

# Ōtara-Papatoetoe Local Board Ngahere Analysis Update 2021

Canopy cover changes with the  
2013 to 2016/2018 LiDAR data

Urban Ngahere Strategy 2019  
Knowing Programme



## A summary of the urban environment in Ōtara-Papatoetoe

Over  
**86,000**  
residents

**1%** of canopy cover more than **30 metres** tall

**110 parks**  
and **40 playgrounds**

**63%** of canopy cover with no statutory protection

**83** hectares of Significant Ecological Area

Only one area (Middlemore) with more than **20%** canopy cover

Average canopy cover of  
**9.6%**

across local board, including canopy cover of:

<b>14%</b>	<b>9%</b>	<b>10%</b>	<b>8%</b>
<b>on public parkland</b>	<b>on road reserves</b>	<b>on other public land</b>	<b>on private land</b>

**180**  
Notable Tree records

Nearly  
**4,000**  
hectares of land, with

**1%** of original indigenous vegetation cover remaining

**64%**  
in urban development

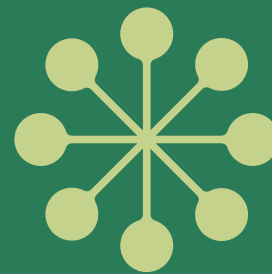
**608**  
hectares of parks, including:

- **Kohuora Park**
- **Colin Maiden Park**
- **Puhinui Reserve**

New zoning under Auckland Unitary Plan includes Mixed Housing Urban, Terrace Housing and Apartment Buildings, and Future Urban

More than **half** of total canopy cover on private land

338ha of urban forest in 2013,  
**increasing to 358ha in 2016/2018**



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Ōtara-Papatoetoe Local Board

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# 1.0 Preface

Tāmaki-Makaurau / Auckland is New Zealand’s largest city, and plantings of exotic and native trees have taken place as the region has developed. Early Māori settlers would have planted trees such as karaka, pūriri and tōtara to indicate a special place or to mark a celebration, while European settlers planted trees that were familiar and provided a sense of place. London Plane, English Oak, and European Lime trees were some of the earliest recorded plantings in Auckland. Settlers arriving from around the world commenced the history of Auckland’s diverse and unique tree cover.

When European settlers arrived to Tāmaki-Makaurau / Auckland, the gullies of the isthmus were filled with raupō, edged with a varied growth of sedges and other moisture loving plants; and slopes of gullies covered with karamu and cabbage trees. By the late nineteenth century, much of the Auckland area was under cultivation with a large number of introduced plants.

Along with residential development commencing in the mid-20th century, these actions have now reduced indigenous forest cover within the Ōtara-Papatoetoe Local Board to small fragments, primarily in local reserves.

The Ōtara-Papatoetoe Local Board has provided locally driven initiatives funding to Auckland Council’s Principal Advisor Urban Ngahere (Forest) in the Parks, Sports and Recreation Department to develop an analysis of the tree cover in its area of responsibility. This update report is the result of a programme of work by Auckland Council involving detailed analysis of urban tree coverages on public and private land, aiming to identify opportunities to nurture, grow and protect urban trees in the local board area. The analysis work is directed by the Auckland Council’s Urban Ngahere (Forest) Strategy 2019, which has 18 key objectives to help Council and local boards to deliver a healthy ngahere for a flourishing future.



## 2.0 Introduction

### 2.1 Ōtara-Papatoetoe Local Board

The Ōtara-Papatoetoe Local Board covers approximately (c.) 3,991 hectares (ha) on the southern part of the Auckland isthmus. It is well connected to the Auckland Central Business District and other parts of Auckland by both road (State Highway 1 and State Highway 20 motorways) and rail (Southern Line). The local board is made up of residential suburbs such as Middlemore, Papatoetoe, Puhinui, Clover Park, Ōtara, and Flat Bush, along with the Manukau Institute of Technology and AUT South Campuses, and the industrial and commercial areas of Puhinui and Manukau Central. A summary of key local board facts and figures is provided at the beginning of this report.

The local board area spans from Tāmaki Estuary in the north to Manukau Harbour in the south, with much of these coastal borders containing local parks and reserves. The northern and eastern parts of the local board area are predominately residential, while the southern board area includes the Manukau Central Business District (CBD). The south-western local board remains in rural productive land, including agriculture and horticulture, however this area is zoned for further future development under the Auckland Unitary Plan 2016.

At present, less than 2% of the land area of Manukau District remains under native vegetation cover (Morphum Environmental Ltd, 2017). In Ōtara-Papatoetoe, only 1% of the original indigenous vegetation cover is still present, and exotic plant species now account for approximately one quarter of the land cover. This is attributed largely to grassed reserves and residential gardens, as well as exotic specimen trees in parks

and road corridors. Continuous tracts of urban forest in the local board area are primarily limited to riparian and coastal vegetation, with mangroves being common in both the upper reaches of the Manukau Harbour and within Ōtara Creek. Key sites for biodiversity in the Ōtara-Papatoetoe Local Board include Puhinui Reserve (Manukau) and Kohuora Park (Papatoetoe).

Amongst these sensitive ecological sites and other scattered areas of vegetation, portions of the local board area are now zoned for development intensification under the Auckland Unitary Plan. The new zoning, including the Mixed Housing Urban Zone and the Terrace Housing and Apartment Buildings Zone, now allows for significantly smaller sections, particularly around Central Ōtara and Central Papatoetoe. Further urban development may also occur around Puhinui Road, as this area is zoned as Future Urban. Consequently, significant portions of the urban forest canopy are under a range of pressures from future development, which could potentially lead to irreversible changes in urban forest cover.



Indigenous restoration planting is restoring the ngahere in Puhinui Reserve

## 2.2 Study Background

‘Urban ngahere’ (‘urban forest’) comprises all the trees within a city – including parks, coastal cliffs, stream corridors, private gardens and streets – both native and naturalised exotic species. For the purposes of this report, ‘urban ngahere’ is defined as all of the trees and other vegetation three metres or taller in stature within the Ōtara-Papatoetoe Local Board, and the soil and water systems that support these trees. This urban ngahere definition encompasses trees and shrubs in streets, parks, private gardens, stream banks, coastal cliffs, rail corridors, and motorway margins and embankments. It also includes both planted and naturally established plants, of both exotic and native provenance.

The Auckland Unitary Plan offers various degrees of protection to urban ngahere and groups of trees meeting specific characteristics (e.g., pre-identified significance, vegetation by coasts or streams); however, other important urban ngahere assets have no statutory protection and can therefore be removed. The completion of a study in urban canopy cover in Ōtara-Papatoetoe is important to provide information on baseline tree distribution that future canopy cover measurements can be compared to. This baseline data also provides information on where there are pressures on canopy cover and opportunities for tree planting. Increases in canopy cover are also intended to contribute to other Auckland Council programmes such as Te Tāruke-ā-Tāwhiri: Auckland’s Climate Plan (Auckland Council 2019c).

The scale of the tree and shrub cover across Auckland is sufficiently extensive on both public and private land to make a meaningful contribution to the liveability and sense of place for its residents. Benefits of the urban ngahere include:

### Social

- Improve health and wellbeing
- Reduce the urban heat island effect
- Provide shade
- Enhance visual amenity

### Environmental

- Enhance biodiversity
- Improve air quality
- Carbon sequestration
- Improve water quality

### Economic

- Increase property values
- Reduce flood risk
- Reduce energy costs
- Reduce healthcare costs

### Cultural

- Support education
- Local food growing
- Sustain and enhance mauri
- Cultural heritage

## 2.3 Data Collection

Urban canopy cover across Auckland was mapped in 2013 (Auckland Council 2019b), and again in 2016/18 by use of LiDAR (Light Detection and Ranging). Airborne LiDAR is an optical remote sensing technology that irradiates a target with a beam of light; usually a pulsed laser, to measure an object’s variable distances from the earth surface. Two LiDAR data sets are covered in this report, collected in the years 2013 and 2016/18. The second survey (2016/18) had to be completed over two years due to unfavourable weather conditions that limited data quality. As these two LiDAR data sets provide a solid baseline for future comparative work, investigations into alternatives to LiDAR for mapping urban ngahere are currently underway.

## 3.0 Results and Discussion

### 3.1 Urban Canopy Cover Overview

Based on the 2013 data set, urban ngahere covers 9.1% of the Ōtara-Papatoetoe Local Board area, including 6.4% of roads, 13.1% of public parks, and 8.4% of private land. Further information on the 2013 data has been provided in a baseline report (An assessment of Urban Ngahere (Forest) cover and distribution within the Ōtara-Papatoetoe Local Board; Auckland Council 2019b).

Overall canopy cover increased to 9.6% based on the 2016/18 data set (Table 1). The Ōtara-Papatoetoe Local Board had an overall net increase in canopy cover of c.20 hectares over the measured time period.

This provides promising evidence that clearance of trees has not occurred to the extent that may have been predicted following removal of general tree protection.

This percentage change may not be reflective of total loss, however, as it is likely some of the forest lost has been replaced by other vegetation growing to over three metres tall. Overall, Ōtara-Papatoetoe has the second lowest forest cover of Auckland’s sixteen urban local boards. Ōtara-Papatoetoe has also retained the lowest canopy cover on public parkland of all Auckland’s urban local boards, while cover within road reserves is also relatively low. The local board also has a low proportion of ‘tall’ trees, being trees more than fifteen metres tall. Loss of larger trees over time means there is a changing structure in the forest cover, which may not be noticeable at a local scale, but on a larger one is a concern. The loss of larger trees reduces the overall ecosystem services the tree cover provides, and it will take a number of decades to see improvements. Retaining medium and large sized trees will be an essential part of increasing tree canopy coverage moving forwards.

Urban Local Board	Public open space		Private land		Roads		Other public land		Overall coverage	
	2013	2016/2018	2013	2016/2018	2013	2016/2018	2013	2016/2018	2013	2016/2018
Kaipātiki	63	64	25	25	12	14	33	34	30	30
Upper Harbour	50	52	29	30	11	13	10	11	27	28
Hibiscus and Bays	28	29	24	23	15	14	43	42	25	24
Puketāpapa	50	50	17	16	10	12	15	15	20	20
Albert-Eden	33	34	19	18	17	20	19	18	20	20
Ōrākei	25	25	20	19	14	16	20	20	20	19
Waitematā	42	43	16	15	15	17	11	10	19	19
Whau	34	34	17	16	12	13	12	12	17	17
Devonport-Takapuna	24	27	17	17	11	13	13	14	16	16
Howick	25	26	17	17	6	8	11	12	16	16
Henderson-Massey	30	32	14	14	7	8	11	12	15	15
Papakura	16	17	15	15	8	11	8	9	13	14
Manurewa	24	26	11	12	6	9	7	7	12	13
Maungakiekie-Tāmaki	21	23	9	9	10	12	11	11	11	12
Ōtara-Papatoetoe	13	14	8	8	7	9	10	10	9	10
Māngere-Ōtāhuhu	14	14	7	7	7	9	8	8	8	8

Table 1: Urban ngahere in Auckland’s urban local board areas: data includes percentage cover (to nearest whole number) of urban ngahere for different land tenures, and the overall percentage cover of urban ngahere within each board, with a comparison between the 2013 and 2016/18 data sets.



## 3.2 Canopy Distribution across Ōtara-Papatoetoe Local Board

The urban ngahere is not distributed evenly throughout the local board, as shown in **Figures 1 and 2**, which display variation by statistical area. Middlemore has at least twice as much percentage urban ngahere cover as most of the local board statistical areas, largely due to the presence of the golf course and hospital. Cover is lowest in the industrial and commercial centres, including Botany Junction, Rongomai East and Manukau Central. The eastern residential areas also have relatively low coverage.

Increases in overall canopy cover between the two data sets are most apparent in Manukau Central and Papatoetoe West, both locations of which have had extensive revegetation planting. Planting areas include Kohuora Park, Puhinui Reserve, riparian planting around Puhinui Stream in the Manukau Town Centre, and planting along the southwestern motorway.

Small decreases in overall canopy cover occurred between 2013 and 2016/18 in Botany Junction, attributed to mainly to redevelopment of commercial and industrial sites. Canopy cover will increase in this area in future, given the extensive planting that has been carried out around the eastern stream channels. Papatoetoe North has also had some small decreases due to clearance of trees around the rail corridor.

Over the whole local board, analysis shows gaps in urban ngahere are generally associated with two categories, the first being high density buildings in industrial and commercial areas. These are mainly found in Manukau Central and in East Tāmaki which fringes the northeast of the local board. Such areas feature extensive buildings and carparks with very little vegetation present, such as around the Farmers Headquarters and Lion Nathan Brewery on Ormiston Road. Other commercial areas, such as Plunket Ave in Manukau Central, have vegetation present that is less than three metres tall, so does not provide the benefits that larger trees do.

The second category of urban ngahere gaps on a local scale is associated with extensive grasslands typical of sports fields and large recreation reserves. In the Ōtara-Papatoetoe Local Board this includes Puhinui Reserve, Colin Dale Park, Manukau Sports Bowl, Rongomai Park, and larger school complexes such as Aorere College. While planting urban ngahere within the sports complexes is not feasible, works could involve increasing forest cover on the edges of the fields and elsewhere in the parks. At Rongomai Park, for example, restoration planting has been undertaken around the stream and wetlands to the south of the sports fields. Further ongoing effort is required.



Ōtara Creek reserve, Ōtara



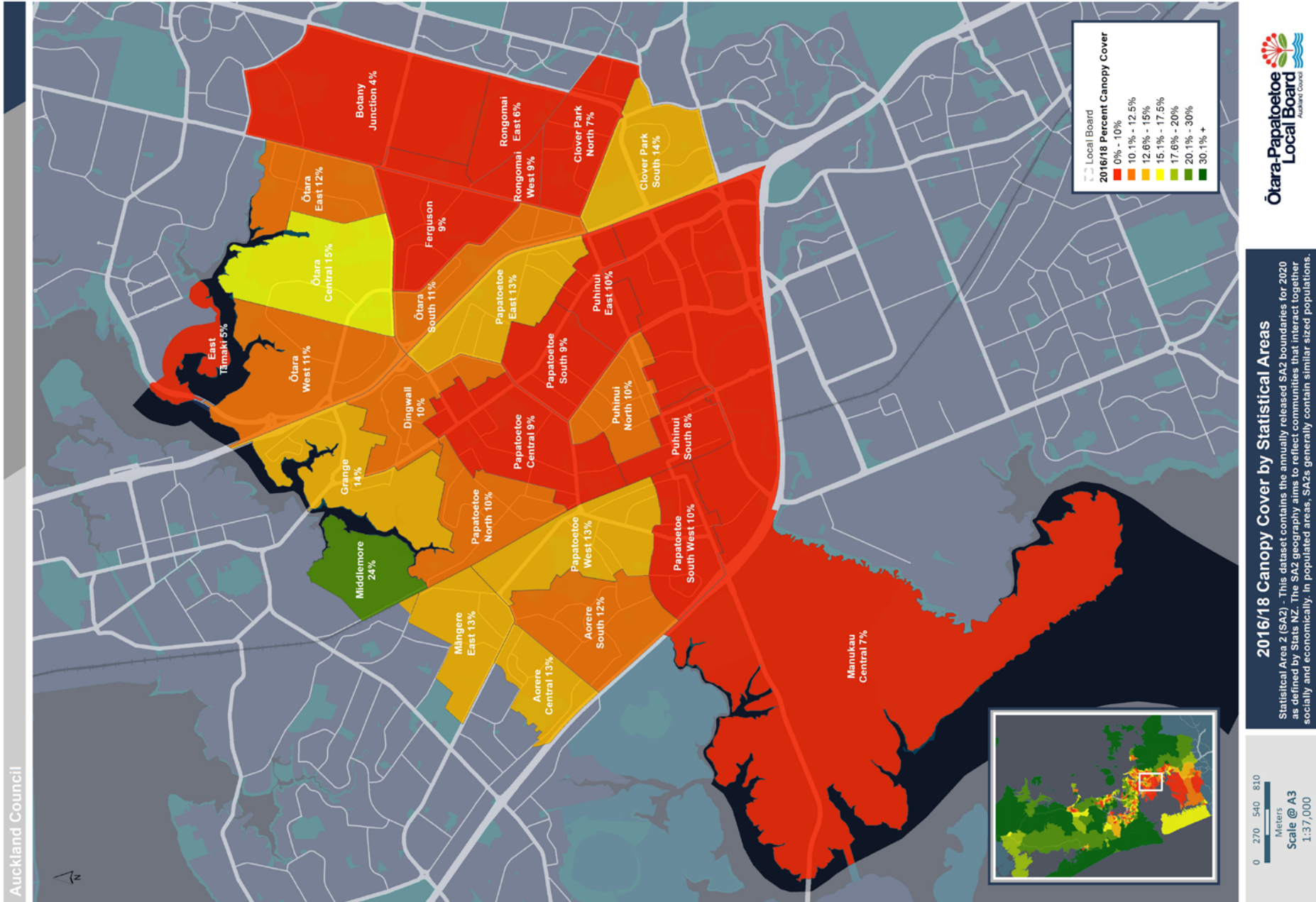


Figure 1: 2016/18 Canopy Cover by Statistical Areas

# Te matomatotanga o Te Ngahere-a-Tāone Te Rohe o Ōtara-Papatoetoe

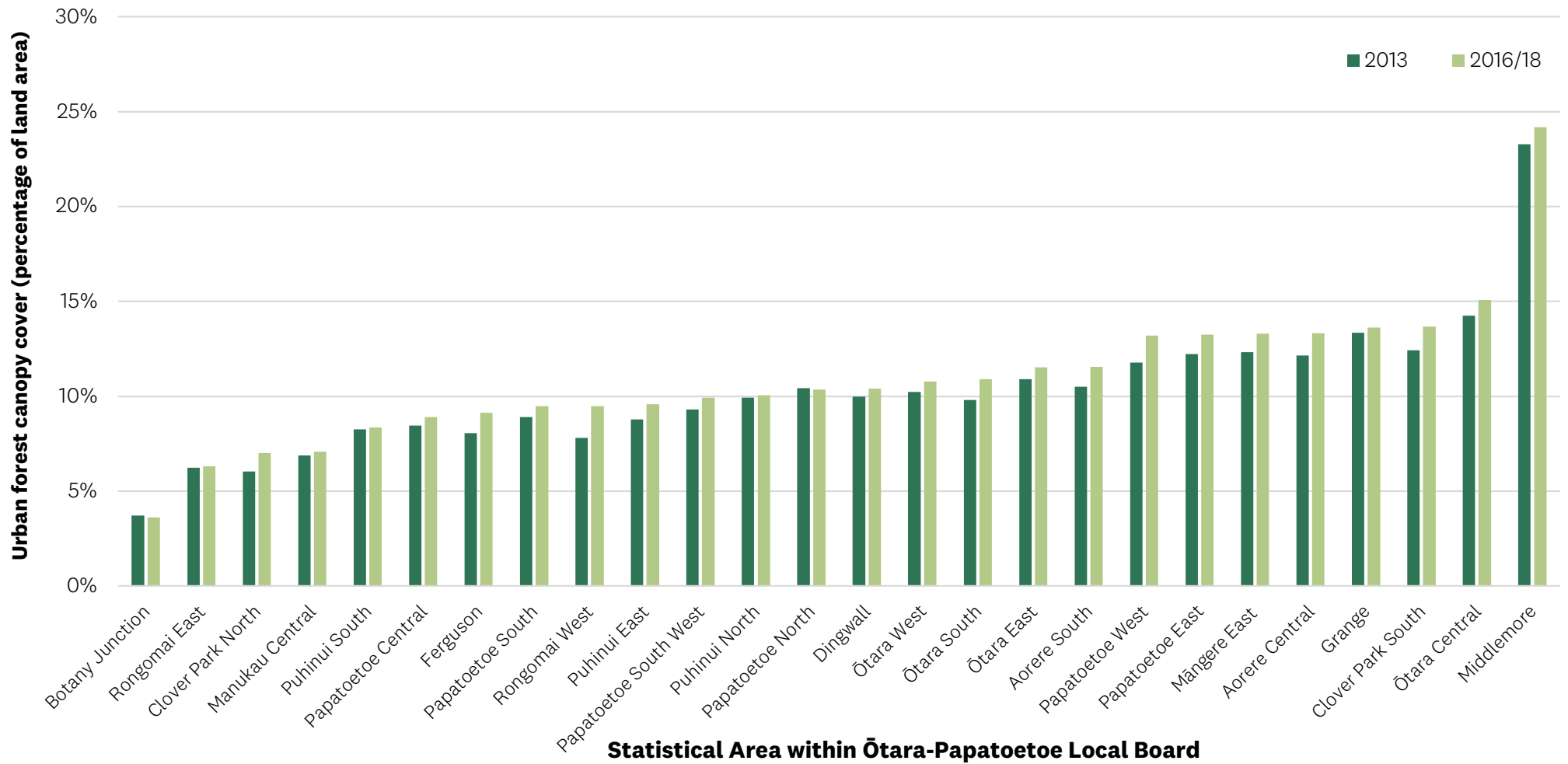


Figure 2: Spatial distribution of urban ngahere canopy within the statistical areas of Ōtara-Papatoetoe Local Board

### 3.3 Urban Ngahere Canopy Height

LiDAR data includes a height component, and this information was used to split the recorded canopy cover into different height categories: 3-5 metres; 5-10 metres; 10-15 metres; 15-20 metres; 20-30 metres; and taller than 30 metres. This data is representative of canopy cover height, rather than tree height, as each individual tree may be recorded in several categories.

The height class distribution of the urban ngahere canopy within Ōtara-Papatoetoe Local Board is displayed in **Figure 3**. In 2013, approximately one quarter of the canopy cover was between 3-5 metres tall, one half between 5-10 metres tall, and the remaining quarter represented canopy taller than 10 metres. This distribution remained similar in the 2016/18 data sets, although the percentage of canopy cover over 10 metres tall slightly decreased, being replaced by an increase in canopy cover 3-5 metres tall.

This data shows only low presence of tall canopy cover within the local board area, with all cover taller than 15 metres (including height categories 15-20 metres, 20-30 metres, and 30 metres plus) representing approximately 12% of the total urban ngahere canopy assessed.

Research has shown that many of the benefits attributed to urban ngahere are disproportionately provided by larger trees (Davies et al. 2011, Moser et al. 2015). Large trees typically create more shade per tree due to a larger and wider canopy spread (Moser et al. 2015); intercept larger amounts of particulate pollutants and rainfall due to significantly larger leaf areas; contain more carbon and have higher carbon sequestration rates (Beets et al. 2012, Schwendenmann and Mitchell 2014, Dahlhausen et al. 2016). Additionally, trees are often less susceptible to careless or malicious vandalism by the general public once established; can be pruned to provide higher canopy clearance over roadways; carparks and pedestrian footpaths; typically contribute more to calming and slowing traffic on local streets than small trees; and absorb more gaseous pollutants. It is therefore an immediate priority to retain existing large trees across the local board area to ensure the positive benefits of these are not lost. The Ngahere strategy (Auckland Council 2019a) specifically highlights the importance of retaining trees that are over 10 metres in height to maximise the benefits that trees of this size and larger provide.

The increase in proportion of shorter vegetation in the 2016/18 data set indicates existing vegetation reaching the height at which it qualifies as urban ngahere for the purposes of this study, which was selected as three metres to allow for more accurate data collection. This vegetation is likely to include restoration planting efforts associated with recent development, for example the subdivisions occurring in Flat Bush and the completion of the State Highway 20 motorway extension. Annual restoration planting is also progressively occurring around the Puhinui Stream and tributaries of the Ōtara Creek.

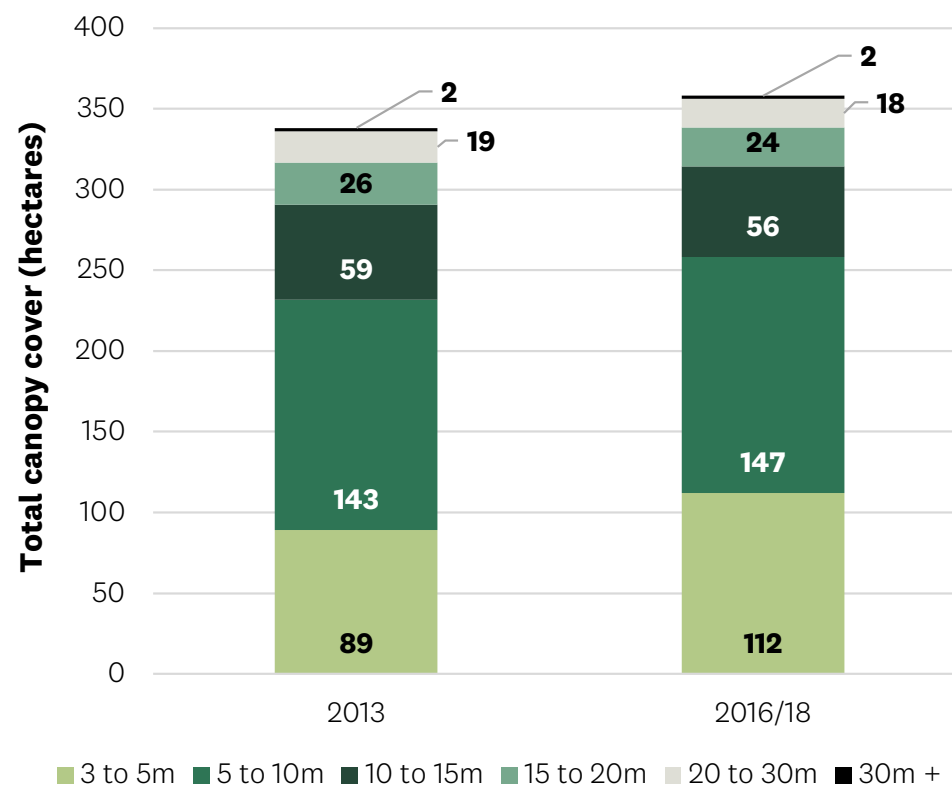


Figure 3: Height class distribution of urban ngahere canopy across all land tenures within Ōtara-Papatoetoe Local Board



### 3.4 Urban Forest Tenure

The tenure of urban ngahere described in this report relates to the zoning and ownership of different land parcels within the local board. Publicly owned land is described as either ‘public parks’ or ‘other public land’ (e.g. schools, Council-owned property), trees in the road corridor/road reserves are described as ‘street trees’, and privately owned land (residential or commercial) is described as ‘private land’.

The tenure distribution of urban ngahere canopy within the Ōtara-Papatoetoe Local Board is displayed in **Figure 4**. Slightly over half (53%) of the urban ngahere is located on private property. Public Parks and other publicly owned land (e.g., schools) contain a similar proportion of urban ngahere, being 22% and 16% of the total urban ngahere cover, respectively.

Public parks have the highest proportion of urban ngahere coverage relative to area out of all the land tenures, as shown in **Figure 5**, followed by private land. There has also been an increase in urban ngahere canopy in public parks, as well as road reserves/road corridors, between the two survey data sets. The percentage canopy cover of other public land and private land has stayed the same.

Street trees have a lesser role in the provision of urban ngahere in Ōtara-Papatoetoe, with the coverage of this land tenure (9%) being relatively low compared to other urban local boards. The recommendation to address this is to protect existing street trees wherever possible and increase efforts to establish new street tree plantings.

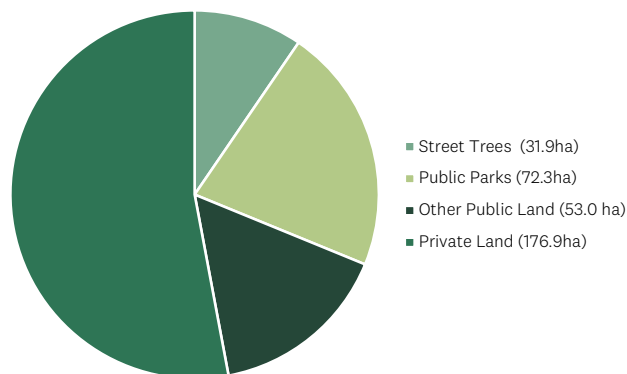


Figure 4: Tenure of urban ngahere canopy within Ōtara-Papatoetoe Local Board (Auckland Council 2019b)

Areas where street trees have less prominence, such as Botany Junction and Middlemore, provide a good opportunity to increase urban ngahere cover within the local board that will provide long term benefits to communities. The net increase in urban ngahere cover in the road corridor from the most recent data set indicates initial actions to increase canopy cover are proving to be successful, along with growth of existing street trees.

Approximately half of the urban ngahere in Ōtara-Papatoetoe is located on private property, which is reflective of parts of the local board being developed in the first half of the 20th century (Auckland Regional Council, 2010). This has allowed nearly 100 years of urban development within the local board, including the establishment of urban ngahere in private gardens and lawn areas. The first developed areas, being Ōtara and Papatoetoe, have more forest than other suburbs, whilst Middlemore has the highest forest coverage relative to land area. However, based on this history, the urban ngahere cover on private land is much lower than would be expected, with only 8% total coverage. This is attributed to both a lack of trees on residential properties, and a large amount of privately owned commercial and industrial land. Tree planting programmes on both accounts would ensure the proportion of canopy cover on private land increases in future data collection.

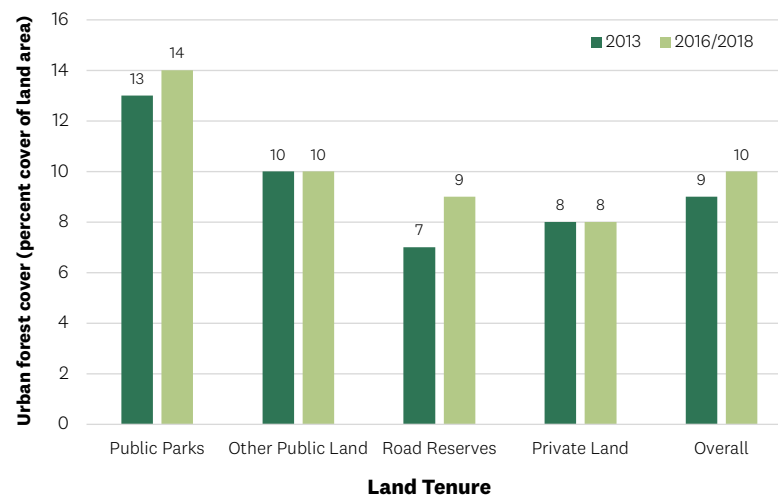


Figure 5: Change in urban ngahere cover of different land tenures in Ōtara-Papatoetoe Local Board between 2013 and 2016/18

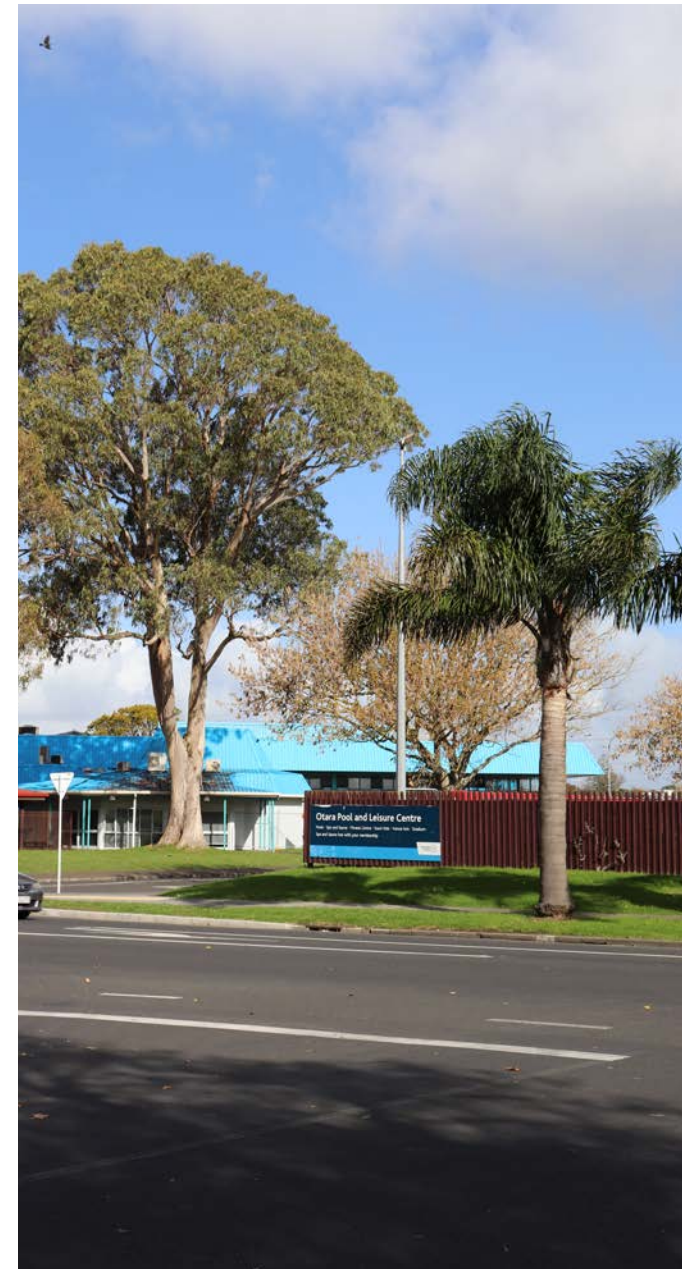
## 3.5 Urban Ngahere in Relation to Growth Pressures

The Significant Ecological Area overlay (SEA; **Figure 6**) prioritises the areas of urban ngahere in Ōtara-Papatoetoe with the highest ecological value, providing a starting point for protection. With future development and urban intensification, however, SEA and other continuous areas of urban ngahere are at risk. Canopy cover in relation to the Auckland Future Urban Land Supply Strategy (Auckland Council 2017) forecasting areas of growth is shown in **Figure 7**. Several areas of Ōtara-Papatoetoe, including the town centres of Ōtara and Papatoetoe, have land zoned as ‘Residential – Terrace Housing and Apartment Buildings’ in the Auckland Unitary Plan, which is the highest density zone for urban residential development. The western part of the local board is also zoned as Future Urban land, to be developed when infrastructure allows and when a Structure Plan has been completed (Auckland Council 2017).

Converting existing rural and residential properties into these new land uses could lead to greater loss of urban ngahere, particularly in regard to trees that can be removed as a permitted activity (i.e., no statutory protection), as tree removal either within the site or on adjacent road reserves may increase the development potential of the site. This is of particular concern for taller trees, as replacement plantings will take many decades to achieve the same height and associated benefits as the canopy cover that has been lost. Structure Planning for future urban areas also requires consideration of existing natural heritage values.

Correspondingly, incorporating urban ngahere plantings in new developments will become essential in retaining and increasing urban ngahere cover throughout the board area, particularly as rural land is converted to urban use. A long-term focus on public parks over time will make these more attractive for local residents who will have progressively less open space on private properties as a result of urban intensification (Ōtara-Papatoetoe Local Board, 2017). Urban design of new streetscapes will also be important in ensuring appropriate provisions for trees in road reserves, and planting of indigenous species or trees with other notable characteristics, for example rarity or cultural value, will increase the chances of these trees having a higher protection status in the future.

The relatively recent conversion of farmland in the northeast of the local board to the Bishops Gate Business Centre provides a good example of a development which has increased, rather than reduced, urban ngahere cover. This development incorporated a large degree of native restoration planting around the margins of the developed land, as well as extensive planting in road reserves and carparks. However, more work is needed in Botany Junction given the still low canopy cover compared to other parts of the local board.



Exotic plantings in Ōtara



# Te matomatotanga o Te Ngahere-a-Tāone Te Rohe o Ōtara-Papatoetoe

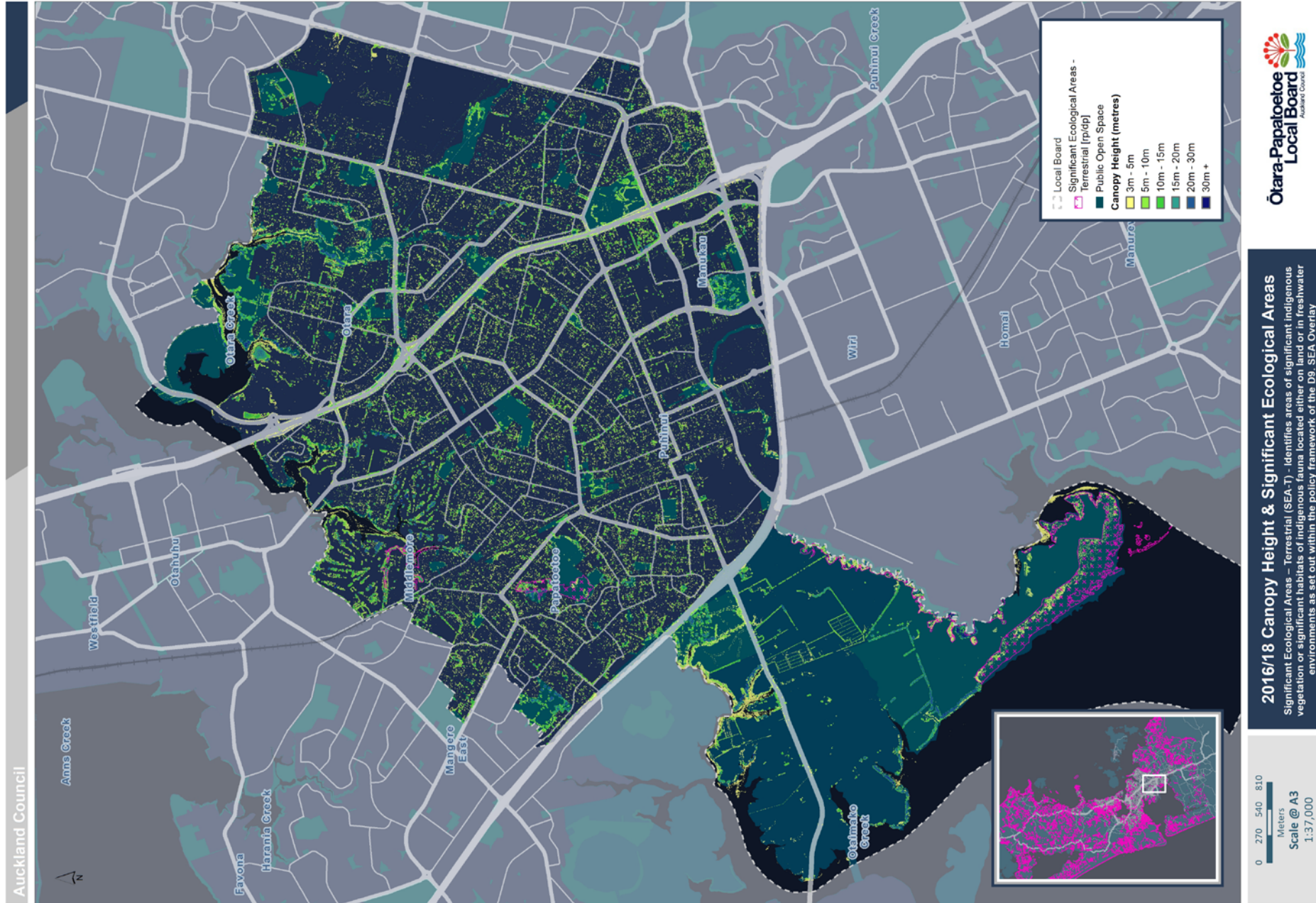


Figure 6: 2016/18 Canopy Height & Significant Ecological Areas



# Te matomatotanga o Te Ngahere-a-Tāone Te Rohe o Ōtara-Papatoetoe

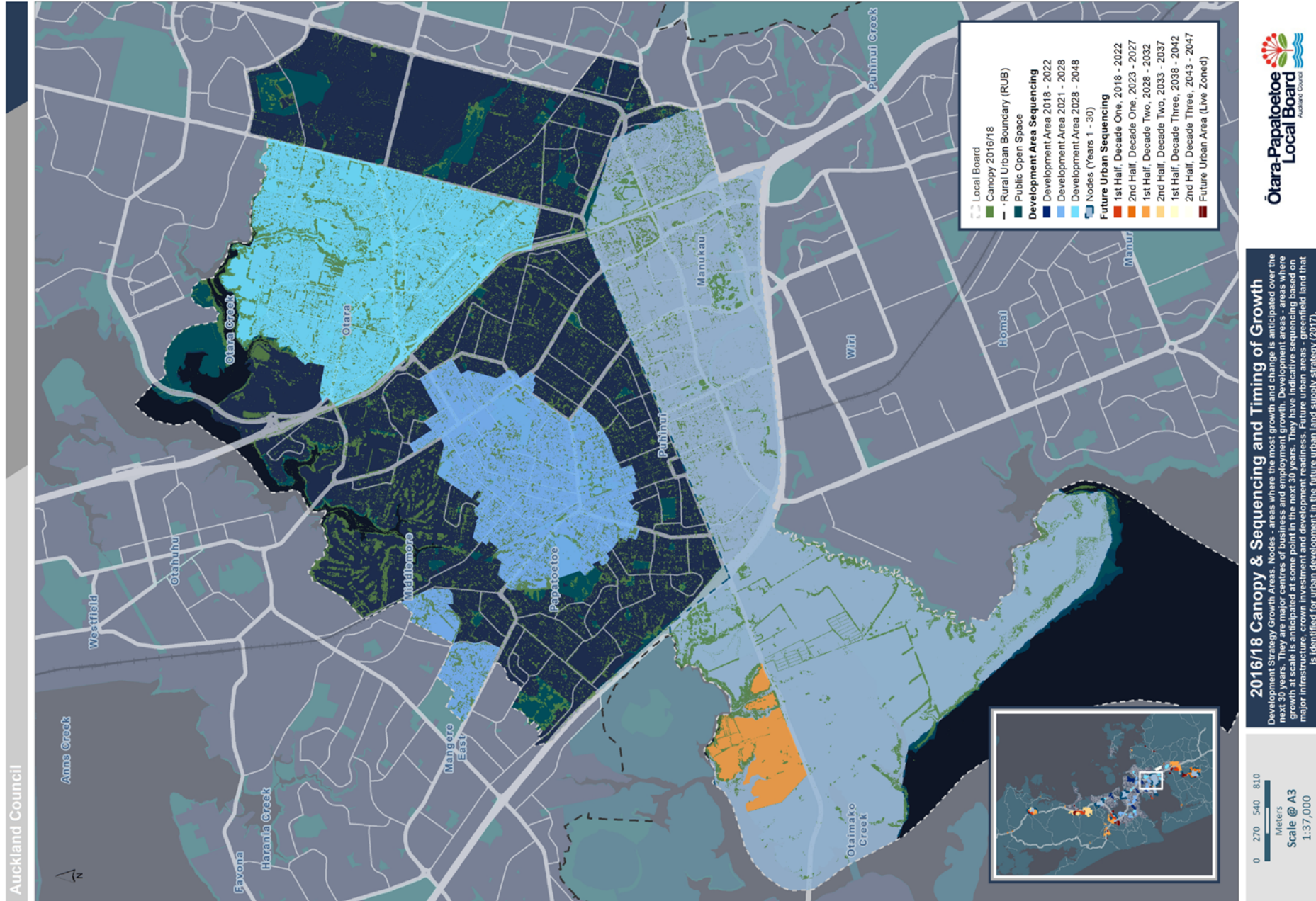


Figure 7: 2016/18 Canopy & Sequencing and Timing of Growth

## 3.6 Recommendations

Recommendations for future urban ngahere management to the Ōtara-Papatoetoe Local Board include:

- Implement the Ōtara-Papatoetoe Local Board Urban Ngahere Action Plan 2021
- raise awareness of the importance of current rules for tree and vegetation protection, including the Significant Ecological Area and Notable Tree overlays
- seek to place a submission on the new Resource Management Act to advocate for the inclusion of rules to enable tree protection to take place at a local scale
- raise awareness of the value and benefits of urban tree canopy coverage and provide advice and assistance to private landowners looking to plant trees on their properties
- initiate tree planting programmes in industrial and commercial areas, and at unused areas of public parkland e.g., Puhinui Reserve
- continue and expand new tree planting around Puhinui Stream and tributaries of the Ōtara Creek and Lake

- undertake connectivity analysis of urban tree canopy coverages (e.g., along streets and watercourses) and determine target locations for increasing cover in parks and road reserves to create ecological corridors to other concentrated vegetation
- facilitate further work with local and central government agencies (including Waka Kotahi, KiwiRail, Kāinga Ora) along with private business to seek funding opportunities for new tree planting using the ‘right tree in the right place’ principle
- continue carrying out urban canopy cover analysis on a regular basis to monitor trends and increases throughout the local board area.

The metrics of the canopy analysis will be used to help inform and prioritise the efforts of the Ōtara-Papatoetoe Urban Ngahere Action Plan. The action plan highlights the areas to plant new trees and sets out the process to fund, implement, and find ways to protect and nurture existing ngahere on public and private land.



Trees are an important part of the streetscape



## 4.0 Acknowledgements

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- Content prepared by Jessica Reaburn (Wildland Consultants Ltd).
- Technical advice and peer review completed by Howell Davies (Principal Advisor Urban Ngahere (Forest), Community Services – Parks, Sports & Recreation, Auckland Council).
- Data and GIS-based figures prepared by Grant Lawrence (Research and Evaluation Unit, Auckland Council).
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- Graphics and formatting completed by Q Brand Agency.

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