Rotorua District Employment, Population, Household and Visitor Projections

for Rotorua Lakes Council

March 2020

Infometrics

Economics put simply

Authorship

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Projections

Rotorua Lakes Council (RLC) commissioned Infometrics to produce population, household, employment and visitor projections for the Rotorua District. The following section outlines the projection results.

Summary

Employment in Rotorua is forecast to increase by an annual average of 0.78%pa between 2019 and 2051 driven by growth in public administration and safety, health care and social assistance, education and training, and arts and recreation services industries.

In addition to job opportunities, Rotorua is expected to continue to benefit from having housing that is relatively affordable compared to other nearby urban centres such as Auckland, Hamilton and Tauranga, which will encourage further inter-regional migration to Rotorua in the near-term.

The near-term influx of inter-regional migrants is projected to result in a bulge in the main childbearing age groups in Rotorua in the early 2030's and consequently a bulge in the number of births.

Labour shortages expected to develop in Rotorua from the mid 2030's. With people retiring in increasing numbers, growth in Rotorua's employment demand is expected to draw working migrants into the region.

Offsetting these drivers of population growth is a rise in deaths as the population ages, and an outflow of young people aged 15-24 which has a strong historical precedent and is expected to continue throughout the projection period.

Projected growth in the population translates into projected growth in the number of households. With the average household size expected to fall due to the ageing population, the number of households is projected to grow faster than the population – an annual average household growth rate of 0.8%pa compared with an annual average population growth rate of 0.6%.

In addition to its resident population, Rotorua is projected to experience strong growth in the number of visitors. Overnight visits (both domestic and international) are expected to grow from around 2.8 million in 2019 to approximately 4.5 million in 2051 while domestic day visits are expected to grow from just over 3.1 million in 2019 to just under 4.3 million by 2051.

Covid-19

We have not taken into account the impact of the Covid-19 pandemic in any of our projections. This is because, at the time of writing, the situation is still relatively new and evolving rapidly. Consequently, the full economic and demographic effects of the pandemic, and government measures to contain it, remain unclear. We will have a much better idea of what the post-pandemic future looks like when labour market statistics for

the June 2020 quarter are released by Stats NZ in mid-August. Infometrics will be able to revise the projections outlined in this report from September 2020.

The remainder of this section is devoted to outlining our current projections of national employment, international visitors and international migrants and discussing their implications for Rotorua.

Employment projections

Rotorua Lakes Council (RLC) requested baseline employment projections for Rotorua District by industry and occupation from 2020 to 2031 inclusive, and then for the years: 2036, 2042, 2046 and 2051.

In 2019, 35,600 people were employed in Rotorua District. This estimate does not take into account any falls in employment resulting from the Covid-19 virus. By 2051, we estimate that an additional 10,000 people will be employed in Rotorua. This projected growth equates to an annual average growth rate of 0.78%pa from 2019-51 compared with 1.04%pa growth from 2001-19.

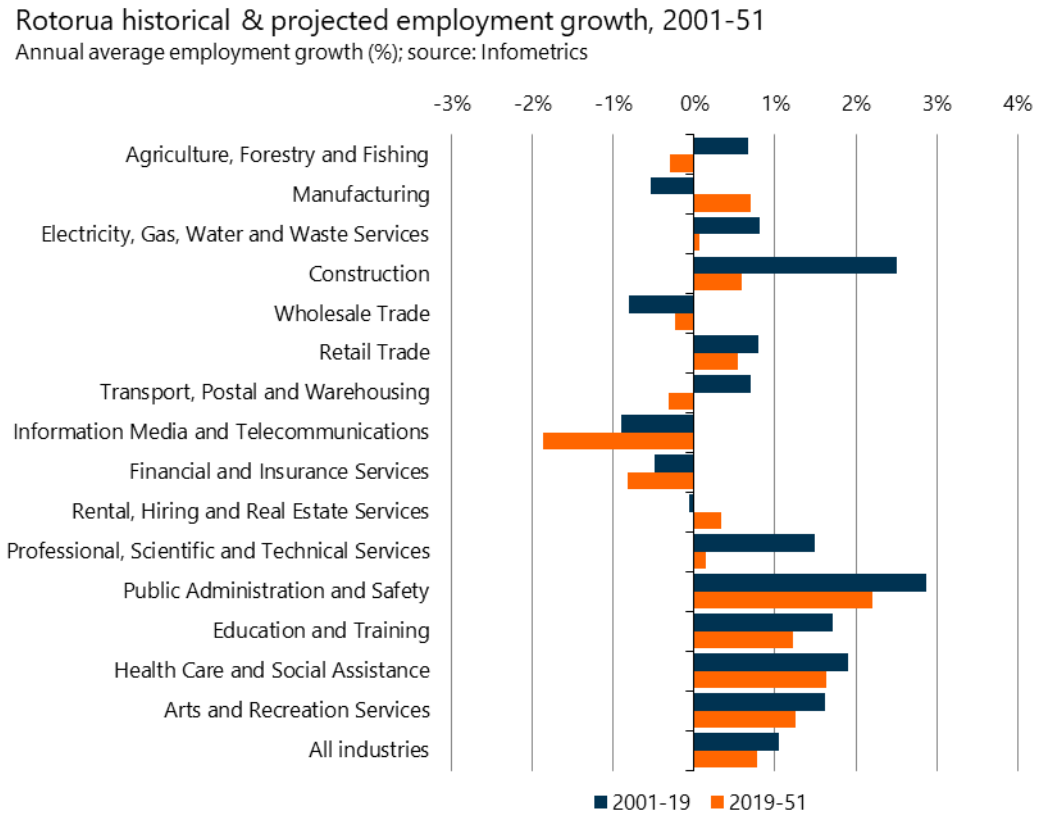
Projected employment growth is expected to be faster in the first half of the projection period then slow in the second half as automation across many industries reduces the demand for labour and skills, and the ageing Rotorua population constrains the size of the available workforce. Between 2019 and 2036, an additional 7,100 people will be employed in Rotorua (an annual average growth rate of 1.08%) compared with an additional 2,900 people between 2036 and 2051 (an annual average growth rate of 0.43%).

Industries

Between 2001 and 2019 employment growth in the public administration and safety and construction industries averaged 2.86%pa and 2.51%pa respectively, and employment growth in the health care and social assistance, education and training, arts and recreation services, and professional, scientific and technical services industries all exceeded 1.5%pa. See Figure 1.

Between 2020 and 2051, strong employment growth is projected to continue in the public administration and safety, health care and social assistance, education and training, and arts and recreation services industries. Employment growth in construction and professional, scientific and technical services industries is projected to be much slower than it has been in the past.

Figure 1



Public administration and safety

The public administration and safety industry has experienced strong employment growth in the past 19 years mainly because of an increase in police services and, to a lesser extent, central government agencies transitioning their functions out to regional centres. We assume that the growth in police services and central government functions in Rotorua will continue.

Health care and social assistance; Education and training; Arts and recreation

The health care and social assistance industry is projected to grow to serve the growing and ageing population. Employment growth in education and training is projected to occur across pre-school, primary, secondary and vocational education providers and is a consequence of the growing population. Continued growth in arts and recreation services is expected to be driven by projected growth in visitor numbers.

Construction

The construction industry is expected to grow from 2,700 to 3,300 between 2019 and 2029 (annual average 2.03%pa) in order to keep pace with population growth and eliminate the housing shortage in Rotorua. Beyond 2029, employment in construction is expected to decline slightly as population and household growth moderates.

Manufacturing

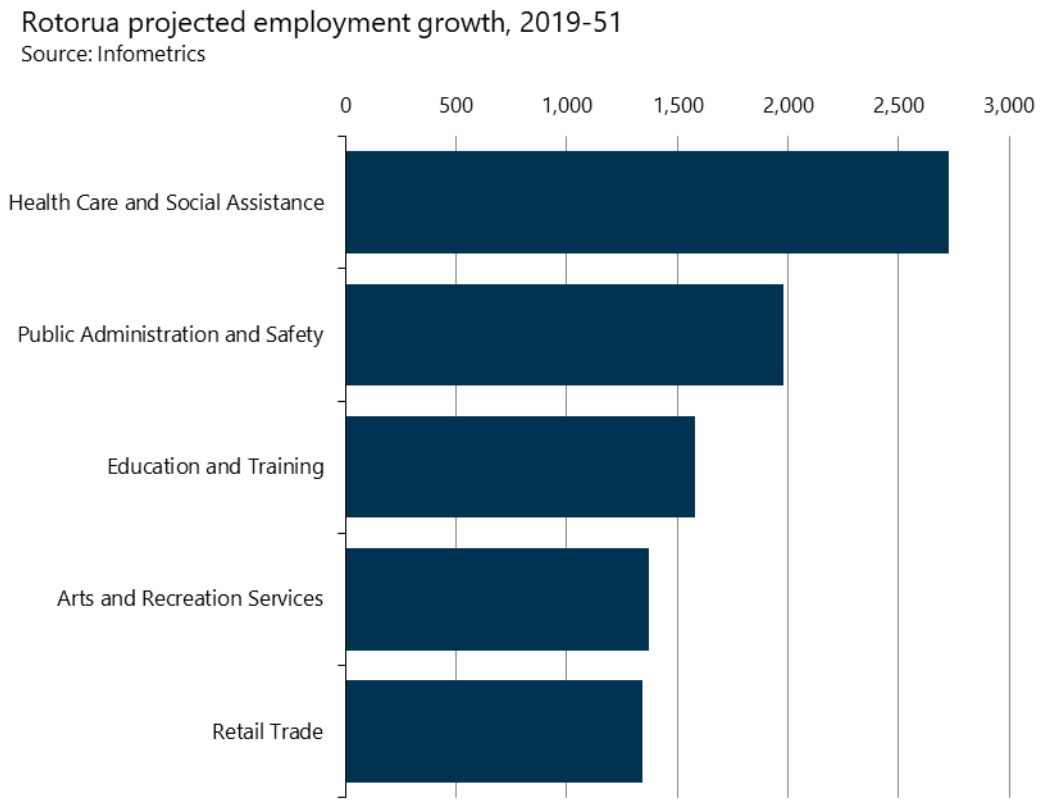
Manufacturing employment in Rotorua is projected to grow by an average of 0.70%pa between 2019 and 2051, in contrast to a 0.54% decline between 2001 and 2019. In the past 19 years, Rotorua's declining manufacturing employment was due largely to falling employment in wood processing. Looking forwards, harvesting volumes are expected to support employment in wood processing at its current level for the next 11 years, after which employment will decline out to 2051. However, the rate of decline in wood processing is projected to be slower than it has been in the past and will be more than offset by increasing employment in the manufacture of fabricated metal products, transport equipment and other machinery.

Job creation

Figure 2 shows the industries in which the most jobs will be created between 2019 and 2051. The health care and social assistance, public administration and safety, education and training, arts and recreation services and retail trade industries are expected to see a total of 9,000 additional jobs by 2051, accounting for almost all the of 10,000 additional jobs during this time.

In the retail trade industry, the accommodation and food services industry is projected to create most jobs as a consequence of growing visitor numbers. Employment in supermarkets and grocery stores is expected to decline slightly due to automation.

Figure 2



Industries where employment is projected to decline

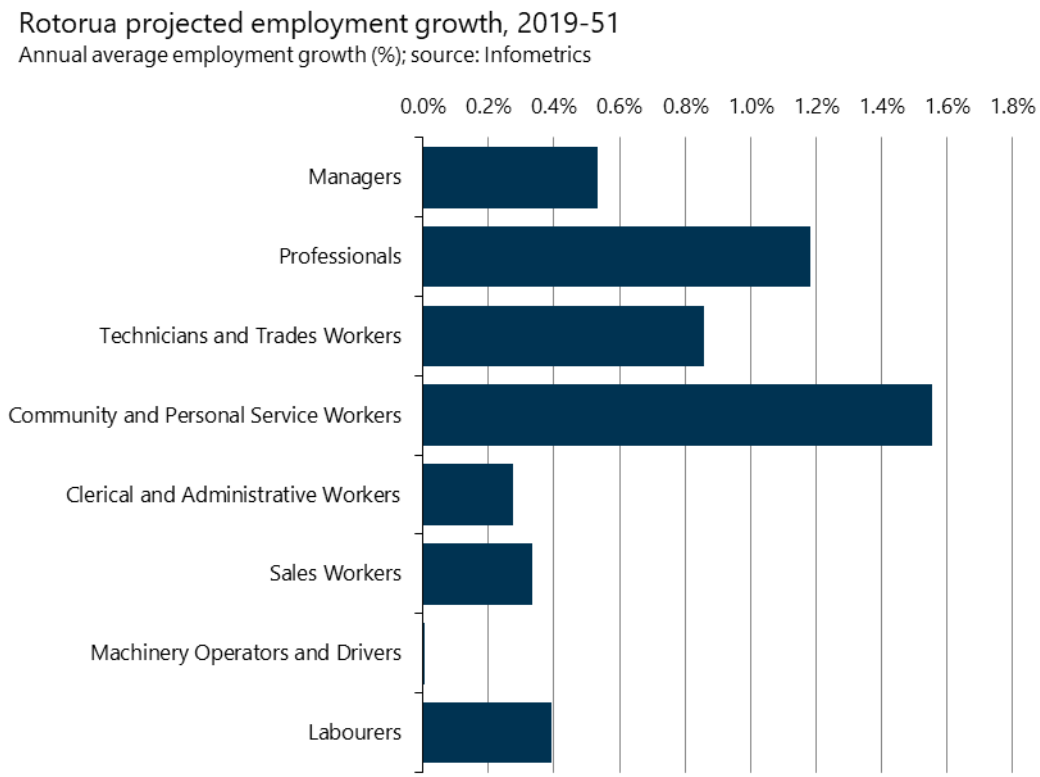
Under the baseline employment growth scenario, the agriculture, forestry and fishing, wholesale trade, transport, postal and warehousing, information media and

communications, and financial and insurance services industries are all projected to see employment decline due to the effects of automation. The transport, postal and warehousing industry is projected to see declines in road transport which reflect constraints on New Zealand's ability to grow its volume of food and forestry exports (and therefore the freight services required to get these goods to ports), as well as a shift away from road transport towards rail in response to a rising carbon price.

Occupations

Employment of community and personal service workers is projected to grow the fastest between 2019 and 2051 (annual average of 1.56%pa), driven by growth in the health care and social assistance industry. Significant growth in the employment of professionals (1.18%pa) driven by growth in the public administration and safety, education and training, and health care and social assistance industries, and technicians and trades workers (0.86%pa) driven by growth in the construction industry is also projected. See Figure 3.

Figure 3



Only the employment of machinery operators and drivers is projected to not increase over the next 30 years. This is despite the manufacturing and construction industries projected to grow and reflects the high potential for tasks relating to machinery operation to be automated.

In terms of job creation, the next 30 years is projected to see almost 3,800 professional jobs created in Rotorua, 2,500 community and personal service jobs, 1,400 technicians and trades worker jobs, and 1,200 managerial jobs. See Figure 4.

Figure 4

Rotorua projected employment growth, 2019-51
Source: Infometrics

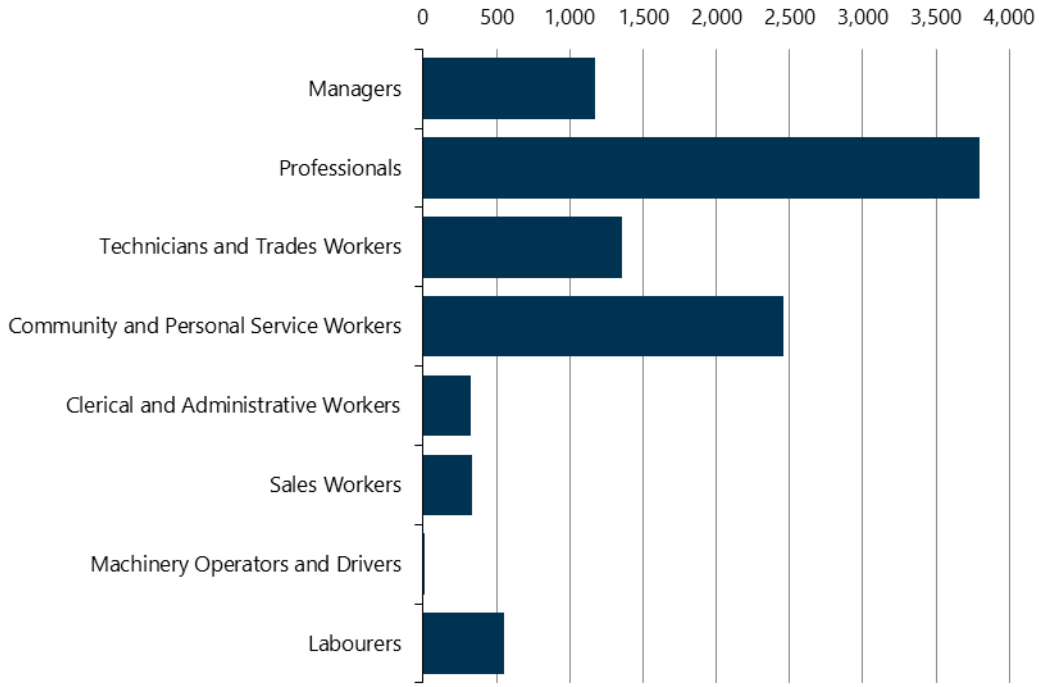
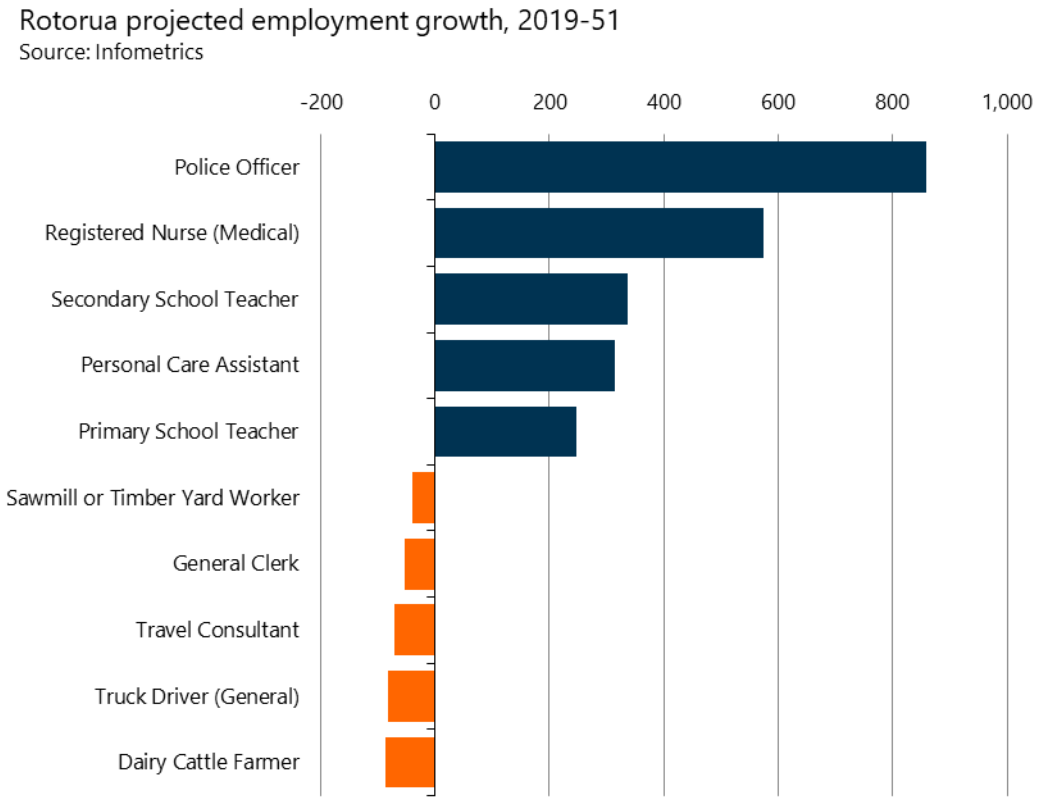


Figure 5 shows the top five occupations that are projected to grow the most between 2019 and 2051 and the five that are projected to decline the most. The strong growth of police officers, nurses and teachers reflects the projected growth in professional occupations. The growth in personal care assistants reflects the growth in the health care and social assistance industry.

The projected decline in truck driver jobs reflects a projected decline in road transport employment resulting from constraints on New Zealand's ability to grow its food and forestry export volumes, a shift towards rail transport in response to a rising carbon price and a degree of automation. Declines in the employment of timber yard workers reflects a forestry sector in which harvesting volumes are not expected to increase significantly over the next 30 years as well as the potential for such jobs to be automated. Declines in the employment of dairy farm workers reflect constraints on the availability of land for dairy farming and a shift away from less intensive agriculture.

Figure 5



Accelerated Automation scenario

The Accelerated Automation scenario assumes employers adopt technology at a faster rate than they have in the past. This scenario captures the effects of certain jobs being lost as their tasks are replaced by computers or machines, the implementation of new technologies resulting in new jobs being created to support the new technology, and automation making some industries more competitive, enabling them to grow faster.

Price Waterhouse Coopers[1] usefully conceives three waves of automation – algorithm, augmentation and autonomy - expected to be deployed over the next 25-30 years. Algorithm automation involves automating simple computational tasks in structured environments and is already being deployed this decade, for example with real-time calculation of accounting metrics in Xero. Augmentation is the next wave of automation, expected to impact in the coming decade. This affects routine tasks which involve dynamic interaction with semi-controlled environments, such as clerical workers filling out forms or exchanging information, or process workers operating machinery in a manufacturing setting. Autonomy, where end-to-end tasks are automated, is the most difficult to achieve and is expected to arrive in the 2030s. This involves real-time problem solving in dynamic environments, such as driving vehicles on public roads or assembly of components on a construction site.

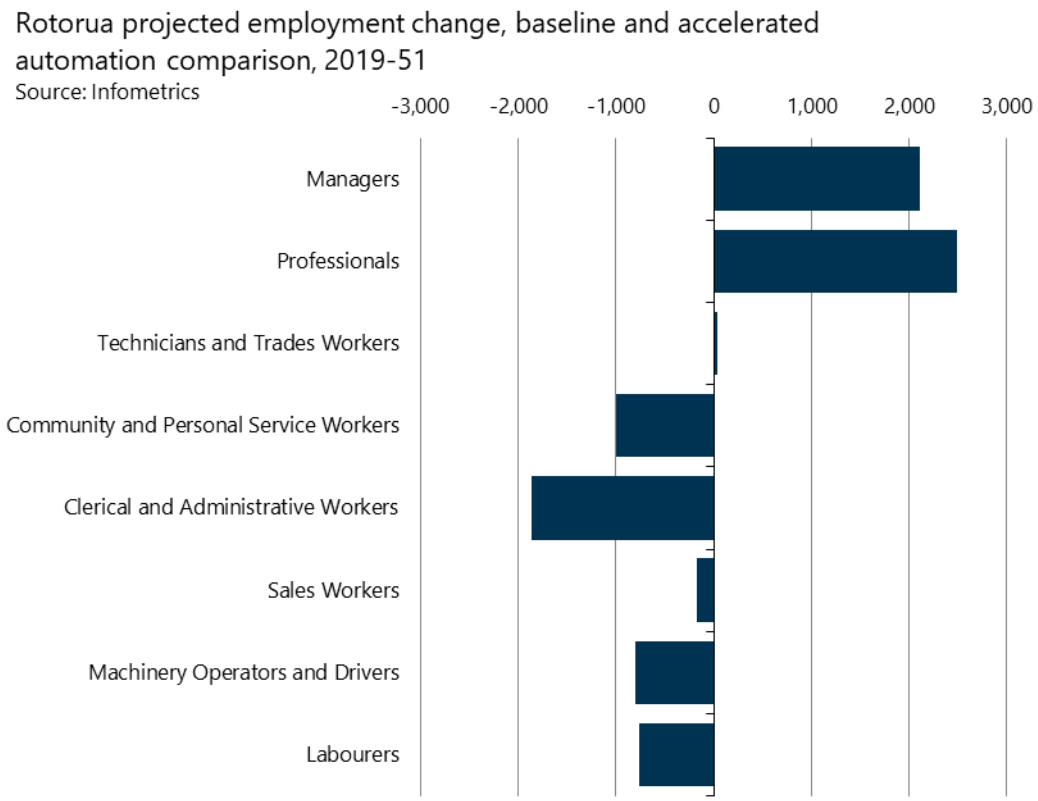
[1] https://www.pwc.co.nz/pdfs/2018pdfs/impact-of-automation-on-jobs-Feb-2018.pdf

The *Accelerated Automation scenario* section in the Methodology chapter, has further details about the methodology used to create these projections.

A key assumption is that automation does not result in a net loss of jobs, but it accelerates the transition away from lower-skilled occupations which will be increasingly automated such as clerical/administrative workers, community and personal service workers, labourers and machine operators and drivers, towards higher-skilled occupations that are less susceptible to automation such as managers and professionals (particularly teachers and nurses) which require social intelligence (tasks involving negotiation, persuasion or care) and creative intelligence (coming up with new ideas) of which a machine is not capable.

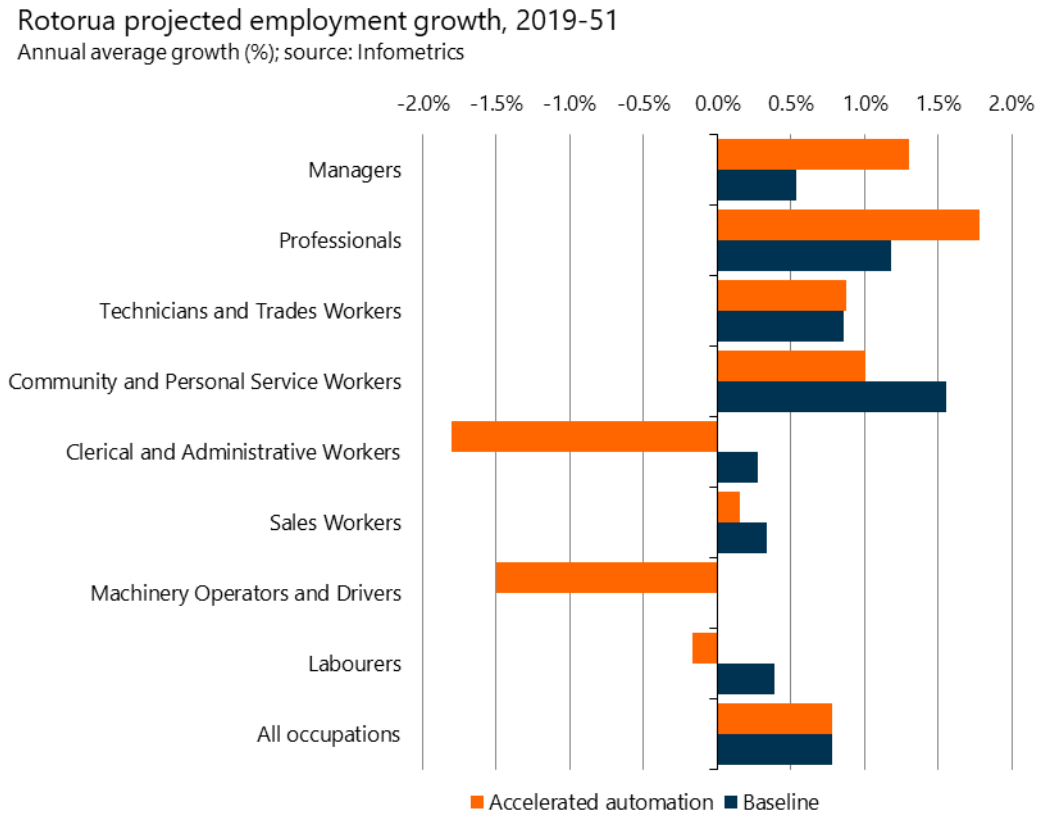
Figure 6 demonstrates this redistribution of jobs by showing the difference between the employment projections under the baseline and accelerated automation scenarios. For example, an additional 300 clerical and administrative workers are projected to be created under the baseline compared with 1500 fewer under the accelerated automation scenario, the difference being 1800 jobs.

Figure 6



The precise effects of accelerated automation on employment growth in each occupation group are shown in Figure 7.

Figure 7

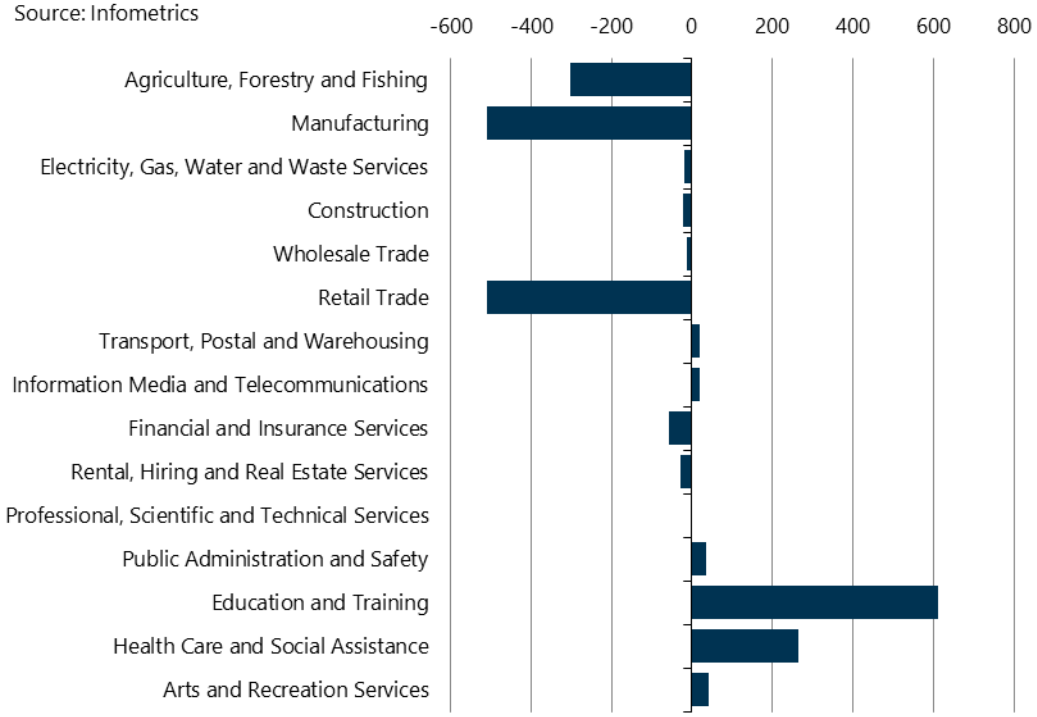


Although the effects of accelerated automation are projected to be quite profound for certain occupation groups, the broad spread of occupations across industries means the industry effects are projected to be more muted.

Broadly speaking, accelerated automation will result in a shift of jobs away from agricultural industries such as dairy cattle farming and forestry, manufacturing industries such as wood processing, and retail industries, towards the education and training, and health care and social assistance industries. This is shown in Figure 8, which shows the difference between the employment projections under the baseline and accelerated automation scenarios. For example, in manufacturing 850 additional jobs are projected to be created under the baseline compared with 350 under the accelerated automation scenario, the difference being 500 jobs.

Figure 8

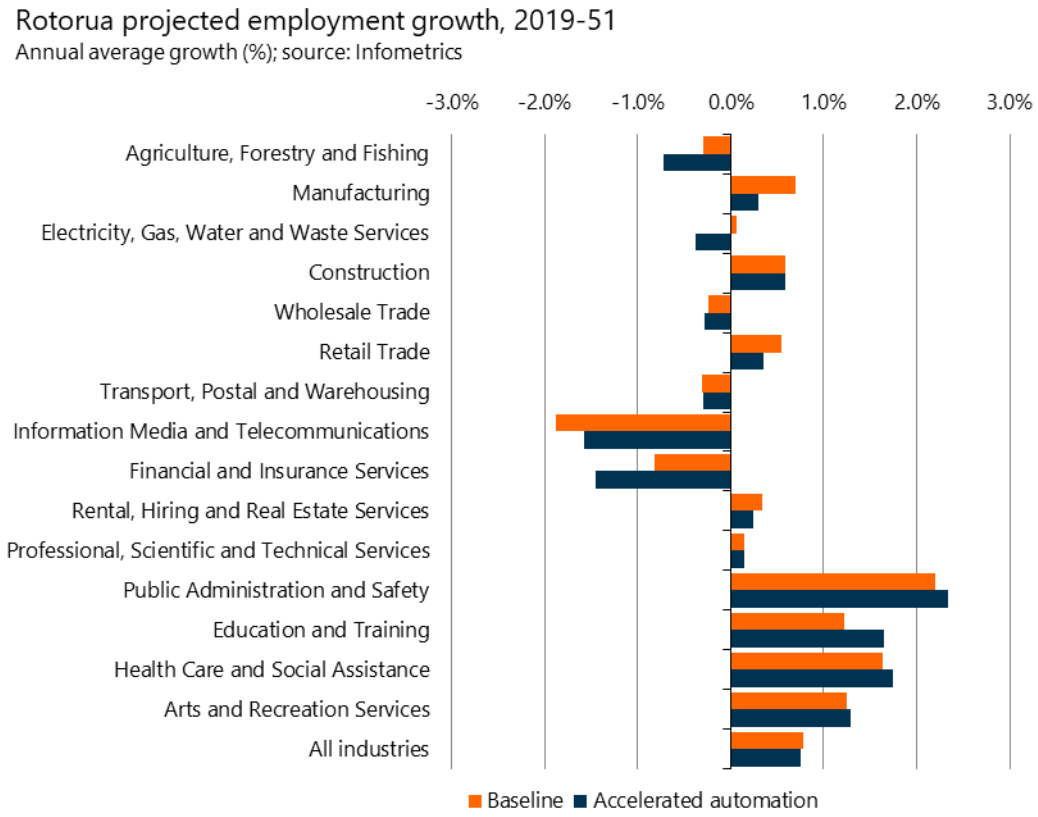
Rotorua projected employment change baseline and accelerated automation comparison, 2019-51
Source: Infometrics



The precise effects of accelerated automation on employment growth in each industry are shown in Figure 9.

- In manufacturing and retail, the replacement of workers by technology is projected to dominate any improvements in productivity, resulting in less employment growth compared with the baseline.
- Accelerated automation will also cause a greater number of job losses in agriculture and financial services compared with the baseline.
- In most industries, particularly construction, public administration and safety, education and training, health care and social assistance, and arts and recreation services, productivity improvements from accelerated automation will more than offset any job losses leading to higher employment than under the baseline.

Figure 9



Accelerated Climate Change Response scenario

The Accelerated Climate Change Response (ACCR) scenario assumes that by 2051 the New Zealand carbon price is higher than the baseline, there is a greater phase out of allocations of free carbon credits to Energy Intensive Trade Exposed industries, and there is a greater decline in the allocation of free carbon credits for biogenic methane and nitrous oxide. The ACCR Scenario makes no assumption of changes to total employment over the forecast period, but only to changes in the distribution of employment between industries. The *Accelerated Climate Change Response scenario* section in the Methodology chapter has further details.

By far the biggest impact of the ACCR scenario in Rotorua is that it accelerates the redistribution of jobs away from agricultural industries with high emissions, particularly dairy cattle farming. The ACCR scenario also reduces job growth in the retail industry, particularly hospitality, by discouraging tourism, and accelerates the redistribution of jobs towards industries with low emissions such as education and training, and health care and social assistance.

Figure 10 shows the difference between the employment projections under the baseline and ACCR scenarios. For example, in retail 1340 additional jobs are projected to be created under the baseline scenario compared with 1260 under the CCAR scenario, the difference being 80 fewer jobs. Figure 11 compares the annual average growth rate of employment from 2019-51 under the baseline and CCAR scenarios and demonstrates that only in agriculture is employment growth notably slower under the ACCR scenario. Interestingly, manufacturing in Rotorua suffers only a very small reduction in

employment under the ACCR scenario compared with the baseline. This is because high-emitting manufacturing industries such as petroleum manufacturing, fertiliser manufacturing and steel manufacturing are not large employers in Rotorua.

Figure 10

Rotorua projected employment change baseline and accelerates climate change response comparison, 2020-51
Source: Infometrics

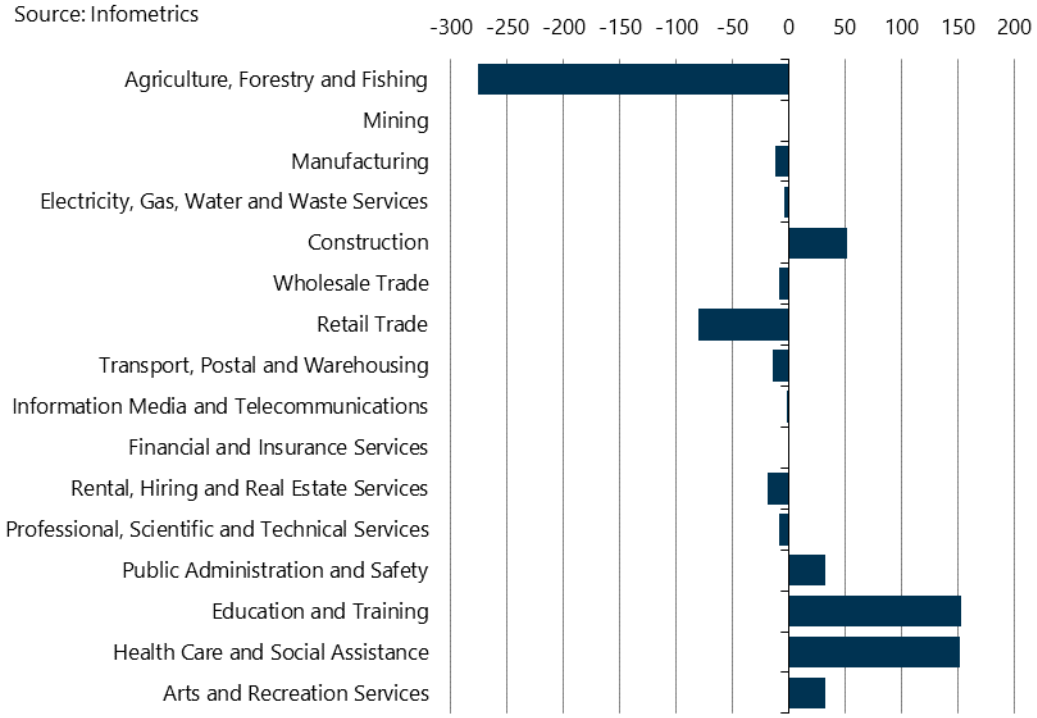
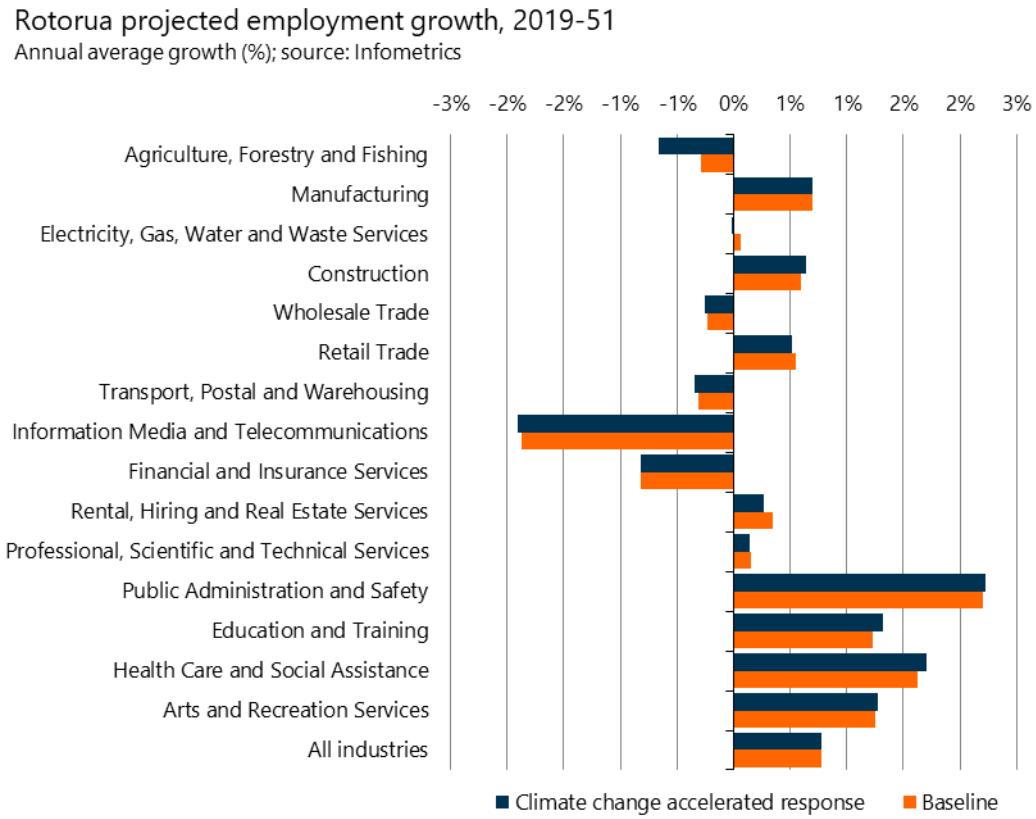


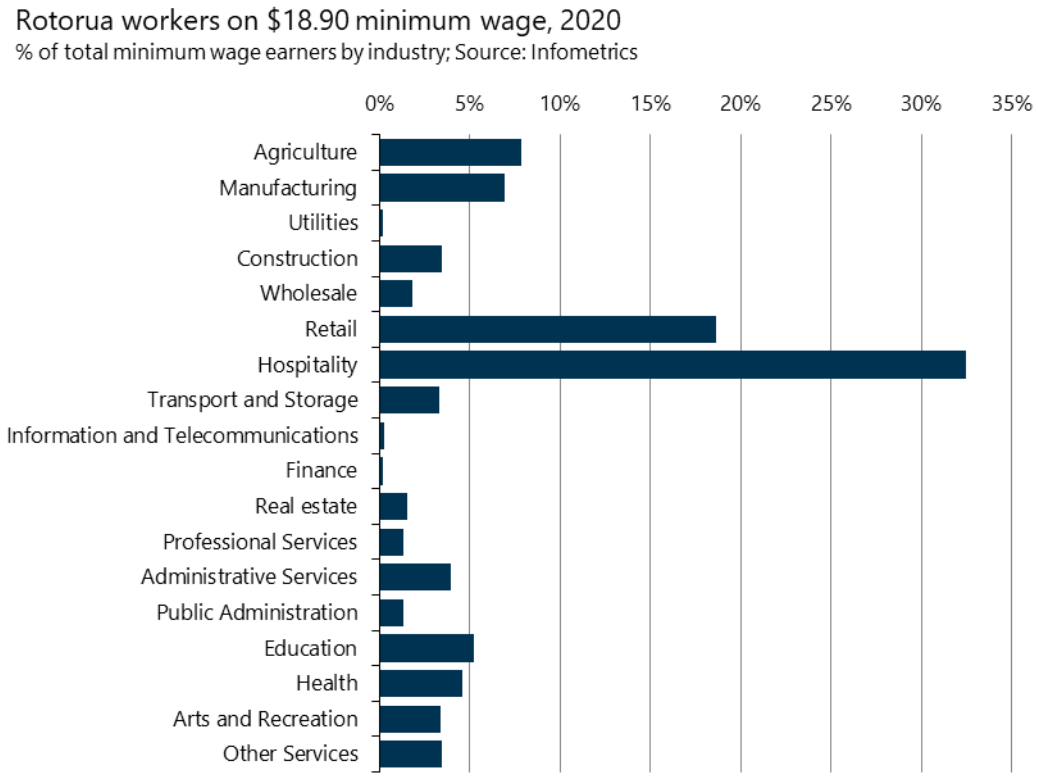
Figure 11



Workers on minimum wage

The Government has announced that from 1 April 2020, the adult minimum wage will rise to $18.90. We estimate that in 2020, 14% of workers (just under 5,100) in Rotorua are on the $18.90 minimum wage compared with 12% across the Bay of Plenty region and 12% nationally. Looking at how these minimum wage earners are spread across industries, most are working in either hospitality (32%) or retail (19%). See Figure 12.

Figure 12



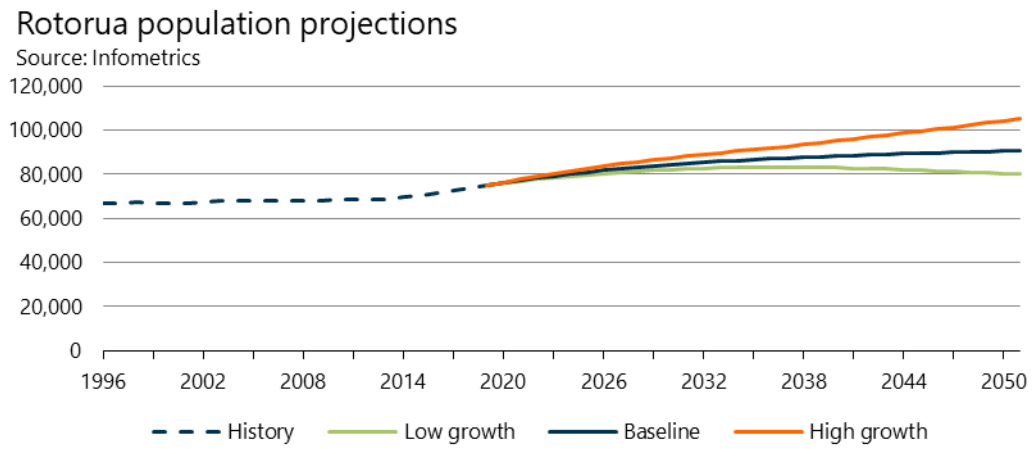
Population

Rotorua Lakes Council (RLC) requested high growth, baseline and low growth resident population projections for Rotorua District by 5-year age group from 2020 to 2031 inclusive, and then for the years: 2036, 2042, 2046 and 2051.

Population projections

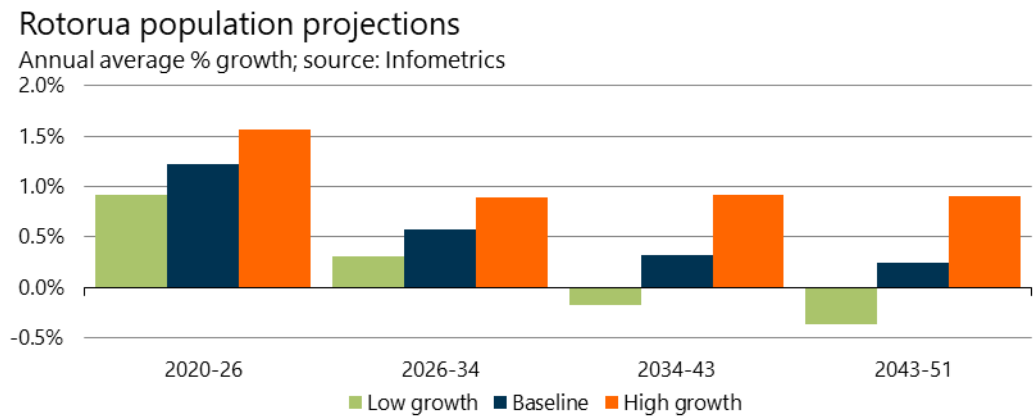
Under the baseline scenario, the Rotorua District population is projected to grow from 76,200 in 2020 to 90,800 in 2051, a rise of 14,600 people and an annual average rate of 0.6%pa. Under the low growth scenario, the population is projected to grow by 3,900 people to 80,000 in 2051. Under the high growth scenario, the population is projected to grow by 28,900 people to 105,200 in 2051 (see Figure 13).

Figure 13



Under both the baseline and high growth scenarios, the population is projected to grow throughout the projection period, but the rate of population growth is projected to steadily decline. Under the low growth scenario, the population is projected to grow until 2037 after which it will undergo a moderate decline. See Figure 14.

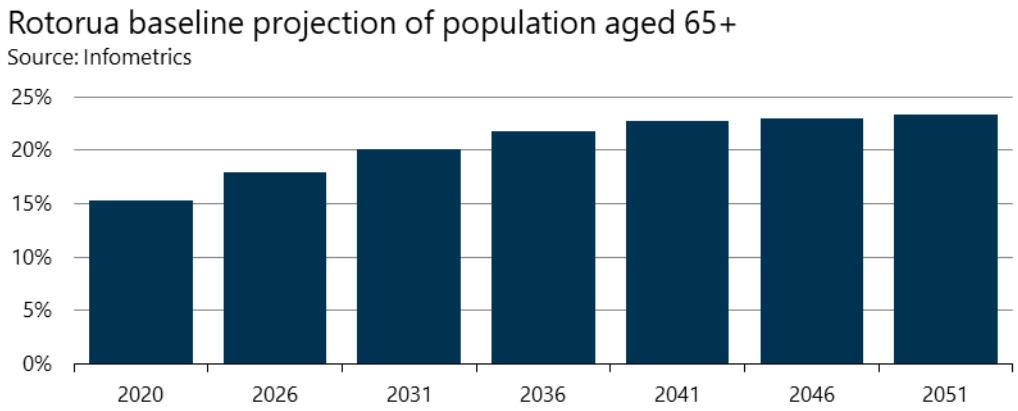
Figure 14



Population by age projections

The Rotorua population is expected to age under all scenarios. The proportion of the population aged 65 years or above is projected to increase from 15% in 2020 to 23% under the baseline scenario (see Figure 15), to 22% under the low growth scenario and to 25% under the high growth scenario.

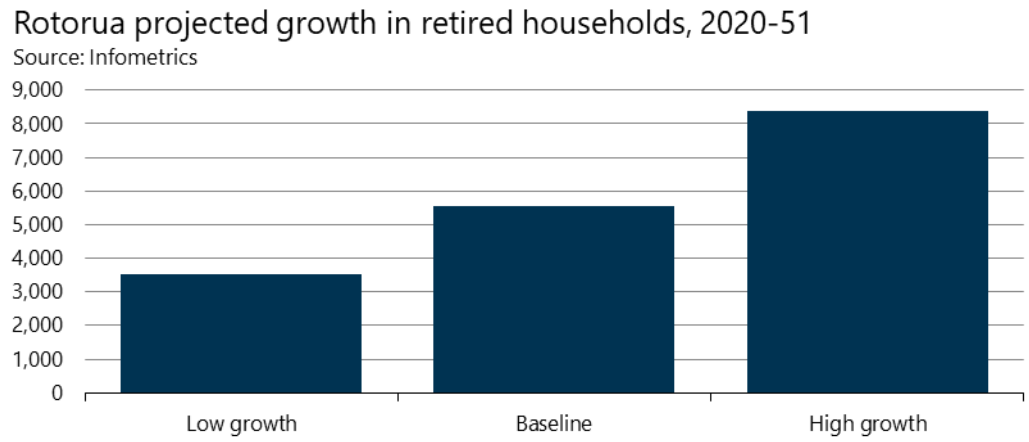
Figure 15



Consequently, the share of the population that is of working age, and the share of the population younger than working age, are projected to decline under all scenarios. Under the baseline scenario the proportion of people aged 15 to 64 years is projected to decline from 63% in 2020 to 59%, and the proportion of people aged 0 to 14 years is projected to fall from 22% to 18% during the same period.

We have also projected the number of retired people in Rotorua based on age (65+) and labour force participation rates taking into account that older people are tending to remain in the workforce longer. In 2020, we estimate that 8,900 people in Rotorua are retired, or 12% of the Rotorua population. By 2051, under the baseline scenario we project there to be 8,300 additional retired people in Rotorua District, 19% of the population. Under the low growth scenario, the number is projected to rise by 5,750 to 18% of the population and under the high growth scenario the number is projected to increase by just over 11,900 to 20% of the population. See Figure 16.

Figure 16



Population by ethnicity projections

Based on the ethnicity profile of each age group in 2013, and taking into account projected changes in the age structure of the Rotorua population, our projections

suggest that, under the baseline, low growth and high growth scenarios, the proportion of the Rotorua population that identifies as European will rise from 57% in 2020 to 60% in 2051 and the proportion of the population that identifies as Maori is projected to fall from 31% in 2020 to 29% in 2051. The proportions of the population that identify as Pacific Peoples and Asian will remain at 4% and 5% respectively.

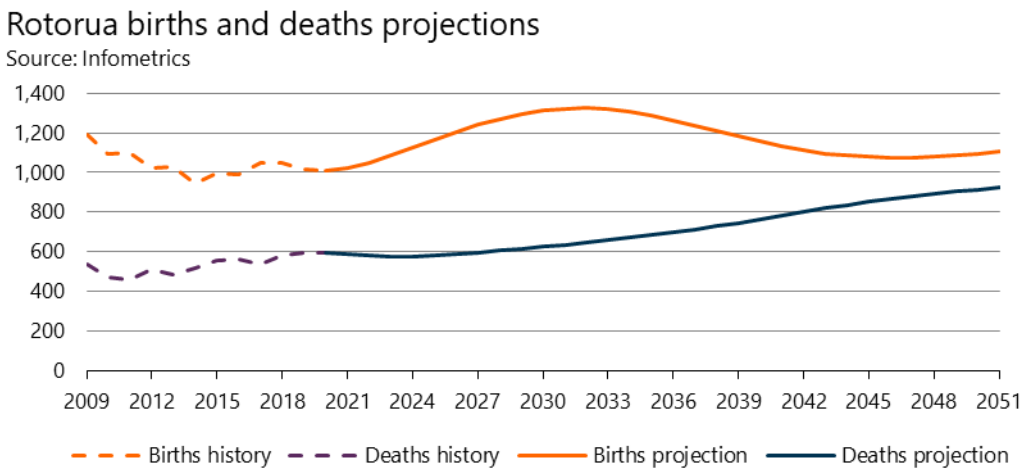
Assumptions

The population projections are based on assumptions about future birth rates and death rates in Rotorua District, and net migration to/from Rotorua District. The *Methodology* section provides further details.

Birth and death rates

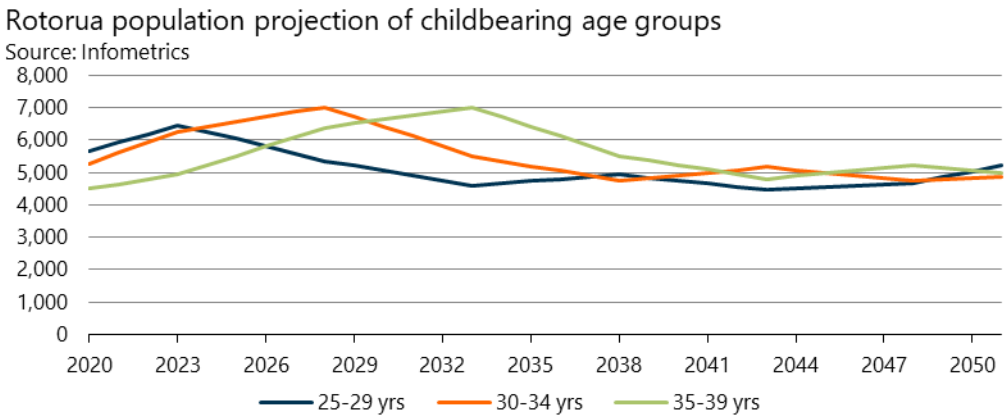
In recent years, there were roughly 1,000 births a year in Rotorua District and around 600 deaths. Deaths increase steadily throughout the projection due to the gradual ageing of the population. In the early part of the projection period, births are expected to increase to around 1,300 a year then drop back to around 1,100. See Figure 17.

Figure 17



This increase in the number of births is due to a bulge in the population aged 25-34. This bulge is the result of the influx of people in their late 20's and early 30's migrating to Rotorua in recent years. This influx is expected to continue in the near-term. As these people age through the main childbearing years (see Figure 18) and then into the post-childbearing years, this produces the bulge in births.

Figure 18



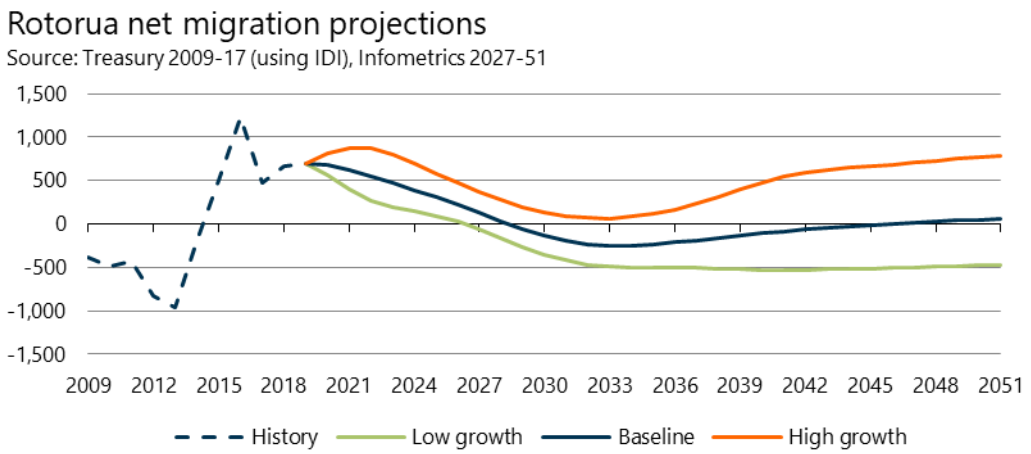
Net migration

Prior to 2014, there was a relatively consistent net outward migration of people from Rotorua District, driven almost entirely by net outflows of young people aged 15 to 24. This net outflow of young people is assumed to continue throughout the projection period, but since 2014 it has been more than offset by inflows of migrants from overseas and migrants from New Zealand's main urban centres. These migrant inflows were driven by a large net inflow of international migrants to New Zealand which peaked at just under 64,000 in 2016, having risen rapidly from a net outflow of just over 8,000 in 2012. The peak in international net inward migration to New Zealand in 2016 was reflected in a peak in net migration to Rotorua in the same year.

The surge of international migrants to New Zealand has contributed to New Zealanders migrating from main urban centres such as Auckland to smaller urban centres where property is more affordable. This secondary migration effect has maintained the momentum of population growth in smaller urban centres such as Rotorua despite international net inward migration to New Zealand declining in recent years.

Our baseline population projection assumes that net inward migration to Rotorua District continues into the near-term. Although we expect the recent surge in international migration to New Zealand to continue to decline from its peak in 2016 (see Figure 32 in the *Methodology* section), with property still relatively affordable in Rotorua compared to urban centres such as Auckland and Tauranga, we expect the Rotorua District population will continue to be swelled by further inter-regional migration until 2023. The baseline also assumes that the forthcoming Rotorua District Housing Strategy is successful in alleviating the district's housing shortfall enabling the near-term projected population growth to be accommodated. See Figure 19.

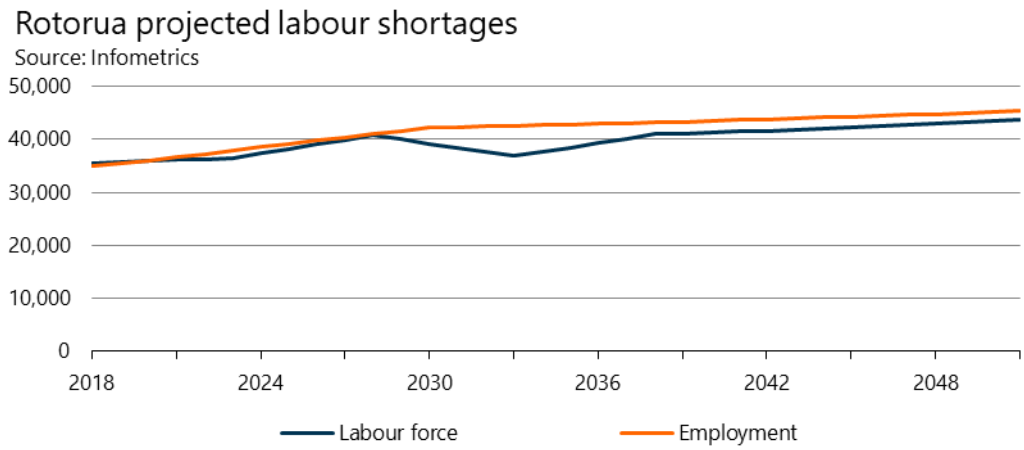
Figure 19



Beyond 2023, the baseline scenario assumes net migration will fall back to halfway between its 2016 peak and its 2013 trough as inward migration from other urban centres declines and is offset by continued outward migration of young people.

From 2034, net migration is projected to be largely neutral as a projected shortfall of labour in Rotorua brought about by retiring baby boomers prompts inflows of economic migrants to Rotorua District, offsetting the outflow of young people aged 15-24. See Figure 20.

Figure 20



The low growth and high growth population scenarios follow a similar trajectory to the baseline. Under the low growth scenario, from 2024 net migration falls back to its pre-2013 historic average, driven by a strong outflow of young people. The high growth scenario assumes net migration remains positive for the entire projection period, as greater numbers of inward migrants are assumed to more than offset the outflow of young people.

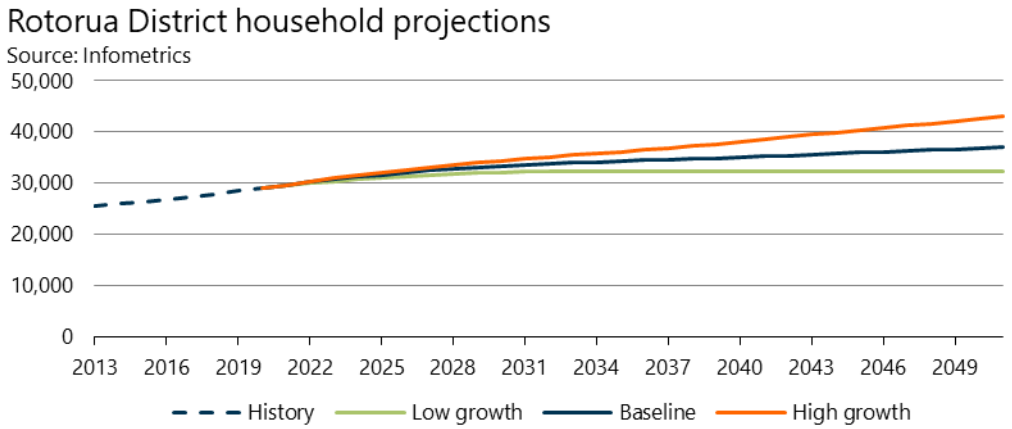
Households

RLC requested high growth, baseline and low growth annual projections of the number of households for Rotorua District by 5-year age group and household type from 2020 to 2031 inclusive, and then for the years: 2036, 2042, 2046 and 2051. RLC also requested projections of the number of households in public housing and households receiving the Accommodation Supplement.

Household projections

Under the baseline scenario, the number of households in Rotorua District is projected to grow from 29,000 in 2020 to 37,000 in 2051, a rise of 8,000 households and an annual average rate of 0.8%pa. Under the low growth scenario, the number of households is projected to grow by 3,300 to 32,300 in 2051. Under the high growth scenario, the number of households is projected to grow by 14,000 people to 43,000 in 2051 (see Figure 21).

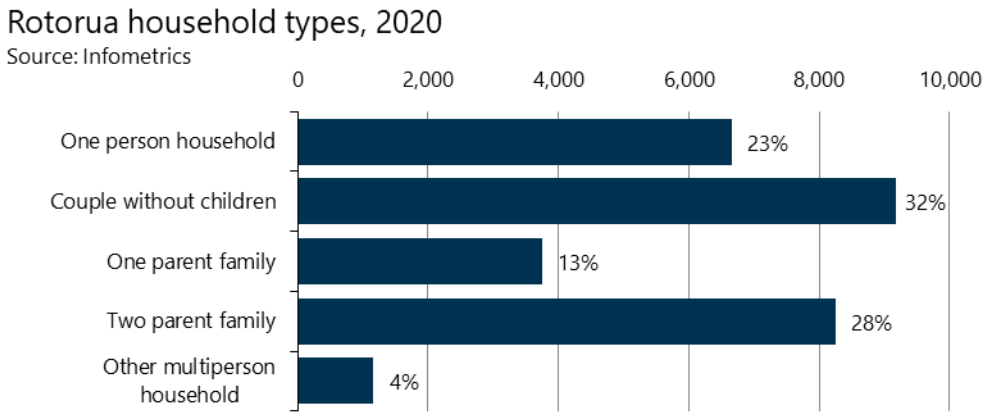
Figure 21



Household type projections

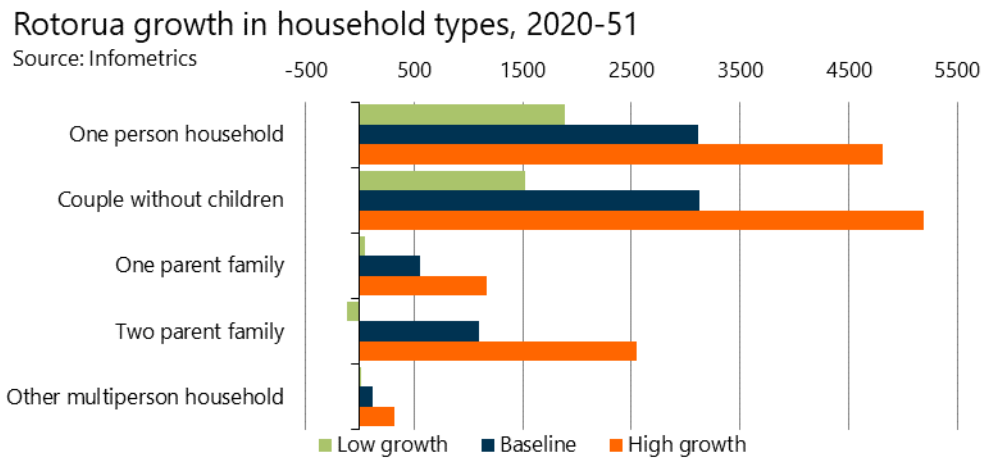
In 2020, 32% of households (9,200) in Rotorua are couple households without children; 28% (8,200) are two parent family households;, 23% (6,700) are one person households;, 13% (3,800) are one parent family households; and 4% (1,200) are other multi-person households (see Figure 22).

Figure 22



Between 2020 and 2051, growth in the number of households is projected to be dominated by relatively small household types: one person households and couple households without children. Under the baseline scenario the number of one person households is projected to increase by 3,100 by 2051, a consequence of the ageing population and life expectancy increases enabling older persons to live independently for longer. The number of couple households without children is also projected to increase by a similar number reflecting a trend towards delayed childbearing and couples deciding not to have children at all.

Figure 23



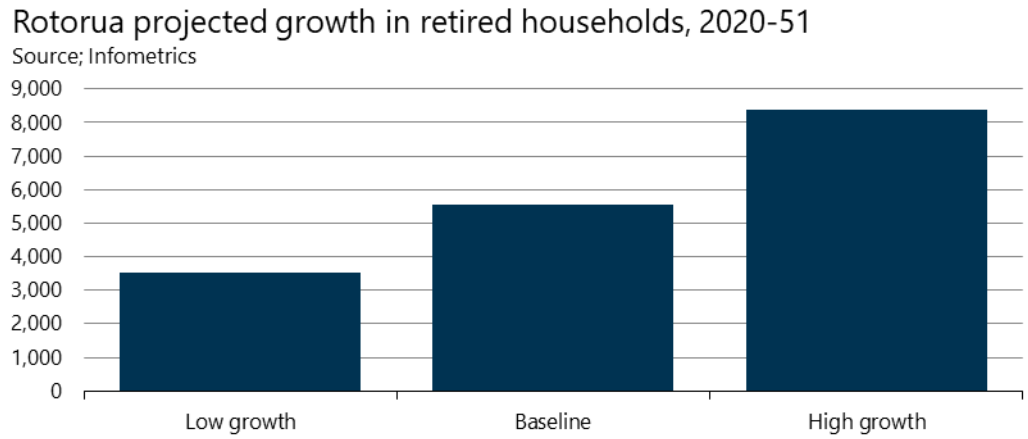
Under the high growth scenario, the number of one person households and couple households without children are each projected to increase by around 5,000. The number of two parent family households is also projected to increase by around 2,500. However, the number of one parent family households is projected to increase only by around 1,100, reflecting decreased rates of single parenting.

Under the low growth scenario, a combined increase in the number of one person households and couple households of 3,400 is projected. No other household types are expected to grow under the low growth scenario.

Retired household projections

Projections of the number of retired households are derived from the population projections and assume that adults living together are of a similar age. We are not able to consider labour force status in the retired household projections but we assume that households with adults over the age of 65 are retired. In 2020, there are 7,000 retired households in the Rotorua District. Under the baseline scenario, the number of retired households is projected to increase by 5,500 by 2051. Under the low growth scenario an additional 3,500 retired households are projected and under the high growth scenario, 8,400. See Figure 24.

Figure 24



Projection of households requiring public housing or the Accommodation Supplement

Based on data from the Ministry of Housing and Urban Development (HUD), as at September 2019, 662 Rotorua households were in public housing and 7,363 households were receiving the Accommodation Supplement: a total of 8,025 households. Of these 8,025 households, 36% (2,870) were households with children and 64% (5,155) were households with no children.

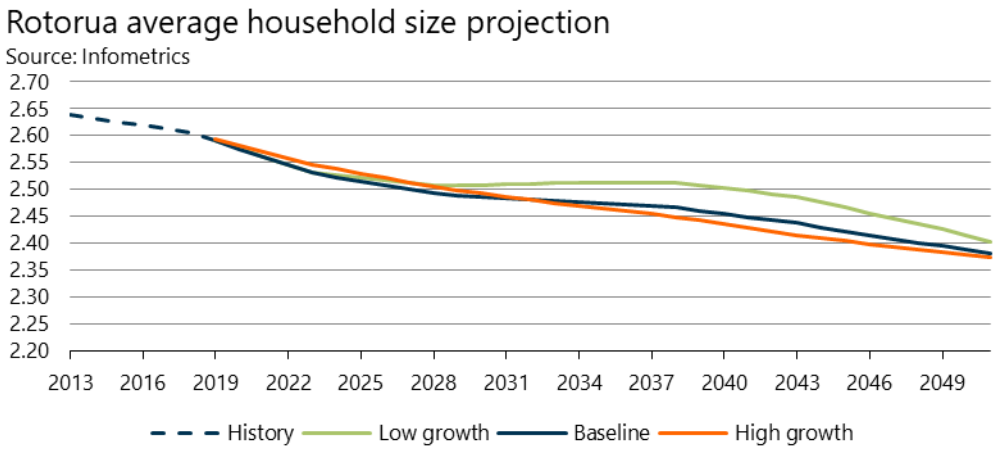
In 2019, the number of Rotorua households with children in public housing or receiving the Accommodation Supplement amounted to 25% of all Rotorua households with children. The number of Rotorua households without children in public housing or receiving the Accommodation Supplement amounted to 33% of all Rotorua households without children. Applying these proportions to the baseline household projection, we estimate that by 2030 an additional 416 households with children will be in public housing or receiving the Accommodation Supplement, and 1,450 households without children will be in public housing or receiving the Accommodation Supplement.

Assumptions

The key assumption underpinning the household projections is the average household size. Under all scenarios, the average household size is projected to decline, mainly because of the ageing population and life expectancy improvements enabling older persons to live independently for longer. See Figure 25. Under the baseline scenario the

average household size is projected to fall from 2.59 in 2019 to 2.38 in 2051. The high growth scenario follows a very similar trend.

Figure 25



Under the low growth scenario, the average household size remains at around 2.51 for the whole of the 2030's. This is because growth in the number of couple households with children just manages to offset the growth in one person households during this time.

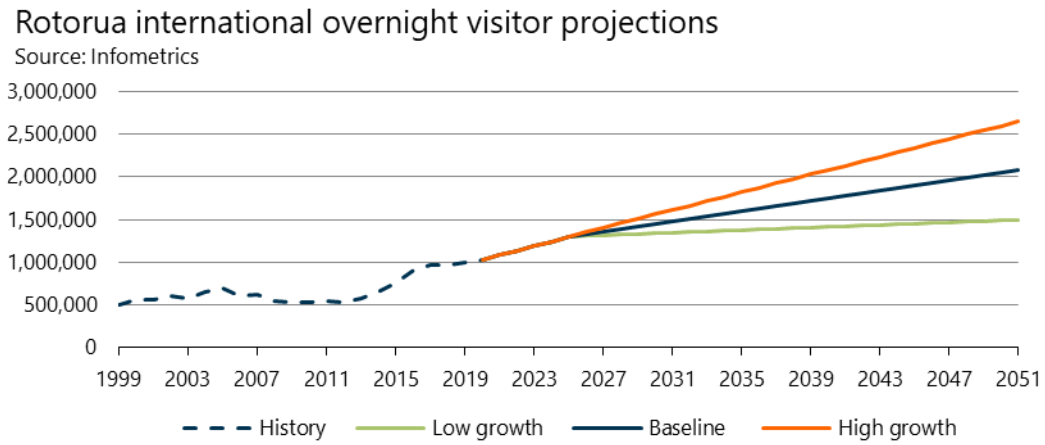
Visitors

RLC requested high growth, baseline and low growth international overnight, domestic overnight and domestic day-trip visitor arrival projections for Rotorua District from 2020 to 2031 inclusive, and then for the years: 2036, 2042, 2046 and 2051.

International overnight visitor arrivals

An estimated 991,000 international overnight visitors visited Rotorua in 2019. By 2032, under the baseline scenario, international overnight visitors are projected to top 1.5 million and by 2049, 2 million. Under the low growth scenario, international overnight visitors are expected to reach 1.499 million by 2051. Under the high growth scenario, they are expected to top 1.5 million by 2029 (three years earlier than the baseline scenario), 2 million by 2039 (10 years earlier than the baseline scenario), and 2.5 million by 2049.

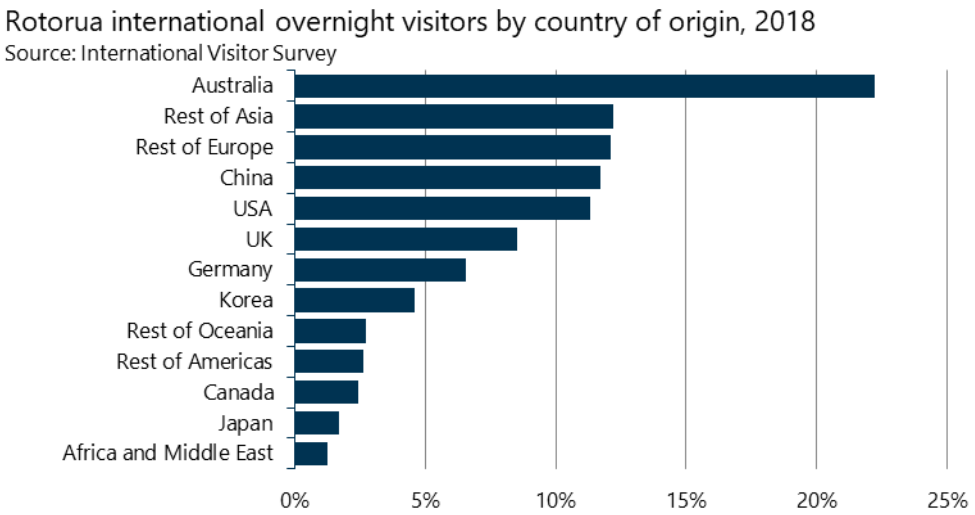
Figure 26



Country of origin

As explained in the *Methodology* section, the proportion of international overnight visitors from each country of origin in 2018 was held constant over the projection period. These proportions are shown in Figure 27 and the projected growth in international overnight visitors by country of origin over the projection period under the baseline scenario is shown in Figure 28.

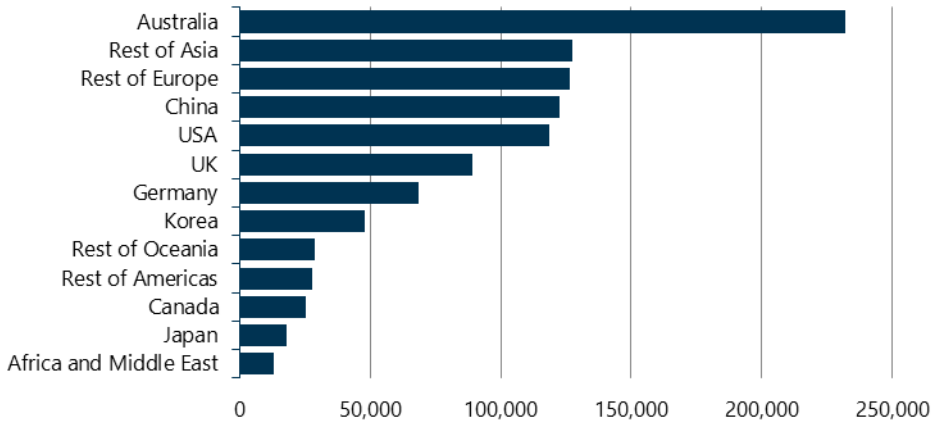
Figure 27



In 2018, Australians made up the greatest proportion (22%) of international overnight visitors to Rotorua. Consequently, the number of Australian overnight visitors to Rotorua is projected to grow more than any other country. Under the baseline scenario, an additional 232,000 Australians are expected to visit Rotorua for an overnight stay by 2051. Additional visitors from the USA, China, the Rest of Asia and the Rest of Europe are also expected to be well above 100,000 by 2051.

Figure 28

Growth in international overnight visitors to Rotorua by country of origin, 2020-51; Source: Infometrics



Projections of international visitors by country of origin are inherently difficult to predict, particularly from countries such as China, but also to a lesser degree Australia, the UK and the Rest of Asia.

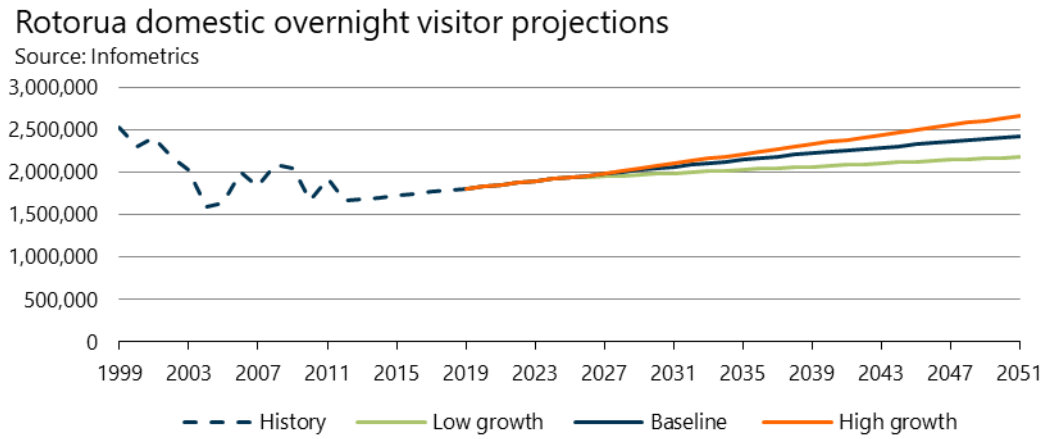
Using China as an example, between 2009 and 2018, the number of international overnight visitors to Rotorua from China varied from a low of 62,000 in 2009 to a high of 126,000 in 2013. In 2013, Chinese visitors made up 22% of all international overnight visitors to Rotorua. In our projections, we have assumed 12% of international overnight visitors to Rotorua will be from China because this was the proportion in 2018. If the proportion of Chinese tourists rises back up to 22% by 2030, that would equate to an additional 218,000 Chinese tourists by 2030 compared with 49,000 under the current baseline.

International visitor numbers can vary with changes to international flight patterns, the exchange rate, tourist preferences and tastes, and attitudes towards air travel in the context of climate change and, of course, pandemics. We have not projected the impact of climate change on attitudes to air travel because there is a high degree of uncertainty around all of the key determinants, including how climate change will play out over the next 30 years; how the airline industry will respond by developing aeroplanes that have a lower carbon footprint; and how people's attitudes will change.

Domestic overnight visitor trips

An estimated 1.81 million trips were made by domestic overnight visitors to Rotorua in 2019. By 2028, under the baseline scenario, domestic overnight trips are projected to pass 2 million, reaching 2.43 million by 2051. Under the low growth scenario, domestic overnight trips are expected to surpass 2 million by 2032 (4 years later than under the baseline) and reach 2.19 million by 2051. Under the high growth scenario, domestic overnight trips are expected to top 2 million by 2028 (the same as the baseline), and 2.5 million by 2045, reaching 2.67 million by 2051. See Figure 29.

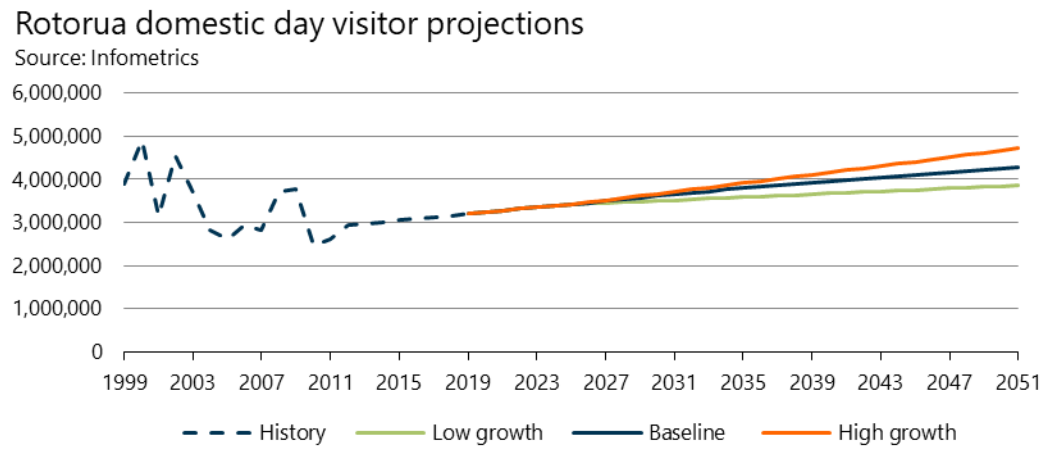
Figure 29



Domestic day visitor trips

An estimated 3.12 million day-trips were made by domestic visitors to Rotorua in 2019. By 2043, under the baseline scenario, domestic day trips are projected to surpass 4 million, reaching 4.29 million by 2051. Under the low growth scenario, domestic overnight trips are expected to pass 3.86 million by 2051. Under the high growth scenario, domestic overnight trips are expected to top 4 million by 2037 (five years earlier than under the baseline), and 4.5 million by 2047, reaching 4.72 million by 2051. See Figure 30.

Figure 30



The variance in domestic overnight and day visitor numbers between the low growth and high growth scenarios is less than the variance of international overnight visitor numbers. This is because domestic visitor numbers are arguably more predictable than international visitor numbers. New Zealand's recent surge in international migration, particularly into Auckland, is expected to boost domestic tourism in coming years as newcomers to New Zealand choose domestic holidays to explore their new surroundings. Rotorua's proximity to Auckland should help in this regard, as will improvements to roading infrastructure that ease congestion and reduce journey times between Rotorua and other major centres in the North Island. However, some

uncertainty remains with such things as the provision of domestic air travel between Rotorua and elsewhere in New Zealand, as well as New Zealanders' preference for Rotorua over other New Zealand destinations and international destinations.

Assumptions

The *Methodology* section details how the visitor projections were developed. The key assumptions used in each projection are as follows.

International overnight visitors

- The baseline trajectory was an extension of the trajectory of the series from 2000-2025.
- The high growth scenario was based on the trajectory of the series during a period of strong growth from 2010 to 2025.
- The low growth scenario assumed that in 2051 the difference between the high growth scenario and the baseline was inverted.

Domestic overnight and domestic day trips

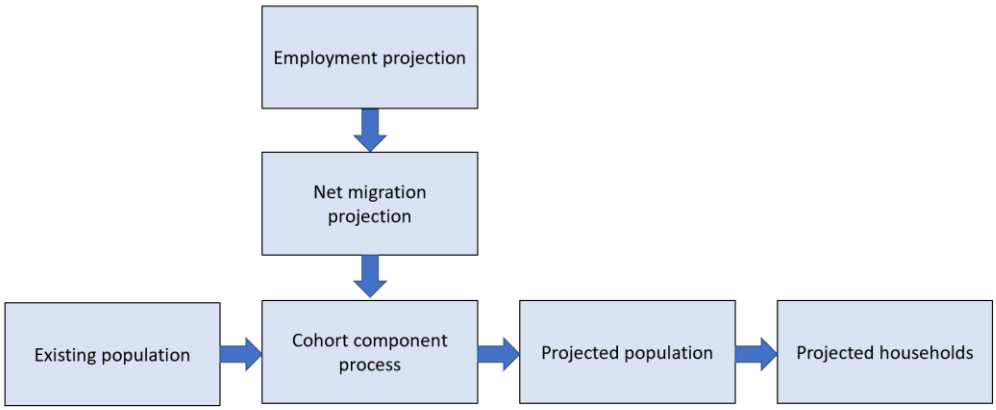
- The baseline was based on Infometrics' projected growth in the New Zealand population.
- The high growth scenario assumed that by 2051 there would be 10% more trips than the baseline projection.
- The low growth scenario assumed that by 2051 there would be 10% fewer trips than the baseline 2015 projection.

Methodology

Overview

We apply a unique approach to projecting population, by first projecting employment, which in turn informs volumes of net migration. In this sense our population projections are informed by the economic prospects of the area. From here, we follow a conventional cohort component approach to project population and households, before translating changes in households into dwelling demand. This process is summarised in Figure 31.

Figure 31



Employment

Employment is forecast using a combination of two approaches for the short-term and long-term, described below. The visitor projections are a key input to the employment projections in tourism-related industries.

Short-term forecasts (2020-2025)

In the first step of the process, we develop forecasts of employment at the national level by 54 industries. Using econometric techniques, we develop approximately 50 separate statistical models for forecasting employment in each industry. The models draw on historic trends, patterns and relationships and extend these into the future.

Using machine learning, we rank the models according to their track record of forecasting future employment in the industry. We can measure each model's forecasting ability by using historical data. For example, using data from 2000 to 2016 we can forecast employment to 2019 with each model and then compare the forecasts against actual numbers from 2017 to 2019. The model with the best track record is used to produce the final forecast for each industry to 2025. The industry forecasts are adjusted to ensure they are consistent with Infometrics' view of total employment growth over the forecast period.

In the second step, we develop forecasts by territorial authority and region that are consistent with our national forecasts. We use a similar technique as in the national forecasts, developing 50 models for each combination of 485 ANZSIC industries and 66 territorial authorities. Slightly different techniques are used for the various industries in the regions, which accounts for different industry drivers.

The future performance of *agriculture, forestry, fishing, mining and manufacturing* industries is influenced predominately by macro-economic conditions that are not specific to local conditions. For example, a boost in forestry from strong demand in China is likely to benefit forestry in all regions. Hence the models we develop for these industries are driven by nationwide industry trends and the extent to which the regional trends historically deviate from the national. Using machine learning, we choose the model that is most effective at mimicking and predicting these components.

The regional forecasts for *service industries* (including trade, accommodation, education, health and professional services) consider more local drivers including population growth, local macroeconomic conditions and visitor numbers.

The regional forecasts for *construction* industries incorporate Infometrics' forecasts of construction work-put-in-place from Infometrics' Regional Construction Outlook. They also take population growth into consideration.

After we have generated forecasts for each industry/territorial authority (TA) combination, we ensure they are mathematically consistent with our national level industry forecasts.

Long-term forecasts (2025+)

The method used in the short-term forecasts draws heavily on a statistical approach to forecasting: they draw on historic trends, patterns and relationships and extend these into the future. This statistical approach becomes less accurate with longer forecast horizons. Therefore, we modify the forecasts from 2025 onwards to ensure consistency with the outputs of Infometrics' general equilibrium model of the New Zealand economy (ESSAM).

ESSAM considers the main inter-dependencies of industries in the economy, such as flows of goods from one industry to another, plus the passing on of higher costs in one industry into prices and thence the costs of other industries. The model presents a picture or scenario of the economy for the target years (in our case 2030 and 2050) based on plausible assumptions of economic factors including international commodity prices, population growth, carbon price, automation, changes in energy efficiency, and substitution between four energy types (coal, oil, gas and electricity). ESSAM's estimate of employment by industry in 2030 and 2050 provides a benchmark for our long-term employment projections. Some of the key macro-economic national assumptions used by the model are shown in Table 1.

Table 1 ESSAM macro-economic assumptions and outputs

Indicator	2025-2030	2030-2050
Population	1.0%pa	1.0% pa
Labour force	0.7%pa	0.46%pa
GDP	2.9%pa	1.7%pa*
World trade	2.7%pa	2.5%pa
Oil price	US$110/bbl in 2030	US$110/bbl in 2050
Carbon price	NZ$100/tonne CO_2 in 2030	NZ$200/tonne CO_2 in 2050
Government consumption	2.1%pa	1.7% pa
Investment in dwellings	2.0%pa	1.0%pa
Public investment	3.0%pa	2.5%

* This is a model result, not an input assumption.

Accelerated Automation scenario

In addition to the baseline employment projections, we have generated an Accelerated Automation scenario in which employers adopt technology at a faster rate than they have in the past.

There are multiple ways automation can impact on industries, the demand for their outputs, and the amount and type of labour they employ.

- Automation can result in specific job types being lost as their tasks are replaced by computers or machines. For example, clerical jobs in accounting firms are being replaced by smart accounting software.
- The implementation of new technologies can result in new jobs being created in some sectors to support the new technology. For example, computer engineers need to be employed to design and implement robots.
- Automation makes some industries more competitive, enabling them to reduce their prices relative to others. For example, new technologies may make the poultry industry more competitive than the beef industry. Lower chicken meat prices will bolster demand and result in the industry growing. The growth in demand for their products will to some extent offset the loss of jobs from the implementation of labour-saving technology.
- New technologies and products become available, which changes the buying patterns of consumers, which in turn changes the growth of different industries. For example, the emergence of smart phones has redistributed a lot of discretionary spending to the electronics industry from other industries such as book publishing.

In our modelling approach we can capture three of the four impacts outlined above. Predicting the changing consumption patterns of consumers is difficult because oftentimes there is little historical precedent.

There are two modelling steps in generating an Accelerated Automation scenario, outlined below.

Estimate the direct impact of automation of tasks on individual occupations in each sector

Frey and Osborne, in their seminal paper, *The Future of Work*, estimated the proportion of jobs in each of 702 detailed occupations in the USA that are susceptible to automation. Infometrics has mapped those occupations to detailed occupations (level 5) of the Australia and New Zealand Standard Classification of Occupations (ANZSCO) and estimated the proportion of each level 5 occupation susceptible to automation. From this we have derived annual rates of automation job loss.

We have applied these rates of automation job loss to our estimates of occupational employment in each sector to arrive at a first estimate of Accelerated Automation employment by occupation in each industry. We then scale all estimates of employment by occupation by a common factor to ensure total employment under Accelerated Automation is consistent with the baseline. The key assumption here is that automation does not result in a net loss of jobs, but it accelerates the transition to occupations less susceptible to automation e.g. managers, which require social intelligence of which a machine is not capable.

Estimate the second-round impact of higher productivity in some sectors

In the previous step we estimated the change in employment for each occupation resulting from Accelerated Automation. In the second step we map the change in employment of occupations back to industries (using the same mapping that we use to translate employment by industries into employment by occupations). This process shows that industries that employ many occupations that will be displaced by technology will require less labour because of automation. Industries that achieve labour saving through increased automation will achieve higher productivity. Their higher productivity means they can charge less for their goods or services relative to other industries. Being more competitive means they will grow relative to other industries. Our ESSAM model (referred to in the *Long-term forecasts (2025+)* section above) can estimate how much each industry grows relative to each other because of productivity improvements.

The ESSAM model is built around the interlinkages between industries, households and the government sector and can measure how changes in one industry (such as increased productivity) have a flow on effect through to other industries. We estimate the increase in productivity in each industry using our knowledge of how much labour saving is achieved in each industry. We feed these changes in labour productivity (and hence competitiveness) in to ESSAM and the model then estimates the flow on effects of these changes to total employment in all other industries. The results may be counterintuitive. For example, in the first step above we may estimate that employment in a sector is likely to decline because the sector employs many occupations that will be displaced by technology. However, because the sector uses less labour it becomes more competitive and grows faster than under BAU. The second-round effects could more than offset the first-round effects of job losses and total employment in the sector may end up being higher than under BAU.

Accelerated Climate Change Response scenario

The Infometrics ESSAM General Equilibrium Model includes consideration of all current New Zealand government policy, including emissions reduction targets defined in the *Climate Change Response (Zero Carbon) Amendment Act of 2019*. Consequently, the model makes use of a range of input factors related to local and international prices for carbon credits, free allocations of emissions volumes to various New Zealand industries, and the rates at which these are to be phased out, and various others.

In order to generate an accelerated Climate Change Response Scenario for this report, the following changes were made to relevant input factors in the ESSAM model.

Table 2. ESSAM climate change-related inputs and assumptions

Indicator	Baseline	Accelerated Climate Change Response
International emissions target	Net zero by 2050 (excl. biogenic methane)	Net zero by 2050 (excl. biogenic methane)
NZ Carbon price	NZ$200/tonne CO_2 in 2050	NZ$400/tonne CO_2 in 2050
Global Carbon price	NZ$200/tonne CO_2 in 2050	NZ$200/tonne CO_2 in 2050*
Phase out of free allocations to EITE industries[2]	1%pa 2021-2030 2%pa 2031-2040 3%pa 2041-2050	2%pa 2021-2030 4%pa 2031-2040 6%pa 2041-2050
Free allocation for biogenic methane & nitrous oxide	Declines to 75% by 2050	Declines to 25% by 2050
Forestry emissions credits	As per existing regulations	As per existing regulations

* To prevent price arbitrage by NZ companies, NZ government accepts only NZ carbon credit units, and only NZ government can buy or sell international units.

As is the case for the Accelerated Automation Scenario, the Accelerated Climate Change Response Scenario makes no assumption of changes to total employment over the forecast period, but only to changes in the distribution of employment between industries.

Projected earnings by industry

Infometrics ESSAM model projects real growth in wages of 0.9% per annum between 2018 and 2030 and 0.5% between 2030 and 2051 for the Rotorua DIstrict. To estimate growth rates by industry we drew on historical growth rates by industry for the period 2008 and 2018. We applied the industry relativities observed over this historical period

[2] Emissions Intensive Trade Exposed Businesses involve production processes that use significant fuel, energy, and produce emissions. They usually either export into international markets or are open to competition from imports. The range of EITE businesses includes fresh vegetables, paper and cardboard, and metal production.

to the projections, while simultaneously ensuring that total growth in earnings was consistent with the ESSAM projections.

Workers on minimum wage

Our estimate of the proportion of the Rotorua workforce on the minimum wage is based on applying MBIE estimates of the proportion of minimum wage earners by industry nationally to employment by industry in Rotorua. In their 2019 minimum wage review[3] MBIE estimates the proportion of workers that would be on a minimum wage of $18.90 by industry. A minimum wage of $18.90 is due to come into effect on 1 April 2020.

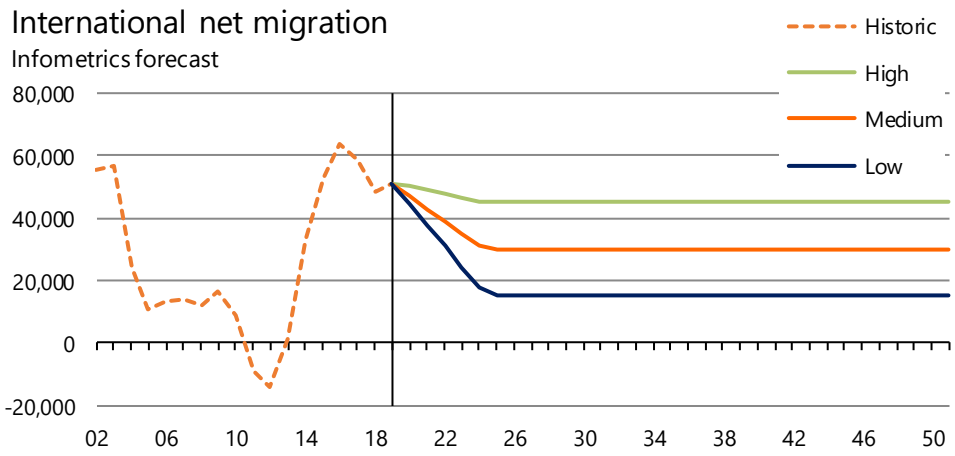
We attempted to develop projections of the proportion of the Rotorua workforce on the minimum wage but decided that any projections would most likely be inaccurate. This is because the minimum wage is set to rise to $20 in 2021, and annual rises are probable in the future. Looking backwards at MBIE's estimates of the proportion of workers on minimum wage at each previous level of the minimum wage, showed that there is no clear relationship between minimum wage rises and the proportion of workers on that wage. For example, a 5% rise in the minimum wage does not result in a 5% increase in the proportion of workers on the minimum wage.

Migration

We forecast long-term international net migration to New Zealand by considering a wide range of factors affecting the New Zealand and global economy. While recent historic levels in excess of 60,000 are unlikely to be achieved for a sustained period in future, with steady employment growth projected and an ageing population, we expect labour market conditions to remain tight leading to sustained positive net migration well into the future, aided by favourable work visa conditions. Between 2018 and 2024, we adopt The Treasury's forecast, which shows a transition from 50,000 in 2018 to 35,000 in 2024. Beyond this, we project a level of 30,000 to be maintained out to 2051. Our low and high scenarios represent net migration levels 50% lower and higher than the medium scenario respectively. This is plotted below in Figure 32.

[3] Source: Minimum wage review, 2019 (MBIE) https://www.mbie.govt.nz/assets/minimum-wage-review-2019.pdf

Figure 32



Migration is apportioned to TAs using a mix of two approaches. Firstly, historic inter-regional migration trends as assessed by Stats NZ are used to forecast the volume of non-employment driven migration, such as people moving towns for retirement. Secondly, forecast labour market shortfalls are used to forecast the volume of employment driven migration, such as people moving towns for a new job. Our approach to assessing labour market shortfalls is described in the next section.

For both employment and non-employment driven migration, Stats NZ's projected age and gender profile of migrants to the district is assumed. Volumes of migration are then manually adjusted to reflect:

- Feedback from regional stakeholders at the workshop
- Recent population growth trends (particularly 2017-2019 population growth to inform projections of 2018-2023)
- Recent building consenting trends
- Provision of capacity for future housing growth
- Patterns of commuting across TA boundaries, based on 2013 and 2018 Census data.

These adjustments were necessary to:

- Ensure that the projections realistically transitioned from historical periods into the future
- Reflect commuting patterns i.e. where employment growth in one TA prompts population (and household) growth in a neighbouring TA
- Reflect that provision of housing will influence the distribution of population within or across regions.

Labour market shortfalls

Labour market shortfalls exist when employers' need for labour exceeds the number of workers available at current wage rates. When labour market shortfalls exist in an area,

extra labour and hence population, is attracted to the area. We estimate future labour market shortfalls by separately considering the projected supply of labour (as measured by the labour force) and demand for labour (as measured by employment) and comparing them. As our starting point for estimating the supply of labour, we use Stats NZ's published population projections by 5-year age group and gender.

Labour force participation rates (LFPR) by age and gender are projected based on Stats NZ national labour force projections. Then, historic LFPRs for each regional council are analysed to identify their deviation from the national average. This deviation is applied to the national LFPR by age to project regional LFPR by age. Historic averages for the unemployment rate in each region are analysed and projected forwards. Our projected LFPR by age is applied to the Stats NZ population projection, and our projected unemployment rate is applied to this to estimate labour supply.

This is done for each TA, enabling the balance between labour supply and demand in each labour market region to be assessed. In periods when there is insufficient supply in a TA and across its broader regional labour market to meet projected labour demand, the area is apportioned additional migration.

Our projected LFPR and unemployment rates are applied to the additional migration, reflecting that it is rarely possible to import only workers – workers tend to come with family members who may not be economically active such as stay at home parents and children, and some of those migrants may not gain employment immediately (spend a period of time unemployed).

Existing population

The appropriate population to use for council long-term planning (LTP) purposes is estimated resident population (ERP). This represents all of the people who permanently reside in an area and could be considered a 'maximum' as a proportion of them is likely to be away at any given point in time.

The base, or starting point, used in these projections is the 2018 ERP. This is produced by Stats NZ with the most recent available Census (2013), and births, deaths and migration that has been recorded since. An ERP based on the 2018 Census is expected to be released at an unspecified time in 2020, too late for inclusion in this projection.

We project the existing population using a conventional cohort component method. Under this approach, the starting population is grouped into cohorts consisting of 5-year age groups of males and females. We draw upon Stats NZ's analysis of historic and expected trends in births and deaths in each age group and gender to inform how each cohort changes throughout the course of the projection.

As most population projection parameters from Stats NZ are published for 5-year intervals, our projection model also operates at 5-year intervals, from 2018 to 2053. We then incorporate the 2019 ERP and interpolate to provide single year estimates for the period 2018 to 2023.

Births and deaths are driven by a combination of factors – the age structure of the population, and age-specific birth and death rates. Actual birth and deaths data by TA, Regional council (RC) and District Health Board (DHB) from Stats NZ are used for 2013-2019 years. Projected age-specific birth and death rates are sourced from Stats NZ and are described below.

Fertility

Stats NZ project an easing in fertility rates for women under the age of 35, and a slight increase in rates for women aged 35 years and older. These are published as regional age-specific fertility rates for 5-year age groups. This includes an open bounded 45+ age group, however we have chosen to only apply this to the 45-49 year age group. This ensures that a growing population beyond the age of fertility does not artificially inflate the projection of births. The impact is expected to be negligible, as between 2012 and 2014, there were an average of 8 births per year to women aged 49 and over, nationally. Similarly, we have ignored births under the age of 15 due to a lack of reliable fertility rates, and again this is not significant as nationwide there were only 21 births to women under the age of 15 annually on average between 2012 and 2014.

We have used the Stats NZ assumed gender ratio of 105.5 males per 100 females born throughout the projection period, which is based on the historic average ratio at the national level. This phenomenon is common around the world and is understood to be a function of slightly higher miscarriage rates amongst females, not selective abortion.

Mortality

Projected age and gender-specific mortality rates by TA from Stats NZ are applied to the population by age and gender to accurately project the number of deaths. Stats NZ project a steadily easing death rate across all age groups as life expectancy increases due to advances in medical care.

Ethnicity

To project the population by ethnicity we use Stats NZ's estimates of the Rotorua population by age by ethnicity in 2013. We take the ethnicity proportions in each age group in 2013 and apply them to our projected population by age. We considered using Stats NZ's projections of ethnicity by age rather than the 2013 estimates, but in consultation with Stats NZ we decided that the 2013 estimates were the better option.

Households

Projections of households also follow a cohort component method, which involves analysing the living arrangements of each age and gender cohort before converting these into the number of households. This utilises projected living arrangement type rates (LATR) produced by Stats NZ, which are based on analysis of historical trends. LATR indicate the proportion of each cohort in each living arrangement type, for example, 22% of 20-24 year old males in 2018 lived in an 'other multi person household', or flatting, arrangement.

The latest LATR available from Stats NZ are from a 2013 Census base. We use the 'B' scenario, which is recommended by Stats NZ, as it includes projected changes in LATR between 2013 and 2038 based on observed historical trends and future expectations. These trends include delayed childbearing (discussed in *Fertility* section above), decreased rates of single parenting, and life expectancy improvements enabling older

persons to live independently for longer[4]. The alternative 'A' scenario assumes that LATR hold constant at 2013 rates. From 2038 onwards, we hold LATR constant.

Applying LATR to the population provides an estimate of the number of people in each living arrangement type; we then translate this into the number of households based on expected family structures – for example, couple households consist of two people. For other multi-person households, we follow Stats NZ assumptions, and assume 2.6 persons per household. This approach produces an estimate of the number of households in each household type. Non-private dwellings such as rest homes, hospitals or prisons are customarily excluded from the count of households. Instead, a count of the number of people in non-private dwellings is provided. Due to rounding, our projected household size varies slightly from 2018 Census measures. This can arise for several reasons:

1) Census counts are randomly rounded to the nearest multiple of 3, or supressed entirely, to ensure confidentiality of Census respondents. However, Census outputs such as average household size are produced based on actual data – meaning that it is impossible for third parties to precisely replicate these outputs.
2) LATR projections are national, representing an average across NZ, so local patterns will differ – this can, for example, be driven by differences in ethnic makeup, with some non-European ethnic groups exhibiting a greater propensity to form multi-generational households, leading to larger households.
3) Household sizes can change in response to non-demographic factors such as housing costs.

Visitors

This section explains the methodology used to create visitor projections.

Overview

Visitor projections were created by constructing an historical time series of the relevant metric, then projecting it forward based on trajectories that either reflected historical trends or aligned with projected determinants of visitor numbers such as the New Zealand population. The following datasets were used:

International overnight visitors

- International visitor survey (IVS), place visited: Rotorua District, by country of origin, calendar year 1997-2018, source: Stats NZ
- Overnight international visitors to Rotorua, calendar year 2018-25, source: Fresh Information LTD, hosted by NZTE https://freshinfo.shinyapps.io/NZVAF/
- International visitor arrivals to New Zealand by country of residence, age and purpose, calendar year 1997-2018, source: Stats NZ.

[4] Full discussion available here http://archive.stats.govt.nz/browse_for_stats/population/estimates_and_projections/NationalFamilyAndHouseholdProjections_HOTP2013base/Data%20Quality.aspx#Livingarrangementtyperates

Domestic day and overnight trips

- Domestic Travel Survey (DTS), place visited: Rotorua District, calendar year 1999-2012, source: Stats NZ
- Overnight domestic trips to Rotorua, calendar year 2018-25, source: Fresh Information LTD hosted by NZTE, https://freshinfo.shinyapps.io/NZVAF/
- Estimated resident population by age 1999-2018, source: Stats NZ.

International overnight visitor projection methodology

An historical time series of international overnight visitors to Rotorua was constructed using IVS data scaled up to include people of all ages. A short-term projection was created using Fresh Information data, and long-term projections were created based on extending trajectories in the historical data.

Converting visitors aged 15+ to all ages

International visitor arrivals to New Zealand by country of residence, age and purpose of visit 1997-2018 were used to calculate the ratio of visitors aged 0-14 years to visitors aged 15+, by country of origin and purpose of visit, in each year from 1997-2018. These ratios were then applied to the IVS estimates of international overnight visitors to Rotorua, aged 15+, by country of origin and purpose of visit, from 1997-2018 to estimate international overnight visitors to Rotorua, of all ages, by country of origin.

Example: the ratio of visitors aged 0-14 years to visitors aged 15+ among Australians visiting New Zealand for a holiday in 2018 was 0.134. In 2018, there were 107,961 holiday visitors to Rotorua from Australia, aged 15+. Therefore, the number of holiday visitors to Rotorua from Australia, of all ages was calculated as follows.

$$107{,}961 * 1.134 = 122{,}417$$

The ratios were applied to IVA estimates of visitors to Rotorua aged 15+, for each country and purpose of visit, for each year from 1997-2018. Some countries in the IVS were not explicitly included in the international visitor arrivals dataset, therefore the following proxies were used:

- (IVS) Rest of Europe – (Arrivals) Germany
- (IVS) Rest of Asia – (Arrivals) average of China, Japan and South Korea
- (IVS) Rest of Oceania – (Arrivals) Australia
- (IVS) Rest of Americas – (Arrivals) Total
- (IVS) Africa/Middle East – (Arrivals) Total.

As a result of scaling up international overnight visitors from those aged 15+ to all ages, the total number of international overnight visitors to Rotorua in 2018 increased from 889,000 to 962,000.

Extending the historical time series to 2025

The estimates of international overnight visitors of all ages from 1997-2018 were extended to 2025, using the annual rates of change in the Fresh Information of international overnight visitors aged 15+ from 2018-25[5].

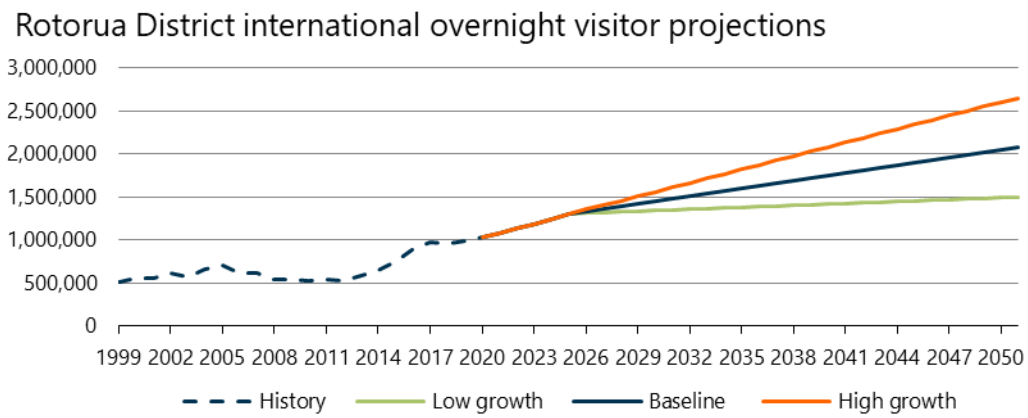
Example: In 2018 there were an estimated 961,637 international overnight visitors to Rotorua of all ages. The Fresh Information data tells us that the number of international overnight visitors to Rotorua aged 15+ grew from 942,900 in 2018 to 971,800 in 2019; 3.1%. The number of international overnight visitors to Rotorua of all ages in 2019 was calculated as follows.

$$961{,}637 * 103.1\% = 991{,}111$$

Extending the baseline series to 2051 and creating scenarios

Estimates of international overnight visitors of all ages from 1997-2025 were extended to 2051 based on the trajectory of the series from 2000-2025. This constituted the baseline series. A 'high growth' scenario was created from 2025-51 based on the trajectory of the series during a period of strong growth from 2010 to 2025. A 'low growth' scenario was created from 2025-51 by assuming that in 2051, the difference between the high growth scenario and the baseline would be inverted. The baseline and the two scenarios were agreed with Gina George of Destination Rotorua. Figure 33 shows the baseline, the high growth scenario, the low growth scenario and (in dashed line) the historical trajectory that formed the basis of the baseline and high growth projections.

Figure 33



Adding country of origin

To estimate the country of origin of international overnight visitors to Rotorua, of all ages, from 2019-51, the proportions of international overnight visitors to Rotorua of all ages, from each country of origin, in 2018 were applied to the total for each year from

[5] It would have been preferable to extend the Fresh Information estimates from 2018-25 backwards to 1997 using the IVS growth rates. This would have been consistent with the domestic visitor methodology. However, the IVS dataset includes country of origin and purpose of visit estimates. The Fresh Information dataset does not. The IVS dataset was therefore preferable as the basis for the series.

2019-51. This was done for the baseline, high growth and low growth projections. The 2018 proportions were chosen because they constituted the latest actual estimates.

Example: in 2018, 12% of international overnight visitors to Rotorua were from China. Therefore, out of a total 991,111 international overnight visitors to Rotorua in 2019, the number of overnight visitors from China in 2019 was calculated as follows.

$$991{,}111 * 0.12 = 116{,}032$$

Domestic overnight trip projection methodology

An historical time series of overnight trips by domestic visitors to Rotorua was constructed using Fresh Information data from 2018-25, scaled up to include people of all ages and extended backwards to 1999 based on Domestic Travel Survey (DTS) data. Long-term projections were based around New Zealand population growth rates.

Converting trips by visitors aged 15+ to all ages

Fresh Information estimates of overnight trips by domestic visitors to Rotorua for visitors aged 15+ from 2018-25 are more accurate than historical estimates from the DTS, which was not designed to provide estimates at the TA level. The Fresh Information estimates were therefore used as the basis of the historical series.

Estimates of the New Zealand population by age were used to calculate the ratio of people aged 0-14 years to people aged 15+. The average ratio for the years 2014-18 was applied to the Fresh Information estimates of overnight trips by domestic visitors to Rotorua aged 15+ from 2018-25, to estimate overnight trips by domestic visitors to Rotorua of all ages from 2018-25.

Extending the 2018-25 time series back to 1999

Overnight trips by domestic visitors to Rotorua of all ages from 2018-25 were extended backwards to 2012 based on the 2018-25 trajectory. The series was then extended further back to 1999 using annual rates of change in the DTS estimates of overnight trips by domestic visitors to Rotorua aged 15+ for the years 1999-2012.

Example: there were an estimated 1,664,213 overnight trips by domestic visitors of all ages to Rotorua in 2012. Based on the Domestic Travel Survey, there were 603,621 overnight trips by domestic visitors aged 15+ in 2011 and 519,590 in 2012; the number of trips in 2011 was 16% higher than in 2012. Therefore, the overnight trips by domestic visitors of all ages to Rotorua in 2011 was calculated as follows.

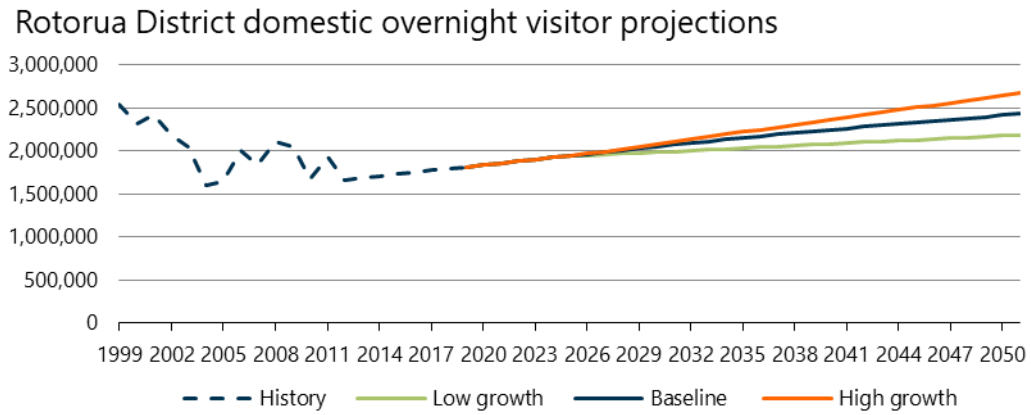
$$1{,}664{,}213 * 1.16 = 1{,}933{,}358$$

Extending the baseline series to 2051 and creating scenarios

Estimates of overnight trips by domestic visitors to Rotorua of all ages from 1999-2025 were extended to 2051 based on Infometrics' projected growth in the New Zealand population. This constitutes the baseline series. A 'high growth' scenario was created from 2025-51 based on the assumption that by 2051, there would be 10% more trips

than the baseline 2051 projection. A 'low growth' scenario was created from 2025-51 based on the assumption that by 2051, there would be 10% fewer trips than the baseline 2015 projection. The baseline and the two scenarios were agreed with Gina George of Destination Rotorua. Figure 34 shows the baseline, the high growth scenario and the low growth scenario.

Figure 34



Domestic day trip projection methodology

A time series of day trips by domestic visitors to Rotorua was constructed using Fresh Information data on overnight trips by domestic visitors from 2018-25 converted to day trips, scaled up to include people of all ages, and extended backwards to 1999 based on Domestic Travel Survey (DTS) data. Long-term projections were based around New Zealand population growth rates.

Creating a time series of day trips by domestic visitors from 2018-25

A time series of domestic day trips by visitors to Rotorua from 2018-25 was constructed as follows.

- DTS data on overnight and day trips to Rotorua by people aged 15+ from 1999-2012 was used to calculate the ratio of day trips to overnight trips.
- The average ratio of day trips to overnight trips for 2008-126 was applied to Fresh Information data on domestic overnight trips of people aged 15+ for 2018-25 to estimate domestic day trips of visitors aged 15+ for 2018-25.

[6] The average ratio for 2008-12 was 1.76. Between 1999 and 2012 the ratio varied between 1.98 in 2009 and 1.46 in 2011.

Example: for domestic visitors to Rotorua, the ratio of day trips to overnight trips from 2008-12 was 1.76. In 2018 there were 1,431,800 overnight trips by domestic visitors to Rotorua. Therefore, the number of day trips by domestic visitors to Rotorua in 2018 was calculated as follows.

$$1{,}431{,}800 * 1.76 = 2{,}526{,}052$$

Converting trips by visitors aged 15+ to all ages

Estimates of the New Zealand population by age were used to calculate the ratio of people aged 0-14 years to people aged 15+. The average ratio for the years 2014-18 was applied to the estimates of day trips by domestic visitors to Rotorua aged 15+ from 2018-25 to estimate day trips by domestic visitors to Rotorua of all ages from 2018-25.

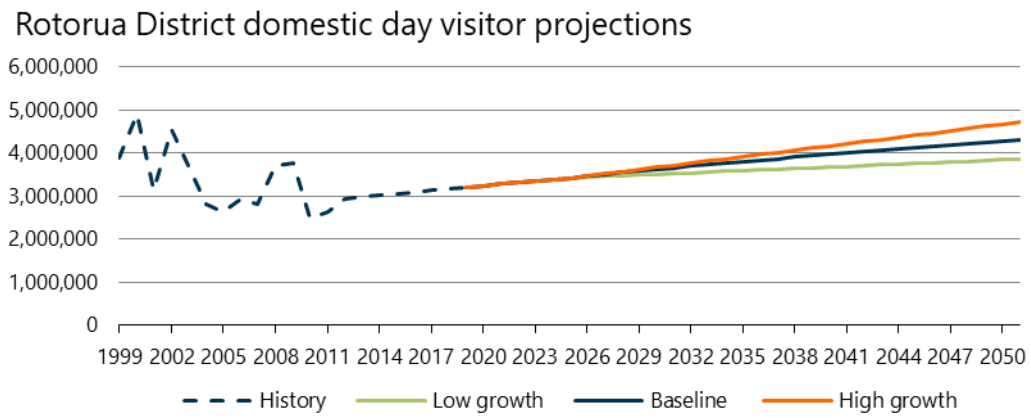
Extending the 2018-25 time series back to 1999

Day trips by domestic visitors to Rotorua of all ages from 2018-25 were extended backwards to 2012 based on the 2018-25 trajectory. The series was then extended further back to 1999 using annual rates of change in the DTS estimates of day trips by domestic visitors to Rotorua aged 15+ for the years 1999-2012.

Extending the baseline series to 2051 and creating scenarios

Estimates of day trips by domestic visitors to Rotorua of all ages from 1999-2025 were extended to 2051, based on Infometrics' projected growth in the New Zealand population. This constitutes the baseline series. A 'high growth' scenario was created from 2025-51 based on the assumption that by 2051, there would be 10% more trips than the baseline 2015 projection. A 'low growth' scenario was created from 2025-51 based on the assumption that by 2051, there would be 10% fewer trips than the baseline 2051 projection. The baseline and the two scenarios were agreed with Gina George of Destination Rotorua. Figure 35 shows the baseline, the high growth scenario and the low growth scenario.

Figure 35



Omissions

The following projections were requested in the service specification but were unable to be produced due to the absence of historical data.

- International day-trip visitors
- Domestic dayand overnight visitor trips
- Point in time international and domestic, day and overnight visitors

Scenario analysis of the impacts of climate change mitigation actions, such as a reduction in long-haul air travel, was also omitted due to an absence of historical data and considerable uncertainty as to how future mitigation actions might play out.