WAIATARUA RESERVE

ENHANCEMENT PLAN

December 2019

Ōrākei Local Board
Auckland Council

CONTENTS

1.0 Introduction 3
2.0 Brief site history 8
3.0 Stormwater functions 10
4.0 Ecology - flora 15
5.0 Ecology - fauna 20
6.0 Park assets and circulation 22
7.0 Consultation summary 24
8.0 Development recommendations 27
9.0 Enhancement plan 28
10.0 Action plan 30

Revision

DATE/REVISION	DESCRIPTION
April 2019	Working Draft Ver. A
May 2019	Local Board Workshop
July 2019	Local Board Workshop 2
September 2019	Local Board Business Meeting 1
December 2019	Final

APPENDICES

A1. Te Aranga design principles
A2. History of the park
A3. Planting list
A4. Pest plant species list
A5. References

1.0 Introduction

1.1 The site

Waiatarua Reserve is situated in Meadowbank, Auckland. The reserve is located within the Tāmaki Ecological District. It covers 41 hectares, comprising 16 hectares of restored wetlands, 16 hectares of open meadows and paths, and 9 hectares of planted forest (native and some eucalyptus). It was originally a tributary valley of Tāmaki River, which was sealed off by a large lava flow from eruptions of nearby Maungarei Mt Wellington approximately 9000 years ago. Subsequent ponding and the deposit of silt and volcanic ash helped create the wetland. The wetland in Waiatarua Reserve is the largest urban constructed wetland in New Zealand. It is mainly a stormwater-treatment system where drains, weirs, bunds and sediment traps remove pollutants from waterways.

Access to the reserve is from Remuera Golf Club / Winstone Drive (east), Abbotts Way (south), Towle Place (west) and Grand Drive (west and north).

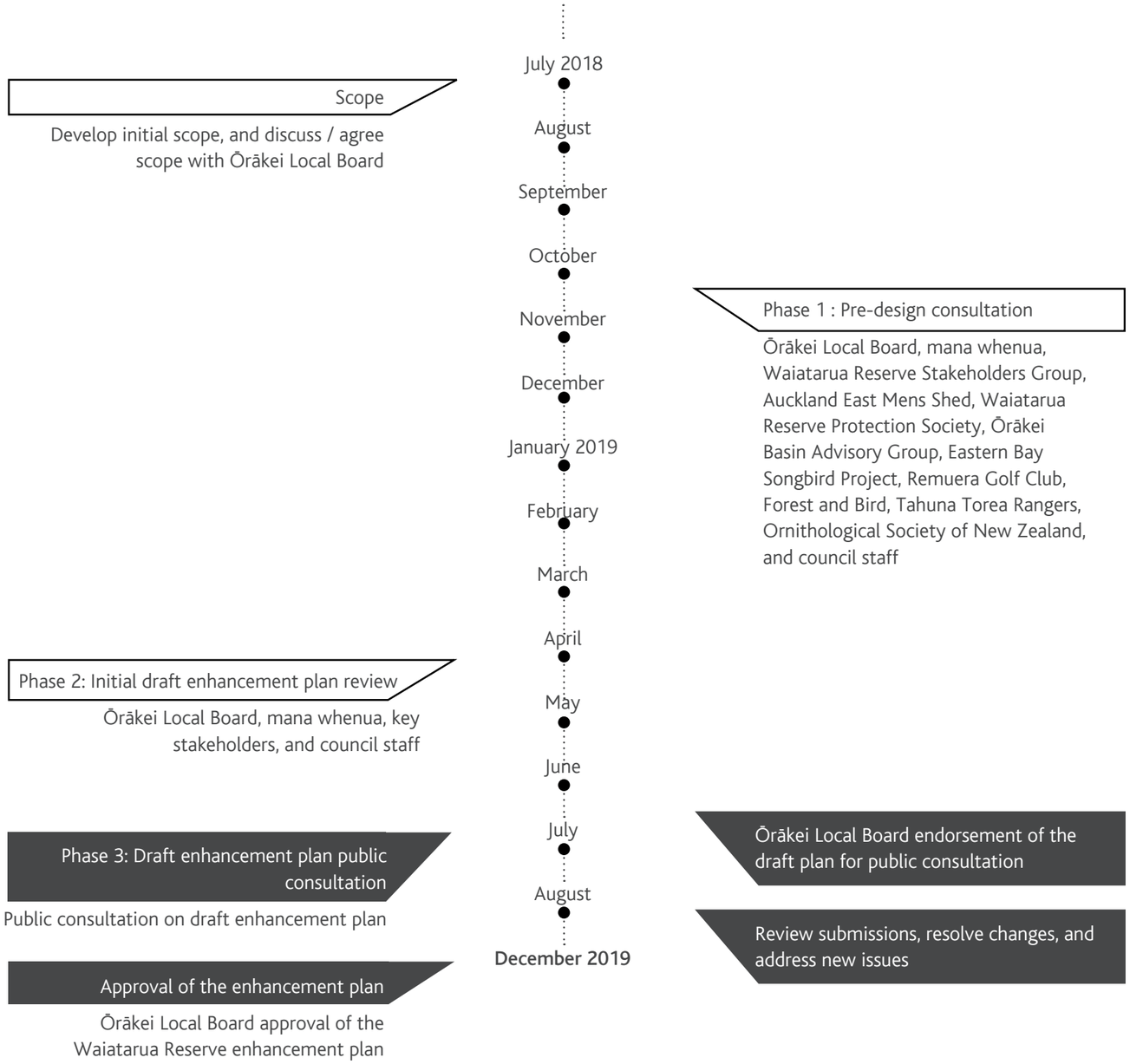
1.2 Project scope

Waiatarua Reserve is a unique wetland and area of open space in the Ōrākei Local Board area. It has many opportunities for environmental and recreational improvements. It is important to plan for developments so that they will be consistent with the themes of the reserve. This will protect the natural values of the reserve and prevent it from becoming cluttered with ad-hoc developments.

This plan will be developed in collaboration with an iwi working group, the community and stakeholder groups. It aims to:

- identify service improvements at Waiatarua Reserve
- monitor and enhance the wetland to ensure the stormwater treatment is working well, supporting biodiversity improvements, recreational opportunities and educational outcomes
- align with existing plans including:
  - Waiatarua Reserve Management Plan 1984
  - The Parks and Open Spaces Strategic Action Plan 2013
  - Ōrākei Local Paths (Greenways) Plan 2016
  - The Ōrākei Local Board Plan 2017
  - Waiatarua Reserve Restoration Plan 2018.

1.3 Project Timeline

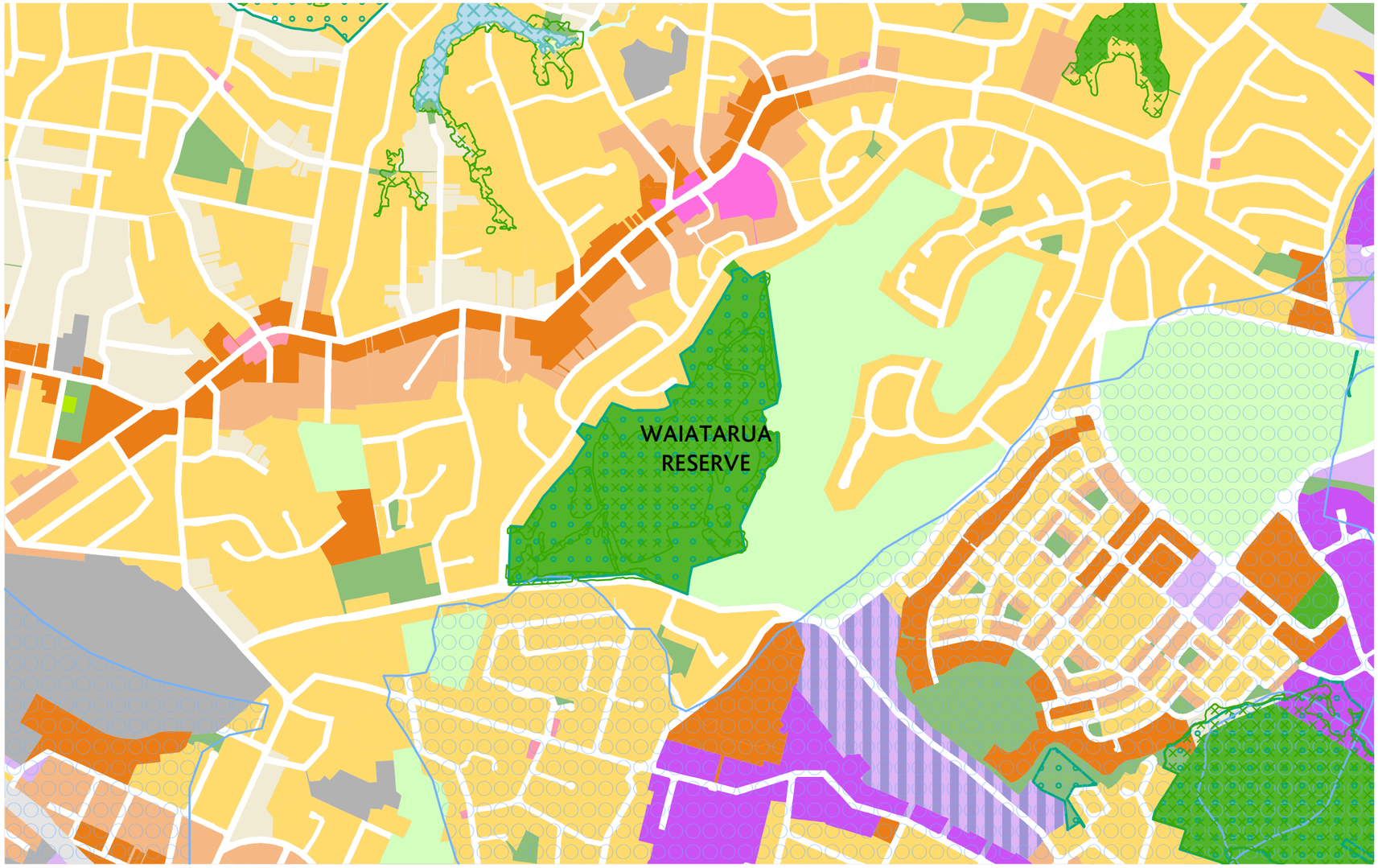


1.4 Location map

Aerial extracted from Auckland Council GIS . Scale 1:15000

1.5 Statutory context

Unitary plan zoning and overlay



The Auckland Unitary Plan - extracted from Auckland Council GIS. Scale 1:15000

Waiatarua Reserve is sited at 98 Abbotts Way in Remuera. It is described as Part Lot 3 DP 68674 and is classified as Open Space - Conservation Zone. It is currently held in fee simple by the Auckland Council and is subject to the provisions of the Local Government Act 2002. The land was originally acquired by the Auckland City Council for the purposes of a public park and recreation ground pursuant to the Municipal Corporations Act 1954.

The reserve has Conservation Zoning under the Unitary Plan. The ecological importance of this area of habitat is underlined by its status as a Significant Ecological Area (SEA) (SEA_T_5287), which includes but is not limited to the following criteria: Threat status, Rarity and Diversity, an Outstanding Natural Feature (ID226) for "Waiatarua Swamp" described as "one of the best examples in Auckland of a freshwater lake formed by the damming of valley by lava flow" and a 'Tranche 2 Biodiversity Focus Area'. Waiatarua Reserveis noted as a Māori Heriage Area by the New Zealand Archaeological Association.

LEGEND

PUBLIC OPEN SPACE

- Conservation Zone
- Informal Recreation Zone
- Sports and Active Recreation Zone
- Community Zone

RESIDENTIAL

- Single House Zone
- Mixed Housing Suburban Zone
- Mixed Housing Urban Zone
- Terrace Housing and Apartment Buildings Zone

BUSINESS

- Local Centre Zone
- Neighbourhood Centre Zone
- Mixed Use Zone
- General Business Zone
- Special Purpose Zone

OVERLAYS

- Aquifers
- Significant Ecological Area- Terrestrial
- Outstanding Natural Features

1.6 Other strategic documents and related projects

Waiatarua Reserve Management Plan 1984

The management plan was written when the land was still grazed. It does not offer much guidance for making current decisions.

The Parks and Open Spaces Strategic Action Plan 2013

The plan has four areas of focus to treasure, enjoy, connect and utilise our parks and open spaces.

Ōrākei Local Paths (Greenways) Plan 2016

Ōrākei Local Paths (Greenways) route 4.0 Ellerslie to the Sea runs through Waiatarua Reserve. The Ōrākei Local Board is currently reviewing the updated priorities for implementation and advocacy of the paths. The map shown on this page is a draft version in relation to the reserve.

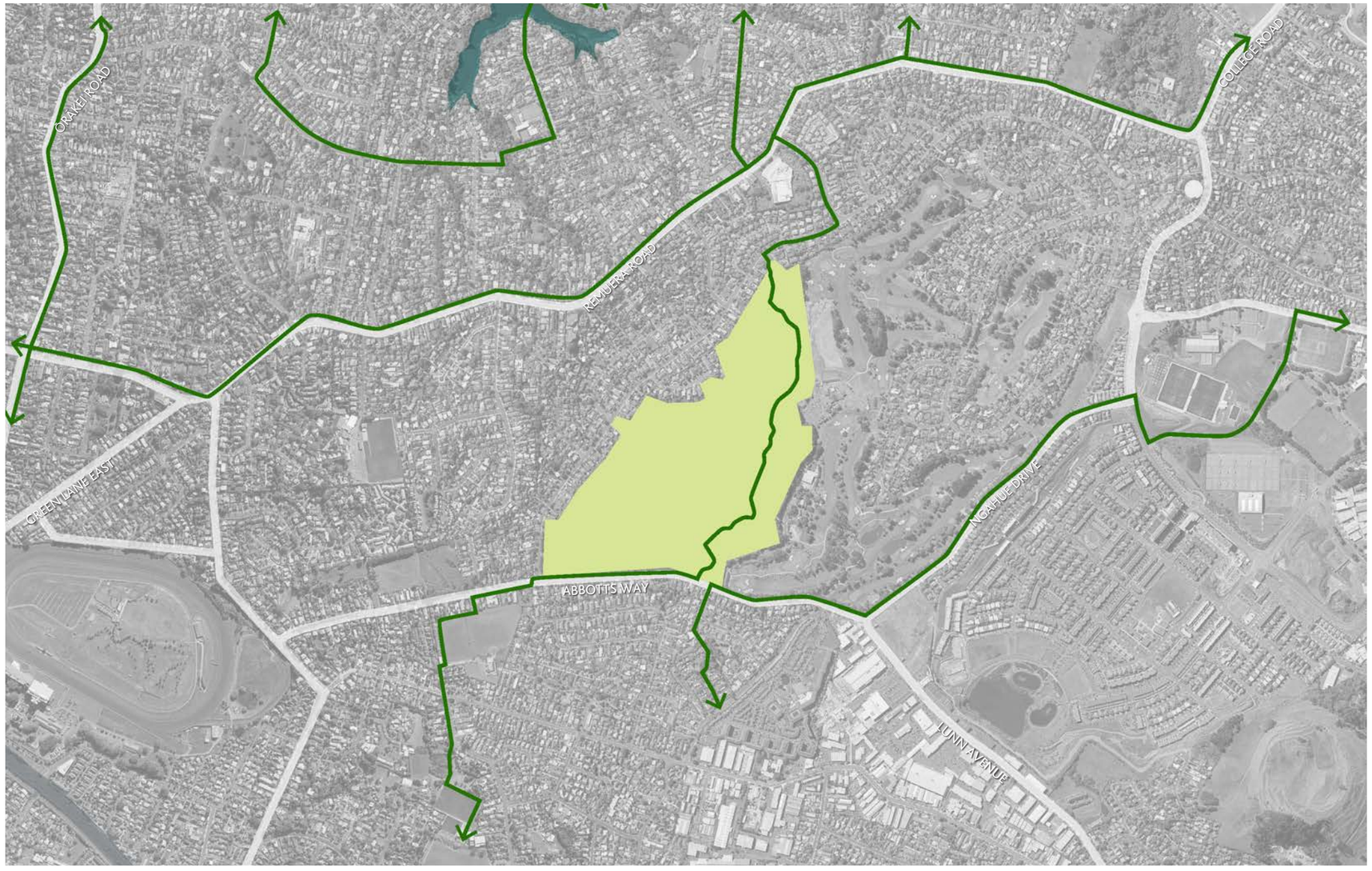
The Ōrākei Local Board Plan 2017

The plan includes an outcome "our local parks and open space areas are valued and enjoyed". It includes a key initiative to "prepare or refresh at least two plans with our communities to increase the safety and enjoyment of local parks and reserves, such as Waiatarua Reserve".

Waiatarua Reserve Restoration Plan 2018

The plan outlines the key vegetation surrounding the wetland including native species and weed species. Proposed planting sites, species and costings are also outlined for a five year programme to continue improving the environmental values of the reserve.

Waiatarua Reserve in relation to Ōrākei Local Paths (Greenways)



LEGEND

- Waiatarua Reserve
- Proposed Ōrākei Local Paths (Greenways) connection*

* Greenways routes are taken from the Ōrākei Local Paths (Greenways) Plan (Adopted August 2016). These routes show an aspirational long term network. The final location of these paths is dependent on a range of factors including permission from landowner(s) and feasibility (contours, access, timing/staging, funding and related projects).

Waiatarua Reserve, 2017. Photo: Jay Farnworth

2.0 Brief site history

Maungarei (Mt. Wellington) erupted, a lava flow dammed a creek that ran down the valley and Lake Waiatarua (also known as Lake St John) was formed

Lake Waiatarua, Meadowbank, Mrs Charles Abraham 1850s. Auckland Libraries Heritage Collections

Lake lands granted to Bishop Selwyn as endowment for St John's College. Lake bed remained Crown land

1851

Water considered for city water supply but not proceeded with. Swamp area partly drained by trench cut to scoria in the south

1876

Prehistoric

1900

1861

Lake Waiatarua, Meadowbank, John Kinder 1861. Auckland Libraries Heritage Collections

1908

Waiatarua Drainage Board was formed

1912

Waiatarua Drainage Board gained provisional approval to drain the swamp lands around the lake

1916

Work began on a tunnel from the lake under today's St John's Road and into Ōrākei Creek and Basin

1918

Tunnel completed and 54 ha of Lake Waiatarua was given to Auckland City Council to create Waiatarua Reserve

1920

Part of the land planted in maize, and orchards

1925

Auckland City Council approved permits to drain the lake and build Grand Drive

1928

The Crown abandoned any claim to the lake bed

1929

Council took over the jurisdiction of the drainage board and funded the completion of the drains to the tunnel, allowing the lake bed to drain into adjacent stream which feeds into Ōrākei Basin

1930

5 miles of drains dug to speed up the process of draining water from the lake

1934

20 ha of the reserve were leased to Remuera Golf Club

Cadastral map of Auckland City showing part of Ellerslie through to Mt Wellington

1947 1952

1940 aerial photo

1950

1954

The reserve started to be used as part of stormwater retention system

1955 aerial photo

1959 aerial photo

1972 aerial photo

1981

Submissions for the production of the draft management plan

1984

Waiatarua Reserve Management Plan was adopted by Auckland City Council

1988 aerial photo

1996 aerial photo

2000

Construction of the upgraded stormwater scheme began

2002

2004

Waiatarua Reserve was reopened by Auckland City Council after 16 years of planning, construction and restoration works at a cost of $5.9 million

2003 - 2004 aerial photo

2006

Auckland City was awarded Arthur Mead Environmental Award for the restoration of Waiatarua Reserve as New Zealand's biggest urban wetland project as well as the inaugural New Zealand Contractors' Federation Environmental Excellence Award for best practice in the field of environmental management of civil construction and related projects

2010

2010 - 2011 aerial photo

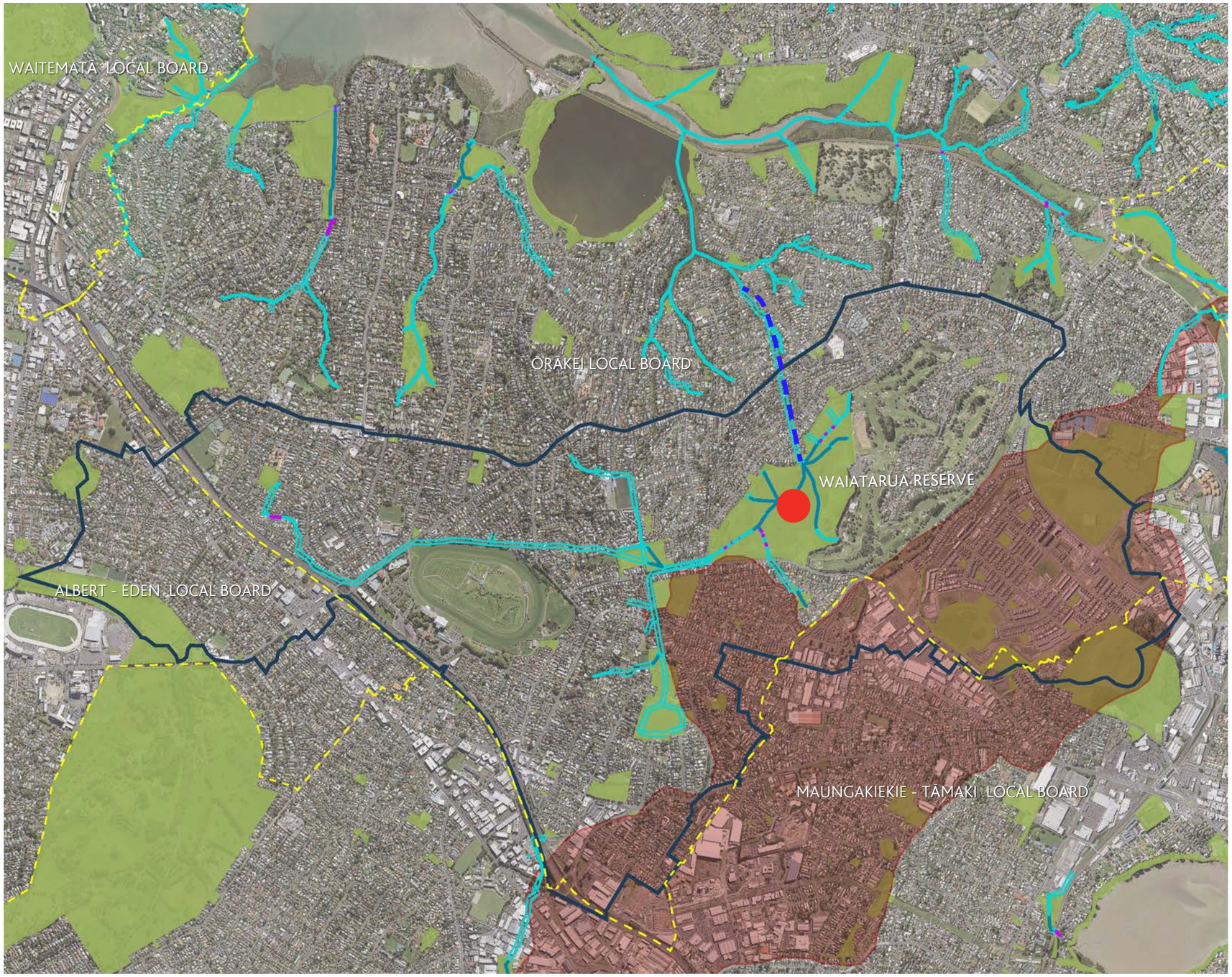
2017 aerial photo

2018

Waiatarua Reserve Restoration Plan drafted

3.0 Stormwater functions

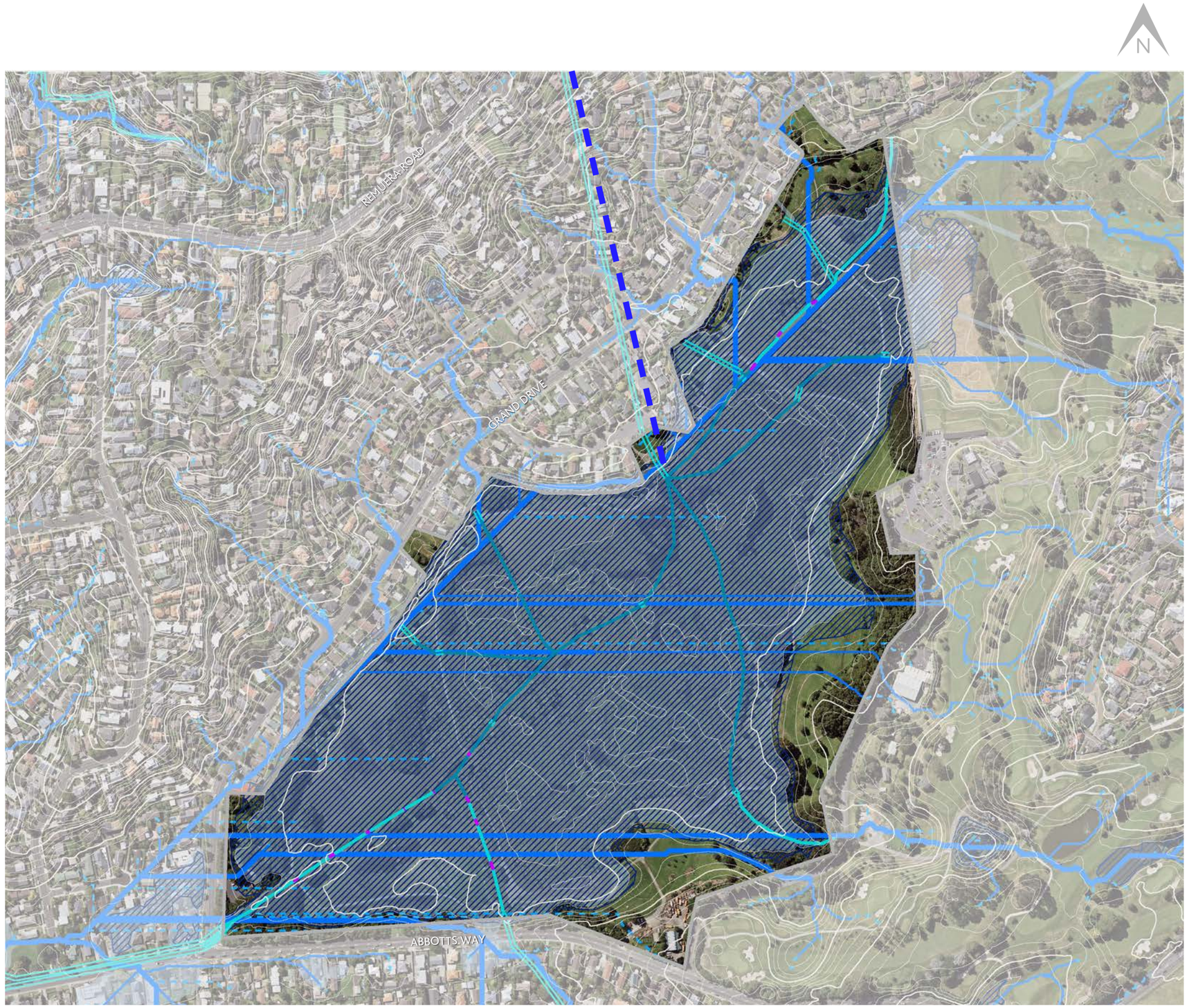
3.1 Hydrology and topography



The Waiatarua Reserve receives stormwater from a 674 hectare catchment in the Greenlane/Ellerslie areas, including flows fed by a tunnel under Ladies Mile and water pumped from the former Mt Wellington quarry. Stormwater from the surrounding catchment suburbs flows into the reserve through large underground pipes.

LEGEND

- Site location
- Local Board boundary
- Ellerslie catchment boundary
- Streams
- Volcanic aquifer
- Parkland
- Piped watercourse
- SW tunnel to Ōrākei Basin



The wetland filters out sediment and other pollutants from stormwater in the surrounding areas before it flows onto the Ōrākei Basin and Waitematā Harbour.

LEGEND

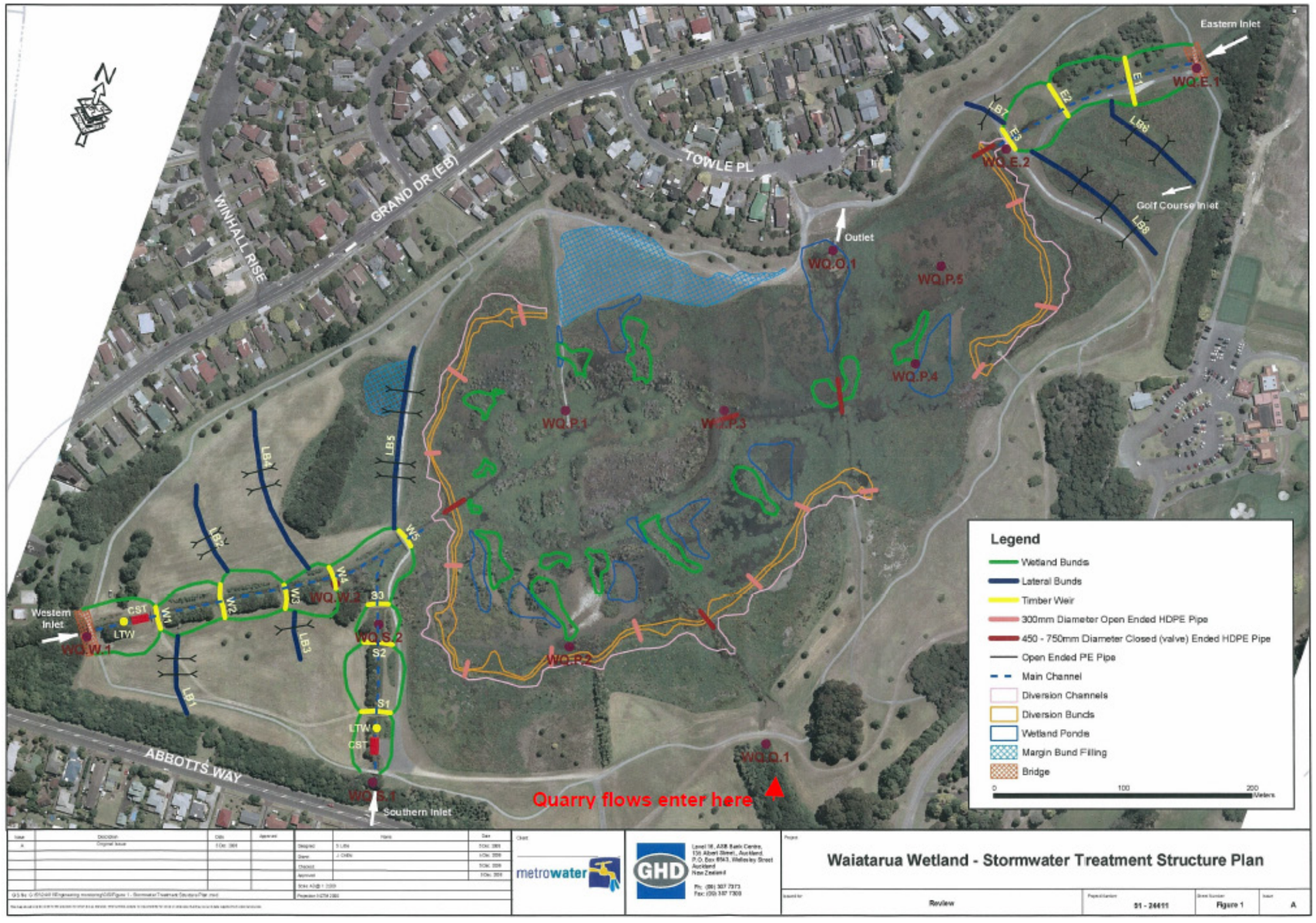
- Site boundary
- Contour (1m intervals)
- Overland flow path
- Flood prone area
- Flood plains
- Open watercourse
- Piped watercourse
- Culvert
- Pond
- SW tunnel to Ōrākei Basin

3.2 The design of the stormwater treatment facility

Construction of the Waiatarua Reserve wetland was completed in 2005. This was designed primarily as a stormwater treatment facility.

The objectives were:

- to reduce the impact of future increases in stormwater flow
- to improve catchment stormwater quality to reduce detrimental impacts on the Waiatarua Reserve, Ōrākei Basin and Waitematā Harbour receiving environments
- to increase the proportion of sediment removed from inflows to at least 80% (long-term average) under all flow conditions
- to limit the re-suspension of sediment under high flow conditions
- to improve discharged stormwater quality by trapping and binding nutrients and pollutants in the deposited sediment
- to maximise habitat values for wildlife by integrating ecological synergy with engineering solutions
- to maximise associated opportunities for public recreation and enjoyment within the upgraded parklands for the local and metropolitan community.



3.3 Monitoring and maintenance of the stormwater treatment facility

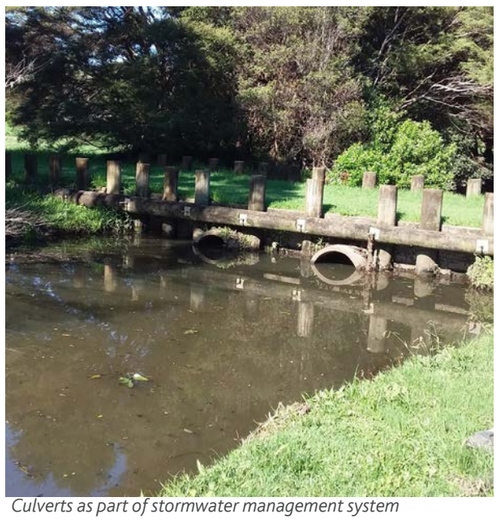
In 2005, as part of the consent conditions for the construction of the wetland, an Operational Management Plan was written. It contained a comprehensive set of monitoring conditions for the first two years. This ensured that the wetland was stabilised and functioning as designed. In 2007, the monitoring conditions were reviewed and reduced to a more efficient and economical set of monitoring conditions. In 2010 the performance of the wetland was reviewed again and further monitoring recommendations were made.

Litter trap before and after debris removal

Existing waterways and wetland photographs (photos taken by council staff)

Waterway on the western side of the reserve

Part of stormwater management system



Culverts as part of stormwater management system

Stormwater channel from golf course

Waterway on the north-east

The wetland main waterbody

The dog pond on the south-east of the reserve

Water ponding on the south part of the reserve

Waterway on the southern side of the reserve

Stream on the northern side of the park along the boundary

The Waiatarua Reserve Operational Management Plan Review (2007) identified the key water quality objectives to be sediment settlement and contaminant removal. Contaminants are interpreted to mean excess metals (specifically copper and zinc) and nutrients (nitrogen and phosphorus).

Water quality changes throughout wetland

Currently, Waiatarua Reserve doesn't appear to have any significant effect on the levels of sediment discharging from the wetland; that is, the turbidity levels in the discharge water are similar to those in the inflows. This may indicate that the wetland is not able to trap or bind sediment, possibly due to the wetland reaching its maximum sediment capacity leaving nowhere for sediment to be withheld. Turbidity levels are not always a direct indicator of total suspended sediments. Turbidity measurements may be affected by coloured dissolved organic matter. Total suspended solids sampling should also be carried out to understand the correlation between turbidity and total suspended solids.

There is a statistically significant decrease in nitrate- and nitrite-nitrogen concentration in the outflow compared to the inflow. This indicates that biological processes in the wetland are consuming nitrogen and, therefore, reducing the amount of nitrogen that is discharged from the wetland. This is ideal because the wetland discharges to the Ōrakei Basin and nitrogen is typically the limiting factor for excessive algal growth in marine environments.

Phosphorus levels are elevated in the pond, relative to the inflows and the outflow. This could be affiliated with the elevated levels of turbidity that also occur within the wetland as phosphorus is typically bound to sediment. The reason for the increase in phosphorus within the wetland is not evident from the data.

Data indicates that generally, the other measured parameters (pH, dissolved oxygen, etc) are not significantly altered by the wetland.

Water quality changes over time

Water quality data has been collected annually from 2012-2017, and there have been no meaningful changes over this period.

Water quality at discharge point

The Ōrakei Basin water discharge quality results at the outflow have been compared to guideline values for estuarine environments. Exceeding one of these guideline values doesn't imply that there are adverse effects, but they may indicate that further investigation is required. Guideline values for copper and zinc are for 90% protection of species and are commonly used for stormwater discharges.

In general, the quality of the outflow is appropriate for discharging into a marine environment, with the exception of elevated phosphorus and low dissolved oxygen concentrations.

Turbidity levels have been below the guideline value since late 2015. This indicates that the wetland is not an unacceptably large source of sediment into the Ōrakei Basin.

Dissolved oxygen levels were substantially lower than the guideline values, likely providing stress to some aquatic organisms. The inflows have low oxygen levels and the wetland does not alleviate this. The combination of slow flowing water, the breaking down organic matter by microbial processes, and warm temperatures are likely contributors to this result.

pH levels were typically within the guideline value range (7–8.5).

Nitrate and nitrate levels were usually below the guideline values. This is important as nitrogen is typically the limiting factor for excessive algal growth in marine environments.

Phosphorus levels are substantially elevated. Excess phosphorus contributes towards nutrient enrichment, which can lead to nuisance algal growth or an increase in algal blooms. Further investigation into potential sources of phosphorus may be useful.

The dissolved metals, **copper and zinc** are common urban contaminants. The levels of both metals were usually below the guideline values. On some occasions, metal concentrations exceeded their guideline values by up to three orders of magnitude; these are substantial exceedances but they have been infrequent and there have been no results of this magnitude since 2014. Overall, this indicates a generally low risk towards aquatic organisms.

Bottom sediments have not yet been analysed. Annual monitoring is recommended by the Operational Management Plan and review.

Water level management

Mean daily water levels and discharge volume have been recorded in the reserve since April 2015. In the 2007 Waiatarua Reserve Operational Management Plan Review , the key discharge level/volume-related objective of the reserve is stormwater attenuation - that is, to reduce the peak flow during rainfall events, which reduces the pressure on the city's stormwater network.

The data indicates that the wetland attenuates the flow of stormwater during rainfall events. Visual inspection of the water level plot shows some large peaks during 2017 and 2018. The discharge rate, although it varies widely, doesn't appear to exceed 1 cumec (m^3/s) very often, even when the water level is high. During rainfall events, water appears to accumulate in the wetland but the discharge rate during these periods is not drastically altered.

Trend analysis of the data showed that both the median water level and median discharge rate have increased by about 15% per year. The median water level has increased by 8.6mm per year from the median water level of 58mm. The median discharge rate has increased by 0.022 cubic metres per second per year from the median discharge rate of 0.143 cubic metres per second. The reason for these increases is not clear.

Sediment management

One of the functions of the wetland is to allow sediment to settle out of incoming stormwater. Ponds and wetlands typically require silt removal every 10 to 20 years depending on the contributing catchment characteristics. Typically, developed catchments produce less sediment than developing catchments due to the earthworks that are undertaken at the time of development. The wetland at Waiatarua Reserve is not a typical design. The intent of the design was that the peat base of the wetland would sink at the same rate that sediment enters. Therefore de-silting of the main body of the wetland would not be necessary. Monitoring should check for delta formations and short circuiting in the main body of the wetland. This can be completed by aerial photography and drone inspections. This can advise targeted areas of sediment removal. Most sediment should settle in the formed inlet channels (forebays). They can be accessed easily to remove silt without disturbing the ecological functions of the main body of the wetland.

Sediment deposition in the main body of the wetland has not been assessed since the construction of the wetland. This is has been recommended during each review. The forebays have been de-silted more frequently than most wetlands and ponds. A sediment survey was completed in 2014 and found that 300 cubic metres of sediment needed to be removed. This was completed in 2017.

Auckland Council's Healthy Waters department manages over 650 stormwater ponds and wetlands. Healthy Waters has a pond renewal programme which inspects 60 to 80 ponds per annum. These inspections calculate sediment volume. Ponds with a loss of storage of more than 20% are added to the pond renewal programme for prioritisation.

Structural monitoring

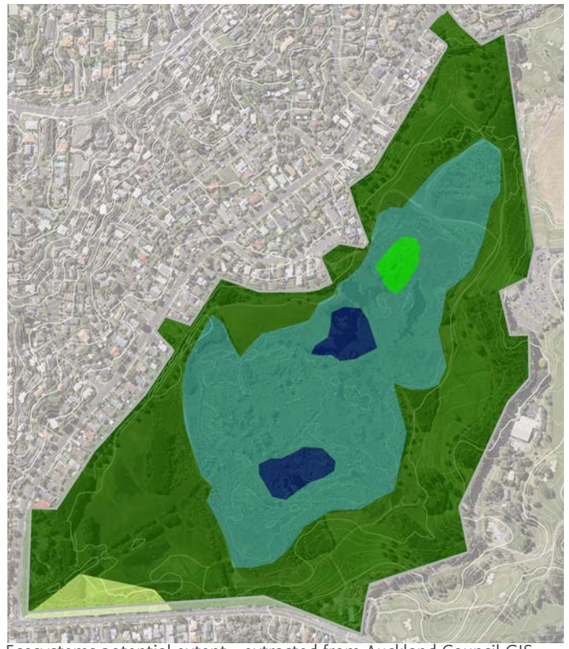
There are many constructed engineering features in the wetland. These include sediment traps, timber weirs, channel bunds, lateral bunds, diversion channels and bunds, wetland channels and bunds, an outlet weir, access tracks, channel crossings and platforms and litter traps. Monitoring was initially completed every three months. This reduced to six-monthly. The last structural inspection was complete in 2010. At that time all structures were reported to be performing well.

Perimeter channels continue to be monitored weekly to ensure there are no obstructions to water flow. Two debris traps are also cleaned weekly to prevent inorganic rubbish from entering the wetland.

Wetland at Waiatarua Reserve, 2012, Theo Leach

4.0 Ecology - flora

4.1 Vegetation



Ecosystems potential extent - extracted from Auckland Council GIS

LEGEND

- Site boundary
- Contour (1m intervals)

Ecosystems

- Open water
- Swamp mosaic
- WF4: Pōhutukawa, pūriri, broadleaved forest
- WF7: Pūriri forest
- WF11: Kauri, podocarp, broadleaved forest

Vegetation within the reserve can be categorised into five habitat types, each with a number of sub types:

- eucalyptus: located along the eastern boundary in form of large areas of plantation forest
- mixed native: includes a strip of vegetation along Abbotts Way and various patches along stream and channel edges
- kanuka: a few patches on the eastern and southern side of the reserve
- wetland: mostly artificially established using wetland native plants of Auckland
- tree land: contains amenity trees both native and exotic species (see also page 19).

There are several kauri trees in the reserve. Currently, they are not showing symptoms of kauri dieback disease .

Syzygium maire (swamp maire, maire tawake) is present in the reserve; it is a critically threatened myrtle species. This is under threat from myrtle rust (see also page 19).

LEGEND

- Site boundary
- Contour (1m intervals)

Ecosystems

- TL: Tree Land
- VS2: Kanuka scrub / forest
- WL19: Raupō reedland

Vegetation associations

- Eucalyptus
- Mixed native
- Kanuka
- Wetland
- Kauri trees
- Swamp maire

Existing vegetation photographs (photos taken by council staff)

Tree land on the western side looking west

Mixed native with a few Kauri trees in the background

Mixed native with kanuka scrub in the background

Mixed native on the wetland perimeter

Eucalyptus forest on the eastern side

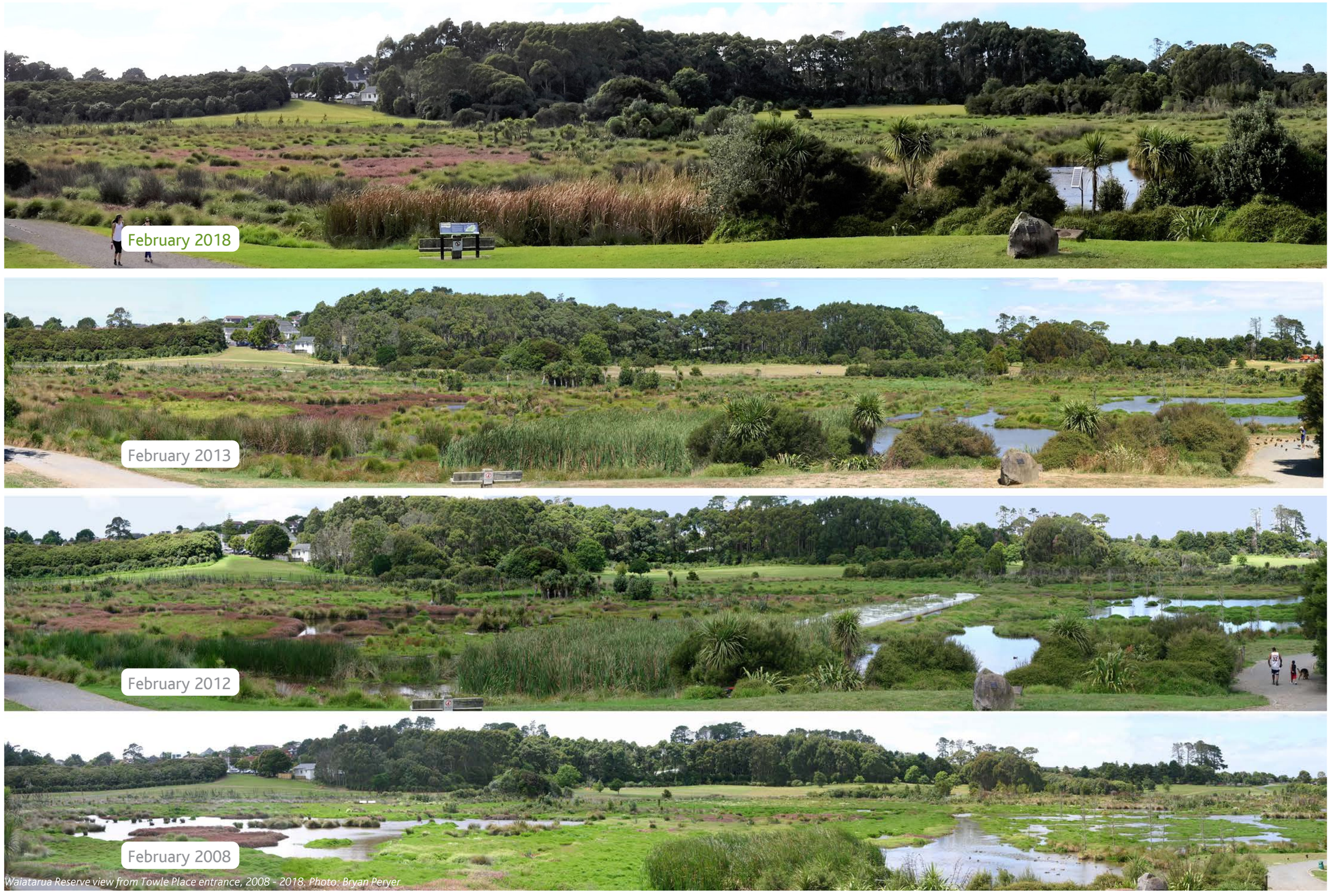
Looking east from western side of the reserve

Weed infested waterway on the south-east of the reserve

Wetland planting with eucalyptus forest in the background

Looking west from eastern side of the reserve

Wetland planting at dog pond



Waiatarua Reserve view from Towle Place entrance, 2008 - 2018. Photo: Bryan Peryer.

4.2 Vegetation monitoring

Monitoring of plants and invasive weeds was initially recommended twice a year. The lack of an on-going planting plan was identified in 2007. Annual vegetation surveys were a recommendation of the 2010 review.

Restoration planting began in 1987, with the objective to create a stormwater management system and habitat for birds, while providing recreation space for the public.

Between 2004 and 2006, as part of the construction of the stormwater wetland, 76,000 plants were planted in the wetland, in buffer areas and in existing forest zones. A Waiatarua Wetland Steering Committee identified actions and improvements to the wetland. These included:

- Improving how sediment was captured early in the wetland system to reduce the rate that the rest of the wetland was becoming filled with sediment and reduce disturbance by maintenance machinery
- Controlling weed species
- Wetland planting in conjunction with weed control
- Removing short-circuits of flows and increasing sunlight infiltration to improve water quality
- Having a joined up approach to maintenance in the perimeter and centre of the wetland
- Starting animal pest control.

In 2013 and 2019 Waiatarua Reserve was included as a wetland site in the State of the Environment monitoring. Seven 10 x 10m monitoring plots were established in 2013, with three additional plots added in 2019. Data collected from each plot includes species present, each species' native or exotic status, height and percentage cover of groundcover, mid-tier and top tier vegetation, and calculation of a surrogate indicator of plant biomass.

Basic analysis of the available data illustrates that the number of plant species recorded from each plot was variable between sites. Where two years of data was available, the number of species present was typically relatively similar or showed marginal increases in diversity. The proportion of native species recorded across the wetland from multiple sites in 2013 and 2019 was relatively similar; 41.9% and 45.1%, respectively.

A biomass surrogate was calculated for each species based on the plant coverage and height at each tier. Results indicate that biomass is variable across the wetland and, where more than one year of monitoring was available, total biomass was marginally greater in 2013 than in 2019. The proportion of plant biomass contributed by native species at these sites was 51% in 2013, increasing to 66% in 2019.

The data to date indicates that the biodiversity of the wetland is generally dominated by exotic species, however, native species comprise greater biomass within the wetland.

4.3 Pest control

In 2016 the distribution and abundance of environmental pest plants in the wetland areas were identified and mapped. A maintenance programme was prepared describing control methods for 16 pest plant species. The first priority weeds were blackberry, Japanese honeysuckle and willow. Maintenance contractors visit the reserve every three months to control these priority weeds. There is no current planting plan for areas inside the wetland.

4.4 Planting

In 2018 a plan was prepared for staged planting and weed control in the terrestrial areas of the reserve. This is primarily implemented by volunteers. The Waiatarua Reserve Protection Society have been involved with annual site preparation, planting and plant release for many years. Conservation Volunteers New Zealand take part in pest plant control several times per year.

Planting by volunteers

Pest control by Auckland Council

Pukeko at wetland area

4.5 Biosecurity

The kauri dieback pathogen is soil-based and can be transferred by water or soil movement. The disease can be spread by just a pinhead of soil, and although there are some physical symptoms, you cannot tell just by looking at a tree whether it is infected or not. The feeding roots are the first to become infected with the disease which spreads up the tree. The feeder roots spread out to a distance which is three times the length of the drip line of the tree canopy. They can pick up the pathogen very easily off people's shoes or dogs' feet which contain soil with the pathogen from walking in diseased areas. The feeder roots will not spread under metalled areas or into waterways or through open drains.

There is no cure for kauri dieback disease, and the disease kills most if not all the kauri it infects. So once a tree is infected it will die. Any tracks or paths within 3x the drip zone must be to kauri safe standards which means you cannot transfer soil in or out of this area. The track must be 'dry', meaning that mud cannot be transmitted onto the kauri zone and people and dogs must stay on the track around kauri.

The kauri trees in Waiatarua Reserve are planted and not naturally occurring. There is a different priority level attributed to cultivated and non-cultivated or naturally occurring kauri. Mature stands of naturally occurring kauri influence the ecosystem that surrounds them. At least 17 other species depend entirely on kauri dominant ecosystems and their unique soil type in order to survive. Kauri planted as a landscape feature or in isolation are not acting as a keystone species in the same capacity. Mitigation still needs to be undertaken as any kauri can become infected and be a source to spread the disease.

The objective when working to make kauri safe from kauri dieback is to stop the transfer of soil in and out of the kauri zone and prevent the walking on the feeder roots, mainly by people and dogs, restrict water flowing over the roots, avoid the tree from being placed under stress with cut roots or restricted feeding area and encourage and support the health of the tree.

There are four locations on the park where kauri have been planted as shown in adjacent plan. There is one lone kauri next to 31 Towle Place and the planned treatment is isolating the root system around the tree to prevent people and dogs from access to the feeder roots. There is an existing metal path along the south side which is already creating a cut off for the feeder roots. A simple barrier fence is planned to be installed around the tree and certified mulch placed in the enclosure area to help with maintenance.

There are two groves located within a small bush area on the park opposite 147 - 153 Abbotts Way. These groves have feeder roots up to the metal track and therefore mitigation will be required to prevent people and dogs from leaving the track and accessing the feeder roots. The path is also subject to flooding, being low lying with the wetland very close to the side of the path. The planned treatment is to isolate the root system with a simple barrier fence and place a certified mulch in the enclosure to help with maintenance. The track will be raised with a sterile bark and soil mix to a suitable level to restrict flooding and the surface topped off with a hard-wearing gravel covering. Drainage will be installed to direct water flow away from the trees. There is a single kauri located away from the track opposite 137 Abbotts Way. The track is further than three times the length of the drip line from the tree, so no action is required at this time.

It is recommended that no further plantings of kauri trees are undertaken until a cure or a method of survival for kauris has been found. No work should be programmed within the three times the length of the drip line from any of these kauri trees.

Remuera has experienced a high incidence of myrtle rust infection due to the prevalence of Syzygium sp (susceptible hosts) as hedging plants there. This includes finds on Grand Drive and Celtic Crescent. The presence and impact of myrtle rust on Waiatarua Reserve, and Ōrākei generally, can be minimised through a precautionary approach to management, vigilance during enhancement and maintenance activities, and enabling reserve users to act as kaitiaki/ stewards.

Reducing the spread and minimising the spore load can be achieved by reducing the co-occurrence of conditions that favour the fungus; presence of susceptible hosts, high humidity, warm temperatures. As the climate cannot be controlled, the option left is to manage hosts. So far, native species showing high susceptibility are plants in the Lophomyrtus genus (ramarama & rōhutu), and Metrosideros (pōhutukawa & rātā). Any new plantings of swamp maire are to be avoided until it becomes clear whether the current population will survive through infection cycles.

5.0 Ecology - fauna

5.1 Macroinvertebrate Communities

Macroinvertebrates are small animals (e.g. insects, crustaceans, worms, and snails) that live on or just below the bed, or amongst debris and aquatic plants of freshwater systems. The macroinvertebrate community of a stream, river, wetland or lake lives with the stresses and changes that occur in the aquatic environment and are responsive to multiple environmental changes such as flow, habitat, temperature, water quality and sediment. That includes those that are a result of human activities (such as nutrient enrichment) and natural events such as floods and droughts. Additionally, they are easy to sample so are ideal candidates for biotic measures of freshwater health.

The key index used in New Zealand to describe macroinvertebrate communities in streams is the MCI, or Macroinvertebrate Community Index. The MCI is calculated from 'tolerance' scores applied to individual taxa, based on habitat preferences and pollution tolerances. The MCI was initially developed for use in stony streams but has since been extended for use in silt or sand dominated streams. A wetland variant (WMCI) has been produced but was developed specifically for wetlands in the South Island and has not been tested for its applicability to wetlands in the North Island.

Macroinvertebrate monitoring data was collected at Waiatarua Reserve between October 2012 and April 2017 at six locations. Site descriptions and photographs from that report indicate that habitats ranged from standing water wetland habitats to wide channelised watercourses with very slow flow conditions.

Results indicate that the number of macroinvertebrate taxa (taxa richness) at each site has been highly variable, however average richness was fairly consistent, ranging between 10 and 12 taxa at each site.

MCI scores varied over time between sites but almost consistently returned scores indicative of 'poor' instream habitat conditions or probable severe organic pollution.

The wetland MCI (WMCI) scores were highly variable across sites, although average scores typically fell within the 'fair' habitat quality band.

Overall there were no clear trends in macroinvertebrate indices over the survey periods. The indices highlight the natural variability that can occur within sites over time. Overall, the macroinvertebrate data indicates that the wetland provides habitat for a moderate range of macroinvertebrate taxa, indicative of poor to fair habitat quality. This is not an unexpected result, given the Waiatarua wetland is a functioning stormwater treatment device, and incoming water quality is affected by urban stormwater contaminants.

Nevertheless, the MCI and WMCI outcomes for these sites need to be interpreted with caution. The MCI was developed for use in flowing stream habitats, so is poorly applicable to the survey sites within the Waiatarua wetland, most of which comprise wetland habitats or very slowly flowing wide channels more closely aligned to wetland than stream habitats. This was recognised through the development of the wetland MCI (WMCI) variant, which reassigned scores for taxa most reflective of wetland habitats. The difficulty then is that the WMCI currently available was developed for wetlands in the South Island, and the authors cautioned against the use of this variant in North Island wetlands due to variations in fauna, wetland types and environmental factors.

5.2 Vertebrates; fish and amphibians

Fish

Shortfin and longfin eels are native fish that are present at the reserve while introduced goldfish, rudd and gambusia (mosquitofish) are also common throughout the wetland and channels.

In 2005 and 2006, annual fish monitoring was completed. Five species were found to be present. Three introduced species were found to be in abundance; they were mosquito fish, goldfish and rudd. The native short fin eel was also found to be in abundance, however there were only sparse observations of the "threatened" native long fin eel (GHD, 2007).

Gambusia
Gambusia affinis

Common rudd
Scardinius erythrophthalmus

Eel
tuna
Typha orientalis

Amphibians

There are no formal monitoring requirements with regards to amphibians at the wetlands. However, the introduced Australian green and golden bell frog has been recorded within the reserve.

Green and golden bell frog
Litoria aurea

5.3 Birds

Birds were initially monitored annually. A series of 5-minute bird counts were organised each summer. Additionally local residents were encouraged to record monthly presence/absence data of bird species. Between 2004 and 2007, 36 species were identified. Almost 60% were native species.

52 bird species have been recorded between 2001 and 2018 on e-bird, a community bird-watching website.

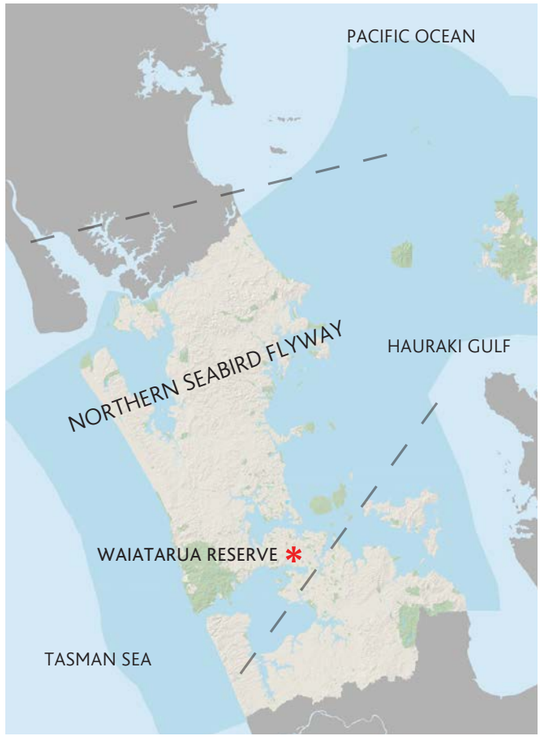
ORIGIN	WETLAND	PARKLAND	FOREST
Native	• Black shag • Black-backed gull • Caspian tern • Grey teal • Harrier • Kingfisher • Little black shag • Little shag • Paradise shelduck • Pied stilt • Pukeko • Red-billed gull • Scaup • Shoveler • Welcome swallow • White heron • White-faced heron	• Spur-winged plover	• Grey warbler • Tūī • Silvereye / wax-eye
Introduced	• Black swan • Mallard	• Blackbird • Goldfinch • Green finch • House sparrow • Magpie • Malay fruit dove • Myna • Pheasant • Song thrush • Starling • Yellow hammer	• Chaffinch • Eastern rosella

'North Auckland Seabird Flyway'

Waiatarua Reserve is within the North Auckland Seabird Flyway, which links the Tasman Sea with the Hauraki Gulf. This flyway is used by petrels which nest on the Hauraki Gulf islands but feed in the Tasman Sea.

White-faced heron
matuku moana
Ardea novaehollandiae novaehollandiae
Not threatened

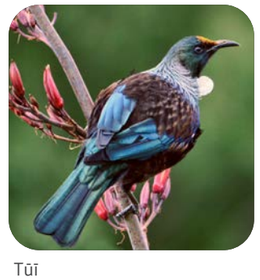
Little black shag
kawau tūi
Phalacrocorax sulcirostris
Naturally Uncommon



North Auckland Seabird Flyway map (not to scale)

Fantail
pīwakawaka
Rhipidura fuliginosa
At risk. Naturally Uncommon

Silvereye / wax-eye
tauhou
Zosterops lateralis
Not threatened



Tūī
Rhipidura fuliginosa
Not threatened

5.4 Mosquitos

Mosquitos were initially monitored during November to March. The last monitoring was in 2006. No mosquito larvae were found in the wetland or wetland channels. Mosquito larvae were found only in a small, enclosed water body away from the main wetland.

5.5 Pest mammals

Rat control is currently completed by volunteers. Rodenticide bait is pulsed four times a year in dry areas. Traps are used closer to the wetland. There are two trapping periods from March to June and August to December. 62 rats and 55 mice were caught between Dec 2017 and Dec 2018.

Possum and rabbit control is completed intermittently by contractors.

More frequent pest control for rats, rabbits, possums, and mustelids is being completed on the adjacent Remuera Golf Course. Further pest control by private properties bordering the reserve and golf course will create an integrated approach to pest management.

Rat
Rattus spp.

Common brushtail possum
Trichosurus vulpecula

European rabbit
Oryctolagus cuniculus

Stoat
Mustela erminea

6.0 Park assets and circulation

Waiatarua Reserve has a good path network. The main path runs along the edge of the park, circling the wetland. Informal paths provide access to viewing platforms. These have been taken over by grass. There is a path cutting through the eucalyptus forest and the wetland.

The playground is located near Grand Drive and mostly designed for the junior age group. There is a half-pipe adjacent to the main carpark, next to the toilet block. The signage is a mix of interpretive, wayfinding and functional signage.

The furniture within the reserve is generally in good repair, although some amenities are located in areas which are not accessible in winter.

LEGEND

- Site boundary
- Contour (1m intervals)
- Parking area
- Concrete pathway
- Gravel pathway
- Service vehicle access
- Steps
- Footbridge
- Viewing platform
- Playground
- Half-pipe
- Primary park entrance
- Secondary park entrance
- Existing signage
- Existing park bench
- Existing picnic table
- Existing drinking fountain
- Existing bin

Existing park asset photographs (photos taken by council staff)

Main entrance from Grand Drive

Entrance from Abbotts Way


Half-pipe and toilet block at the Grand Drive entrance by the carpark


Playground at the Grand Drive entrance


Typical main path


Typical secondary path accross the wetland


Footbridge to residential area


Footbridge across the wetland


Footbridge across the stormwater culverts


Viewing platform overlooking the wetland


Viewing platform overlooking the dog pond


Typical seat


Typical picnic set

Typical directional and interpretation signs


Typical drinking fountain

7.0 Consultation summary

Pre-design consultation

Key stakeholders were invited to respond to a pre-plan questionnaire. Stakeholders included all residents' associations and business associations in the Ōrākei Local Board area. Responses were received from:

- Auckland East Mens Shed
- Waiatarua Reserve Protection Society
- Remuera Golf Club
- Tahuna Torea Rangers.

14 responses were received.

Iwi working group

A presentation was made to the parks Mana Whenua Forum on 26 September 2018. The outcome from the forum was to invite all central-south iwi to participate in a working group.

Six iwi representatives responded to form a working group. Five representatives attended a site visit on 19 November 2018. Iwi representatives reviewed and provided further input into the draft plan on 23 April 2019 and 4 September 2019. Participating iwi would like to continue their involvement as elements of the plan are implemented.

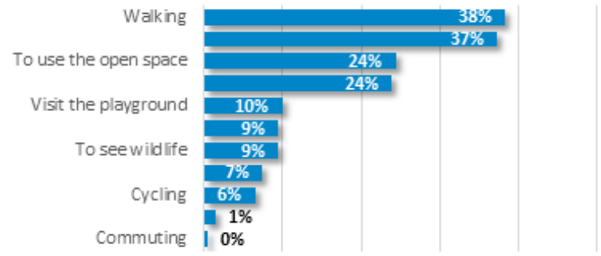
TOPIC	KEY CONSULTATION FEEDBACK	DESIGN RESPONSES
INTEGRATED PRINCIPLES	N/A	• Integrate mana whenua values • Incorporate universal design, crime prevention through environmental design (CPTED) and injury prevention through environmental design (IPTED) principles.
STORMWATER	• Improve stormwater drainage at the southern end of the reserve • Review of drainage and flooded areas • Better maintenance of the wetland to improve water circulation and weed control • Ensure good water treatment and wetland health • Northern perimeter channel is now filled in and needs to be reinstated • Maintain some deep diving channels for wildlife.	• Monitor sedimentation • Monitor water quality, sediment chemistry and water level.
BIODIVERSITY	• Extend trapping to include possums, stoats, weasels, feral cats, wasps and rabbits • Use trapping as the primary mode of pest control • Establish improved habitat for ground-nesting birds such as kiwi, weka and rails • Separate dogs from the bird areas • Appropriate planting of wetland species • Assess safety of eucalyptus trees • Plant nature trees for food and habitat • Weed control of blackberry • Stop weedeating close to planted trees • Add lizard nesting boxes • Consider Waiatarua Reserve and the Remuera Golf Course as one continuous green space.	• Collate an inventory of terrestrial and aquatic, flora and fauna • Remove pest fish • Reintroduce fauna as habitat conditions permit • Continue with volunteer pest control • Continue with the volunteer planting, implementing the restoration plan • Prepare a freshwater restoration plan • Address fish passage • Contribute to ecological corridors beyond the site boundary • Take steps to manage the spread of kauri die-back to healthy kauri trees
RECREATIONAL	• Community use of the shed for storage • Educational area in existing park buildings • Reuse of recovered timber to make furniture for the reserve • Allow mobile food vendors in the car park • Automatically closing car park gates • Prevent freedom camping in Waiatarua Reserve car parks • More furniture in shaded locations • Improve and increase bird watching locations • Add a fenced off open grass area that is free from dogs • Keep off-leash dog areas • Keep picnic benches away from the track • Raise footpaths out of flooding zone • Keep gravel paths • Improve public toilets • Add toilets at the eastern end of the park • More playground facilities • Add boardwalks through the wetland.	• Maintain large off-leash access for dogs • Provide more facilities for dogs and dog owners • Provide on-leash or dog-free areas • Upgrade the youth play area • Add additional play • Add active recreation opportunities • Manage seasonal flooding • Align with the Ōrākei Greenways (Local Paths) plan • Improve placemaking and accessibility at all entrances.
EDUCATIONAL	• Signage that explains more about the Maori history of the reserve, the history of the lake, bird habitats, pest control, water treatment structures and processes, links to the wetland catchment beyond Waiatarua Reserve • Annual public meetings to explain the stormwater management features and ecology • Make wetland monitoring results available to the public.	• Identify a location for an Environmental Education Centre • Include a location for bee hives • Include additional low-level, low-impact boardwalks and bird hides into the wetland and/or improve existing lookouts • Knowledge sharing with iwi • Promote Waiatarua Reserve as an educational resource.

Post-design consultation

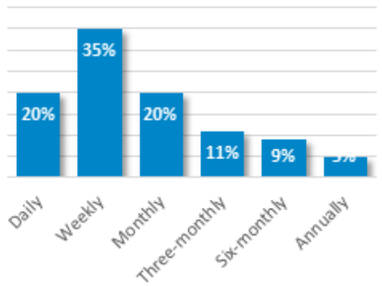
Public consultation on the draft Waiatarua Reserve Enhancement Plan took place between 22 July and 12 August 2019. An online questionnaire was available on the Auckland Council 'Have Your Say' internet page. This was publicised via posters at all entrances to the reserve, by fliers delivered to all adjacent properties, through communication with all residents' associations, business associations and stakeholder groups and was listed on the Ōrākei Local Board Facebook page. A two-hour, drop-in event took place at the Men's Shed on 3 August 2019.

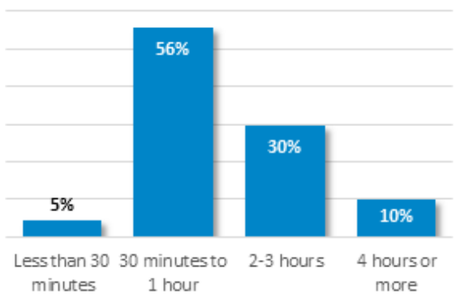
205 responses were received. The plan has been amended based on these responses.

1. The two most popular reasons for people to visit the reserve were walking and dog-walking.

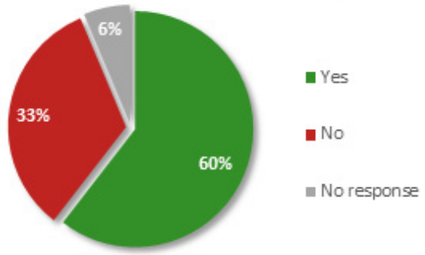


2. Most people spent 30 minutes to 1 hour in the reserve and visited weekly.

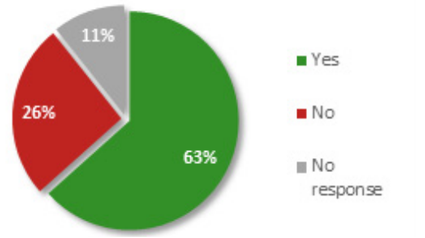


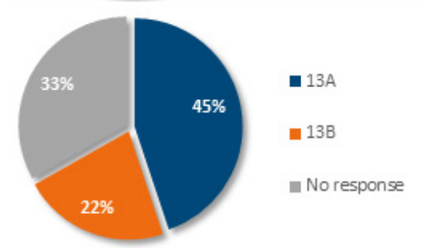


3. 60% of people supported a frisbee golf course.

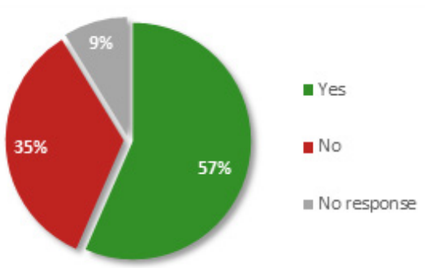


4. 63% of people supported a dog agility course. Area 13a, at the western side of the reserve, was the preferred choice for the dog agility course location. Comments from respondents explained that the reason for this choice was that it was the larger, flatter and less well used area. It was also further from the main path and reduces conflicts with other user groups (dog walkers, pedestrians, excited dogs at the dog pond, frisbee golf) which would allow dogs to focus. It would avoid congestion in an already busy area by the dog pond.

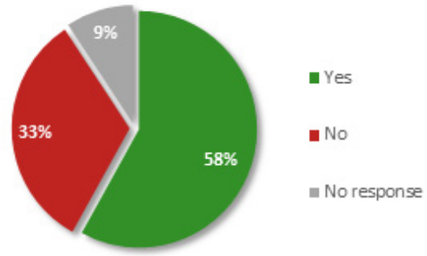




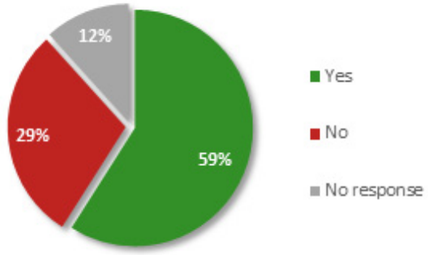
5. 57% of people supported relocating bins to the entry and exit points of the reserve only.



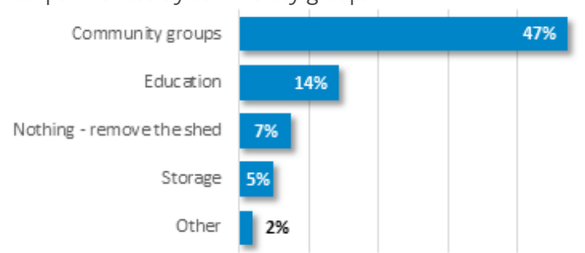
6. 58% of people supported an additional toilet in the reserve.



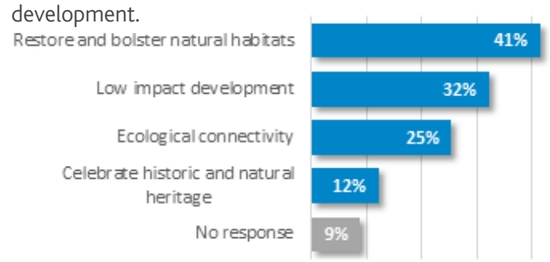
7. 59% of people supported an additional pathway connection to the café at the Remuera Golf Course.



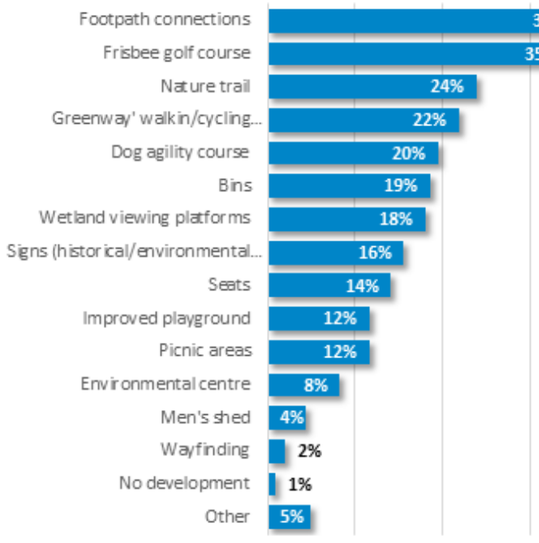
8. 47% of people supported the use of the small shed in the Abbotts Way car park for use by community groups.



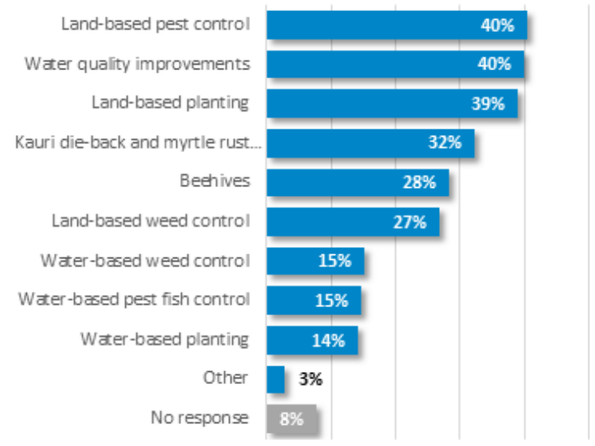
9. Restore and bolster natural habitats was the most important development principle. Other key principles that were suggested included high quality maintenance, allowing recreational uses which do not compromise the natural features of the reserve and minimal development.



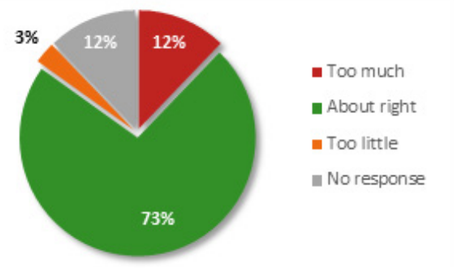
10. The three most important asset developments were footpath connections, a frisbee golf course and a nature trail. Other suggestions included an 18-hole frisbee golf course, dog washing facilities, BMX and mountain biking areas, a predator-proof fence, bird feeding stations, weta homes, fitness equipment, dog-free space, improved signs identifying the dog rules, sealing of footpaths, bike racks, a second play area, a calisthenics gym, a covered area in the play area, fencing the deep water channels, a protective fence to stop golf balls, sealed footpaths, raised footpaths in flood-prone areas and keeping a small all-season circuit as well as the large perimeter path.



11. Land-based pest control, water quality improvement and land-based planting were the equal top priorities for ecological developments. Other suggestions included separating dogs from birdlife, sediment control, phosphorous control, upstream stormwater management.



12. 73% of people agreed that the level of development was about right.



13. Other comments included fixing areas of ponding water, closing the park before 10pm to reduce anti-social behaviour, improving maintenance, improving the existing features and health of the reserve before asset enhancements, restricting freedom campers, concerns about pest control methodology, potential for more community participation and creating more open water areas.

Changes to the plan based on public consultation

- Add two additional key design principles:
  - "Value naturalness". Keep the open space free from assets and developments. Contribute to the physical and mental health and wellbeing of park users through connection with the natural environment.
  - "Shared use for recreation". Allow varied recreational activities providing they respect other users and do not compromise the natural values.
- Keep the frisbee golf course, dog agility course and nature trail. These three elements are positioned outside of the four main development areas. They should be sensitively designed to be rustic and blend into the natural landscape and rustic character of the park. The footprint should be reduced to avoid cluttering the reserve. They should be positioned away from the main perimeter path to reduce user conflicts.
- Keep location 13b (between the Abbotts Way car park and the dog pond) as the location for the dog agility course. The preference during public consultation was for the dog agility course to be positioned in area 13a, near the Grand Drive car park. This result was highly debated. Finally 13b was chosen because it was more in keeping with the development principles to leave wide open spaces unobstructed and was closer to a high infrastructure intensity zone.
- Keep the actions to relocate bins to the entry and exit points of the reserve only and add an additional pathway connection to the café at the Remuera Golf Course.
- Consider two ways to incorporate additional toilet facilities in the reserve, either by extending the existing toilet when it is due for replacement or by incorporating it into the proposed environmental centre.
- Identify the small shed in the Abbotts Way car park for use by community groups.
- Identify two all-weather circuits: the full perimeter path and a shorter circuit.
- Remove northern proposed playground. Nature play will be incorporated into the nature trail.
- Redesign the playground layout to make full use of the existing fenced area.
- Incorporate nature play into the bush area and increase areas for picnics.

Further changes to the plan based following the September 2019 business meeting

Two public submissions were made against elements of the plan during the business meeting on 19 September 2019. The Orakei Local Board resolved to defer the decision to adopt the Waiatarua Reserve Enhancement Plan pending further consideration of specifying a minimum sediment removal programme and exploring an additional designated on-leash dog area. Further changes have been made to the plan which include:

- Initiating a bylaw review on the on-leash, off-leash and prohibited areas for dogs. An indicative area has been marked on the map on page 31 as a starting point for discussion during the bylaw.
- Supporting dog training and obedience initiatives and programmes.
- Increasing education and enforcement of the animal management bylaw.
- Further details on the management of sediment within the wetland and forebays.

8.0 Development recommendations

KEY DEVELOPMENT PRINCIPLES

• RESTORE AND BOLSTER NATURAL HABITATS

Design around nature. Enhance the natural contours and landscapes. Allow the wetland to re-occupy the land.

• VALUE NATURALNESS

Prioritise nature and open space. Contribute to the mental and physical health and wellbeing of park users through connection with the natural environment.

• LOW IMPACT DEVELOPMENT

Direct most infrastructure to the high infrastructure intensity zones. Design infrastructure in the medium infrastructure intensity zones to be sensitive to the visual and ecological values of the reserve.

• ECOLOGICAL CONNECTIVITY

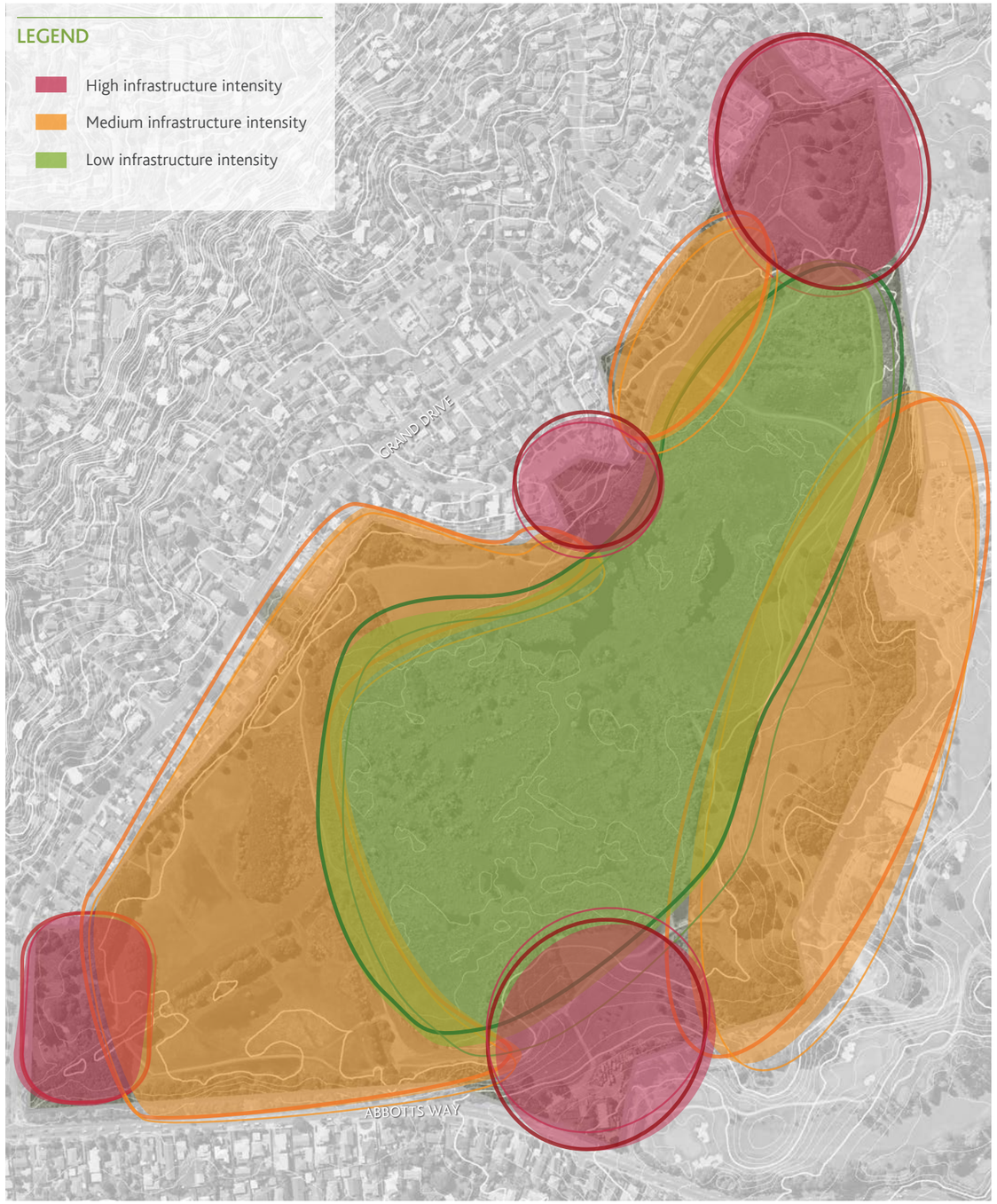
Increase connectivity to other areas of ecological value within the wider landscape. Contribute to environmental improvements upstream, downstream and surrounding the reserve.

• CELEBRATE HISTORIC AND NATURAL HERITAGE

Provide opportunities to connect with nature and learn about natural and cultural aspects of the reserve.

• SHARED USE FOR RECREATION

Improve the reserve as a recreation destination by enhancing and maintaining the amenities and facilities within the reserve.



9.0 Enhancement plan

9.1 Ecology and connectivity

SITE WIDE

Ecology

- Proposed min 3m wide planting buffer around the edges of drains and forebays to reduce erosion
- Increase wetland planting area in flooded low land
- Undertake enrichment, companion, succession and understorey planting with codependent species.

Connectivity

- Identify all-season circuit and seasonal paths
- Improve entrance and wayfinding signage.

KEY CONCEPT DESIGN CONSIDERATIONS

1. Proposed new path connection to carpark on the north-west corner of the reserve
2. Proposed new path to connect to park entrance from Abbotts Way
3. Upgrade existing path to connect to park entrance from Abbotts Way
4. Restore path, complete weeding and maintenance around the existing lookout platforms and upgrade the structure to provide better view towards the wetland
5. Upgrade existing path along the eastern side of the reserve from Abbotts Way entrance to Grand Drive north entrance into a 3m wide Ōrākei Local Paths (greenways)
6. Proposed new path connection to Remuera Golf Club
7. Prevent the spread of kauri dieback to healthy trees
8. Proposed bee hives
9. Proposed additional bush track
10. Proposed environmental centre
11. Proposed waterwheel.

LEGEND

- Site boundary
- Waterway / waterbody
- Waterway buffer planting
- Wetland planting
- Mixed native vegetation
- Eucalyptus forest

Paths

- 3m wide greenways
- All seasons path
- Winter path closure
- Footbridge

Signage

- Existing entrance signage
- Proposed entrance signage
- Existing directional signage
- Proposed directional signage
- Existing interpretation signage
- Proposed interpretation signage

N

Not to scale

9.2 Recreation

SITE WIDE

Recreation and services

- Relocate picnic sets and seats to an all-season accessible locations
- Remove bins from the central portion of the reserve. Relocate to entrance points only
- Increase toilet facilities, either by extending the existing toilet when it is due for replacement or by incorporating it in into the proposed environmental centre.

KEY CONCEPT DESIGN CONSIDERATIONS

12. Redesign the playground layout to make full use of the existing fenced area. Upgrade existing play equipment to include accessible play, nature play and more play for the 8-12 year old age group
13. Proposed dog agility area
14. Upgrade existing basketball half-court and half-pipe
15. Community use of the shed in line with the design principles of the reserve
16. Proposed frisbee golf course (indicative location only)
17. Proposed all-accessible lookout point
18. Proposed nature trail around the reserve which includes pockets of Māori traditional play (māra hūpara), education, interpretation and connection to the water (indicative location only)
19. Consider an additional on-leash area for dogs through bylaw review

LEGEND

- Site boundary
- Waterway / waterbody
- Planting
- Carpark
- Footpath
- Additional on-leash area

Site furniture and structures

- Existing drinking fountain
- Proposed drinking fountain
- Existing Bin
- Proposed Bin
- Half-pipe
- Lookout point
- Accessible lookout point
- Existing playground
- Proposed playground
- Dog pond
- Existing picnic table
- Proposed picnic table
- Existing bench
- Proposed bench

N

Not to scale

10.0 Action plan

ITEM/PROJECT	KEY INITIATIVES	DESIRED OUTCOMES	PRIORITY
A. Investigation and analysis	1. Complete missing monitoring	• Identify any upgrades and maintenance to the stormwater wetland system • Define and implement a new water quality monitoring regime	High
		• Complete a structural assessment of all engineered features of the wetland • Monitor sediment deposition levels, delta formations and circulation flows in the main body of the wetland • Analyse bottom sediments	High
	2. Ecological assessment of the wetland	• Review the pest plants in the wetland areas and identify the next priorities for maintenance. Align land-based and water-based pest plant control • Prepare a wetland planting plan to complement the pest plant control and the terrestrial planting plan and which will enhance the performance of the wetland • Complete bird counts	Medium
		• Increase the level of pest control for rabbits, mustelids and possums	High
	3. Reduce the number of pest fish	• Confirm actions and limitations to the removal of pest fish	High
	4. Improve fish passage between Ōrākei Basin and Waiatarua	• Confirm actions and limitations to improve fish passage	Medium
	5. Advocate for a bylaw review to consider more on-leash areas for dogs	• Undertake full consultation on changes to the animal management bylaw (on-leash, off-leash, and prohibited areas for dogs)	High
B. Recreational outcomes	Refer to Key Concept Design Considerations on enhancement plan (page 26)		Medium
C. Collaboration	1. Collaboration with iwi	• Review planting palette and ecological restoration plan recommendations • Eco-sourcing seed for planting in the reserve • Cultural harvesting • Knowledge sharing with volunteers and the public • Include elements of Māra hūpara – Māori traditional playground	High
	2. Collaboration with the Remuera Golf Club	• Align pest control activities for rats, possums and rabbits • Additional public access points though the golf course linking residential streets with Waiatarua Reserve • Align planting and tree management	High
	3. Collaboration with Auckland Council Parks Sports and Recreation, Community Facilities, Biosecurity and Infrastructure and Environmental Services and volunteers	• Increase the level of pest control in Waiatarua Reserve • Undertake best practices to reduce the spread and impact of kauri dieback and myrtle rust in Waiatarua Reserve • Raise public awareness about domestic cats predating on native birds	High
	4. Collaboration with the Men's Shed	• Construct a dog agility course • Re-use fallen timber from trees to construct unique furniture for Waiatarua Reserve	Medium
	5. Collaboration with schools	• Promote the use of Waiatarua Reserve for environmental education	Low
	6. Collaboration with Meadowbank Residents Association and neighbouring private landowners	• Undertake pest control and native planting on private properties	Low
	7. Collaboration between Healthy Waters and private landowners	• Require high quality stormwater inputs for new developments and connections to the stormwater network	High
	8. Collaboration between animal management dog owners and non-dog owners	• Support dog training and obedience initiatives. Increase education and enforcement of the animal management bylaw	High
	9. Collaboration with Waiatarua Reserve Protection Society	• Support habitat enhancement for native wildlife through planting • Increase the ecological diversity of the reserve through introducing native species • Install gecko enclosures and bird nests.	High

Gravel path at Waiatarua Reserve, 2012, Theo Leach

Appendices

A1. Te Aranga design principles

The New Zealand Urban Design Protocol (UDP) was published by the Ministry for the Environment in March 2005. It was recognised that a clear Māori voice and meaningful involvement in the creation of the UDP had been absent, and that the process undertaken did not adequately engage with Māori interests.

In response to this, and with the support of the Ministry for the Environment and Te Puni Kōkiri, a hui of Māori professionals working across the design disciplines, the resource management sector and representatives of iwi/hapū organisations from across Aotearoa gathered at Waitākere in June 2006 and then in November 2006 at Te Aranga Marae in Flaxmere to discuss and formulate a draft National Māori Cultural Landscape Strategy. The resulting Te Aranga Māori Cultural Landscape Strategy represented the first concerted and cohesive effort by Māori to articulate Māori interests and design aspirations in the built environment.

The Te Aranga Māori Design Principles are a set of outcome-based principles founded on intrinsic Māori cultural values and designed to provide practical guidance for enhancing outcomes for the built environment. The principles have arisen from a widely held desire to enhance mana whenua presence, visibility and participation in the design of the physical realm.

The Te Aranga Design Principles:

1 MANA
Rangatiratanga, Authority

Outcome:
The status of Iwi and Hapū as mana whenua is recognised and respected as a council partner

2 WHAKAPAPA
Names and Naming

Outcome:
Māori names are celebrated

3 TOHU
The Wider Cultural Landscape

Outcome:
Opportunities should be taken through the design of proposals, to promote cultural heritage and incorporate mana whenua creative expression.

KEY THEMES FROM WORKSHOP:

- *Mana whenua partnering with council staff throughout design process*
- *New informational signage to reflect mana whenua involvement*
- *Māra hūpara provides opportunities to teach about tikanga (Māori customs) and cultural narratives*
- *Investigate naming opportunities*
- *Signage and wayfinding to express correct ancestral names*
- *Ensure visual and physical connections to the wider landscape are made, including views to wetland*
- *Signage and wayfinding to reflect the presence of significant sites, including kauri and wetland*
- *Potential for māra hūpara augmented reality features to bring the cultural narratives of hūpara to life*

4 TAIAO
The Natural Environment

Outcome:
The natural environment is protected, restored and enhanced.

- *Protection and enhancement of all native ecosystems*
- *Protect from kauri dieback (Trigene stations at track entrances) and myrtle rust*
- *Stormwater/wetland enhancement*
- *Create fish passage for migratory eels*
- *Investigate pest/predator proof fencing*

5 MAURI TU
Environmental Health

Outcome:
Environmental health is protected, maintained and/or enhanced.

- *Allow for eco-sourcing of seeds for plant stock to restore the surrounding landscape*
- *Ongoing work to improve water quality*
- *Ongoing management of plant and animal pests to protect native species*
- *Staged removal of exotic species, with native species replacing them*
- *Exclusive use of native planting in the future*

6 MAHI TOI
Creative Expression

Outcome:
Iwi/hapū narratives are captured and expressed creatively and appropriately through engagement with mana whenua.

- *Māra hūpara provides an educational opportunity on the reserve*
- *Māori cultural art opportunities*
- *Interpretative panels/information, including at entrance (formal and informal)*

7 AHI KA
The Living Presence

Outcome:
Mana whenua live, work and play within their own role.

- *Educate through restoration*
- *Māori cultural art and design opportunities*
- *Māra hūpara helps to acknowledge Māori history in the area*

A2. History of the park

Māori history

The Waiatarua Wetland was historically a fresh water lake ecosystem formed following an eruption from Mt Wellington approximately 9000 years ago. Freshwater springs were named and greatly valued by Māori. It was called Waiatarua or 'water of double reflections'. It was also known as Lake St John, a 22 ha lake, ranging in depth from 1 to 5m deep, depending on the season. It was the only freshwater lake in the East Auckland isthmus lying in the area near where the Remuera Golf Course is today.

Although the impact of human arrival could not be detected in the Waiatarua core, the range of plants found at Waiatarua is a good indication of what the vegetation in the vicinity of Maungarei (Mt Wellington) was like when Māori first arrived. The land provided sites for food cultivation and collection, as part of a resource zone of Maungarei. It was part of a tuku whenua (gift of land) to Hauraki iwi of Ngāti Paoa (established on the west bank of the Tāmaki Estuary) by Ngāti Whātua. The land then was sold by local iwi to Thomas Cleghorne for £5, three coats, three pairs of trousers and one watch in 1844.

Wetland and stormwater history

In 1870, the first efforts were made to drain the area. In 1912, in times of prolonged rain, the lake depth reached 17ft and flooded much of the surrounding land and the Waiatarua Drainage Board gained provisional approval to drain the swamp lands around the lake. However, it wasn't until 1918 that the first tunnel connecting the wetlands and the Ōrākei Creek was made. The aim was to create a park and also to use some of the surrounding land for roading purposes.

In 1920, parts of land were planted in maize and orchards. A road from Ladies Mile along the lake was built through R.H Abbott's property (Abbotts Way) in 1922.

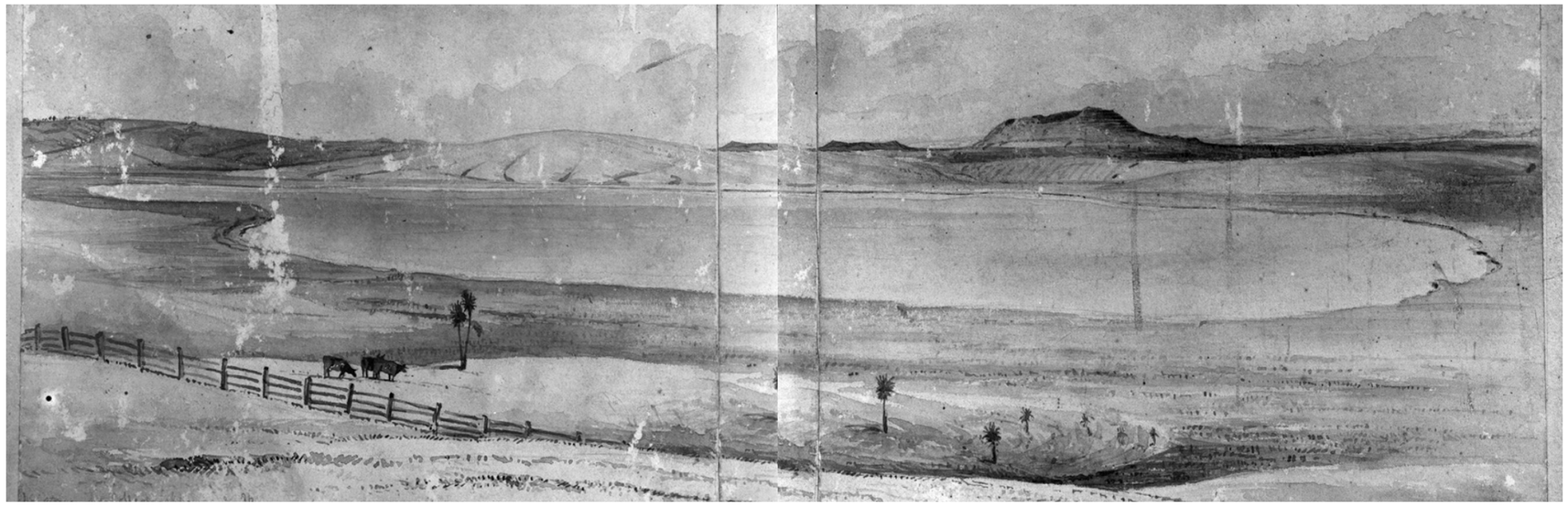
In 1925, government approved permits to drain the lake and build Grand Drive, promised in 1918, around the area. It was also proposed to provide 155 acres of playing fields including the lake bed. However the lake did not fully drain as the lowest level of the lake was below the level of the drains. Thus, from 1954 onwards the park has been used as part of a surface water drainage system for Stormwater retention purposes.

A channel network was installed in the 1980s in an attempt to retain some water in the reserve to create a wetland. This resulted in some wildlife benefits, however it also detrimentally affected the hydraulics of the wetland. The channelised system meant that flows progressed through the system quickly, particularly during high flows. Settled sediment would be resuspended and be discharged out into the Ōrākei Basin. A formalised upgrade of the channelised system to a designed treatment wetland system was undertaken in two stages, over the summers of 2002/03 and 2003/04. After 16 years of planning and construction, the restored Waiatarua Reserve and wetland was reopened by Auckland City Council at a cost of $5.9 milllion. The objectives of the wetland were to provide for:

- Stormwater treatment and prevent around 130 tons of sediment and contaminants being washed out of Waiatarua Reserve into the Ōrākei Basin each year
- Community recreation
- A refuge for native life.

In 2006, Auckland City Council was awarded the Arthur Mead Environmental Award for excellence in sustainable environmental engineering of the biggest urban wetland project in New Zealand as well as the inaugural New Zealand Contractors' Federation Environmental Excellence Award for best practice in the field of environmental management of civil construction and related projects.

1861 -Painting by John Kinder of Lake Waiatarua (now Waiatarua Reserve) and adjoining swamp, looking south east, showing One Tree Hill. Auckland Libraries Heritage Collections



1861 -Painting by John Kinder looking south and south east of Lake Waiatarua (now Waiatarua Reserve), looking south east. Auckland Libraries Heritage Collections

The Waiatarua Reserve now covers 41 hectares, with the wetlands taking up approximately 20 hectares of this. The wetlands service a catchment of 679 hectares and discharges to an inlet, through an 800m long tunnel into the western tributary of Ōrākei Creek and then into the Ōrākei Basin.

FLOODING OF TUNNEL.

On Sunday night the very heavy rainfall had the effect of flooding the outlet tunnel from Lake St. John.

The tunnel is part of the scheme for partially draining the lake, and has been driven through papa rock from the Orakei side. The cutting of the tunnel had been completed, but about six weeks ago the roof subsided at about 500ft from the lake end. A large hole was excavated, and the sides and roof of the tunnel were supported by heavy timber work, the hole being left open. The original intention to pipe the tunnel was abandoned, and it was to have been lined with concrete, but this work has not yet been commenced.

Now the level of the lake is two feet higher than ever before, and the outlee water, finding its way to the recent excavation, has caused another collapse of the roof.

The engineer to the Drainage Board Mr. J. W. Harrison, is of opinion that very little damage has been done to the tunnel itself, while the property surrounding has also escaped.

Yesterday workmen had the situation in hand, and the engineer expects that to-day the tunnel will be freed from the water.

1917 - An article by Auckland Star newspaper about the flooding of stormwater tunnel at Lake Waiatarua. Courtesy of Fairfax Media

1919 - Looking south from the vicinity of St Johns Road towards Ellerslie district, showing Lake Waiatarua (foreground), now drained, and part of the Remuera Golf Course. Auckland Libraries Heritage Collections

1919 - Looking south west from the vicinity of St Johns Road towards the Onehunga district, showing Lake Waiatarua (foreground), now drained, and part of the Remuera Golf Course, with Mangere Mountain in far distance. Auckland Libraries Heritage Collections

1959 -Abbotts Way, Ellerslie - Waiatarua drainage. Auckland Libraries Heritage Collections

1959 -Showing Abbotts Way near the junction with Grand Drive - Waiatarua drainage. Auckland Libraries Heritage Collections

A3. Planting list (based on Waiatarua Reserve Restoration Plan 2018)

Native species found in Waiatarua Reserve. Note this does not include the wetland areas.

Latin name	Common name(s)	Area									
		A	B	C	D	E	F	G	H	I	J	K
Gymnosperm trees and shrubs												
Agathis australis	Kauri						■					
Dacrycarpus dacrydioides	Kahikatea				■	■	■				■	■
Dacrydium cupressinum	Rimu						■	■	■			
Libocedrus plumosa	Kawaka								■			
Podocarpus totara	Tōtara			■	■	■	■	■	■		■	
Prumnopitys ferruginea	Miro					■						
Monocotyledonous trees and shrubs												
Cordyline australis	Tī kōuka, cabbage tree	■			■	■	■	■	■	■	■	■
Rhopalostylis sapida	Nīkau						■			■		
Dicotyledonous trees and shrubs												
Alectryon excelsus subsp. *excelsus*	Tītoki		■			■				■		
Aristotelia serrata	Makomako, wineberry											■
Beilschmiedia tarairi	Taraire		■		■					■		
Coprosma lucida	Shining karamu						■	■	■		■	
Coprosma macrocarpa subsp. *minor*	Coastal karamū, large-fruited karamū		■									
Coprosma propinqua	Mingimingi					■			■			
Coprosma repens	Taupata			■								
Coprosma robusta	Karamū	■		■		■		■			■	
Corynocarpus laevigatus	Karaka		■				■	■		■		
Dysoxylum spectabile	Kohekohe			■								
Elaeocarpus dentatua	Hinau								■			
Entelea arboresens	Whau						■					
Griselinia lucida	Akeapuka, puka		■			■	■		■			
Hedycarya arborea	Porokaiwhiri, pigeonwood											■
Hoheria populnea	Hohere, lacebark		■	■	■	■					■	■
Knightia excelsa	Rewarewa				■	■	■					
Kunzea robusta	Kānuka		■	■	■	■	■	■		■	■	
Laurelia novae-zelandiae	Pukatea				■							
Leptospermum scoparium var. *scoparium*	Mānuka	■		■		■	■		■			
Melicytus ramiflorus	Māhoe					■	■	■	■	■		■
Metrosideros excelsa	Pōhutukawa					■						■
Myrsine salicina	Toro											
Nestegis cunninghamii	Black maire										■	
Nestegis lanceolata	White maire							■				
Olearia traversiorum	Chatham Island tree daisy											■
Piper excelsum subsp. *excelsum*	Kawakawa				■		■	■	■			
Piper excelsum subsp. *peltatum*	Kawakawa (offshore island)						■					

Native species found in Waiatarua Reserve. Note this does not include the wetland areas (contd.)

Latin name	Common name(s)	Area										
		A	B	C	D	E	F	G	H	I	J	K
Pittosporum crassifolium	Karo		■	■		■	■		■	■	■	
Pittosporum eugenioides	Tarata, lemonwood		■			■	■			■	■	■
Pittosporum tenuifolium	Kōhūhū, black matipo			■	■	■	■	■	■	■	■	■
Plagianthus divaricatus	Makamaka, salt marsh ribbonwood								■		■	
Pomaderris apetala	Tainui									■		
Pomaderris hamiltonii	Pale flowered kumarahou										■	
Pomaderris kumeraho	Kūmarahou										■	
Pseudopanax arboreus	Whauwhaupaku, five finger								■			
Pseudopanax crassifolius	Horoeka, lancewood				■			■				
Pseudopanax lessonii	Houpara						■					
Schefflera digitata	Pate				■							■
Solanum laciniatum	Poroporo		■	■		■	■		■	■		
Sophora chathamica	Kōwhai, coastal kowhai		■		■							■
Sophora microphylla	Kōwhai, small-leaved kōwhai	■			■	■				■		
Sophora tetraptera	Kōwhai, large-leaved kōwhai	■			■							
Veronica stricta var. *stricta*	Koromiko, hebe			■					■	■	■	■
Vitex lucens	Pūriri		■				■		■	■	■	
Dicotyledonous lianes and related trailing plants												
Muelhenbeckia australis	Pōhuehue, large-leaved muehlenbeckia						■					
Parsonsia heterophylla	New Zealand Jasmine					■				■		
Ferns												
Cyathea dealbata	Ponga, silver fern	■		■	■		■					
Cyathea medullaris	Mamaku, black tree fern						■					
Doodia australis (syn. *Blechnum parrisiae*)	Rasp fern, pukupuku				■							
Histiopteris incisa	Mātātā, water fern, bat's wing fern				■	■						■
Pteris tremula	Shaking brake, tender brake				■		■					
Grasses												
Microlaena stipoides	Meadow rice grass, slender rice grass				■							
Oplismenus hirtellus subsp. *imbecillis*	Basket grass				■							■
Sedges												
Carex secta	Pūrei				■							
Cyperus ustulatus	Upokotangata, giant umbrella sedge	■		■								
Monocotyledonous herbs (other than orchids, grasses, sedges, and rushes)												
Phormium tenax	Harakeke, flax	■			■	■	■		■	■	■	■
Dicotyledonous herbs - other than Composites												
Haloragis erecta subsp. *erecta*	Shrubby toatoa					■						■
Persicaria decipiens	Swamp willow-weed	■			■				■	■		

Exotic species found in Waiatarua Reserve. Note this does not include the wetland areas.

Latin name	Common name(s)	RPMS status[1]	Area									
			A	B	C	D	E	F	G	H	I	J	K
Gymnosperm trees and shrubs													
Taxodium distichum	Swamp cypress												■
Monocotyledonous trees and shrubs													
Phoenix canariensis	Phoenix palm, Canary Island date palm	Surveillance			■								■
Dicotyledonous trees and shrubs													
Acer negundo var. *negundo*	Box elder								■				
Banksia integrifolia	Coastal banksia	Surveillance		■	■		■				■		
Casuarina glauca	Swamp oak											■	
Eucalyptus spp.	Eucalyptus				■	■							
Ficus elastica	Indian rubber tree						■						
Ligustrum lucidum	Tree Privet	Surveillance; Community Initiatives			■				■			■	
Ligustrum sinense	Chinese Privet	Surveillance; Community Initiatives									■		
Impatiens sodenii	Shrub balsam											■	
Phytolacca octandra	Inkweed						■	■				■	
Prunus campanulata	Taiwan cherry	To be researched			■								
Rubus fruticosus agg.	Blackberry	Surveillance			■	■	■						
Solanum mauritianum	Woolly nightshade	Containment (boundary); Community Initiatives		■	■		■					■	■
Syzygium smithii	Monkey apple	Surveillance; Community Initiatives			■	■							
Ulex europaeus	Gorse			■			■						
Monocotyledonous lianes													
Asparagus scandens	Climbing asparagus	Surveillance; Community Initiatives			■								
Dicotyledonous lianes and related trailing plants													
Araujia sericifera	Moth plant, kapok vine	Surveillance; Community Initiatives					■			■	■	■	
Calystegia sepium subsp. *roseata* x *C. silvatica* subsp. *disjuncta*	Hybrid bindweed		■				■	■		■		■	
Hedera helix	English ivy	Surveillance			■				■			■	
Lonicera japonica	Japanese honeysuckle	Surveillance; Community Initiatives									■		■
Ferns													
Cyathea cooperi	Australian tree fern	Surveillance			■		■						
Grasses													
Cenchrus clandestinus	Kikuyu grass					■				■		■	
Cortaderia selloana	White pampas	Surveillance; Community Initiatives	■				■	■					

Exotic species found in Waiatarua Reserve. Note this does not include the wetland areas (contd.)

Latin name	Common name(s)	RPMS status[1]	Area									
			A	B	C	D	E	F	G	H	I	J	K
Ehrharta erecta	Panic veldt grass			■		■			■				■
Sedges													
Carex divulsa	Grey sedge				■								
Monocotyledonous herbs (other than orchids, grasses, sedges, and rushes)													
Agapathus praecox subsp. *orientalis*	Agapanthus	Surveillance		■	■							■	
Alisma plantago-aquatica	Water plantain											■	
Colocasia esculenta 'Black Magic'	Black taro											■	
Iris foetiissima	Stinking iris							■					
Tradescantia fluminensis	Tradescantia	Surveillance; Community Initiatives		■	■	■		■	■	■		■	
Zantedeschia aethiopica	Arum lily	Surveillance		■	■			■	■		■	■	■
Dicotyledonous herbs - other than Composites													
Alternanthera philoxeroides	Alligator weed	Surveillance									■		
Solanum americanum (syn. *S. nodiflorum* subsp. *nutans*)	Small-flowered nightshade			■									
Solanum nigrum	Black nightshade							■					

A4. Pest plant species list (April 2015)

Pest plant species observed within the Waiatarua wetland, April 2015 were listed below (priority weeds were blackberry, japanese honeysuckle, and willow).

COMMON NAME	SCIENTIFIC NAME	DISTRIBUTION	DESIGNATION	CONTROL METHOD
Japanese honeysuckle	*Lonicera japonica*	++	Surveillance	Control Japanese honeysuckle in November to January. The honeysuckle is primarily growing up and over native plants. Find where the vine is growing from on the ground. Cut the vine as close to the ground as possible. Paste the freshly cut stump with herbicide. Leave the vines hanging in the tree to wither and die. However glyphosate is not very effective in controlling this species.
Tradescantia	*Tradescantia fluminensis*	+	Surveillance	Manually remove from site. Glyphosate is not very effective in controlling this species; however 3% glyphosate is the preferred method around the stream banks where tradescantia is often occurring in the wetland. Triclopyr is more effective. Repeat treatment is required (3-4 times a year).
Arum lily	*Zantedeschia aethiopica*	+	Surveillance	Control Arum lily during drier months. Small plants can be dug out and roots removed off site. For larger plants, cut and spray stumps.
Willow weed	*Persicaria maculosa*	+++		A vast majority of the willow weed growing in the wetland is the native species. Do not control the native willow weed. Native willow weed will only be controlled if deemed to be inhibiting conveyance and detention of the wetland. Foliar spray with glyphosate (100-200ml/10L).
Garden nasturtium	*Tropaeolum majus*	+		Hand remove or foliar spray with glyphosate (100ml/10L).
Blackberry	*Rubus sp. (R. fruticosus agg.)*	+++	Surveillance	Effective control of blackberry occurs during flowering, approximately November to April. Where underlying vegetation is undesirable, spraying is preferred as gives 95%+ control with little regrowth. However, in most areas of the wetland native vegetation is growing among the blackberry and care with control methods is required. With infestations growing with natives, Stem scrape and paint (glyphosate 100mls/100mls) immediately. Or Cut and paint (glyphosate 200-500mls/1l). However glyphosate is not very effective in controlling this species.
Woolly nightshade	*Solanum mauritianum*	+	Containment	Control woolly nightshade year round. Hand-pull small plants, elevate and hang off the ground to prevent re-sprouting. For larger plants, ring-bark or cut stump treat the tree (200ml glyphosate/L).
Pampas	*Cortaderia selloana*	+	Surveillance	Establish that species is not native toetoe. Control during drier months (approximately October – March). Spray dense sites of pampas where non-target damage is unlikely (100ml glyphosate (non-selective) + 20ml penetrant/10L). Where spray drift could damage natives in close proximity, thoroughly soak centre of large plants or cut down and spray base (200ml glyphosate + 2ml penetrant/1L).
Gorse	*Ulex spp.*	+	Containment	Gorse can be controlled year around. In most instances, gorse is growing amongst native plants. Cut gorse at the base and paste the stump with herbicide (200ml glyphosate + 10ml penetrant/1L). Use foliar spray when non-native species are present (100ml glyphosate + 20ml penetrant/10L). However glyphosate is not very effective in controlling this species.
Crack willow	*Salix fragilis*	++	Surveillance	Drill and inject is the best control methodology for willows. This method is suitable for both crack and grey willows with branches greater than 50mm diameter. Drill holes as close as possible to the ground. Repeat every 10cm to form a ring of holes around the base of the tree. Drill down on an angle of 45o from the horizontal and 30o from the vertical. The hole diameter should be 12-16mm. Use 25-50% glyphosate and approximately 10-25ml herbicide mixture per hole. Apply quickly once drilled.
Grey willow	*Salix cinerea*	++	Surveillance	As above.
Moth plant	*Araujia hortorum*	+	Containment	Control moth plant year round. Hand pull ensuring all roots are removed, or cut stump treat the vine. Leave vines to die in tree. Pick viable seed pods off the vine and dispose of off-site.
Mercer grass	*Paspalum distichum*	++		Only control areas of Mercer grass where no natives are present. In some areas Mercer grass is growing among natives – do not control. Spray Mercer grass in aquatic sites (100ml glyphosate (non-selective)/10L).
Yellow flag iris	*Iris pseudacorus*	+	Surveillance	Spray sites in spring to autumn (100ml glyphosate/10L).
Water-plantain	*Alisma plantago-aquatica*	+		Foliar spray with glyphosate (100-200ml/10L).
Water celery	*Apium nodiflorum*	++		Foliar spray with glyphosate (100-200ml/10L).

The distribution and abundance of environmental pest plant infestations at Waiatarua wetland, April 2015

A5. References

- Auckland Unitary Plan (Operative in Part)
- Davidson, J (2011). *Archaeological investigations at Maungarei: A large Māori settlement on a volcanic cone in Auckland, New Zealand*. Museum of New Zealand Te Papa Tongarewa
- Lee, M.N and Salter, J (June 2018). *Auckland Botanical Society Journal Volume 73 (1)*. Auckand Botanical Society
- Mairs, A (November 2018). *Waiatarua Reserve Restoration Plan*. Te Ngahere Limited
- Ōrākei Local Board (April 2018). *Heritage sites of significance and public artwork in the Ōrākei Local Board Area*. Auckland Council