience Department (Healthy Waters) is lodging a referral application to increase flood storage at A F Thomas Park, Wairau Valley under the Fast-track Approvals Act 2024.

The project broadly involves:

- a) Flood resilience infrastructure works; and
- b) Reserve reinstatement, including site stabilisation, landscaping, new footpaths/boardwalks, and formal and informal recreation.

This report provides a high-level ecological assessment of the proposal.

1.1 Project Description

The Ngā Wairau project is part of Auckland Council's Making Space for Water – Blue-green Network programme and is focused on the key areas within the Wairau catchment that were impacted by the 2023 storm events. Given the large scale of the Wairau catchment, the Ngā Wairau project is being delivered in three stages. This proposal covers Stage 1, which involves increasing the existing flood storage at A F Thomas Park, together with reserve reinstatement. The stormwater detention capacity created through Stage 1 works is critical to enabling future Stages 2 and 3. Further design development and funding confirmation is required for Stages 2 and 3, and they therefore do not form part of this proposal.

The works proposed under Stage 1 enable the delivery of flood resilience in the catchment by increasing flood storage within A F Thomas Park, initially for the downstream residential area, and undertaking additional stormwater improvement works.

The proposed works to increase flood storage at A F Thomas Park include the following:

- Excavate the park to increase the existing flood storage to reduce flood flows and flood levels. Formalisation of a wetland on the northern end of the park where water naturally ponds as a result of the works and dry detention in other areas of the park. At this stage the earthworks on the site are indicatively estimated to be in the order of 700,000m³ – 800,000m³ (cut and fill) to achieve a flood storage volume of approximately 550,000m³. All excavated material is to remain onsite unless unsuitable.
- The proposed flood storage changes will amend the consented dam. At this stage, the proposed changes may include reducing the dam height, increasing the flood storage capacity and providing an additional spillway.
- Construct a new spillway channel linking the existing channel north of A F Thomas Park that flows east under State Highway 1 to A F Thomas Park to optimise storage and release of flood flows in the park to maximise benefits.
- Reshaping ground using cut material to convey flood flows between proposed raise areas.
- Vegetation removal is required to facilitate the works.
- A temporary construction laydown area will be established on-site (location TBC).
- Reinstatement of A F Thomas Park and constructing new multi-use maintenance accessways.

The technical parameters provided above are indicative, as design is ongoing. The referral is sought on the basis of the broader project description provided above (i.e. (a) flood resilience infrastructure works and (b) reserve reinstatement, including site stabilisation, landscaping, new footpaths/boardwalks, and formal and informal recreation), with final design specifications and precise quantities to follow in the substantive application.

2 Methodology

A high-level desktop assessment¹ has been undertaken to inform the preliminary assessment of the existing ecological values at A F Thomas Park. This includes assessment of historical imagery, Auckland Council GeoMaps environmental layers and AUP overlays, catchment information, national databases of native fauna records, and other publicly available ecological information.

A site visit has also been undertaken by Beca Limited (Beca) ecologists on the 26th of September 2025 to support the preliminary ecology assessment. Terrestrial features at the site have been assessed based on their botanic values and provision of habitat for indigenous fauna, including birds, lizards and bats. Modelled overland flow paths across the site have been ground-truthed and mapped during the site visit. Freshwater features across the site were assessed based on their classification, ecological function, riparian values, and associated freshwater vertebrate values. Initial fauna surveys including incidental bird observations, manual searches and two checks of Artificial Cover Objects (ACO) for lizards, and bioacoustic monitoring for native bats using Automatic Bat Detectors (ABMs) was conducted over late September – early November 2025.

Further assessment of ecological values on-site will be undertaken for the substantive application and will include detailed fauna surveys, additional freshwater assessments, and a wetland classification and delineation. Further fauna surveys will include environmental DNA (eDNA) sampling, netting and trapping for freshwater fish, additional ACO checks for lizards, 5-minute bird counts, and continued bioacoustic monitoring for native bats. Further freshwater value assessment will include Stream Ecological Valuation (SEV) (Storey et al., 2011) for impacted reaches and macroinvertebrate community sampling. National wetland delineation protocols (Ministry for the Environment, 2022) will also be implemented to identify, delineate, and value any natural inland wetlands within A F Thomas Park. These assessments will primarily be completed in November 2025, with results informing the formal Ecological Impact Assessment (EclA) report to be prepared for the substantive FTA Act application.

All ecological values provided within this report, as well as identification of potential ecological effects of the proposed project (direct and indirect, and both during and after completion) have been assessed in accordance with the Environment Institute of Australia and New Zealand (EIANZ) EclA Guidelines (Roper-Lindsay et al., 2018). Appropriate effects management recommendations have been selected through application of the mitigation hierarchy (avoidance, minimisation, remediation/restoration, and mitigation) with reference to these guidelines. This assessment of values, effects, and management aligns with a structured, transparent approach consistent with good industry practice, and will be refined within the formal EclA report as further site information and design details become available.

3 Ecological Context

A F Thomas Park is located within the Tāmaki Ecological District of the Auckland Ecological Region. Historically (prior to human colonisation), the wider area is expected to have been comprised of lowland forest and wetland ecosystems. Contiguous catchments draining into the Hauraki Gulf and Waitematā Harbour would likely have contained extensive wetland systems hosting diverse vegetation communities and supporting a range of both terrestrial and freshwater indigenous fauna species.

Potential ecosystem extents (mapped on Auckland Council GeoMaps) within and surrounding A F Thomas Park include Kahikatea, pukatea forest (WF8), Kauri, podocarp, broadleaved forest (WF11), and Pūriri forest

¹ A preliminary review was previously undertaken of historical aerial imagery (Auckland Council, n.d. -a), which has also informed the high-level desktop assessment.

(WF7). WF8 ecosystems are strongly associated with topographic depressions and high water tables, described by Singers et. al. as a 'swamp forest' (2017). The extent of this potential WF8 across A F Thomas Park aligns with a remnant vegetated low-land area which persists in the northwestern corner of the site from 1940-1983 (New Zealand LINZ historical aerial imagery). This area can be clearly seen in aerial imagery dated 1960-1970 (Appendix A), and alignment with potential WF8 suggests that it likely contained persisting wetland conditions.

In addition to wetland areas, historic aerial imagery indicates the presence of natural streams throughout the site (1940-1941), however, by 2000, the majority of these natural channels had been reclaimed by additional developments, incorporated into the piped stormwater network, or subject to intensive modification and realignment. A comparison of historical natural streams and current mapped watercourses is provided in Appendix B. Overall, the landscape surrounding A F Thomas Park has undergone a significant transition since 1940 from low density housing and agricultural land use to a high density and highly modified urban landscape, with notable loss of natural vegetation coverage and freshwater systems (Appendix C).

Currently, A F Thomas Park is classified as Urban Parkland/Open Space (IRIS New Zealand Land Cover 1996-2018) and is comprised of the maintained fairways of Takapuna Golf Course, isolated patches of exotic and native vegetation, and several ponds and channelised watercourses. These watercourses are within the Wairau Valley catchment of Wairau Creek, which flows into Castor Bay through the Wairau Estuary Reserve. The current Auckland Council floodplains overlay² indicates extensive modelled floodplains through the Wairau Valley catchment, including over fifty percent of A F Thomas Park, and aligning with the potential WF8 extent. A notable portion of the northeastern corner of the site is also within the Auckland Council flood prone areas overlay, including much of the area likely to have historically provided a hydrosystem for wetland conditions (Appendix A). Recurring flood conditions have been documented within this area of the site, including during the 2023 extreme weather events.

No areas of the site are recognised under the Auckland Unitary Plan: Operative in Part (AUP: OP) as Significant Ecological Areas (SEAs), however, numerous scattered SEAs are located within the wider landscape, largely including vegetated gully systems which have persisted or restored since the dramatic urbanisation of the area. The only recognised current ecosystem types mapped on Auckland Council's GeoMaps are limited to an open water body (OW) where an existing pond is present, and two unclassified (UC) areas of vegetation.

4 Ecological Features

4.1 Terrestrial Ecology

Vegetation across the site is highly modified and is expected to have a Low-Moderate ecological value, in respect to the EIANZ EclA guidelines. Vegetation communities throughout the site are dominated by exotic species, with maintained and exotic mowed grass comprising the turf which makes up the majority of the golf course. Trees throughout the site are mainly exotic amenity trees, though some common native amenity trees are also present, notably pōhutukawa (*Metrosideros excelsa*). Some clusters of trees contain an understory consisting of both native and exotic regeneration, though this is largely unmanaged, and pest plants are also present. Areas of planted native vegetation are also present within the site, consisting of typical pioneer species (e.g., *Coprosma robusta*, *Kunzea robusta*, *Podocarpus totara*, and *Phormium tenax*). These plantings were well established at the time of the site visit and progressing towards canopy closure. Areas of native regeneration and restoration planting are mapped in Appendix B. Additional high-level details

² Auckland Council GeoMaps

of the trees present within A F Thomas Park, including locations of large native trees, are included within the associated arboricultural memorandum prepared by The Tree Consultancy Company (2025) for this project.

4.2 Freshwater Ecology

Freshwater ecological features at A F Thomas Park consist of modified natural streams and some watercourses that could be considered modified waterbodies or artificial drains (collectively referred to as watercourses in this report), as well as two pond features. All watercourses on-site are fed by multiple stormwater inputs from the local reticulated network. Some watercourses require more site-based work to confirm their status as a modified stream or constructed drain, and to delineate their flow status (ephemeral, intermittent, permanent). Due to reliance on stormwater input, it is expected that both intermittent and permanent watercourses are present. However, formalised classification was unable to be undertaken for marginal watercourses during this preliminary assessment due to a period of heavy rainfall which preceded the site visit. Confirmed classification will be subject to further investigation and the application of AUP: OP stream classification technical guidance (Auckland Council, 2021).

The entirety of the site has been highly modified to control water flow and drainage in order to maintain function of the golf course facilities. While natural channels that are readily identifiable in historic aerial imagery are no longer present, the majority of the channels on-site are assessed as streams for the purpose of the Resource Management Act (RMA) definition, albeit they are heavily modified – i.e. on the basis of this preliminary assessment, they are likely to have been diverted from their natural alignments historically to where they occur now. There are also some possible artificial drains that have been noted on-site, likely having been constructed with the purpose of intercepting groundwater to maintain dry ground conditions. Additional ephemeral waterbodies / overland flow paths are also present on-site, directed into drains or along aggregate lined depressions.

All watercourses on-site are largely linear and channelised in nature, and numerous culverts convey these beneath pathways and sections of golf turf. Several of these culverts have perched inlets and/or outlets. Notably, culvert outlets near the downstream confluence of the on-site stream systems with Wairau Creek exhibited perched and overhanging conditions, posing a significant barrier to fish passage (locations mapped in Appendix B).

All watercourses on-site are soft bottomed with substrate comprised predominantly of silt. Macrophytes and periphyton are also prolific. There is a limited diversity of stream hydrological features across the site due to the straight and channelised nature of freshwater features. Additionally, sections of the stream system in the northern lowland area of the site, where wetland conditions were historically present, exhibit stagnant pooling, and common water lily (*Nymphaea alba*) were identified there.

For the purpose of clarity, the two ponds in the northwestern corner of the site are considered preliminarily to be surface water bodies that are standalone and artificially constructed for amenity. Review of historic aerial imagery indicates that they are unlikely to be connected to any natural stream or wetland system. These ponds are expected to provide some habitat for native avifauna.

Overall, the freshwater features on-site are expected to have Low to Moderate ecological value, in respect to the EIANZ EcIA guidelines, although this will be further assessed through the application of SEV methodology, macroinvertebrate sampling, and freshwater fish surveys programmed to be undertaken in October/November 2025. The potential ecological value of freshwater features for the purpose of considering the National Policy Statement for Freshwater Management 2022 (NPS-FM), when including possible practicable restoration measures could be Moderate to High. Limitations to potential ecological value may be the straight, shallow, and the somewhat fragmented and discontinuous nature of waterbodies on-site.

4.3 Wetlands

A desktop-based assessment for potential wetland areas on-site was conducted utilising current site topography, and Auckland Council flood plain and overland flow paths overlays. Historical (1990-2025) and current aerial imagery was also used to identify areas that showed visual characteristics of water retention (e.g., green vegetation during dry seasons, and potential surface water presence). While some potential wetland areas were identified during this desktop assessment, on-site investigation at the time of the initial site visit did not identify any potential 'wetlands', as defined in the RMA, or 'natural inland wetlands', as defined in the NPS-FM, which provides a more refined assessment framework. Wetland presence will be confirmed through the application of national wetland delineation protocols, to be carried out across the site during future ecological assessment.

4.4 Indigenous Fauna

Avifauna

Local records (within 5km) and on-site observations indicate both exotic and common native species presence. Common native species identified at the time of the site assessment include kōtare (*Todiramphus sanctus*), tūī (*Prothemadera novaeseelandiae*), grey warbler (*Gerygone igata*), spur-winged plover (*Vanellus miles*), pūkeko (*Porphyrio melanotus*), welcome swallow (*Hirundo neoxena*), shining cuckoo (*Chrysococcyx lucidus*), and paradise shelduck (*Tadorna variegata*).

Vegetation on-site is expected to provide moderate nesting, foraging, and roosting habitat for common native species, though diversity and/or abundance of species utilisation may be impacted by high levels of disturbance on-site and within the surrounding urban landscape. Species classified regionally as At Risk and Threatened have also been recorded within proximity to the site, including kākā (*Nestor meridionalis septentrionalis*; At Risk – Recovering), spotless crake (*Zapornia tabuensis*, Threatened – Regionally Vulnerable), and banded rail (*Gallirallus philippensis assimilis*, Threatened – Regionally Vulnerable). While not observed within the site and the lack of high-quality habitat suitable to support these species, there remains potential for At Risk or Threatened individuals to be present on-site. Future surveys to identify presence of species will be undertaken within differing habitats on-site to confirm initial findings and further inform the site's avifauna values.

Lizards

The vegetation on-site provides overall low-quality habitat for native lizards, with the majority of the site consisting of mowed exotic grass. Low-quality habitat for native ground-dwelling skinks, including At Risk copper skink (*Oligosoma aeneum*) and, though less likely, ornate skink (*Oligosoma ornatum*), is present, with possibly appropriate habitat available in leaf litter and groundcover vegetation within isolated vegetated patches throughout the site. It is considered highly unlikely that native geckos are present on-site due to fragmentation of habitat, urban pest animal pressures, and lack of mature native vegetation. Additionally, the site lacks connectivity to potential gecko habitat within the wider landscape.

No native lizards were found during manual searches of skink habitat conducted during the initial site visit or the first two ACO survey checks. However, the site's lizard values will be further informed through additional ACO surveys to be carried out over November 2025.

Bats

Long-tailed bats (*Chalinolobus tuberculatus*) classified as Threatened – Nationally Vulnerable, have been previously identified within approximately 12km and 13km of A F Thomas Park in 2020 and 2023, respectively. However, as shown in the Department of Conservation bat records (2025), multiple surveys have been conducted in closer proximity to the site with no native bats recorded. Additionally, preliminary

acoustic survey monitoring conducted on site from late September – early October did not identify bats, although it is acknowledged monitoring season for bats begins in October therefore, these findings present an initial suite of observations only, with further monitoring programmed as noted.

While a small number of trees containing potential bat roost features were identified at the site, it is considered highly unlikely that this species is present within the local area. This can be attributed to a lack of connectivity or commuting corridors between high quality native bat habitat, along with disturbance and pest animal pressures from a highly urban environment. The site's native bat values will be further informed by further survey results collected via Acoustic Bat Monitors deployed during bat monitoring season, during November 2025.

Freshwater Fish

Native freshwater fish species diversity within the site is expected to be limited primarily to *Anguilla* species. While a range of native and exotic species have been historically recorded within the wider Wairau Valley catchment, significant limitations to migratory fish passage observed at the time of the site assessment is expected to prevent all but climbing-adept eels to be able to navigate the watercourses on-site. Fish passage barriers primarily include perched and overhanging culvert outlets within the downstream extent of the on-site stream system, along with multiple perched culverts throughout the site. During the site visit, an unidentified eel was observed within a modified stream on-site. It is expected that both shortfin eel (*Anguilla australis*; Not Threatened) and longfin eels (*Anguilla dieffenbachia*; At Risk – Declining) may utilise freshwater habitat on-site. Netting and trapping for freshwater fish, as well as eDNA sampling to be carried out in October 2025, will further inform the freshwater fish species composition and values of A F Thomas Park.

5 Potential Ecological Effects

The works associated with the proposed project (detailed in Section 1.1) will result in potential ecological effects impacting both the terrestrial and freshwater ecology values of A F Thomas Park, as well as the site's native fauna values. Potential ecological effects are mainly associated with vegetation removal, earthworks, and watercourse reclamation required for Stage 1 of the Ngā Wairau project.

The removal of vegetation is expected to be temporary, and to have a low-level effect on the site's ecological values. Vegetation loss will consist of exotic grasses comprising the golf course turf, large trees, including some large natives, and areas of regenerating and planted native vegetation. Removal of vegetation will result in a temporary reduction in native vegetation cover and low to moderate quality terrestrial habitat for native fauna (birds and lizards) within an already highly urbanised environment. However, remediation of vegetation and habitat loss is expected to be achieved through ecologically sensitive design and incorporation of native vegetation species into the project's landscaping plans. This is also expected to protect and restore on-site indigenous biodiversity values. Along with existing areas of SEA within the wider landscape, A F Thomas Park may serve as an additional stepping stone for highly mobile native fauna following the completion of the proposed works.

Stream reclamation associated with the proposed works will result in the permanent loss of Low to Moderate value, highly modified, natural streams. The works will also result in the loss of artificial drains and pond features, as well as existing habitat for native fauna. There is expected to be a low level of effect resulting from this impact, as the wetland to be created on-site as a component of the proposed project will be of greater freshwater ecological value, in terms of ecological functioning and habitat quality, than that of the watercourses and ponds proposed to be lost. Freshwater wetland ecosystems have experienced notable decline across the Auckland Region. Historically comprising approximately 25 percent of the region's coverage, wetlands have been reduced to less than five percent today, which is reflective of the largescale national reduction of this ecosystem type (Auckland Council, n.d.-b). The return of this site to wetland conditions not only improves the diversity of ecological systems within the area, but aids in the preservation

of wetlands regionally and nationally. To effectively manage effects of reclamation of natural streams, design considerations are expected to allow for the creation of on-site compensatory stream habitat. There is also potential for increased on-site species diversity should the restoration of fish passage throughout the site be incorporated into the project design.

There is a potential risk of increased sedimentation and/or decreased water quality during the works, which may impact downstream ecosystems. This risk is expected to be adequately managed through the implementation of erosion and sedimentation control throughout the works. Following the completion of the project, the enhanced stormwater filtration capacity of the proposed wetland will likely improve water quality in Wairau Creek downstream of the site.

Additional hydrological effects (on groundwater and surface water) may arise as a result of earthworks and recontouring required for the proposal, however comprehensive hydrological assessment of the confirmed design plans will be required to assess these impacts. Similarly, vegetation clearance and earthworks may impact any wetland features on or within proximity of the site, though this risk is unconfirmed until wetland presence is determined through official wetland assessment.

Finally, direct impacts of the project include risk of injury and/or mortality of native terrestrial and freshwater species, potentially including At Risk or Threatened species, at the time of the proposed construction works. There may also be a risk of habitat loss for native avifauna due to construction related disturbance. Under the Wildlife Act 1953, which specifies absolute protection for certain native species, there may be requirement to seek Wildlife Act Authority (WAA) permits in addition to the implementation of fauna management plans in order to appropriately mitigate impacts on native fauna. The most likely scenario in which a WWA permit will be required, in this case, is if protected herpetofauna species are found on-site during further ecological assessments.

6 Conclusion

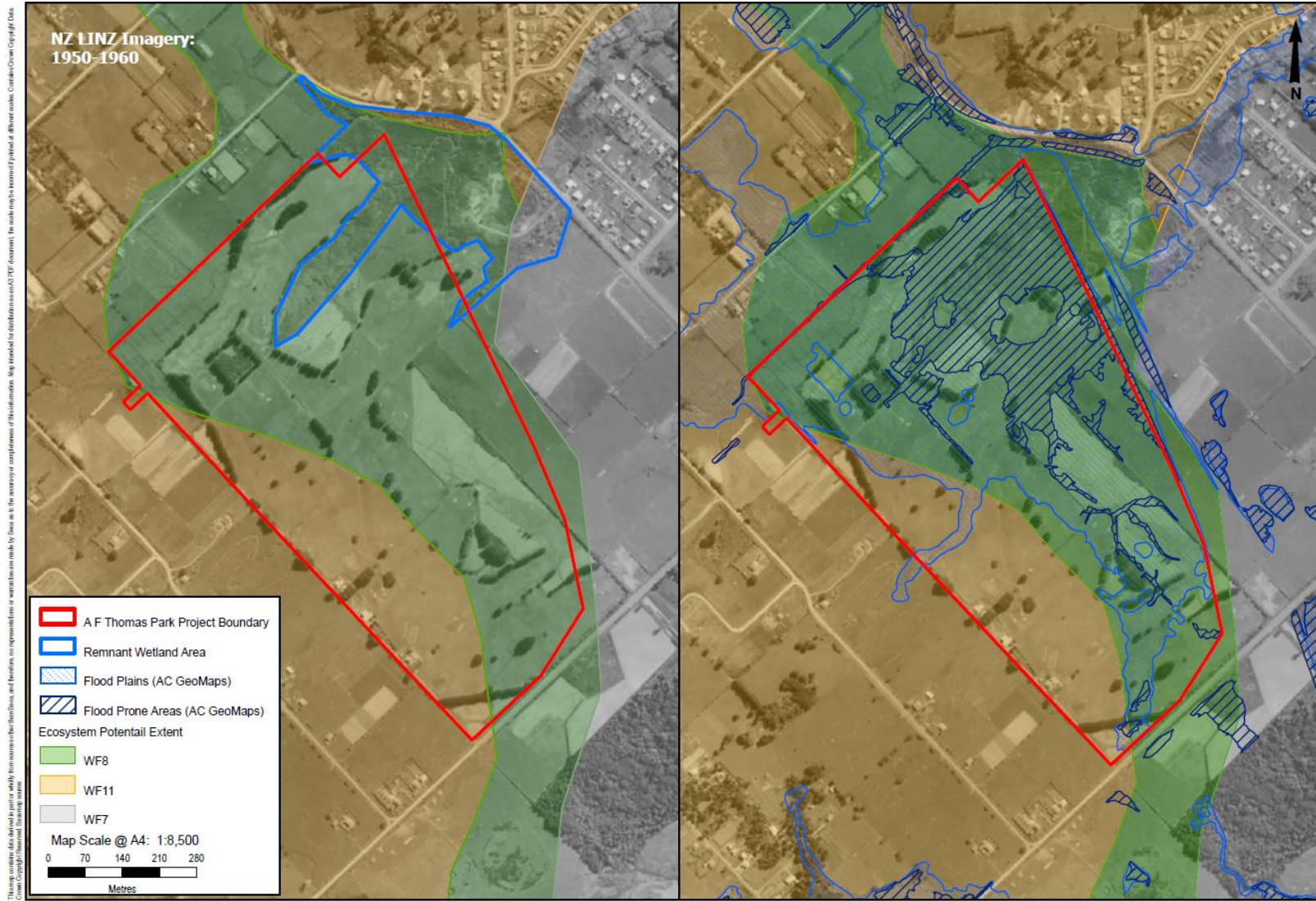
A high-level assessment of the potential effects of the Stage 1 of the Ngā Wairau project at A F Thomas Park has been undertaken with respect to the site's historical and existing ecological values. Historically, the site is likely located within a historical wetland environment, with historical imagery and modelled flood data indicating wetland conditions concentrated within the northern corner of the site. Existing terrestrial ecological features identified on-site include native vegetation, moderate value habitat for native birds, and low value potential habitat for native lizards. Freshwater ecological features on-site include modified natural streams, artificial drains, and two ponds. Habitat for native freshwater fauna within on-site watercourses is of Low to Moderate value, in respect to the EIANZ EcIA guidelines. This will be confirmed with additional assessment. Fish passage barriers on-site are expected to further restrict freshwater fauna biodiversity. Wetland presence on-site is considered unlikely following the initial site assessment; however, wetland presence will be confirmed through future application of the national wetland delineation protocols.

The ecological values assessment in this report should be considered preliminary, and the extent and value of ecological features will be refined within subsequent assessment of ecological impacts, supported by further survey and assessment results.

Potential adverse effects of the proposed project that can be assessed at this time are attributable to removal of native vegetation and freshwater features, habitat loss, risk of harm to native fauna, and sedimentation and erosion impacts arising from earthworks on downstream ecosystems. Management of these impacts will be achieved through the proposed construction of a wetland environment within the site, incorporation of site-wide landscaping, implementation of fauna management plans, and application of sediment and erosion control measures.

Positive impacts expected to result from the proposed project include the restoration of a historical wetland ecosystem, and opportunities for the creation of on-site stream habitat. Along with flood prevention services and improved stormwater filtration, the proposed wetland construction is expected to have positive effects on local biodiversity, habitat, and ecosystem functioning, thus positively influencing the site's ecological values. Overall, Stage 1 of the Ngā Wairau project presents substantial opportunities to enhance and protect key ecological features and is overall likely to deliver a positive environmental outcome.

Appendix A – Historical Wetland, Potential Ecosystem Extent, and Flood Overlays



Appendix B – Historic and Current Site Conditions



Appendix C – Land Use Change Over Time



BECA

References

- Auckland Council. (n.d.-a). Stream Classification and Wetland Indication - AF Thomas Park. *Memo Addressed to Rowan Carter Manager Design Partnerships - Sustainable Outcomes*.
- Auckland Council. (n.d.-b). *Wetlands facts 01*.
- Auckland Council. (2021). *Auckland Unitary Plan Practice and Guidance Note: River/Stream Classification*.
- Ministry for the Environment. (2022). *Wetland Delineation Protocols*.
<https://environment.govt.nz/assets/publications/Wetland-delineation-protocols.pdf>
- Roper-Lindsay, J., Fuller, S. A., Hooson, S., Sanders, M. D., & Ussher, G. T. (2018). *Ecological impact assessment. EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems. 2nd edition*. Environmental Institute of Australia and New Zealand.
- Singers, N., Osborne, B., Lovegrove, T., Jamieson, A., Boow, J., Sawyer, J., Hill, K., Andrews, J., Hill, S., & Webb, C. (2017). *Indigenous terrestrial and wetland ecosystems of Auckland*.
- Storey, R. G., Neale, M. W., Rowe, D. ., Collier, K. ., Hatton, C., Joy, M., Maxted, J. R., Moore, S. H., Parkyn, S. ., Phillips, N., & Quinn, J. (2011). *Stream Ecological Valuation (SEV): a method for assessing the ecological functions of Auckland streams* (Issue October).
- The Tree Consultancy Company. (2025). *Nga Wairau Stage 1 - AF Thomas Park Draft preliminary comments on arboricultural effects*.