

Ōrākei Basin State of the Basin Monitoring Report 2018

Parks, Sports and Recreation
July 2018





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Auckland Council

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- Parks, Sports and Recreation
- Biodiversity
- Coastal and Geotechnical Services, Infrastructure & Environmental Services

and with the assistance of the Ōrākei Local Board and the Ōrākei Basin Advisory Group (OBAG).

Executive summary

The Ōrākei Basin Management Plan (2010) has a requirement for an annual environmental monitoring report to be completed for the Basin and associated open space areas.

This report is the first monitoring report to be completed since the adoption of the management plan. The report addresses measures that have been undertaken to give effect to the ten objectives and 34 policies of the plan, and provides a view on the overall state of the Basin and its connected open space areas. This is a desktop review of the information currently available which has been sourced from council staff relating to maintenance activities, project planning and delivery, the preservation and management of natural and cultural heritage, the use and management of the Basin and surrounding reserves, active testing and monitoring of environmental elements, and stakeholder feedback including that of iwi. This information should be used to inform future planning and management initiatives for the Ōrākei Basin and open space areas.

The collation of this information highlights the following key features of the state of Ōrākei Basin:

- Auckland Council's Ecological Restoration contract sets out a comprehensive framework for focusing on plant and pest control at Ōrākei Basin. A five year programme for control of these plant and animal pests within the Basin is in place. A number of pest plant species are considered common within the open space areas. Pockets of weedy exotic trees have been removed from areas of the Basin in recent years, with indigenous trees and shrubs establishing in areas to replace them. This restored habitat has continued to grow in stature, density and species richness. Plant pest control, and enrichment planting of native species is required within selected areas in the Basin. Mechanical and hand weed control and removal is required as a method of weed control by contractors to minimise erosion and adverse environmental effects.
- Within the Basin water body, the lack of tidal action has significantly altered the intertidal regime, with common invertebrates adapting to a much reduced tidal zone and normal intertidal algae excluded from its habitat.
- Water quality testing undertaken within Ōrākei Basin and Ōrākei Creek in late 2017 produced water samples from the freshwater and marine sites that exceeded recreational guideline levels for *E. coli* and *Enterococci*. In some cases these exceedances occurred during dry weather events, and in others during and after light

and heavy rain fall events, indicating exceedances are recorded irrespective of rainfall events.

- During the warmer months, or at times when excessive nutrients are available algal blooms may be present in Ōrākei Basin.
- No sediment monitoring programme has been implemented to understand the rate of sedimentation within the Basin since the adoption of the management plan. This monitoring programme is needed if the rate of sedimentation build up in the Basin and it's effect on water levels and recreational use of the Basin is to be better understood.
- A baseline survey was completed in March 2018 of the five scheduled archaeological sites within the Basin and reserves. Of the five, two have been significantly degraded over time(both middens); one was inaccessible (midden); and two were in moderate condition (Ōrākei Pa and midden).
- As an area of high significance to Ngāti Whātua Ōrākei, with a number of scheduled archaeological sites within the Basin, further ongoing work is required with Ngāti Whātua Ōrākei to determine appropriate interpretation opportunities of the Ōrākei Basin and surrounding area.
- Further to this, the Basin has a consistent suite of way finding and by-law signage which provide users with good decision making information, but lacks any interpretation signage which tells the geological and biodiversity story of Ōrākei Basin.
- The most important geological features at the Ōrākei Basin are the landform of the tuff ring, and the deposits within the lake that record the eruptive history of the field. Neither of these elements are particularly sensitive to small-scale disruption and probably not vulnerable to recreation activity, so a site specific monitoring programme is of limited value.
- The Ōrākei Basin Advisory Group (OBAG) plays an advisory role in supporting the Ōrākei Local Board who have decision making authority in the planning, use and management of Ōrākei Basin. A high proportion of OBAG's efforts to date have focused on operational and stakeholder issues within the Basin. There is a need for the group to fulfil their advisory role to the Ōrākei Local Board and recommending an action plan of prioritised works as required by their terms of reference. OBAG has scope to also contribute to the protection and enhancement of the Basin and surrounding open space areas through supporting a programme of education and engagement with private land owners and the wider public around appropriate land use practices.
- A co-ordinated education programme for raising awareness of private property owners on the matters of erosion, weed and pest control, and revegetation is lacking

and is a key priority area for the Ōrākei Basin Advisory Group in conjunction with the Ōrākei Local Board.

- Feedback provided by the members of the Ōrākei Basin Advisory Group on the utilisation of the existing club buildings and storage buildings within Ōrākei Basin indicate that all buildings are utilised to capacity.
- Condition inspection surveys indicate some asset types such as the aggregate walkways around the Basin are subject to high wear and require more regular maintenance, with other asset types such as hard structures, fixtures and furniture, signage, and staircases remaining in a serviceable condition for longer with less preventative maintenance necessary.
- The Ōrākei Basin is subject to steep slopes and areas where erosion and slips are more prone to occur. Areas of erosion and bank instability are in part being caused by poor stormwater drainage. Poor channelling of runoff and poor outlet erosion control from private and public stormwater outlets have been identified as causal factors. Continuing work to identify and upgrade stormwater discharge points into the Basin is required to minimise areas of erosion and slips from occurring. A number of measures have been implemented including a staged approach to pest plant removal, revegetation of slopes to avoid erosion of bare areas of ground where weed removal has been undertaken, and upgrading stormwater outlets to minimise scouring of slopes. Council has commissioned extensive investigation and design work on options to improve the access road, main car parking, and boat ramp area which are areas subject to land stability, soil erosion, and water edge erosion. Physical works to address these issues were completed in 2015. A peer review exercise of the completed physical works is being completed to identify ways of minimising the physical dominance of the rock rip rap wall, and stormwater outlet chambers.
- Not currently provided for within the Ōrākei Basin reserve network and worth consideration in future Local Board programmes are new park assets to support a better user experience:
 - A public toilet located in the vicinity of the main car park at Ōrākei Basin West Reserve
 - Picnic tables close to the car park and open grassed areas
 - Drinking fountains at selected positions on the loop walkway

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1.0 Introduction

1.1 Scope

The Ōrākei Basin Management Plan was developed in 2010 by the legacy Auckland City Council prior to amalgamation of the legacy local authorities into Auckland Council.

The Ōrākei Basin Management Plan provides a strategic framework for the ongoing management and operation of the Ōrākei Basin and surrounding open space networks.

An outcome specified in the plan is the development of an annual environmental monitoring report of Ōrākei Basin and adjacent open space areas. This report is the first such report to be produced in accordance with this requirement. It is envisaged that this report will set a template for future annual reports to be completed.

The scope for this State of the Basin report was developed with council staff and the Ōrākei Local Board in late 2017, and finalised at a workshop with the board in February 2018.

The scope for this report is:

- evaluate the environmental condition of the reserve in relation to the ten plan objectives
- prepare an environmental snapshot of the Basin and surrounding public open spaces:
 - communicate the environmental condition of the Basin in relation to the ten plan objectives
- develop an achievable annual monitoring methodology (with AC staff support) that is appropriate to the plan objectives, significance of the Basin, and regional priorities
- identify and record the status of recommended actions in the management plan
- recommend actions to address any issues which can be resolved by solutions in the short term
- identify issues which may require strategic, medium term, or long term solutions

The management plan contains ten objectives and 34 specific policies for the development, management and use of the public land that adjoins the water bodies of Ōrākei Creek and Ōrākei Basin. This report has undertaken a desktop review of current known practices by council departments and community groups, with technical

input from council specialists, including analysis of results from existing monitoring activities to consider progress to date in achieving these objectives and policies.

Recommendations are provided in this report on future opportunities to undertake environmental monitoring and to measure future progress in achieving the outcomes of the management plan.

Each objective and policy in the plan is discussed in the main section of this report and covers the following ten themes:

- The natural environment
- Water quality
- Heritage values
- Implementation
- Buildings and structures
- Walkways and access
- Recreation and use
- Water access
- Encroachments
- Erosion

1.2 The Site

Ōrākei Basin is comprehensively described in the management plan under Part 1 – Background and context. The Basin and surrounding open space network covered by the plan is described as providing high geological, recreation, community, landscape, ecological, cultural heritage, and archaeological value.

Ōrākei Basin is classified in the Auckland Unitary Plan as Open Space – Informal Recreation zone and Coastal - General Coastal Marine zone.

The following Unitary Plan overlays, controls and special features apply to the Basin and surrounding open space areas:

- Natural Resources: Significant Ecological Areas Overlay - SEA_T_5243, Terrestrial
- Natural Resources: Significant Ecological Areas Overlay - SEA-M2-51b, Marine

- Natural Heritage: Outstanding Natural Features Overlay [rcp/dp] - ID 143, Ōrākei Basin volcano
- Natural Heritage: Regionally Significant Volcanic Viewshafts And Height Sensitive Areas Overlay [rcp/dp] - E13, Mount Eden, Viewshafts
- Natural Heritage: Regionally Significant Volcanic Viewshafts And Height Sensitive Areas Overlay [rcp/dp] - H4, Mount Hobson, Viewshafts
- Built Heritage and Character: Historic Heritage Overlay Extent of Place [rcp/dp] - 1586, Headland pa site R11_87 Pa site including terrace/s, ditch/s and midden
- Controls: Coastal Inundation 1 per cent AEP Plus 1m Control - 1m sea level rise
- Controls: Macroinvertebrate Community Index – Urban

The open space areas covered by the management plan and confirmed as within the scope of this report are:

- The water bodies of Ōrākei Basin and Creek
- The Ōrākei East and West Reserves
- Macpherson Street Reserve
- Bonnie Brae Reserve
- Meadowbank Reserve
- Kelvin Reserve
- Waiatarua Road access
- Macpherson Street access
- Lucerne Road access



Figure 1: Ōrākei Basin and surrounding open space areas as included in the Ōrākei Basin Management Plan 2010

2.0 Assessment of Objectives and Policies from the Ōrākei Basin Management Plan

2.1 Objectives and Policies

Objective 1: The natural environment

To manage reserves in a way that ensures the protection and enhancement of the natural environment and provides for increased indigenous biodiversity.

Policy 1:

Prepare and implement an overarching vegetation enhancement and weed control plan

Comment on Policy 1:

Auckland Council has an Ecological Restoration contract that commenced in July 2017 for a contract period of five years. This contract replaces previous ecological contract services delivered for council. The new contract services are delivered by Wildlands Consultants, which focuses on plant and pest control at identified 'High Value' sites owned by council across the region. Ōrākei Basin is classified as a 'High Value' site which means that the reserve will receive a higher degree of weed and pest control than a 'general site'.

The Ecological Restoration contract requires that at the start of the contract the Contractor must scope each High Value reserve, segment and GPS plot the reserves into management units, assess and report existing levels and types of target plant and animal pests (including GPS photo point surveys), and prepare a draft Ecological Restoration Plan including suggestions for planting. The plan shall consider 'Significant Ecological Area' (SEA) status and ecosystem classification of each site.

The contract requires an annual visit by the Contractor to deliver on the contract specifications.

Wildlands Consultants completed a Site Assessment Report in October 2017 for Ōrākei Basin. The plan outlines planned pest plant maintenance and ecological enhancement activities over coming years. The Basin is segmented into four management units as shown below.



Figure 2: Ōrākei Basin management units for Ecological Restoration contract



Figure 3: Photopoint 1. Madeira vine, woolly nightshade, and mature coral tree. MU3, Ōrākei Basin Reserve. 5 July 2017



Figure 4: Photopoint 2. Tree privet and English ivy infestation. MU2, Ōrākei Basin Reserve. 5 July 2017

The outcome of the first round of site works for the four management areas is summarised in the assessment report below.

| Pest Plants - Management Units: | | | | | | | |
|---------------------------------|--------------------|--|-----------------|----------------------------|---------------------|----------|-----------|
| Maturity: | | | Abundance: | | | | |
| J | Juvenile | 1 | Abundant (>50%) | 3 | Frequent (10 - 19%) | | |
| F | Fruiting/flowering | 2 | Common (20-49%) | 4 | Ocassional (1-9%) | | |
| MU | Phase of Control | Key Weed Species Present | | Other Weed Species Present | | Maturity | Abundance |
| 1 | Follow-up control | Arum lily, climbing asparagus, tradescantia | | | | F, J | 4 |
| 2 | Initial control | English ivy, tree privet | | | | F, J | 2 |
| 3 | Initial control | Madeira vine, moth plant, tree privet, woolly nightshade | | | | F, J | 3 |
| 4 | Follow-up control | Madeira vine, smilax, tree privet | | | | F, J | 4 |

Table 1: Methodology for plant pest control by the Ecological Restoration contractor

The assessment report outlines a five year programme for vegetation enhancement and weed control activity at Ōrākei Basin.

| YEAR | Year 1 - 2017/18 | | | | Year 2 – 2018/19 | | | | Year 3 – 2019/20 | | | | Year 4 – 2020/21 | | | | Year 5 – 2021/22 | | | |
|------------------------------------|------------------|-----|-----|-----|------------------|-----|-----|-----|------------------|-----|-----|-----|------------------|-----|-----|-----|------------------|-----|-----|-----|
| PHASE | FOLLOW UP | | | | FOLLOW UP | | | | FOLLOW UP | | | | MAINTENANCE | | | | MAINTENANCE | | | |
| SEASON | Win | Spr | Sum | Aut | Win | Spr | Sum | Aut | Win | Spr | Sum | Aut | Win | Spr | Sum | Aut | Win | Spr | Sum | Aut |
| TASK | | | | | | | | | | | | | | | | | | | | |
| Pest Plant Control: | | | | | | | | | | | | | | | | | | | | |
| MU1 – Follow-up pest plant control | | █ | | | | █ | | | | █ | | | | | █ | | | | | █ |
| MU2 – Initial pest plant control | | █ | | | | █ | | | | █ | | | | | █ | | | | | █ |
| MU3 – Initial pest plant control | | █ | | | | █ | | | | █ | | | | | █ | | | | | █ |
| MU4 – Follow-up pest plant control | | █ | | | | █ | | | | █ | | | | | █ | | | | | █ |
| Planting: | | | | | | | | | | | | | | | | | | | | |
| Site Preparation | | | | | | | | | | | | | | | | | | | | |
| Planting | | | | █ | | | █ | | | █ | | | | █ | | | | | | █ |
| Maintenance | | | | | | █ | | █ | | █ | | █ | | | █ | | | | █ | |

Table 2: Programming for plant pest control by the Ecological Restoration contractor

The objectives outlined within the vegetation enhancement and weed control plan for Ōrākei Basin are:

- MU1, 2, 3, 4 - Control pest plants.
- Staged removal of tree privet required over the next 10 years at ~10% per year.
- Multiple visits required to control madeira vine and moth plant.
- Ongoing surveillance of pest plant invasion from neighbouring properties required.

Policy 2:

Measure changes to flora and fauna biodiversity, via initial and follow up surveys

Comment on Policy 2:**Terrestrial**Site history

The Ōrākei Basin volcano erupted alongside Purewa Creek about 85,000 years ago (Hayward et al. 2011). Most of the forest and scrub which surrounds the Basin today is located on the steep ash and tephra deposits along the raised margin of the crater (or tuff ring) that encircles Ōrākei Basin. The whole tuff ring and surrounding land would have been forested in pre-human times, with the forest grading into scrub and saline wetlands around the rim of the Basin itself. Following human colonisation of Auckland, Māori lived around the shores of the Basin and built a pā on part of the tuff ring that Ōrākei Road now runs along (ibid.). During this period most of the pre-human forest in the area surrounding the Basin was converted to low scrub and bracken through burning and felling.

After 1840 the development of the Auckland isthmus intensified and this resulted in widespread clearance of native vegetation to provide land for housing, gardens and pasture. The earliest aerial photographs of the Basin - taken in 1940 - show a landscape with almost all forest and scrub vegetation removed (Figure 5a); just grassland and small, patchy areas of fernland with a few scattered shrubs remain. Nineteen years later aerial photographs show taller stature vegetation beginning to return to the steeper slopes facing the Basin, particularly along the southern and south-western margins (Figure 5b). By 1996 this band of mixed forest and scrub had thickened and grown in stature (Figure 5c) and this is the core of the forest habitat that remains around the Basin today.



Figure 5 : Ōrākei Basin a) 1940, b) 1959, c) 1996 aerial imagery



(a)



(b)



(c)

Figure 6: Ōrākei Basin a) 2001, b) 2010/11, c) 2016 aerial imagery

In the 1990s a large number of weedy exotic trees were removed from the vegetation along the western margin of the Basin, and indigenous trees and shrubs planted to replace them. This restored habitat has continued to grow in stature, density and species richness through the early part of the 21st century (Figure 6 a, b and c).

Current ecosystems

The vegetation composition of terrestrial ecosystems surrounding Ōrākei Basin is described in detail and mapped in an earlier report on the site. For this report the different ecosystems around the crater margin were re-visited and qualitatively assessed against the following parameters: species richness of native plants; regeneration of native seedlings and saplings; spread and dominance of exotic plants; regeneration of exotic seedlings and saplings; and clearance and physical damage to native vegetation.

Observations were made separately for the seven different zones outlined in Figure 7, and these are summarized below in Table 3:

| Vegetation Zone | Description | Total area (ha) in 2016 |
|-----------------|--|-------------------------|
| 1 | Planted native forest along the western section of the tuff crater rim | 2.32ha |
| 2 | Small patch of recently planted native forest | 0.06 ha |
| 3 | Exotic forest along the southern section of the tuff crater rim | 1.32 ha |
| 4 | Mixed exotic-native forest along the southern section of the tuff crater rim | 1.01 ha |
| 5 | Macpherson and Lucerne street reserves | 1.42 ha |
| 6 | Privately owned mixed exotic-native forest alongside Ōrākei Stream | 3.8ha |
| 7 | Exotic treeland and forest along the western crater rim | 1.36 ha |

Table 3: Area and general characteristics of terrestrial forest and scrub ecosystems surrounding Ōrākei Basin and stream

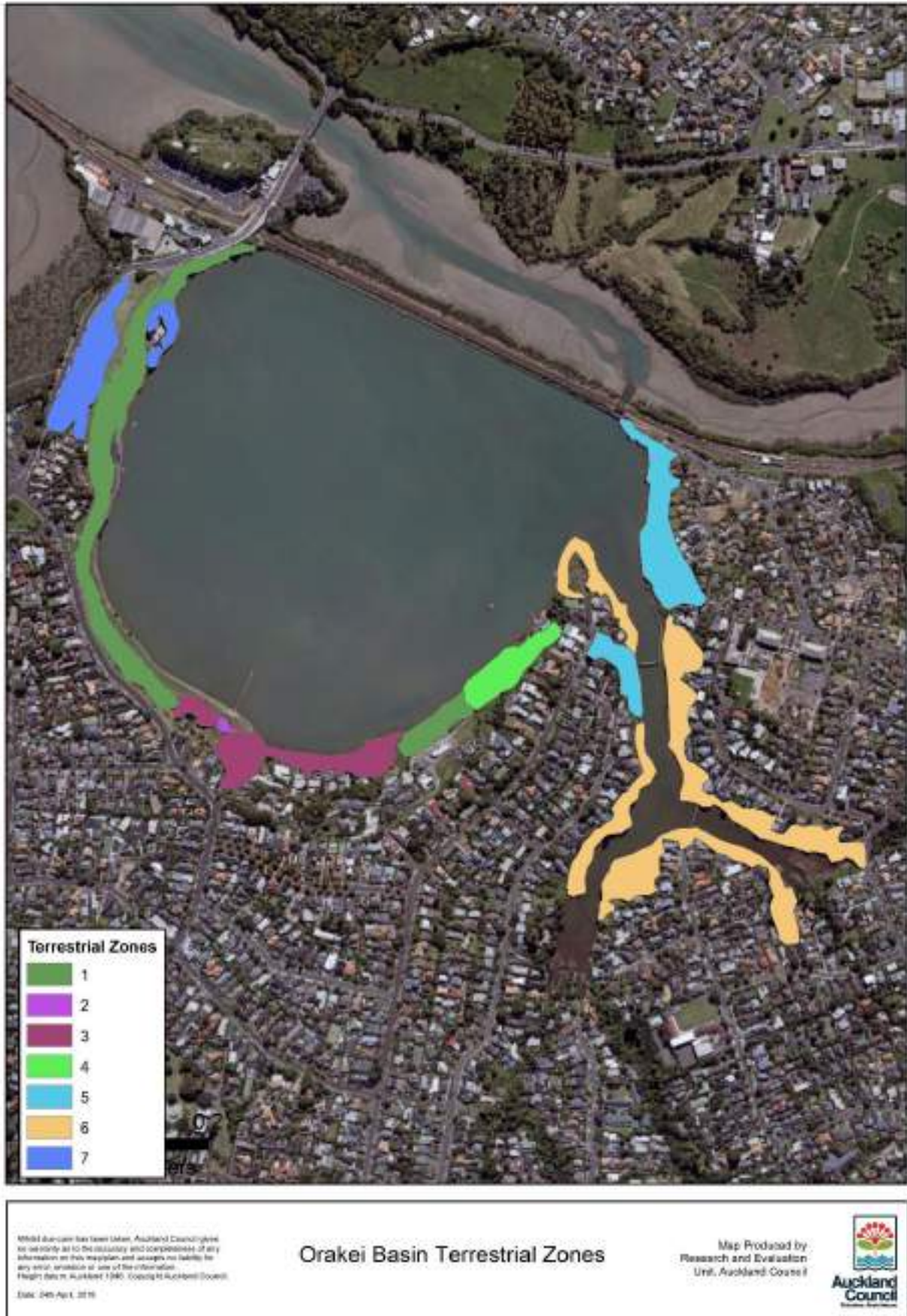


Figure 7: Ōrākei Basin Terrestrial Zones

Zone 1 – Planted native forest along the western section of the tuff crater rim

Native plantings established in the 1990s have matured to produce a good example of native coastal forest. These ecosystems are missing some native plants that could be expected to be present in less disturbed coastal forest, especially shade tolerant species typical of mature forest. However, native species form a mostly continuous canopy, there are well developed sub-canopy and shrub tiers of native plants, and good regeneration of a diverse range of native seedlings and saplings. So overall, these habitat patches are of good quality and are ecologically significant. This entire zone has been designated as a Significant Ecological Area in the Auckland Unitary Plan (operative in part).

As a result of ongoing management to remove pest plants, there are very few weeds in the Zone 1 area. The plant biomass is overwhelmingly native and pest plants are restricted to the margins and sites of recent disturbance. There has been some relatively minor physical damage to trees in Zone 1, and there is also evidence of elevated erosion of soil from the steepest parts of the site during intense rainfall events. However, colonisation of disturbed sites is dominated by indigenous plant species and the total area of disturbance is relatively small. Animal pest control is also undertaken throughout this zone.

Zone 2 – Recently planted native forest

Zone 2 comprises a very small (0.06 ha) area of planted native shrub and shrubland species that were established following the removal of a large, dense patch of bamboo that previously dominated this area. The bamboo spread across the reserve and adjacent private land and was cleared in c.2010. The reserve land has been re-planted with typical early successional native species (e.g. manuka, kohuhu, cabbage tree and flax) that have yet to achieve full canopy closure. The high light, open environment of this zone has allowed the establishment of gorse and pampas, along with a relatively dense cover of exotic grasses beneath the shrubs.

In order to ensure the survival of planted natives, and expedite canopy closure by increasing their growth rates, weeds in this zone need to be controlled. Woody weeds should be physically removed over the next three years minimum.

Zone 3 – Exotic forest along the southern section of the tuff crater rim

This zone includes an area of forest that is dominated by tall exotic trees; including weedy species such as tree privet, wattles and Phoenix palm, and other less weedy exotic trees such as coral or flame tree (*Erythrina crista-galli*). Native trees and shrubs

are present throughout; including some relatively large native trees such as karaka. However this zone is mostly exotic in character. The forest understorey includes both 'natural' habitat and areas that have been extensively modified by gardening to open the understorey and/ or enhance the regeneration of different native and exotic plants. The gardening is more common within sections of privately owned forest that adjoin the reserve. English ivy is rampant through large parts of this zone.

Zone 4 – Mixed exotic-native forest along the southern section of the tuff crater rim

The weed tree privet is a prominent feature of the forest canopy in this zone, and wattle is common along the Basin margin. However, there is a much greater concentration of native species in the canopy, sub-canopy and shrub tiers in this zone, compared to Zone 3. The density and species diversity of native saplings and seedlings is relatively high and it is clear that ongoing weed removal and re-placement planting with native plants is gradually 'tipping the balance' towards indigenous species in this zone. Animal pest control is also undertaken throughout this zone. This entire zone has been designated as a Significant Ecological Area in the Auckland Unitary Plan (operative in part).

Zone 5 – Macpherson and Lucerne street reserves

Time series aerial photographs show that the vegetation that is currently present within both of these reserves is of more recent origin (see Figures 1 and 2). As late as 1960 the reserves were characterised by rank exotic grassland, with scattered trees and shrubs. By the early 1990s a mixed native-exotic community had established and in more recent decades the reserves have been actively managed to improve their indigenous biodiversity values through removal of weedy plants and replacement planting of native species. The current vegetation within these zones is dominated by a good diversity of native plants that are typical of regenerating forest along the coast. Weeds are much more prominent in this zone, compared with Zone 1, but are being actively controlled and indigenous biodiversity values are probably improving over time. Animal pest control is also undertaken throughout this zone. This entire zone has been designated as a Significant Ecological Area in the Auckland Unitary Plan (operative in part).

Zone 6 – Privately owned mixed exotic-native forest and scrub along the margins of Ōrākei Stream

Areas of forest on private land were not surveyed for this report. However, time series aerial photographs of this zone were examined to look for gross changes in forest canopy cover. In the last eight years approximately 0.5 ha of privately owned forest canopy has been removed in this zone. This is around 13% of the estimated 3.8 ha of privately owned forest alongside the Ōrākei Stream. It is important that as much of the remaining area of forest and scrub habitat as possible is retained; to provide buffering to the Ōrākei Stream, reduce sedimentation and provide habitat for native animals.

Zone 7 – Exotic treeland and forest along the western crater rim

This zone includes a number of tall, mature, exotic trees - including poplar, coral tree, and willow surrounding the Ōrākei Sea Scouts building, and an area of mature privet forest along the margin of Ōrākei Road. The privet forest has a few indigenous species within it, particularly in the forest understorey, but overall has low indigenous biodiversity value. These large privet trees are providing a nearby source of abundant seed, which will be dispersing into the better quality patches of native habitat around the Basin margin (i.e. Zones 1, 4 & 5). Long-term, the best solution would be to remove the privet trees within Zone 7 and re-plant canopy gaps with native plants. However, given the abundance of privet around the reserve margin and the more immediate weed control needs in other zones, intensive weed control in this zone could be 'parked' for the next few years. The large exotic trees surrounding the Sea Scouts building are not invading into the surrounding native forest and should be left in place.

Recommended management actions

- Continue with animal pest control throughout the Ōrākei Basin reserve network.
- Continue with plant pest control in the blocks of good-quality restored native forest along the western margin of the site, in Macpherson St. Reserve and in Lucerne St. Reserve (Zones 1 and 5).
- Expand plant pest control – with follow-up planting of native species – into areas of mixed native-exotic forest and exotic forest, as resources permit (Zones 3 and 4).
- Plant pest control, and enrichment planting of native species is required within a small area of recent plantings on the southern edge of the Basin (Zone 2).

Marine

Auckland City commissioned Bioresarches Ltd to survey the ecology of Ōrākei Basin in 1976. Algal blooms occurred in summer months as a result of impoundment of Basin waters. The lack of tidal action in the Basin (Figure 8) has significantly altered the intertidal regime, with common invertebrates adapting to a much reduced tidal zone and normal intertidal algae excluded from its habitat. Intertidal algae have been replaced by permanently submerged algal species (Oldham et al. 1996).



Figure 8: Intertidal and subtidal environments of the Basin.

The restriction of tidal flow into the Basin could cause the reduction in larval movement and recruitment from within and outside the Basin. It could also reduce the number of species, such as fish, moving from outside the Basin into the Basin.



Figure 9 : The gates which control the water level of the Basin.

Physical changes, such as an increase in salinity during the period of water impoundment, will not only impact those species with low tolerance to salinity but also those species that are capable of withstanding higher salinity levels.

An ecological survey carried out by Bioresarches found that Ōrākei Creek supported higher ecological diversity than Ōrākei Basin (Oldham et al. 1996).

Hayward and Hayward (1999) concluded that prior to 1920s Ōrākei Basin had a firm, light coloured, shelly, sand or mud floor inhabited by abundant cockles, wedge shells and patches of pipis, with numerous mud crabs, polychaete worms, snails and other bivalves. But with constrained tidal flushing, by the mid 1990s the Basin was covered by a thick layer of soft dark mud. Most of the original biota had disappeared or been greatly reduced. In many places the floor of the Basin was covered in mats of nuisance red and green algae (*Enteromorpha*, *Gracilaria*, *Rhizoclonium*, and *Solieriaceae*), which bloomed seasonally, then died and rotted, causing foul odours. Invasive marine species had also become dominant, with large populations of Asian date mussels (*Arcuatula senhousia*) living in the mud and amongst the weed. Pacific oysters (*Crassostrea gigas*) had colonised the shore, and an introduced barnacle (*Amphibalanus amphitrite*) covered hard surfaces (Kelly 2016).

Shane Kelly carried out an ecological assessment and literature review of the Basin in 2016. The visual survey by Kelly indicated there had been a recent die-off of shellfish within the Basin. Shells from pacific oysters, cockles, blue mussels and Asian date mussels were present, with only a small number of live Asian date mussels confirmed. All other species were not sighted alive, however there may be low numbers present.

The Basin has a depauperate benthic community with a high incidence of invasive species. In addition to those mentioned above, species present included whelks, blue mussels, horn shells, saltmarsh, sea rush, and scattered mangroves. The tributary that feeds the north-eastern corner of the Basin differed in species composition. At low tide, this area consists of adjoining mud flats and is notable for having high densities of unidentified burrows – likely to be from the tunnelling mud crab or stalk-eyed mud crab (Kelly 2016).

Sediment cores from upper tidal zones indicated an infaunal community with relatively low diversity and few individuals consisting of mostly worms and polychaetes and the occasional mysid shrimp, barnacle, oligochaete and a single cockle (Kelly 2016).

Policy 3:

Utilise weed control methods, consistent with Auckland Council policy, with a view to minimising adverse environmental effects.

Comment on Policy 3:

Auckland Council has developed a policy for weed control in parks and open spaces titled the Auckland Council Weed Management Policy for Parks and Open Spaces 2013. This policy provides guidance for prevention and management of weeds and the control of vegetation within all parks and open spaces owned or administered by Auckland Council or its Council Controlled Organisations (CCOs).

In addition to compliance with this policy, weed control works undertaken through the Ecological Restoration contract also requires pest plant works to comply with the Auckland Regional Pest Management Strategy.

Ōrākei Basin has been classified as a no-spray site to prevent the erosion of slopes and banks around the Basin. Mechanical and hand weed control and removal are required as a method of weed control by contractors to minimise erosion and adverse environmental effects.

Weed control methods and practices specified within the restoration contract undertaken within Ōrākei Basin include:

- Cut stump methodology in accordance with industry best practice
- Hand pulling methodologies in accordance with industry best practice
- Where complete removal of pest plants is deemed to promote adverse environmental conditions, the contractor shall plan removal of pest plants in selected areas over time.

Performance measures in the contract include:

- 100% effective weed control; agrichemical weed control is completed only when approved by the Principal; Auckland Council Weed Management Policy and procedure conditions are fully adhered to, including but not limited to no agrichemical control in spray-free areas and use of signage; guidelines of specified publications adhered to; and public notices published.

Management of the contract deliverables and contractor compliance requirements sits with the Community Facilities Contract Co-ordinator for the Ecological Restoration contract.

Policy 4:

Prepare and implement an ongoing pest management programme to control pests including rats, possums and feral cats.

Comment on Policy 4:

The Ecological Restoration contract with Wildlands Consultants requires the control of rats and possums within the Basin reserves. The contractor has prepared a five year programme for control of these pests within the Basin as follows:

| YEAR | Year 1 - 2017/18 | | | | Year 2 – 2018/19 | | | | Year 3 – 2019/20 | | | | Year 4 – 2020/21 | | | | Year 5 – 2021/22 | | | |
|-----------------------------|------------------|-----|-----|-----|------------------|-----|-----|-----|------------------|-----|-----|-----|------------------|-----|-----|-----|------------------|-----|-----|-----|
| PHASE | FOLLOW UP | | | | FOLLOW UP | | | | FOLLOW UP | | | | MAINTENANCE | | | | MAINTENANCE | | | |
| SEASON | Win | Spr | Sum | Aut | Win | Spr | Sum | Aut | Win | Spr | Sum | Aut | Win | Spr | Sum | Aut | Win | Spr | Sum | Aut |
| TASK | | | | | | | | | | | | | | | | | | | | |
| Pest Animal Control: | | | | | | | | | | | | | | | | | | | | |
| Rat control | | | | | | | | | | | | | | | | | | | | |
| Possum control | | | | | | | | | | | | | | | | | | | | |
| Planting: | | | | | | | | | | | | | | | | | | | | |
| Site Preparation | | | | | | | | | | | | | | | | | | | | |
| Planting | | | | | | | | | | | | | | | | | | | | |
| Maintenance | | | | | | | | | | | | | | | | | | | | |

Table 4: Programming for animal pest control by the Ecological Restoration contractor

The methodology for completing the works is as follows:

| Pest Animals | | | |
|---|----|-----------------------------|----|
| Control Requirements: | | | |
| Two bait stations per hectare, and one Timms trap per hectare. | | | |
| Equipment has been installed where suitable. | | | |
| Four pulses of rat control per annum using locakable bait stations (pulse 1 using Bromadiolone, pulses 2, 3 & 4 using Diphacinone). | | | |
| Monitoring Requirements: | | | |
| Two tracking tunnels per hectare, and one line of wax tags. | | | |
| Equipment has been installed where suitable. | | | |
| Control Equipment | | Monitoring Equipment | |
| No. Timms Traps | 6 | No. Wax Tags | 10 |
| No. Rat Bait Stations | 12 | No. Tracking tunnels | 12 |
| Other Equipment: | | | |

Table 5: Methodology for animal pest control by the Ecological Restoration contractor

Pest control work in the Basin reserves is ongoing throughout the seasons for rats, with possum control undertaken during the winter months.

In the wider landscape there is the new Eastern Songbird initiative which is part of Pest Free NZ. This initiative is undertaking predator control around Ōrākei and the other eastern bays to encourage native bird migration from the islands to the mainland. This includes intensive pest control in Kepa Bush which is nearby, while Ngāti Whātua Ōrākei is doing pest control and restoration work on their land in Ōrākei .

Recommended management actions

- Support the implementation of a community led project for regular bird monitoring within the Ōrākei Basin and surrounding park network.

Objective 2: Water Quality

To monitor and manage water quality to be suitable for recreational use as provided for within the Ōrākei Basin Bylaw 2006 and its lease from the Crown.

Policy 5:

Prepare and implement a water quality monitoring programme to monitor human health risk in terms of harmful bacteria. The plan should outline appropriate responses to mitigate risk to persons who use the water for recreation.

Comment on Policy 5:

Water Quality Monitoring

Enterococci and *Escherichia coli* concentration were monitored by 4SIGHT Consulting Limited between 12 July and 7 December 2017 at 12 marine sites and five freshwater sites around the Basin. Water column samples were collected during dry, light, and heavy wet weather conditions. Two rounds of sampling were completed during each weather condition. *Enterococci* counts are the recommended (MfE 2003) indicator for human health concerns when samples are collected from salt water; *E. coli* is the recommended indicator (MfE 2003) when samples are collected from freshwater.

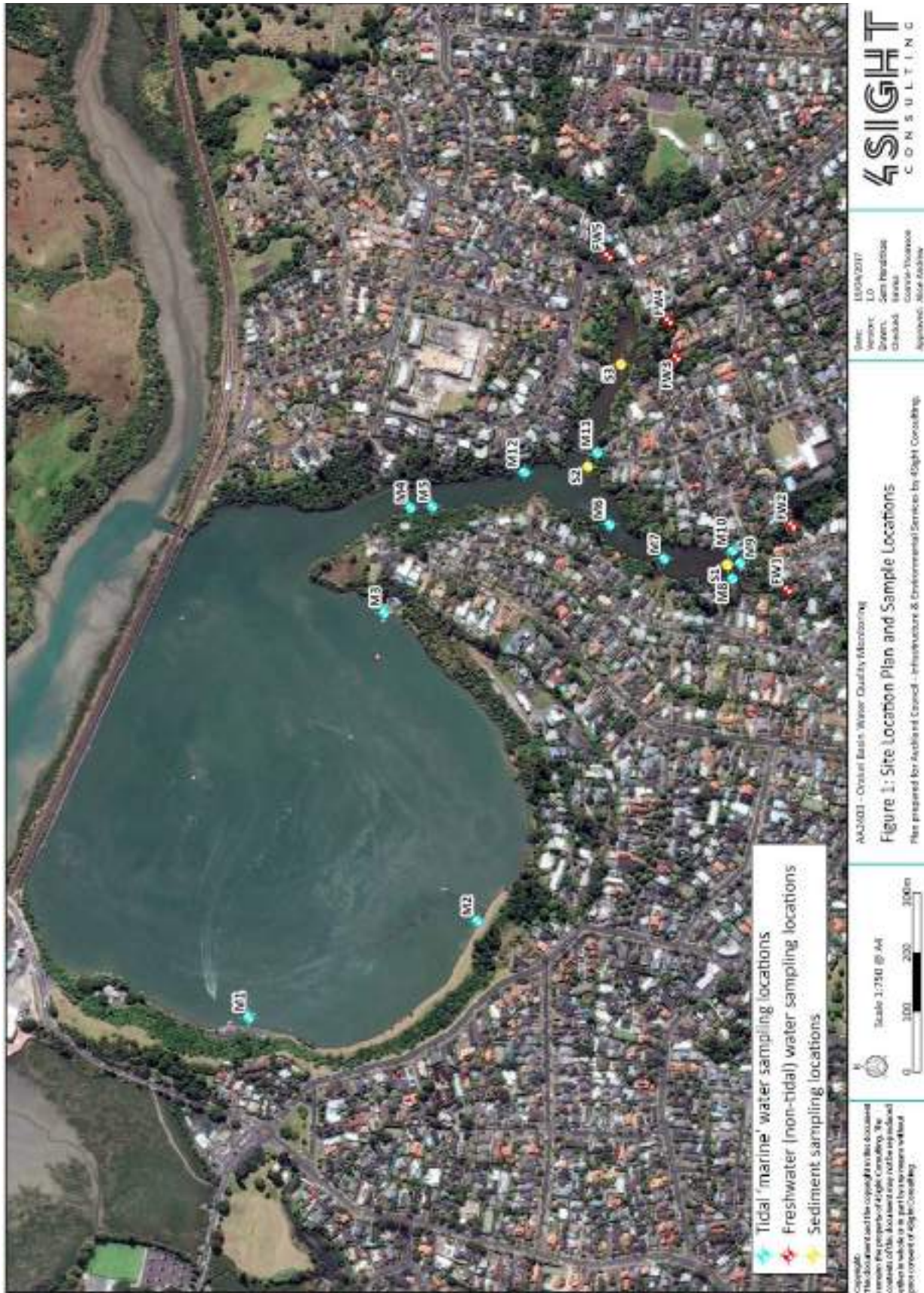


Figure 10. Map of water sampling locations throughout the Ōrākei Basin and freshwater creeks. Sample locations starting with M denote the marine sites (n = 12); FW indicates freshwater sites (n = 5).

Water samples collected from the marine sites (M1-M12 see Figure 10 for the map of testing sites) showed that *Enterococci* levels were below alert levels during dry weather conditions at sites within the Basin and in the proximal Basin arm (Figure 11). However, sites further up the Basin arm were near or above alert levels. During light rain events, only the three sites within the Basin were below alert levels while the rest of the sites exceeded guideline levels. Only one site remained below alert levels during heavy rain events, and 11 exceeded guideline levels (Figure 11). To put these results in context, the highest concentrations recorded were 400-500/100mL where raw sewage can be 24,000/100mL and upwards.

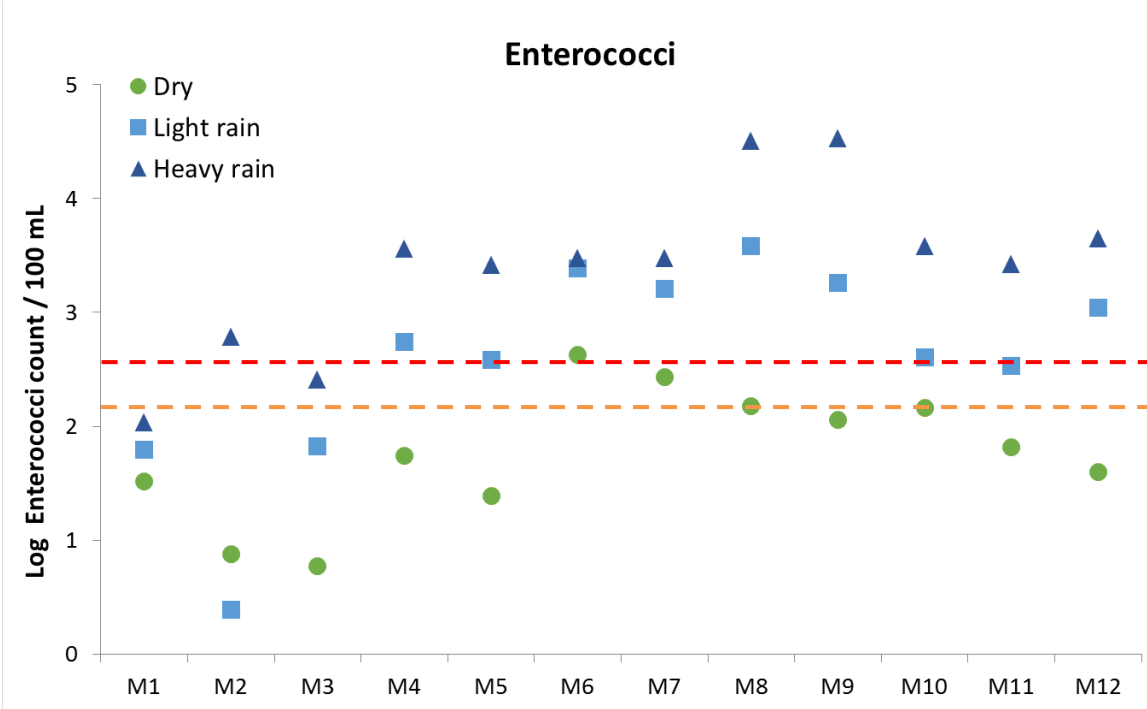


Figure 11. *Enterococci* counts per 100 mL for samples collected during dry weather (green circles), light rain (light blue squares), and heavy rain (dark blue triangles) at the 12 marine sites. The dashed lines represent warning levels for *Enterococci* counts: above the orange and below the red line indicates potentially contaminated conditions; counts above the red line indicate contaminated water.

All water samples collected from the freshwater sites (FW1-FW5 on the map; Figure 10) exceeded guideline levels for *E. coli* regardless of when the samples were collected. Understanding the source of *E. coli* at these sites could help to identify how best to mitigate these polluted water quality conditions. The source of the freshwater within the Ōrākei Creek is Waiatarua Wetland which drains through an extensive pipe system from the wetland under St Johns Road. Additional water quality testing conducted by 4Sight in the Orakei Basin in 2018 showed that enterococci levels continually exceeded thresholds at most marine sites (not M1, M2, and M3), and

exceeded *E. coli* thresholds at all freshwater sites except F5. Microbial source tracking analyses on the samples also revealed that the source of faecal bacteria is mainly human. Contamination from dogs was found in about half of the samples and the incidence of contamination from waterfowl was low.

Because *Enterococci* and *E. coli* counts are particularly high following rain events (light or heavy), we recommend allowing the Basin to flush following these events for multiple days. This will likely reduce the residence time of harmful bacteria levels in areas where people and animals are in contact with the water.

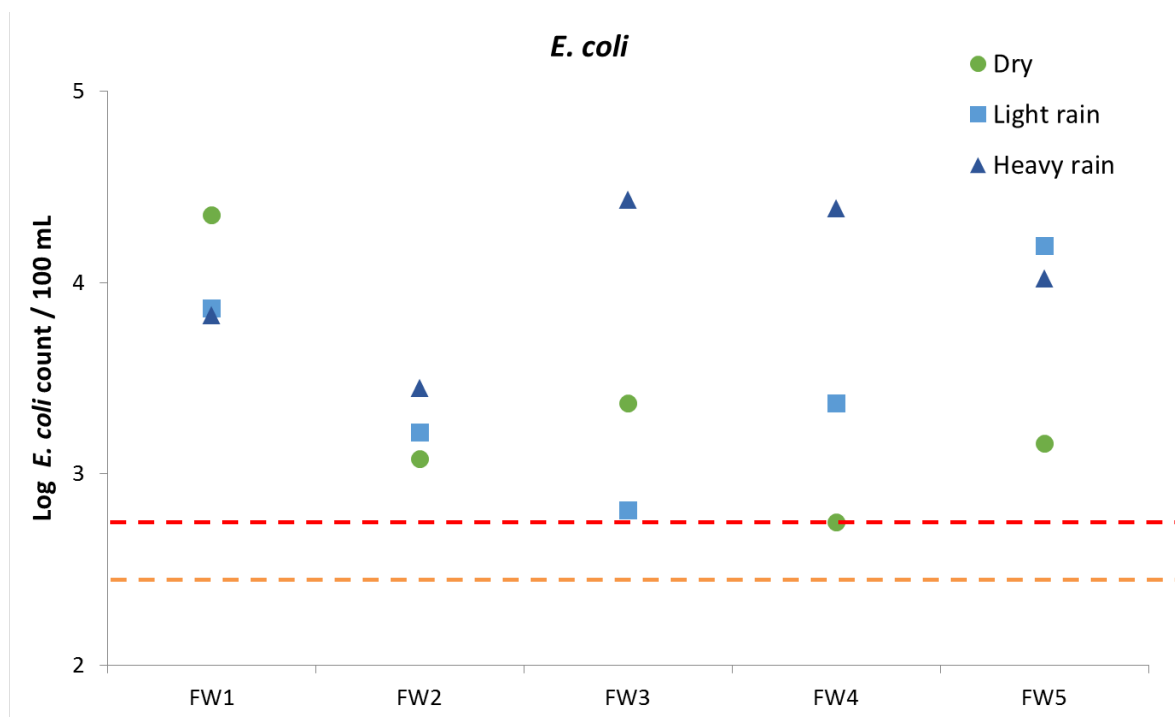


Figure 12. *E. coli* counts per 100 mL for samples collected during dry weather (green circles), light rain (light blue squares), and heavy rain (dark blue triangles). The dashed lines represent warning levels for *E. coli* counts: above the orange and below the red line indicates potentially contaminated conditions; counts above the red line indicate contaminated water.

Recommended management actions

- Ongoing sampling should continue to target various weather conditions. It would also be useful to know how long conditions exceeding guideline levels persist at the various sites so the effects of flushing can be measured.
- Key sampling would be to continue monitoring for *Enterococci* and *E. coli* during the weeks that the Basin is in high recreational use.

Policy 6:

Prepare and implement a visual algae monitoring programme during times of higher risk. The programme should outline trigger levels and methodologies for remedial action.

Comment on Policy 6:**Algae**

Cyanobacteria (commonly known as blue-green algae) are photosynthetic prokaryotic organisms that are integral parts of many aquatic ecosystems. They can either be planktonic or benthic (MfE and MoH 2009). During the warmer months, or at times when excessive nutrients are available or when sewage is present, algal blooms may be present in Ōrākei Basin. Algal blooms can cause the water in the Basin to turn green, red, bright blue, white, cloudy or foamy. This section does not consider mangrove growth.

While the blooms may look unpleasant and sometimes smell, most algae is harmless. However, this is not always the case and some species are known to be toxin-producing strains. These natural toxins known as *cyanotoxins* may be harmful to people and animals if ingested. The only way to work out if the algae present is harmful is through laboratory testing from water quality samples.

Historically, the presence of a variety of algae is abundant at different times of the year in the Basin.

- Dense mats of a red/brown algae (*Unknown spp.*), which cover large areas (70-80%) of the Ōrākei Basin and Creek mudflats.
- The floating algae (*Enteromorpha spp.*), which is common during summer (Oldham et al. 1996).

The high density of algae is thought to be related to the high concentration of nutrients released into the Basin from the sewerage overflows in Ōrākei Creek (Bioreserches 1978).

Monitoring algae

Blooms are much more common during the summer months, and routine monitoring should occur during this time, or more specifically during the months of high recreational use. It is likely that this will be December through March.

The table below outlines when each stage is triggered and the actions that need to take place, taken from the New Zealand Guidelines for Cyanobacteria in Recreational Fresh Waters.

Benthic cyanobacteria

Surveillance (green mode) – this is triggered when cyanobacteria are first detected at low abundance (up to 20% coverage), signalling the early stages of possible mat proliferation. Site surveys and sampling to confirm species present should be undertaken. Weekly sampling should occur during spring to autumn and during high recreational use periods. Fortnightly/monthly sampling may be appropriate during cooler months.

Alert (amber mode) – this mode is triggered when there is 20-50% coverage of potentially toxigenic cyanobacteria attached to substrate. Weekly sampling should occur to understand the rate of change in cyanobacteria populations. Number of sites will depend on the spread of growth.

Action (red mode) – when sampling reveals more than 50% of substrate covered in potentially toxigenic cyanobacteria, or up to 50% covered and are seen visibly detaching from substrate and accumulating as scum at the edge of the Basin.

At action mode, consideration should be given to increasing the frequency of flushing the Basin.

Planktonic cyanobacteria

During sampling it is important to record all relevant details e.g.

- Weather conditions (at time of sampling and 24 hours earlier – including wind direction and strength)
- Water transparency
- Any discolouration of the water
- Water temperature
- Dissolved oxygen

| Alert level | Actions |
|---|--|
| <p>Surveillance (green mode)</p> <p><i>Situation 1:</i> The cell concentration of total cyanobacteria does not exceed 500 cells/mL</p> | <ul style="list-style-type: none"> • Undertake weekly or fortnightly visual inspection and sampling of water bodies where cyanobacteria |

| | |
|---|--|
| <i>Situation 2:</i> The biovolume equivalent of the combined total of all cyanobacteria does not exceed 0.5 mm ³ /L | are known to proliferate between spring and autumn |
| <p>Alert (amber mode)</p> <p><i>Situation 1:</i> Biovolume equivalent of 0.5 to 1.8 mm³/L of potentially toxic cyanobacteria</p> <p><i>Situation 2:</i> 0.5 to <10 mm³/L total biovolume of all cyanobacterial material</p> | <ul style="list-style-type: none"> • Increase sampling frequency to at least weekly • Notify the public health unit • Multiple sites should be inspected and sampled |
| <p>Action (red mode)</p> <p><i>Situation 1:</i> ≥ µg/L total microcystins: or biovolume equivalent or ≥ 1.8mm³/L of potentially toxic cyanobacteria</p> <p><i>Situation 2:</i> ≥ 10mm³/L total biovolume of all cyanobacterial material</p> <p><i>Situation 3:</i> cyanobacterial scums consistently present</p> | <ul style="list-style-type: none"> • Continue monitoring as for alert (amber mode) • If potentially toxic taxa are present, then consider testing samples for cyanotoxins • Notify the public of a potential risk to health |

Table 6: Triggers and actions for cyanobacteria monitoring

(See New Zealand Guidelines for Cyanobacteria in Recreational Fresh Waters for further guidance - including a sampling sheet)

Below is the recommended MfE framework for ongoing sampling and reporting:

1. The regional council coordinates the monitoring, sample analysis and reporting strategy.
2. The regional council implements surveillance and alert-level monitoring.
3. The public health unit reviews the effectiveness of the monitoring and reporting strategy.
4. The regional council informs the public health unit and territorial authority if alert or action levels are reached.
5. The public health unit ensures that the territorial authority is informed.
6. The public health unit or territorial authority informs the public when the action level is exceeded (e.g. through media releases). The public health unit requests that territorial authorities erect warning signs at affected water bodies.
7. If the action level is reached, the territorial authority undertakes nuisance monitoring and causes all proper steps to be taken to remove or abate the nuisance. (On occasion it may be more appropriate for the regional council to

undertake this duty.) The public health unit should provide advice to help territorial authorities and/or regional councils undertake necessary actions.

8. It is the responsibility of the public health unit to downgrade alert levels in accordance with these guidelines and in consultation with territorial authorities and regional councils.
9. The regional council collates the information for state of the environment reporting and a review of management policies.

It should be noted that no historic reports of toxic algae blooms that have had an impact on human health have been found since the management plan was adopted in 2010.

Recommended management actions

- Implement a programme of routine monitoring for algal blooms during the summer months, or more specifically during the months of high recreational use. It is likely that this will be December through March. If necessary undertake water quality sampling to determine if algae present is harmful to human health.

Policy 7:

Inform the public how to improve water quality within the Basin and Creek by undertaking measures on their own properties relating to erosion, siltation control, riparian planting and fertiliser use.

Comment on Policy 7:

The Ōrākei Local Board has not taken any active steps in delivering a co-ordinated programme of education for raising awareness of private property owners in these matters to date.

This is a key outcome of the advocacy work to be delivered by the Ōrākei Basin Advisory Group (OBAG) as outlined in the group's terms of reference dated April 2017.

The group is currently considering methods with which to deliver such information to local land owners and stakeholders. The co-ordination of the appropriate level of information from internal Council departments should be a key focus of OBAG activity.

Recommended management actions

- Undertake a public education programme for local land owners on measures to be taken on private property to minimise erosion and silt entry into local waterways to improve water quality.

Policy 8:

Maintain silt mitigation devices within the stormwater infrastructure (such as catchpits) to ensure effective operation.

Comment on Policy 8:

A number of silt mitigation devices are provided within the internal road, car park, and walkway areas of Ōrākei Basin. Catchpits, dish channels, and bubble up chambers within the reserve are maintained via the Community Facilities Full Facility Maintenance contract, which ensures a basic level of maintenance (debris removal, clearing blockages) is undertaken. Consideration of stormwater infrastructure within the wider stormwater catchment is not considered in this report. Auckland Transport and Healthy Waters have maintenance responsibilities for this infrastructure in the wider network in the road corridor and stormwater treatment ponds which feed in to Ōrākei Creek and Ōrākei Basin.

A visual inspection of a number of the park assets within the Basin road and walkway network completed in March 2018 indicated that the existing infrastructure is maintained sufficiently.



Figure 13: Stormwater devices in Ōrākei Basin West Reserve

Objective 3: Heritage Values

To provide for a variety of recreational pursuits to the extent that these are compatible with the landscape, cultural and natural values of the water body and reserves.

Policy 9:

In consultation with Iwi, decide on the appropriate form of interpretation for sites of Maori cultural significance and treatment of these sites.

Comment on Policy 9:

Ōrākei Basin is an area of significance to Ngāti Whātua Ōrākei , with scheduled archaeological sites within the Basin. Further ongoing work is required with Ngāti Whātua Ōrākei to determine appropriate interpretation opportunities of the Ōrākei Basin and surrounding area. Aside from some limited way finding signage on Ōrākei Road and Upland Road that identifies the general location of the Ōrākei Pa site, there is no interpretation provided on the site of the significance of the area to Iwi.

Feedback from Ngāti Whātua Ōrākei emphasises the significance of the Basin to Iwi. They seek direct involvement of Ngāti Whātua Ōrākei as kaitiaki of the land, which goes beyond providing interpretation information of the cultural significance of the area. A desire for recognition of contemporary kaitiakitanga is envisioned by the Iwi, for example in planting and maintenance activities or in the design of appropriate artworks and cultural design features.

Recommended management actions

- Continue to work with Ngāti Whātua Ōrākei to identify opportunities where shared stewardship of future initiatives and activities within the Basin could be achieved.

Policy 10:

Where appropriate, signs should be used to identify archaeological sites.

Comment on Policy 10:

Limited signage is installed in the Basin to identify known archaeological features. Two way finding signs on Ōrākei Road and Upland Road identify the direction of Ōrākei Pa. The archaeological site R11/87 – Ōrākei Pa (see Policy 11 commentary below) would be an appropriate location for information signage. Currently there are no interpretation panels, or information signage. There is potential for installing information panels, possibly one at each entrance to the site and a smaller one at the top of the pa site explaining the site, its history, its context and its significance to mana whenua. This would highlight the importance of the site as more than a reserve to enjoy for its amenity or as a good place for active recreation, but also as a significant heritage feature, which may in turn lead to more active stewardship by the local community and park users.

There is also room to add information panels for the ruins of the railway housing located in the reserve on the right of the main Basin access road, which are quite obvious and remain an unknown feature to park visitors. Rubbish dumping is unfortunately not uncommon in this area of the reserve. Again, interpretation information may lead to a better understanding, and more respect for the heritage of the site, and in turn more active stewardship by local groups.

Recommended management actions

- Identify opportunities where it is appropriate for interpretation signage to inform park users of the archaeological features around Ōrākei Basin.

Policy 11:
Known archaeological sites should be managed to avoid any ongoing degradation.

Comment on Policy 11:



Figure 14: Recorded archaeological sites within Ōrākei Basin (ArchSite, June 2018)

There are five archaeological sites listed in the Ōrākei Basin Management Plan:
 R11/87 – Ōrākei Pa (pa)

R11/1765 – Kelvin Reserve (shell midden)

R11/2343 – Macpherson Street Reserve (shell midden)

R11/2536 – Macpherson Street Reserve (rail line end) (shell midden)

R11/2538 – Ōrākei Basin East Reserve access from Lucerne Road (shell midden)

A baseline survey has been completed in March 2018 of the five listed sites by Heritage Unit staff at Auckland Council. Of the five, two were badly degraded (R11/2343 and R11/2538 – both midden sites); one was inaccessible (R11/2536 – midden); and two were in moderate condition (R11/87 and R11/1765 – pa and midden respectively). Condition monitoring forms were completed for all five scheduled sites and are included in Appendix A.

Management recommendations have only been able to be provided for the two extant and accessible sites (R11/87 and R11/1765). The two destroyed sites have been affected by park upgrade works and general erosion and wear and tear. The inaccessible site has been damaged but seems relatively secure in its location within the rail corridor.

In addition to these five sites, at least five more sites that seem to be within the reserve area have been recorded since the management plan was adopted:

R11/2342 – Lucerne Road Access

R11/2667 – Macpherson Street Reserve

R11/2683 – Ōrākei Basin West Reserve

R11/2701 – Ōrākei Basin East Reserve

R11/2719 – Ōrākei Basin East Reserve

These are shown in the map above. An initial scoping survey was undertaken for R11/2683 and R11/2667 but monitoring forms were not completed for them. R11/2683 is noted as a significant midden site that extends over a large area and is already cut by tracks.

Recommended management actions

- R11/1765 (Kelvin Reserve) – do nothing. The site appears to be intact and in good condition. It is secure as a subsurface deposit with no significant threats other than gradual fluvial erosion at the toe of the headland on which it is situated, and potential vegetation removal. In short, if Kelvin Reserve stays as

it is the site is not in danger. There is limited potential for interpretation signage for the site as it is subsurface with no visible remains.

- R11/87 (Ōrākei Pa) – amend operational mowing maintenance practices and provide interpretation signage. Site R11/87 has significant potential for information signage to enhance the site as a heritage destination within the reserve area. The site has been historically damaged and its features are now quite obscure but there is enough left on the ground to highlight as a feature.

The most apparent issue is the tracking of people across the site, particularly along desire lines and in physically constrained spaces, accelerating erosion of features and ground surfaces and in turn exposing subsurface archaeological features. The site seems to be fairly well-used by walkers and runners and offers pleasant viewpoints making it a popular spot, which will only increase with further development and intensification in the area. In the more open grassed areas an approach similar to that used on the maunga could be adopted by dissolving desire lines and encouraging people to disperse across the area rather than cut tracks along desire lines. This could be achieved by a more nuanced mowing regime, mowing down track strips and encouraging people to shift off established desire lines. The other option would be to formalise tracking across the whole area with a carefully planned and constructed path layout, however this would pose problems from an archaeological and heritage perspective and would probably be of limited value given the relatively low visitor numbers at present.

Several secondary tracks have been observed forming through the extant defensive ditches on the southern end of the pa. The ditches seem to make an attractive path to ascend/descend onto the lower terraces and onto Ōrākei Road. As a result the ditches are experiencing edge damage and increasing erosion and subsurface midden deposits are being exposed. This is a difficult situation to resolve, but could be aided by directional signage.

- It is recommended that monitoring forms are completed for the five additional sites, and they be incorporated into any future update of the management plan.
- Undertake archaeological assessments during any developments so that any evidence is recorded.

Policy 12:

Avoid works that may significantly adversely affect the integrity and values of geological features.

Comment on Policy 12:

The Ōrākei maar and surrounding tuff ring are a near-symmetrical explosion crater almost a kilometre across. Although there are over fifty volcanoes in Auckland, well preserved explosion craters are much less common. The tuff ring is listed in the New Zealand Geopreservation Inventory as class 3B, where it is described as “A large, conspicuous tuff ring within a closely populated suburb. It has been breached by a stream and invaded by rising sea level. Tuff mantles that rest on soft beds or steep slopes adjacent to the crater are prone to slumping when saturated.”

The Geopreservation Inventory categories are defined as:

| | |
|-------------------|--|
| Importance: | Vulnerability: |
| A = international | 1 = vulnerable to complete destruction by human actions |
| B = national | 2 = vulnerable to significant modifications by human actions |
| C = regional | 3 = probably not vulnerable to any likely human actions |
| | 4 = already destroyed by human actions |

From this it can be seen that the most important features of the Ōrākei Basin are of relatively low vulnerability.

The Ōrākei Basin has also recently been the subject of intensive scientific investigation. A borehole drilled through the marine sediments in the Basin to older deposits beneath has been critical in building a more detailed picture of the eruptive history of the Auckland Volcanic Field from layers of ash left by each eruption. This research is important for understanding changes in the field over time, and therefore the current risk posed to the residents of Auckland. As with the tuff ring, this aspect is probably not vulnerable to likely human actions.

The most important geological features at the Ōrākei Basin are the landform of the tuff ring, and the deposits within the lake that record the eruptive history of the field. Neither of these elements are particularly sensitive to small-scale disruption.

Exposures of the tuff are found in locations around the Basin, and have some value as a resource for education and tourism. Before excavation works take place in the vicinity of any natural exposures of volcanic material, an assessment of the impact of the proposed work shall be undertaken by a suitably qualified geologist. Their recommendations shall be incorporated into the work method statement.

Recommended management actions

- Ensure a suitably qualified geologist is included as part of the project team for any works planned in the vicinity of natural exposures of volcanic material around the Basin.
- Manage sites to avoid any ongoing degradation.

Objective 4: Implementation

Support ongoing implementation of the management plan via an advisory group.

Policy 13:

Establish an advisory group to prepare an 'action plan' to prioritise work to be delivered, based on the objectives and policies contained within the management plan.

Comment on Policy 13:

The establishment of an Ōrākei Basin Advisory Group (OBAG) was undertaken after the adoption of the management plan. The terms of reference for the Group were updated in April 2017 by the Ōrākei Local Board. The purpose of the Group is confirmed as:

(from the Terms of Reference dated 20 April 2017)

Purpose of the Ōrākei Basin Advisory Group

- (1) To operate in accordance with the Terms of Reference.
- (2) To advise and advocate to the board on works identified in the plan and progress thereof, which will assist the Board to determine areas of priority and to allocate budget funding to deliver the objectives of the Plan.
- (3) To work with the local community and landowners adjacent to the Ōrākei Basin to advocate for land use practices which support the objectives of the Plan, which the Plan cannot address, such as erosion control, planting, weed and vermin clearance on private property.
- (4) To encourage and work with residents in the area to support the objectives identified in the Plan.
- (5) To set up a “Friends of Ōrākei Basin” group, as required by the Plan, whose purpose is to assist with education of residents regarding erosion management and weed control as envisaged by the Plan and to be responsible for carrying out approved voluntary activities working with Council staff, on local projects such as planting and weed and vermin clearance.

Membership of the group is contained to:

- a member appointed by Ngāti Whātua Ōrākei
- a member of the Auckland Water Ski Club
- a member of the Ōrākei Yacht Club
- a member of the Ōrākei Sea Scouts
- a member of the Akarana Young Mariners
- a member of Youth Town

- a member of the Ōrākei Local Board
- a council parks officer (ex officio)

No recommended action plan of prioritised works has been advocated by OBAG in line with the requirements of Policy 13. A review of previous meeting minutes for the Group indicates significant effort by Group members over the years in highlighting areas of operational focus for Auckland Council. These areas include vegetation management; user access issues involving the walkways, road access, and car parking; erosion control and stormwater management; access and water use issues for recreational water use; and operation of the sluice gates.

An advocacy function is a core focus for the Group, and is required to identify relevant works for implementing or programming to the Local Board. Education and engagement with private land owners and the wider public around appropriate land use practices, and activities that contribute to the protection and enhancement of the Basin and surrounding open space areas is also a key focus.

The Auckland Water Ski Club has advised that they support the purpose of OBAG and see it as an excellent forum for the community's views to be passed through to the Ōrākei Local Board and Auckland Council. The club has assigned an Executive Committee Member to OBAG.

Recommended management actions

- OBAG to prepare a recommended 'action plan' for advocating to the Ōrākei Local Board on prioritised works to be delivered, based on the objectives and policies contained within the management plan.
- Programme a review of the management plan to ensure the plan continues to reflect the strategic priorities and core values of Ōrākei Basin.

Objective 5: Buildings and structures

To protect and enhance the natural character of the Ōrākei Basin by ensuring that buildings and structures are appropriately designed and located.

Policy 14:

Ensure that proposals for new buildings and structures, or alterations to existing buildings, are considered in terms of:

- Need to be in the reserve
- Existing buildings are fully utilised
- Visual impacts on cultural and landscape values
- Design and materials are appropriate for the site and receiving landscape character
- Ecological impact is minimal
- Long term maintenance cost
- Structures no longer required are removed

Comment on Policy 14:

No further buildings have been added to the reserve areas since the adoption of the management plan in 2010.

Some user groups have leases or encumbrances over areas of the Ōrākei Basin. Feedback has been sought from member groups of the Ōrākei Basin Advisory Group on the utilisation of the existing club buildings and storage buildings within Ōrākei Basin West and East reserves and their capacity for expansion. The existing club room buildings on the reserves are home to:

- Auckland Water Ski Club (Ōrākei Basin East Reserve)
- Akarana Young Mariners (Ōrākei Basin West Reserve)
- Ōrākei Sea Scouts (Ōrākei Basin West Reserve)
- Ōrākei Yacht Club (Ōrākei Basin West Reserve)
- Youthtown (Ōrākei Basin West Reserve)

Feedback from the Auckland Water Ski Club indicates that their club building and surrounding structures are fully utilised. The club has approximately 300 members from throughout the Auckland region and is the eminent water ski club for greater Auckland. The club maintains facilities for families and non-skiers to enjoy the Basin both on and off the water.

Responses were not received from Ōrākei Sea Scouts, Akarana Young Mariners, and Ōrākei Yacht Club but feedback from the Chair of the Ōrākei Basin Advisory Group confirmed the buildings these groups operate from are fully utilised.



Figure 15: Clubroom buildings located on Ōrākei Basin West and East reserves

Auckland Water Ski Club has concerns that the storm water and waste water systems adjacent to the Basin are unable to cope during heavy downpours.

Projects have been implemented over the past five years relating to the retaining wall and staircase behind Auckland Water Ski Club; new water pontoons; Basin edge rip-

rap erosion control structures along the access road to the main car park; and the car park and boat ramp upgrade. There have been concerns raised about the 'over engineering' of elements of stormwater infrastructure and rock rip rap in the main car park and Scout boat ramp areas. A peer review of this completed work has been commissioned by council to identify if any alternative solutions exist to minimise the visual impact of these features while performing their required function. The review is still in progress and will be finalised in 2018.

A sample review of resource consents granted for works relating to new structures within the Basin since the adoption of this management plan show that consideration has been given in the consent decisions to the relevant matters listed in Policy 14, for example:

- Stage 1 boardwalk construction along the railway embankment (R/LUC/2004/8469) including a subsequent variation to consent (R/LUC/2004/8469-1)
 - Reduction from two to one viewing platforms to minimise visual impact
 - Consideration of appropriate materials and construction methodology
- Stage 2 walkway upgrade along the southern shoreline through Ōrākei Basin West and East Reserve, rock armouring of erosion prone parts of the shoreline, timber stairs from end of Purewa Road to Ōrākei Basin beach (R/LUC/2012/963 and Permit 40210)
 - The works were considered consistent in terms of scale and character with the modified coastal environment and other structures and activities in the Basin
 - The structures were considered to have a less than minor visual effect on the Ōrākei Basin geological feature as the works would be visually congruous with other existing rock walls in the Basin
 - The works did not adversely affect the remaining natural character values of the coastal environment

Consideration is also given to the long term maintenance cost of new structures during the planning and design for a project by council officers. This leads to decisions favouring material types that are proven to be robust and can withstand public use and exposure to environmental conditions, which then reduces the likely future cost of replacement and repair. Design standards and in-house officer knowledge and experience on appropriate material selection provides guidance in this decision making process.

Recommended management actions

- Undertake a building survey of the existing clubs and users to identify future building requirements within the Basin.

Objective 6: Walkways and access

To improve pedestrian access to and within the reserves

Policy 15:

Complete the consented walkway loop track including the pedestrian bridge across Ōrākei Creek

Comment on Policy 15:

The consented walkway loop track and pedestrian bridge across Ōrākei Creek were completed in 2011/12 and enable a continuous loop walk around the Basin. The boardwalk along the rail embankment was completed as a shared cycle / pathway in November 2010. Ōrākei

The walkway can be accessed from several pedestrian access points around the Basin, including the main entrance off Ōrākei Road, and from Lucerne and Meadowbank Roads.



Figure 16: Pedestrian bridge across Ōrākei Creek

The walkway appears popular with a range of users. A better understanding of numbers of users, who uses the walkway and for what purpose could be achieved through the placement of track counters, the use of engagement surveys, and social