2018-base Population, Family and Household, and Labour Force Projections for the Waikato Region, 2018-2068

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1. Introduction

The Waikato Regional Council (WRC) approached the University of Waikato in 2016 with a request to produce new Territorial Authority (TA) level population, household and labour force projections for the Waikato Region, subsequent to the release of data from the 2018 Census. These projections use a newly-developed multi-regional cohort component model that covers the whole of New Zealand (except the Chatham Islands Territory), and incorporates separate components of population change for internal migration flows (based on a gravity model) and international migration flows (immigration and emigration). This represents an improvement on the previously used Whole-of-Waikato (WOW) population model, which had been used in previous 2013-base and earlier population projections developed by the University of Waikato (Cameron 2020a; 2020b; 2020c; Cameron and Cochrane, 2014a; 2015; 2016; Cameron *et al*., 2007; 2008; Jackson et al., 2014b), as well as being integrated into the Waikato Integrated Scenario Explorer (WISE) model (Rutledge *et al*., 2008; 2010). The WISE model is a systems-based integrated model that incorporates economic, demographic, and environmental components across the entire Waikato Region. The new population projections model is not incorporated directly into WISE, but remains a key input into the WISE model.

This report briefly summarises the the Waikato 2018-base population projections for TAs in the Waikato Region. The methodology underlying the new population model is described in detail, along with the assumptions that were applied for the 2018-base projections. This model represents an improvement on previous models (e.g. Cameron and Cochrane, 2014; 2015; 2016), as it incorporates directional migration flows, and separates internal and international migration. It also incorporates improvements in the age distribution of migration. These improvements to the population model were requested subsequent to a peer review of the WOW population model (Wilson, 2015). The family and household, and labour force, projections derived from the population projections follow a similar methodology as that employed in Cameron and Cochrane (2016) for the 2016-updated Waikato projections.

This project continues to build on the pioneering demographic projections work by the University of Waikato (Cameron *et al*., 2007; 2008). The model has developed over time, and the methodology and assumptions that are now employed are substantially different from those adopted for official Statistics New Zealand (SNZ) projections. The population model generates projections for all of the TAs in New Zealand (with the exception of Chatham Islands Territory).

However, in this report we limit ourselves to reporting the results for TAs that are wholly or substantively contained within the Waikato Region.

Three projection variants were developed for the TA-level population, family and households, and labour force: (1) a low-variant; (2) a medium-variant; and (3) a high-variant. As discussed in Section 2.9 of the report, these three variants should be interpreted as individual scenarios from the many possible futures that could be realised for population, family and households, and the labour force. In sum, this project involved calculating population, family and household, and labour force projections for each TA in the Waikato Region, and for the region in total, for each of the three variants (low, medium, and high). These projections will feed into a follow-up report on population, and family and household, projections at the SA2 statistical area level (Cameron and Cochrane, 2021 forthcoming). In addition, a fourth scenario was prepared for population only, which ignored the assumed impact of the coronavirus pandemic (see Section 2.7 for further details).

The projections were delayed several times due to delays in the release of necessary data from the 2018 Census of Population and Dwellings.[1] In particular, the 2018-base Estimated Resident Population data for June 2018 was only updated and made available by SNZ in October of 2020.[2] Moreover, at the time of compiling these projections, updated fertility and mortality assumptions from SNZ were not available (see Section 2.4), nor were living arrangement type rate assumptions (see Section 2.10). However, our expectation is that the lack of these assumptions does not lead to significant bias in the resulting projections, and waiting for their availability would have further delayed delivery of this report and the associated projections.

The remainder of the report is structured as follows:

- Section 2 briefly summarises the data and methodology used in preparing the projections;
- Section 3 presents and briefly discusses the national-level population projections, obtained by summing the TA-level projections for the entire country;
- Section 4 presents and briefly discusses the TA level demographic (population, family and household, and labour force) projections, for all (low-variant, medium-variant, and high-variant) scenarios; and

[1] For example, see https://www.stats.govt.nz/news/2018-census-data-release-delayed.
[2] See https://www.stats.govt.nz/information-releases/subnational-population-estimates-at-30-june-2020.

- Section 5 concludes.

2. Data and Methods

2.1 Data

The data used in the formulation of these projections were sourced from Statistics New Zealand (SNZ). This includes national and subnational data from the five-yearly Census of Population and Dwellings (1991, 1996, 2001, 2006, 2013, and 2018), SNZ national and subnational population estimates, national and subnational period life tables, national and subnational vital statistics data, the SNZ subnational demographic projections series, and the reported assumptions underlying those projections. The TA-level boundaries for the projections are consistent with boundaries at the time of the 2018 Census of Population and Dwellings.

In each case, the TA-level projections presented in this report are for the whole territorial authority. In the case of the Waikato Region projections (see Section 4.12), the projections are for the whole Waikato Region. The regional projections require some post-hoc calculations because of the inconsistency in boundaries between TAs and the region. Specifically, in the Waikato region projections we assume that the proportion of the TA-level population (and families and households, and labour force) that lives outside of the region (for Waitomo and Taupo Districts), and the proportion of the TA-level population (and families and households, and labour force) that lives inside the region (for Rotorua District), remains constant over time.

2.2 The Cohort Component Model

The most common methodology used to generate population projections relies on the cohort component model, which dates back at least to Whelpton (1928). This is the methodology used by SNZ, the major supplier of data on current and projected population size, growth and structure for New Zealand regions and districts. In recent years, new methodologies have been developed for population projections, such as stochastic and microsimulation approaches (see e.g. Dharmalingam and Pool, 2006). This report adopts a new methodology for the cohort component model, improving on the methodology originally developed by Cameron et al. (2007; 2008) and used in subsequent projections (Cameron 2020a; 2020b; 2020c; Cameron and Cochrane, 2014a; 2015; 2016; Jackson et al., 2014b).

The general approach that was used in developing the population projections is as follows. The current population (base population) is first defined, and then assumptions are made about demographic changes to this population, which are then applied using the cohort component model. The cohort component model is a stock-flow model that is based on the following fundamental ‘accounting identity’ of population growth:

usually resident population in area *i* at the end of year *t*

= usually resident population in area *i* at the beginning of year *t*

+ births to mothers residing in area *i* during year *t*

– deaths of residents of area *i* during year *t*

+ inward migration from other regions into region *i* during year *t*

– outward migration of residents from area *i* to other regions during year *t*

+ inward migration from overseas into region *i* during year *t*

– outward migration of residents from area *i* to overseas during year *t*

Starting with a given base year usually resident population (see Section 2.3), the usually resident population one year later is calculated using the equation above. This end-year usually resident population becomes the start-year usually resident population for the next iteration of the model. This procedure is repeated for each year through to the end of the projection period (the projection horizon), and separately for each sex. Separate assumptions are used for each of the demographic ‘drivers’. Births are derived by multiplying age-specific fertility rates by the numbers of women of childbearing age (13-49) (see Section 2.4). Deaths are derived by multiplying age- and sex-specific mortality rates by the numbers of people of each age and sex (see Section 2.4). Age- and sex-specific internal migration flows are derived by applying an age-sex-specific migration profile to total internal migration flows between pairs of TAs derived from a gravity model (Poot *et al*., 2016). Age- and sex-specific international migration flows are derived by applying an age-sex-specific migration profile to total international migration flows (separately for immigration and emigration).

The procedure for deriving estimates of migration flows is a key departure from the method employed by SNZ, and is also the main improvement on the method previously employed in projections by the University of Waikato (e.g. Cameron and Cochrane, 2016). Another key departure from the modelling approach used by SNZ is that our model is bottom-up, rather than top-down (Willekens, 1983). A top-down approach projects the population at the national level first, using a national-level model, then projects each sub-national area either separately or as part of a multi-regional model. The sub-national projections in a top-down approach are constrained to sum to the previously determined national projection. A bottom-up approach instead projects each subnational area separately first, and derives a national projection as a sum of the subnational projections. The bottom-up approach has the advantage of more accurately reflecting differences in sub-national drivers of population change; however, the lack of an 'adding-up' constraint could lead to unrealistic national-level projections (which can be addressed through appropriate calibration of the model, as described in Section 2.8). For more on the advantages and disadvantages of top-down versus bottom-up approaches to population projections, see Cameron et al. (2021).

The remainder of this section describes the methods used for deriving each of the components used in the cohort component model, as well as the methods used to validate and calibrate the model. Finally, the methods employed in the family and household projections and labour force projections are described.

2.3 Base Populations

The base populations used for the projections were the Estimated Resident Populations (ERP) at 30 June 2018, revised by SNZ in 2020. As this ERP is only reported by SNZ in 5-year age groups, the single-year age groups necessary for the population projection model were derived by interpolating the ERP for each territorial authority using the TA-level Census Usually Resident Population (CURP) counts by single-year-of-age from the 2018 Census of Population and Dwellings. Separate interpolations were undertaken for each sex.

2.4 Fertility and Mortality Assumptions

The fertility and mortality assumptions used in the projections were initially based on the subnational 'medium' fertility and mortality assumptions used by SNZ in their 2013-base subnational population projections. These are the same fertility and mortality assumptions as used in the Waikato 2016-update demographic projections (Cameron and Cochrane, 2016).

More recent SNZ assumptions (i.e. those used in their 2018-base subnational population projections) were not available at the time that these projections were developed. Moreover, having considered alternative time series for fertility and mortality, in the past the assumptions used by SNZ with respect to fertility and mortality in their subnational population projections have proven to be adequate for our purposes (see Cameron *et al*., 2007; 2008), and they remain relevant and generally unbiased even five years later. As SNZ use past fertility and mortality (survivorship) rates based on the official deaths and births statistics to develop their projections, the SNZ assumptions therefore represent an appropriate starting point.

Age-specific fertility rates by single-year-of-age (of the mother) were derived by first interpolating the five-year subnational age-specific fertility rate using the national-level age-specific fertility rate profile by single-year-of-age. The resulting profiles were then scaled to match the projected total fertility rate (from SNZ) for each territorial authority. The total fertility rate for each territorial authority was assumed to follow the SNZ projections to 2043 then remain invariant after 2043. Sex at birth was assumed to follow a constant pattern similar to past trends, with 105.5 males for every 100 females at birth.

However, during the calibration process (see Section 2.8), it became clear that the SNZ fertility assumptions generate far too many births at both the national and subnational levels, and resulted in a projected national population that was implausibly high. This was confirmed by comparing the number of projected births by TA for the June years 2018 to 2020, with the actual numbers reported in vital statistics data. In part, this over-projection of births arose because New Zealand has been going through a period of historic low fertility.[3] To better account for this lower-than-expected fertility, we scaled the SNZ fertility assumptions for each TA down so that they replicated the 2018-2020 total number of reported births, then applied the TA-level scaling factors to all of the future projected age-specific fertility rates. Ultimately though, a better approach for future projections may be to generate our own age-specific fertility rate projections that adequately capture current fertility trends. We leave this as an exercise for future improvements in the projections model.

In terms of mortality, age-specific survivorship rates by single-year-of-age and sex were derived by first interpolating the survivorship rates from the subnational abridged life tables for each territorial authority using the national life tables by single-year-of-age. The resulting

[3] For example, see https://www.stats.govt.nz/news/new-zealands-birth-rate-lowest-on-record-deaths-drop-in-2020.

profiles were then scaled to match the projected life expectancy at birth for each territorial authority. Life expectancy at birth for each territorial authority was assumed to follow the SNZ projections to 2043, then continue to improve in a linear fashion through until 2068. This represents a slight modification on the previous mortality assumptions, which assumed no further improvements in life expectancy after 2043 (Cameron and Cochrane, 2016).

2.5 Internal Migration Model

In a departure from previous University of Waikato population projection models, we derive the internal migration flows using a gravity model. The gravity model of migration is an empirical regularity, and recognises that the migration flow between two places (the origin *i*, and the destination *j*) depends on the 'economic mass' of the origin and destination (proxied by the population size), and the distance between them (Poot et al., 2016). Specifically, migration flows (in both directions) between larger origins and destinations, and between places that are closer together, are substantially larger (holding other factors constant) than migration flows between smaller origins and destinations, and between places that are further apart.

We first estimated the internal migration gravity model using 2013 and 2018 Census data on internal migration flows, population estimates, and inter-TA distances. We limited our analysis to two consecutive Censuses to avoid, because taking more data could lead us to under-weight more recent structural factors that affect internal migration and over-weight historical trends.

Internal migration flows data were derived from the Census question on address five years ago, combined with current address. We used those data to construct an origin-destination matrix for all people who answered the address-five-years-ago question in the 2013 Census, and anyone for whom the same data were available for the 2018 Census.[4] Population data were the estimated usually resident population by TA at 30 June of 2013 and 2008 (the population at the start of each five-year period). Distance was the straight-line distance between the geographic centroid of each TA. Poot et al. (2016) showed that the gravity model is robust to the choice of alternative distance measures. In addition, we included dummy variables for internal migration

[4] The address-five-years-ago question was not asked in the 2018 Census. Instead, an address-one-year-ago question was asked, and data on address-five-years-ago were constructed by SNZ from administrative data sources, as well as data from the 2013 Census. See http://datainfoplus.stats.govt.nz/item/nz.govt.stats/58180123-b856-4fed-9b91-b006d16e43b8/13/ for further details.

flows between geographically contiguous (i.e. neighbouring) TAs, and between the North and South Islands. Past research has shown that internal migration flows between the islands are much lower than can be explained purely by distance (Poot, 1986). To ensure the model picks up idiosyncratic differences in push and pull factors between TAs, it also includes origin and destination fixed effects. This specification of gravity model has previously been successfully used for inter-regional (Cameron and Poot, 2014a; 2014b) and inter-urban (Poot et al., 2016) migration flows in New Zealand.

The resulting gravity model is shown in Table 1. Overall, the model explains around 84.9% of the variation in internal migration flows. The origin population is statistically significant and has the expected positive sign. The destination population is not statistically significant and is negative in sign; however, this is not unusual in a gravity model that also includes both origin and destination fixed effects, and it is not straightforward to interpret the coefficients on the population variables (Cameron and Poot, 2019). The distance variable is negative and highly statistically significant. The contiguity and Cook Strait dummy variables are also statistically significant and of the expected sign.

Table 1: Gravity model of internal migration

Variable	**Coefficient (Standard Error)**
Ln(Origin Population)	1.171^{***} (0.289)
Ln(Destination Population)	-0.345 (0.275)
Ln(Distance)	-1.010^{***} (0.016)
Cook Strait Dummy	-0.480^{***} (0.023)
Contiguity Dummy	0.536^{***} (0.038)
N	7,630
Adjusted R^2	0.8491

N.B. Origin and destination fixed effects are omitted from the table for brevity; * p<0.1; ** p<0.05; *** p<0.01.

The gravity model shown in Table 1 was embedded within the population model. The projected internal migration flows depend on the populations of origin and destination at a given point in time, as well as the time-invariant distance, contiguity, and Cook Strait variables, and the fixed effects. The embedding of the gravity model within the population model represents one of the key innovations in this latest population model, and has been developed over a number of years (Cameron and Poot, 2013; 2014a; 2014b; 2016).

The gravity model provides a projection of the *total* annual internal migration flow between each pair of origin and destination TAs in each year. To convert this total into *age-sex-specific* migration flows, we first estimated a profile of the age-specific in-migration rates based on address-five-years-ago data for each TA from the 2018 Census. The age-specific migration profile for each TA was based on data for that TA as a destination, as this was expected to more accurately reflect age-specific origin-destination internal migration flows. These data were first smoothed using the model migration schedule method described by Rogers et al. (1978) and the Microsoft Excel algorithm developed by Wilson (2010). Then, a second round of smoothing was used to reduce high migration rates at older ages for some TAs. Finally, each migration profile was standardised to sum to one. Separate migration profiles were not developed by sex, due to the sparse nature of the data for many TAs. Instead, internal migration flows were assumed to be equally prevalent for each sex (in effect, each migration profile was converted to a sex-specific migration profile that was standardised to sum to 0.5). For some TAs, the migration profile algorithm could not convert to a plausible profile. In those cases, mostly occurring for TAs with small populations (and hence a small number of internal migrants), the profile for a neighbouring TA was substituted. This process was not necessary for any TAs in the Waikato region.

An example of a resulting migration profile is shown in Figure 1, for Hamilton City. Note that there is a significant peak in migration flows to Hamilton City at young ages, followed by a tapering off at older ages. In contrast, other TAs often have a peak of in-migration at older ages, representing retirement migration flows.

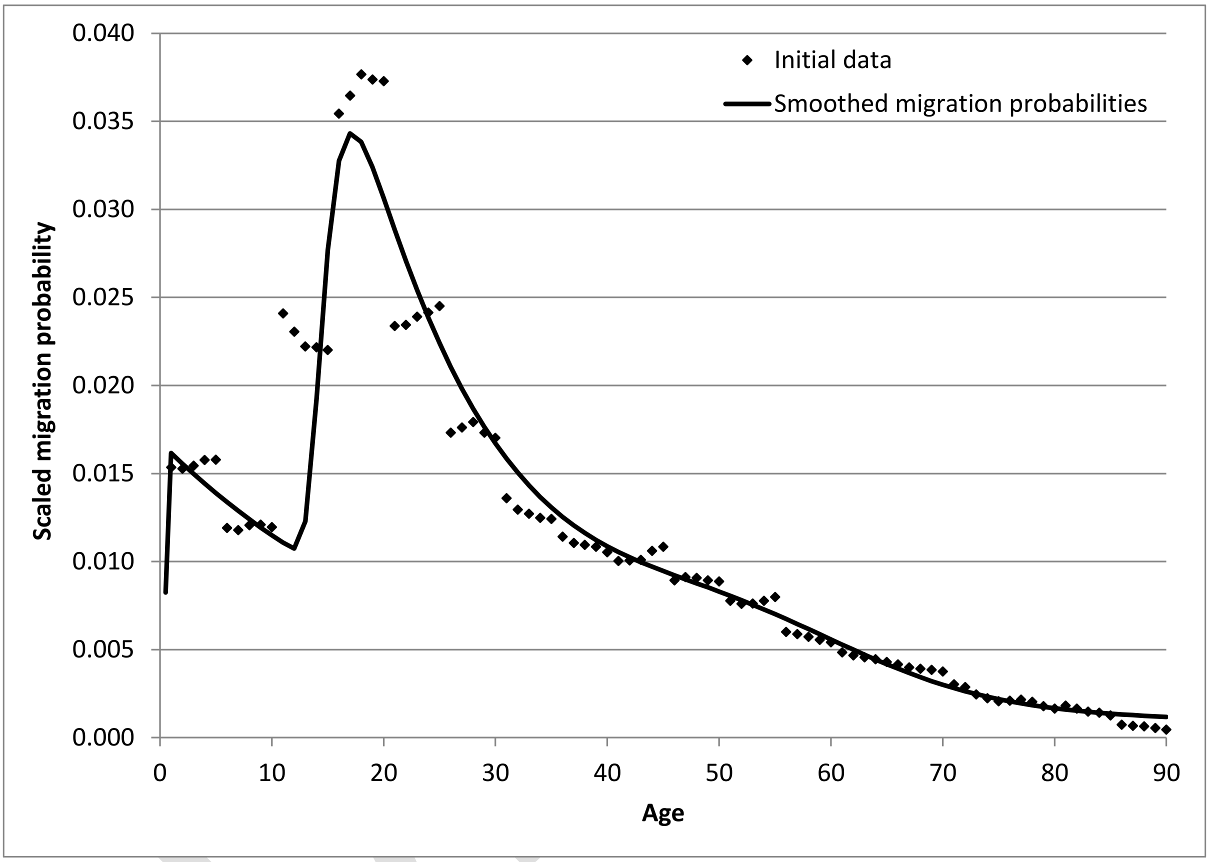
2.6 International Migration Assumptions

International migration flows represent the most challenging component of population change to project, due to the extensive uncertainty over their future trajectory. Our original intention was to model emigration based on a TA-specific partial gravity model, and immigration based on a time series model, with TA-specific immigration flows based on TA-level population shares. This is the approach adopted by IPSS in Japan for their subnational projections.[5]

[5] See http://www.ipss.go.jp/site-ad/index_english/population-e.html.

However, when we tested various structural models of international migration flows (immigration and emigration), based on partial gravity models, these models either did not perform well in-sample, or generated projections of future emigration flows that were implausibly large.

Figure 1: Age-specific in-migration profile for Hamilton City



We then tested various time series econometric models of national-level international migration flows (both immigration and emigration). The best model, in terms of both in-sample and out-of-sample performance, appears to be a fairly simple error correction model. This model takes a long-run average level of immigration and emigration, and 'decays' deviations from that long-run average over time, until the flows reach the average. In principle the long-run average could be replaced by a time trend, but in this case the time trend would lead to implausibly large projected migration flows, especially later in the projection period. The long-run average for both immigration and emigration was taken as the average annual level over the period from 1990-2020. The optimal 'decay rate' in the error correction model for immigration was 27 percent (meaning that the difference between the projected annual immigration flow and the long-run trend reduced by 27 percent each year), while the optimal 'decay rate' in the error correction model for immigration was 31 percent.

Figure 2 illustrates the actual and projected national-level immigration flows. All scenarios are presented (see Sections 2.7 and 2.8 for further details on the different variant scenarios). This figure clearly shows the historically high immigration flows that New Zealand has experienced in recent years, as well as the variability in those flows. The impact of the coronavirus pandemic is evident in the substantial drop in immigration in the June 2021 year, followed by a gradual error correction back to the long-term trend level of immigration, which is 106,947 per year. Figure 3 shows the corresponding data for emigration, with similar features, and a gradual error correction back to the long-term trend level of emigration, which is 83,842 per year. Figure 4 shows the data for net international migration (immigration minus emigration), where the high degree of uncertainty is clearly on display.

Figure 2: Actual and projection national-level immigration flows, 2002-2068

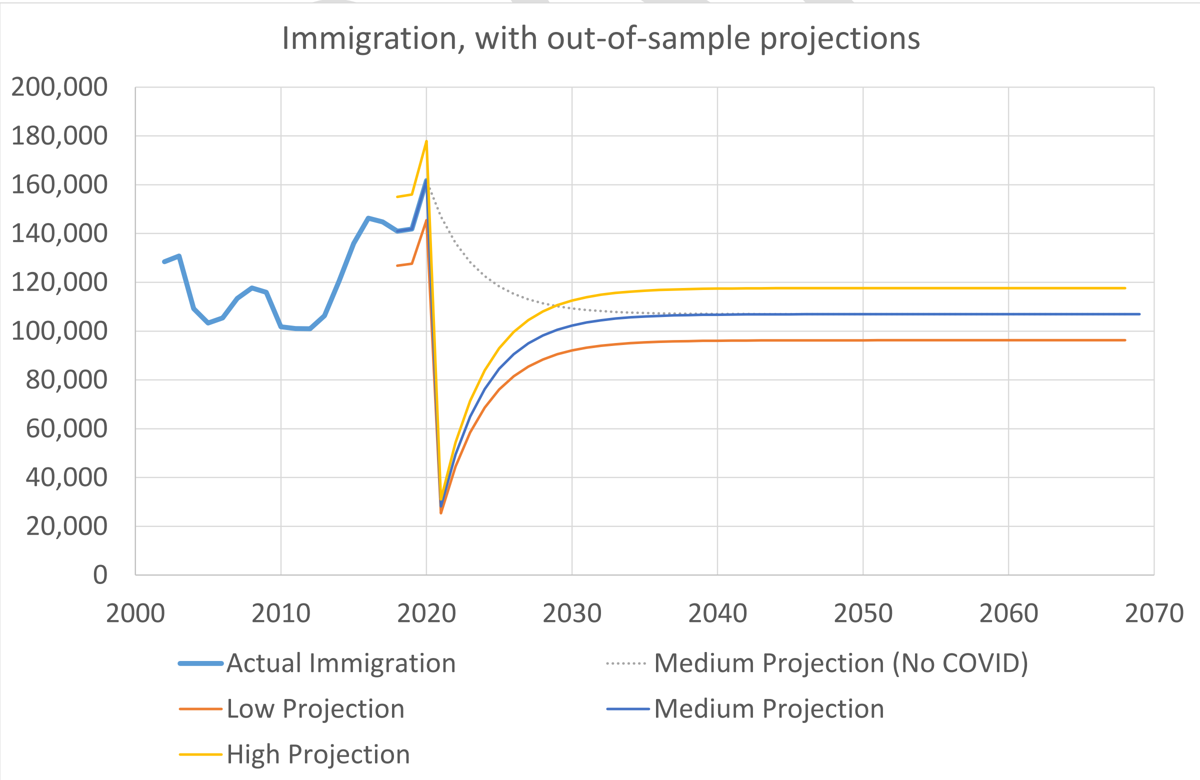


Figure 3: Actual and projection national-level emigration flows, 2002-2068

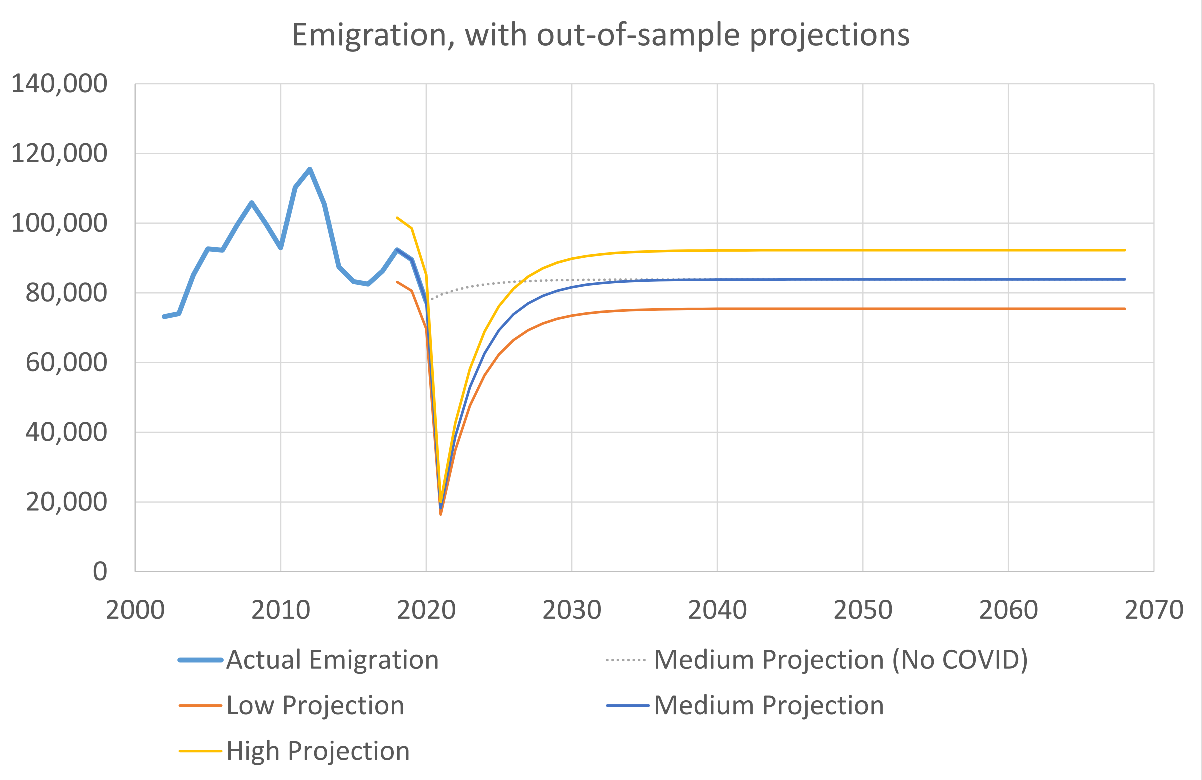
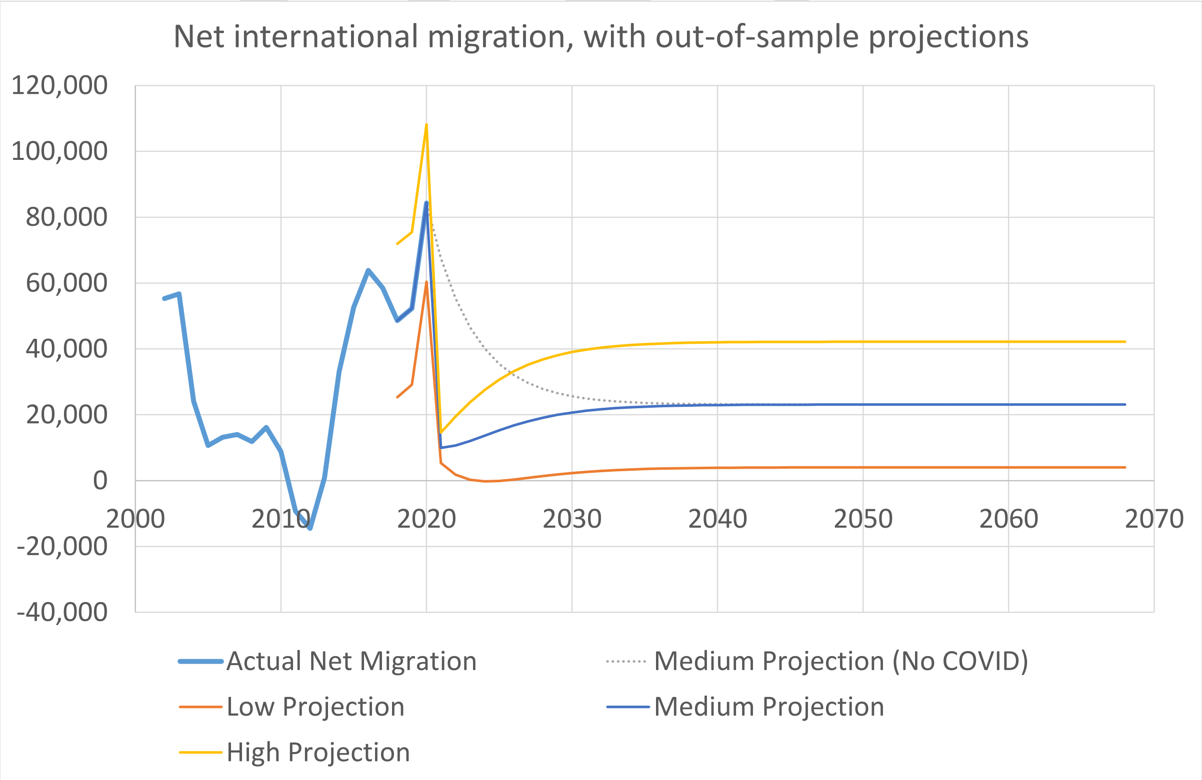


Figure 4: Actual and projection national-level net international migration flows, 2002-2068



Similar to the gravity model of internal migration, the error correction models provide projections of annual *total* international migration flows in each direction (emigration and immigration), but at the national level. To apportion immigration and emigration flows by TA, we first attempted structural modelling (as noted above). We then compared the TA shares of immigration and emigration flows with TA shares of population for the periods 2008-2013 and 2013-2018 (as reported in the 2013 and 2018 Censuses). We identified that an assumption of constant shares of immigration and emigration, based on shares of past immigration and emigration flows (evaluated separately) provided plausible projections of future flows. That then provided TA-specific total emigration and immigration flows. To convert these totals into age-sex-specific international migration flows for each TA, we estimated separate of the age-specific immigration and emigration profiles based on address-five-years-ago data for each TA from the 2018 Census. The age-specific immigration profile for each TA was based on data for that TA as a destination, as this was expected to more accurately reflect age-specific international migration flows. The age-specific emigration profile for each TA was based on data for that TA as an origin for *internal* migration flows, because data on emigration flows are not available.[6] The process of developing the profiles was identical to that used for internal migration profiles, with each migration profile was standardised to sum to one. Separate migration profiles were not developed by sex, again due to the sparse nature of the data for many TAs. Similar to the case for internal migration profiles, for some TAs, the migration profile algorithm could not convert to a plausible profile. In those cases, mostly occurring for TAs with small populations (and hence a small number of internal migrants), the profile for a neighbouring TA was substituted. In the Waikato Region, only one TA was affected, with the emigration profile for Waikato District replaced by the profile for Waipa District.

2.7 The Projected Impact of the Coronavirus Pandemic

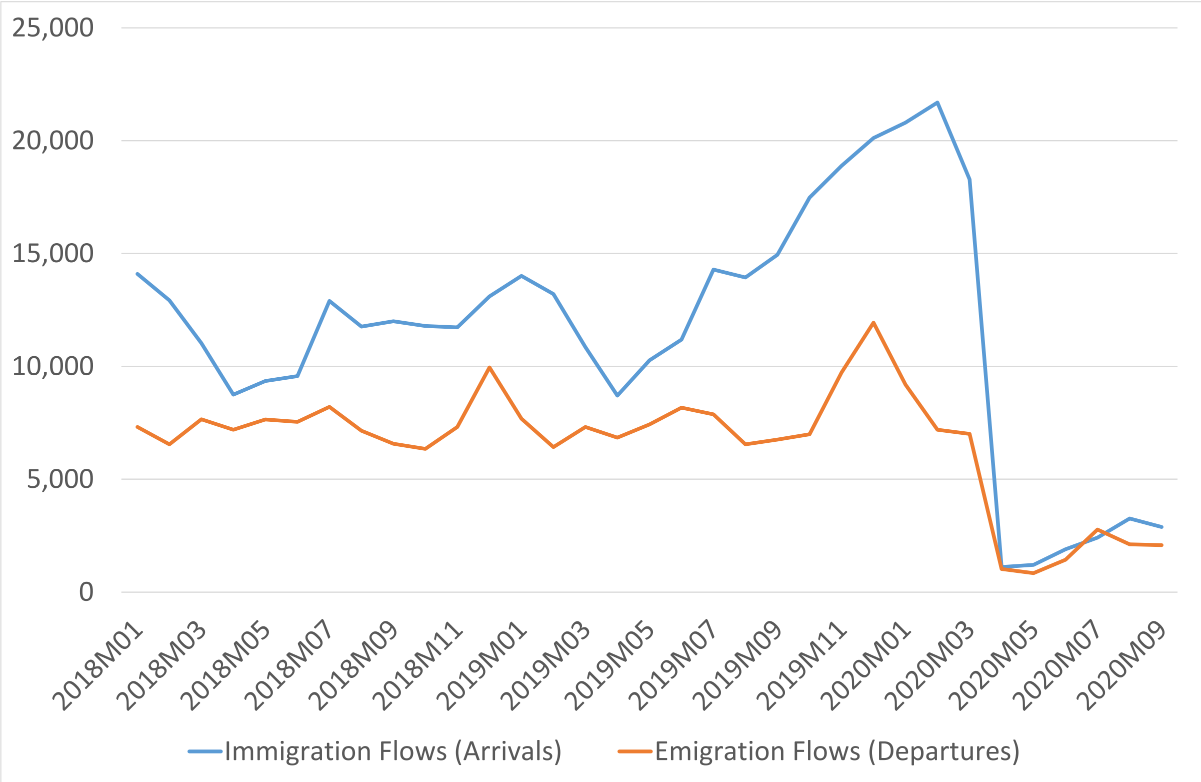
One challenge to contemporary population projections in 2020/21 is anticipating and projecting the impact of the ongoing coronavirus pandemic. New Zealand has been fortunate to avoid the worst impacts on mortality that many other countries are experiencing (Balmford et al., 2020). Thus, we assumed no current or future impact on mortality arising from the pandemic. Similarly, there is little evidence currently to support significant changes in fertility as a result of the pandemic. While it is known that fertility is lower in times of economic recession

[6] Emigrants are not observed in the Census because they have moved overseas.

(Sobotka et al., 2011), the New Zealand economy has bounced back from the pandemic well, and other than some changes in the timing of births, we anticipate no long-run deviation from trend fertility as a result of the pandemic. We also anticipate no change in internal migration flows, which might only be disrupted for short periods as the result of geographically-specific and time-limited lockdowns.

In contrast, international migration flows have been heavily affected by the pandemic. This is illustrated in Figure 5, which shows monthly immigration and emigration flows over the period from January 2018 to September 2020. After the coronavirus pandemic started, migration flows in *both* directions fell by around 80 percent, and have remained low since. Specifically, immigration flows in April-September 2020 were 82.6 percent lower than the corresponding months in 2019, and emigration flows in the same months were 76.5 percent lower. To account for the impacts of coronavirus on immigration and emigration, these percentage reductions were explicitly built into the projected immigration and emigration flows. The effect of this can be seen in Figures 2 and 3 above, by comparing the medium-variant projection with the medium (No COVID) projection. The medium projection starts low, with both immigration and emigration recovering to the long run trend over time. In contrast, the projection of immigration and emigration excluding the impact of the coronavirus pandemic start high and fall gradually over time towards the long run average.

Figure 5: Monthly international migration flows, 2018-2020



2.8 Validation and Calibration of the Population Model

Once the population model was parameterised, it was validated to ensure fidelity of the model, i.e. that all components (fertility and births; mortality and survivorship; internal migration; and international migration) were working as intended. This process identified no issues with the structure or initial parameterisation of the model.

Calibration of the model involved several stages. First, the projected number of births, by TA and in total for New Zealand as a whole, were compared with the actual number of births over the period from 2017 to 2020. As noted above, this resulted in a necessary downward adjustment to the projected total fertility rates for each TA. Second, the total population of New Zealand was calibrated by comparing the growth rate with recent national population projections. This resulted in no adjustment to the model parameters, as it confirmed a plausible path for future national population (in total, and by age and gender) (see also Section 3). Third, the TA-level shares of net international migration flows were calibrated by adjusting TA-level immigration shares in comparison with past and projected inter-Censal international migration flows. This resulted in only minor adjustments to the model parameters. Fourth, the total populations and growth rates for each TA were calibrated by adjusting the gravity model fixed effects, in order to more accurately reflect the relative growth rates from past subnational population projections. As no prior University of Waikato projections were available for TAs outside of the Waikato and Bay of Plenty regions, the medium-variant 2013-base SNZ projections were used as the baseline for these comparisons. Finally, the TA-level age structures were calibrated through minor adjustments to the migration age profiles. This ensured that the model did not over- or under-project TA-level migration flows into or out of certain age groups, unbalancing the resulting age distribution.

2.9 Low-variant and High-variant Population Projection Assumptions

Following calibration of the medium-variant population projection model (see Section 2.8), other projection scenarios were run. In addition to the baseline (medium-variant) projections outlined above, we present low-variant and high-variant (as well as the medium-variant without COVID) population projections which are based on an alternative set of assumptions. These represent plausible alternative scenarios to the baseline (medium-variant) population projection scenario (see Section below on interpretation of the results).

For fertility and mortality, each age- and gender-specific rate (fertility, and mortality/survivorship) was multiplied by a shift factor, following Cameron and Poot (2010; 2011). The percentage change in each of the rates is given by k, whereby k is based on a distribution for fertility and mortality/survivorship. The entire deterministic path of fertility and mortality rates over the 2018-2068 projection period was shifted by the corresponding factors. In this way, setting all multipliers to zero would result in the baseline projection, and the multiplier was varied around zero to increase or decrease each rate.

Following Cameron and Poot (2010; 2011), distributional assumptions for each multiplier were based on observed data from 1950 to 2009. The fertility multiplier was assumed normally distributed with a mean zero and standard deviation of 1.25 (giving a range of about +/- 5% of the mean fertility rates). The survivorship multiplier was assumed normally distributed with mean zero and a standard deviation of 0.5 (i.e. giving a range of +/- 2% of the mean mortality rates).

For international migration (emigration and immigration), the high-variant projections assumed 10% lower emigration and 10% higher total immigration throughout the projection period, while the low-variant projections assumed 10% higher emigration and 10% lower total immigration throughout the projection period. These assumptions were based on observed variation in emigration and immigration over the period from 1980 to 2020, and approximately represent one standard deviation lower, and higher, net migration flows for the low-variant and high-variant projections respectively.

The internal migration model was not adjusted for the low-variant or high-variant projections from that used for the medium-variant projections. That is because internal migration is a means of distributing population within the country, so by definition has no role in creating higher or lower projected populations, when the population of the entire country is being projected. That is, if internal migration were increased for some TAs, it must be reduced for other TAs, because the overall sum of net internal migration must be zero.

The interpretation of different projection scenarios is important. Specifically, the three variants (low, medium, and high) should be interpreted as individual scenarios from the many possible futures that could be realised for population, family and households, and the labour force. No scenario is any more likely than any other scenario of being the 'actual' path that future trends follow. However, the three variants (low, medium, and high) can be used to give a coarse representation of the uncertainty in the projections.

The medium-variant scenario represents approximately the centre of the distribution of all potential scenarios generated with this model and within the plausible distribution of assumptions. It is not exactly the middle of the distribution because the distribution of scenarios is likely to be asymmetric (for most TAs, the distribution has more 'upside risk' than 'downside risk') – for a demonstration of this, see Jackson et al. (2014a; 2014b), which include both a medium scenario projection, and a median stochastic projection. The interval between the low-variant scenario and the high-variant scenario represents approximately a 67 percent projection interval of all potential scenarios generated with this model and within the plausible distribution of assumptions. This interpretation was demonstrated by Stoto (1983) and Alho et al. (2008), and has recently been employed by Cameron *et al*. (2021) in a book chapter on uncertainty in subnational population projections. Under this interpretation, the interval between the low-variant and high-variant projections should be expected to capture the actual future population approximately 67 percent of the time. Approximately 33 percent of the time, the actual future population can be expected to be either higher than the high-variant projection, or lower than the low-variant projection.

An alternative way of interpreting the three variants (low, medium, and high) is that the low-variant projection is broadly representative of the bottom one-third of all potential scenarios generated with this model and within the plausible distribution of assumptions. The medium-variant projection is broadly representative of the middle one-third of all potential scenarios generated with this model and within the plausible distribution of assumptions. The high-variant projection is broadly representative of the top one-third of all potential scenarios generated with this model and within the plausible distribution of assumptions.

Regardless of interpretation, it should be recognised that population projections are not a forecast of the future, unless they are considered alongside an appropriate measure of uncertainty. While the interval between the low-variant and high-variant projection adequately captures this uncertainty for the medium-variant projection, an even better method for representing uncertainty is to use stochastic population projections, where the uncertainty is directly modelled (e.g. see Cameron and Poot, 2010; 2011).

2.10 Family and Household Projection Methods and Assumptions

Projections of the future number of families and households were obtained by applying age- and gender-specific assumptions about future trends in living arrangement type rates (LATRs) and average household sizes to the projected population, as described in Cameron et al. (2007). The number of persons living in a particular living arrangement type is derived by multiplying the age- and gender-specific living arrangement type rate (LATR) by the number of persons at that age and gender and summating. LATRs can be thought of as the probability of an individual being in a particular living arrangement. Living arrangements include families (couples without children, couples with children, and one-parent families), other multi-person households (containing no families), single-person households, and people living in non-private dwellings (such as prisons, nursing homes, or student halls of residence). The number of households is made up of the number of family households (which is necessarily smaller than the number of families, because some households contain more than one family), other multi-person households, and single-person households.

We used LATRs and other assumptions (the average number of families per family household, and the average household size for other multi-person households) provided by SNZ, which were used in their 2013-base subnational family and household projections, as these were the best available data at the time of these projections. The 2016-update projections made a further modification of the base populations to account for people living in non-private dwellings. Following discussions with SNZ and careful inspection of the base data, we note that these adjustments are not necessary. However, applying the LATR assumptions of SNZ clearly leads to an over-projection of families and households, compared with Census data (see Cameron and Cochrane, 2016). In the current projections, rather than making a population adjustment to better reflect the expected number of Census-year households at the beginning of the projection period (scaled to account for net Census undercount, as well as an adjustment for the difference between the March Census date and the 30 June projections date), we instead directly scaled the initial number of family households, other multi-person households, and single-person households to match the expected number in each TA. Those TA-specific scaling factors were then applied to the projected living arrangement type rates throughout the projection period, to ensure a consistent time series with the actual Census data on families and households in each TA.

LATRs were assumed to follow the SNZ projections to 2038, then continue to improve in a linear fashion through until 2068. This represents a slight modification on the previous LATR assumptions, which assumed no further changes in LATRs after 2038 (Cameron and Cochrane, 2016). In contrast, the number of households per multi-family household and the number of persons per other multi-person household were assumed to follow the SNZ projections to 2038, then held constant from 2038 through until 2068.

Separate family and household projections were created corresponding to each of the low-variant, medium-variant, and high-variant population projections. Each family and household projection used the same projected LATRs and other assumptions.

2.11 Labour Force Projection Methods and Assumptions

The Labour Force projections were obtained by applying age- and sex-specific assumptions about future trends in labour force participation rates (LFPR) to the population projections (see Cameron *et al*., 2007). Following Bryant *et al*. (2004) and Jackson *et al*. (2014b), we assumed three long-run trends in labour force participation would continue into the future, specifically we assumed that: (1) age- and sex-specific participation rates increase in a linear fashion to 2043 before stabilising and remaining constant thereafter; (2) the labour force participation of prime age women increases over a twenty year period (2018-2043) so that half of the age-specific gender gap in labour force participation in 2013 is closed by 2043 (i.e. if the difference in labour force participation rates between the genders in a particular age group was six percentage points in 2018, we assume that the gap would have closed to three percentage points by 2043); and (3) current increases in labour force participation rates amongst older workers continue out to 2043 before stabilising.

In the case of the latter assumption, we essentially assume that over the twenty-year period 2018-2043 the labour force participation rate profile of those older than the age group in which peak labour force participation occurs ages by five years, e.g. in 2043 the labour force participation rates of 50-54 year olds will be equal to the participation rates of 45-49 year olds in 2018. In instances where this would result in a fall in the age specific participation rate the higher (previous) rate is used. Similarly, in applying the second assumption (on changes in the labour force participation of women), if the female labour force participation rate was higher than the male labour force participation rate in any age group the higher rate was used. This ensured that the labour force participation rate of women did not fall in any age group. The effect of considering these three assumptions separately can be seen in earlier projections (Jackson *et al*., 2014b).

Separate labour force projections were created corresponding to each of the low-variant, medium-variant, and high-variant population projections. Each labour force projection used the same projected labour force participation rates, which correspond to Scenario 4 in Jackson et al. (2014b).

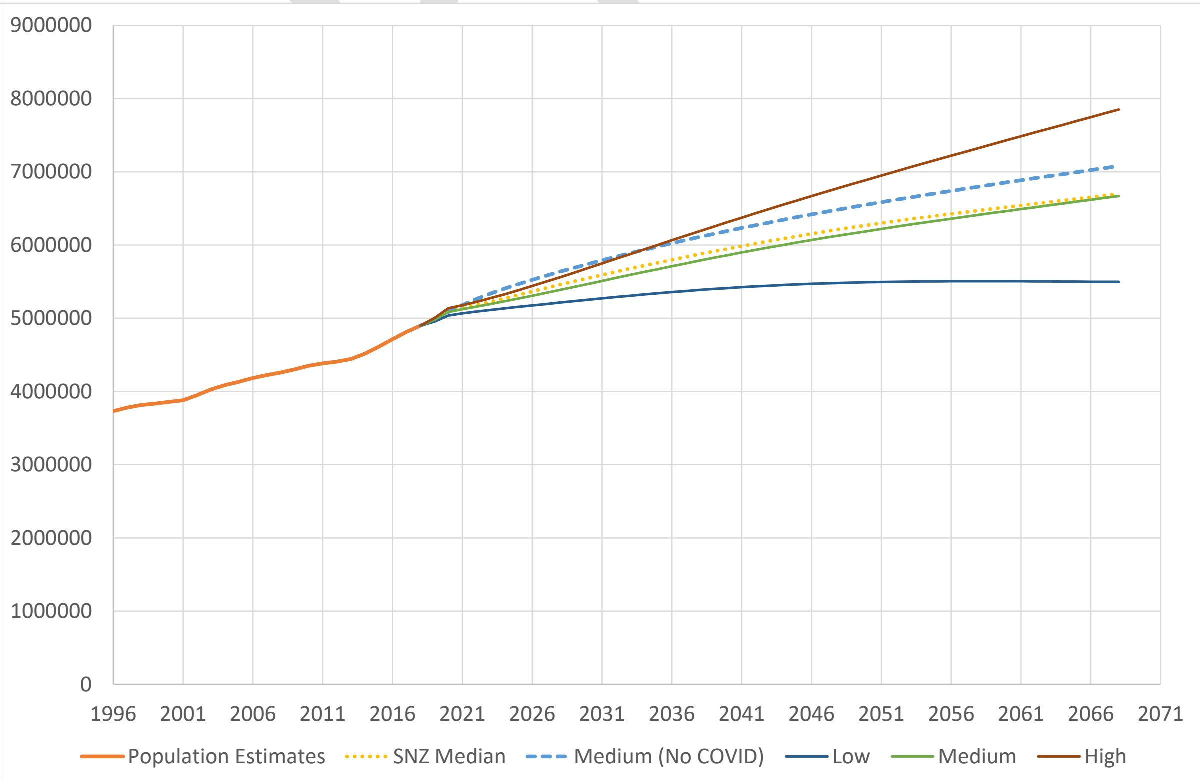
3. National-Level Population Projections

This section presents the population projections at the national level, obtained by summing the TA-level population projections for all TAs (except Chatham Islands Territory, which is not included in the model). As noted in the previous section, four projection scenarios are presented: (1) a low-variant population projection; (2) a medium-variant population projection; (3) a high-variant population projection; and (4) a medium-variant population projection that ignores the effect of the coronavirus pandemic. As noted in Section 2.9, the first three scenarios should be viewed as three possible futures, based on known assumptions about future fertility, mortality and net migration, and should not be interpreted as forecasts of future population.

Figure 6 presents the 2018-base national population projections to 2068, along with historical population estimates from Statistics New Zealand back to 1996. The 2020-base Statistics New Zealand (SNZ) median stochastic projection is also included for comparison. A 2018-base national population projection from SNZ was no longer available at the time of writing.

The June 2018 national population estimate (base population) is 4.90 million. Under the medium-variant population projection scenario, the national population increases throughout the projection period, reaching 6.67 million in 2068. Under the low-variant scenario, the national population increases to a peak of 5.51 million in 2058 before declining to 5.50 million in 2068. Under the high-variant scenario, the population increases throughout the projection period, reaching 7.85 million in 2068. In comparison, the SNZ 2020-base median stochastic projection tracks very similar to the medium-variant projection presented here, with the national population projected to increase to 6.70 million in 2068. The low-variant projection is somewhat lower than the 10th percentile of the SNZ stochastic projections, while the high-variant projection is similar to the 90th percentile of the SNZ stochastic projections (data not shown).

Figure 6: National population projections, 2018-2068



The medium-variant with no coronavirus impact tracks initially higher than the high-variant projection until 2034, then runs approximately parallel to the medium-variant projection thereafter. The impact of the coronavirus pandemic on the national population is a reduction in the total population size by 2068 of approximately 400,000 people.

4. Population, Family and Household, and Labour Force Projections

This section presents the population, family and household, and labour force projections for each TA wholly or substantially located in the Waikato Region.[7] For population, four projection scenarios are presented: (1) a low-variant population projection; (2) a medium-variant population projection; (3) a high-variant population projection; and (4) a medium-variant population projection that ignores the effect of the coronavirus pandemic. As noted in the previous section, these three scenarios should be viewed as three possible futures, based on known assumptions about future fertility, mortality and net migration, and should not be interpreted as forecasts of future population. The family and household projections and labour force projections are also each presented for the first three scenarios.

All projections are presented in diagrammatic form[8] – tables showing the population projections numerically are included in Appendix I, which are also available using the Waikato Integrated Scenario Explorer software tool (Rutledge *et al.*, 2008; 2010). Tables showing the family and household projections numerically are included in Appendix II, and tables showing the labour force projections numerically are included in Appendix III.

[7] Rotorua District is excluded, as it is substantially located in the Bay of Plenty region. However, parts of Rotorua District are included in the Waikato Region projections presented in Section 4.11.

[8] In the figures for the family and household projections, the difference between the sum of the four categories presented (couples with children, two-parent families, one-parent families, and one-person households) and the total number of households is made up of the number of 'other multi-person households', as well as accounting for the number of households that contain more than one family.

4.1 Population, Family and Household, and Labour Force Projections for Thames-Coromandel District

Figure 7 presents the 2018-base population projections for Thames-Coromandel District to 2068, along with historical population estimates from Statistics New Zealand back to 1996. The 2018-base Statistics New Zealand (SNZ) projections are also included for comparison.

The June 2018 population estimate (base population) for Thames-Coromandel District is 30,700. Under the medium-variant population projection scenario, the population increases throughout the projection period, reaching 34,172 in 2068. The medium-variant projection shows much lower growth than the recent experience of Thames-Coromandel District, but this reflects the much lower projection international migration flows. The annualised projected population growth over the period 2018-2038 of 0.14% per year is substantially lower than the 0.87% annualised growth experienced over the period 1996-2018, again reflecting the much lower projected international migration. Under the low-variant scenario, the population increases to a peak of 30,990 in 2021 before declining to 27,736 in 2068. Under the high-variant scenario, the population increases throughout the projection period, reaching 40,674 in 2068. In comparison, the SNZ 2018-base medium-variant projection is similar to the high-variant projection for much of the projection period, but then falls away after the mid-2030s, with the SNZ low-variant similar to the Waikato medium-variant scenario until the early-2030s.

Figure 8 disaggregates the components of population change for Thames-Coromandel District over the period 2019-2068 for the medium-variant population projection. As previously noted, net population change in the medium-variant projection scenario is positive throughout the projection period. This is made up of net inward internal migration (more in-migration from the rest of New Zealand than out-migration), offset by natural decrease (more deaths than births), and net outward international migration (more out-migration to overseas than in-migration from overseas). The initial bump in population from the historically high net international migration at the national level can clearly be seen in the first two years of the projections, but is quickly eliminated by the coronavirus border closures and the resulting substantial decrease in international migration flows. The growing contribution of net internal migration reflects mainly spill-over growth from surrounding faster growing TAs.

Figure 7: Population projections for Thames-Coromandel District, 2018-2068

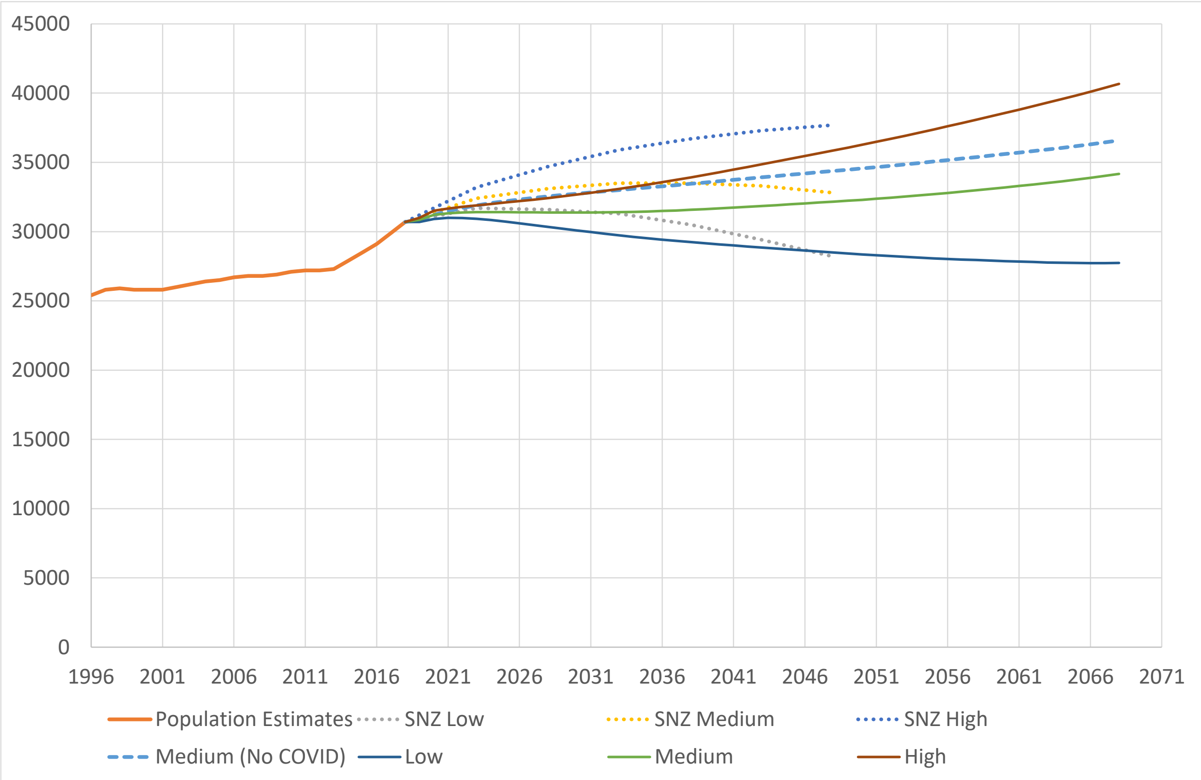
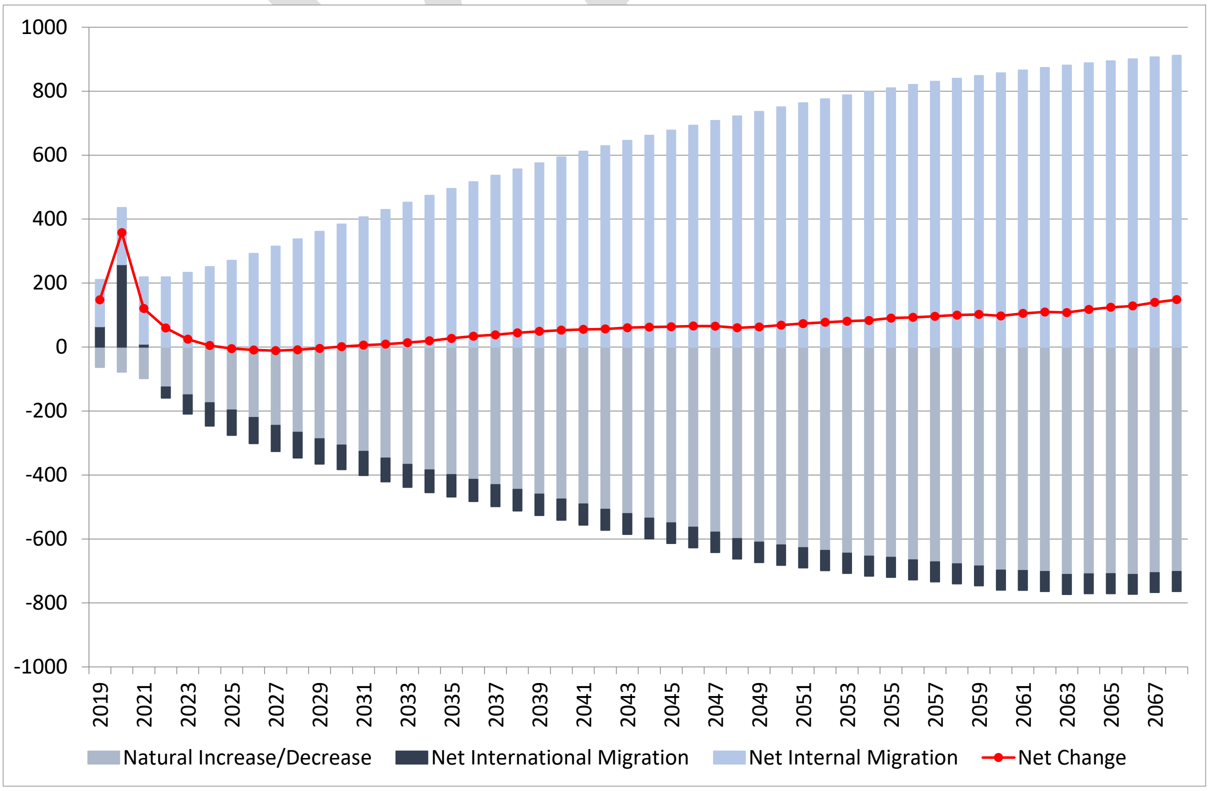


Figure 8: Projected components of population change for Thames-Coromandel District, medium-variant projection, 2019-2068



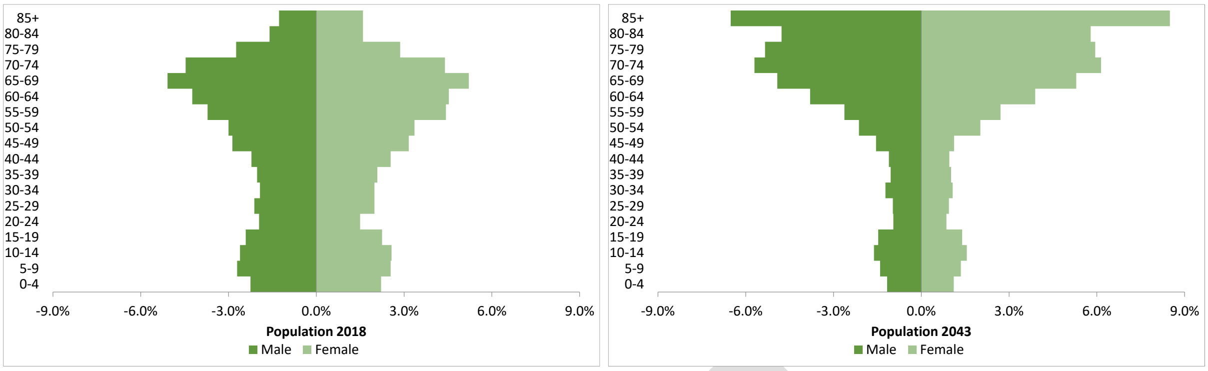
The spill-over growth from net internal migration for Thames Coromandel District is clearly shown in Table 2, which summarises the largest sources and destinations of inward and outward internal migrants respectively, for Thames Coromandel District in 2043 (being the middle of the projection period) for the medium-variant population projection. The largest flows in and out of the district can be attributed to Auckland, Hamilton City, and Tauranga City, all of which are large population centres in close proximity to Thames-Coromandel District. The inward migration from each of those TAs is larger than the outward flow, suggesting that the nearby cities are projected to be a substantial source of net internal migration for Thames-Coromandel District. This may also reflect the ageing New Zealand population, and Thames-Coromandel's attractiveness as a retirement destination.

Table 2: Top sources and destinations of internal migration for Thames-Coromandel District, 2043

Source	**Number**		**Destination**	**Number**
Auckland	1118		Auckland	512
Hamilton	120		Hamilton	96
Tauranga	90		Tauranga	90
Waikato	64		Hauraki	50
Hauraki	58		Waikato	48
Whangarei	35		Western Bay of Plenty	33
Rotorua	35		Whangarei	32
Western Bay of Plenty	32		Rotorua	30
Waipa	31		Waipa	28
Matamata-Piako	30		Matamata-Piako	27

The age structure of Thames-Coromandel District is the oldest in the region and continues ageing rapidly, as shown in Figure 9. In 2018, 30.8 percent of the population are aged 65 years and over, and this is projected to increase to 58.9 percent by 2043. This old age profile leads to the natural decrease shown in the previous figure.

Figure 9: Age-sex structure for Thames-Coromandel District, 2018 and 2043 (medium-variant projection)



The medium-variant family and household projection (by type) for Thames-Coromandel District is shown in Figure 10. The estimated number of total households in June 2018 is 12,807. In terms of total households, the projection closely follows the medium-variant population projection, with the total number of households increasing throughout the projection period, reaching 15,845 in 2068. The number of one- and two-parent families decline fairly consistently over the projection period, while the number of couples without children and one-person households increase throughout the projection period. The low-variant and high-variant family and household projection (by type) for Thames-Coromandel District are shown in Figures 11 and 12 respectively. In terms of total households, the low-variant projection closely follows the low-variant population projection, with the total number of households increasing to a peak of 13,540 in 2038, before declining to 13,158 in 2068. The high-variant projection closely follows the high-variant population projection, with the total number of households throughout the projection period, reaching 18,542 in 2068. The relative size of the families and households by type are similar in the low-variant and high-variant projections to those in the medium-variant projection.

Figure 10: Medium-variant family and household projections for Thames-Coromandel District, 2018-2068

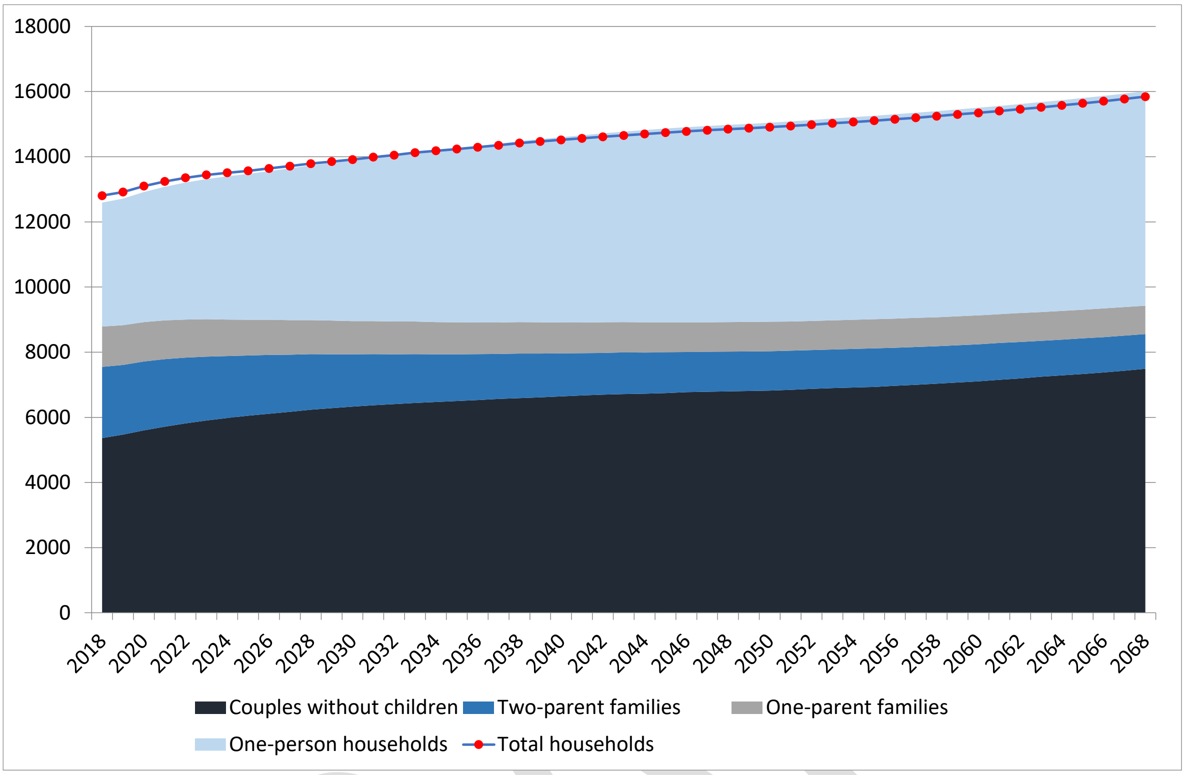


Figure 11: Low-variant family and household projections for Thames-Coromandel District, 2018-2068

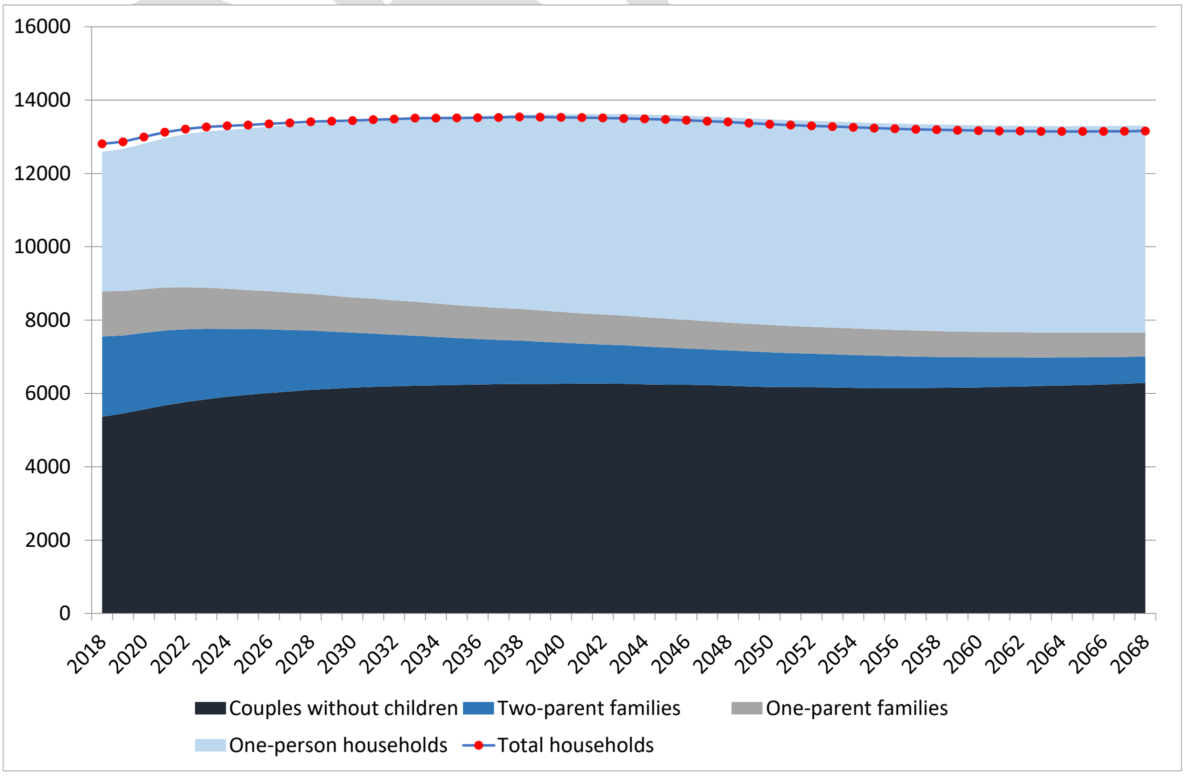
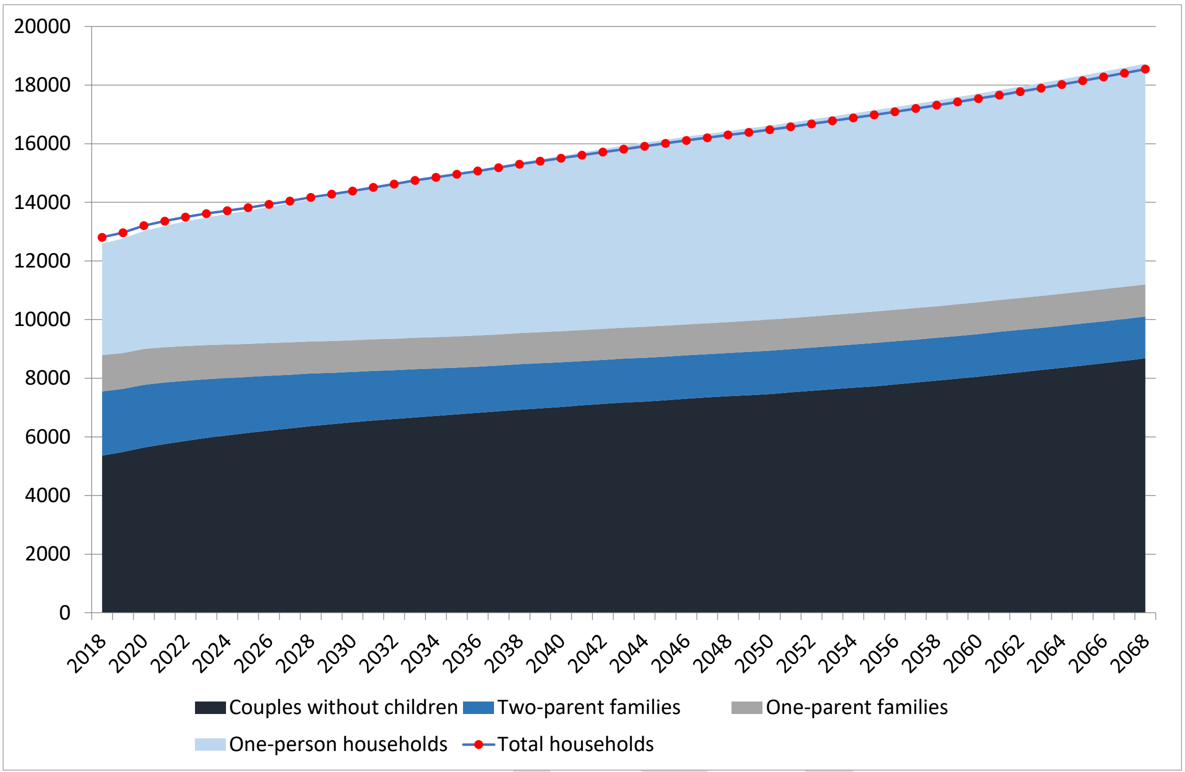
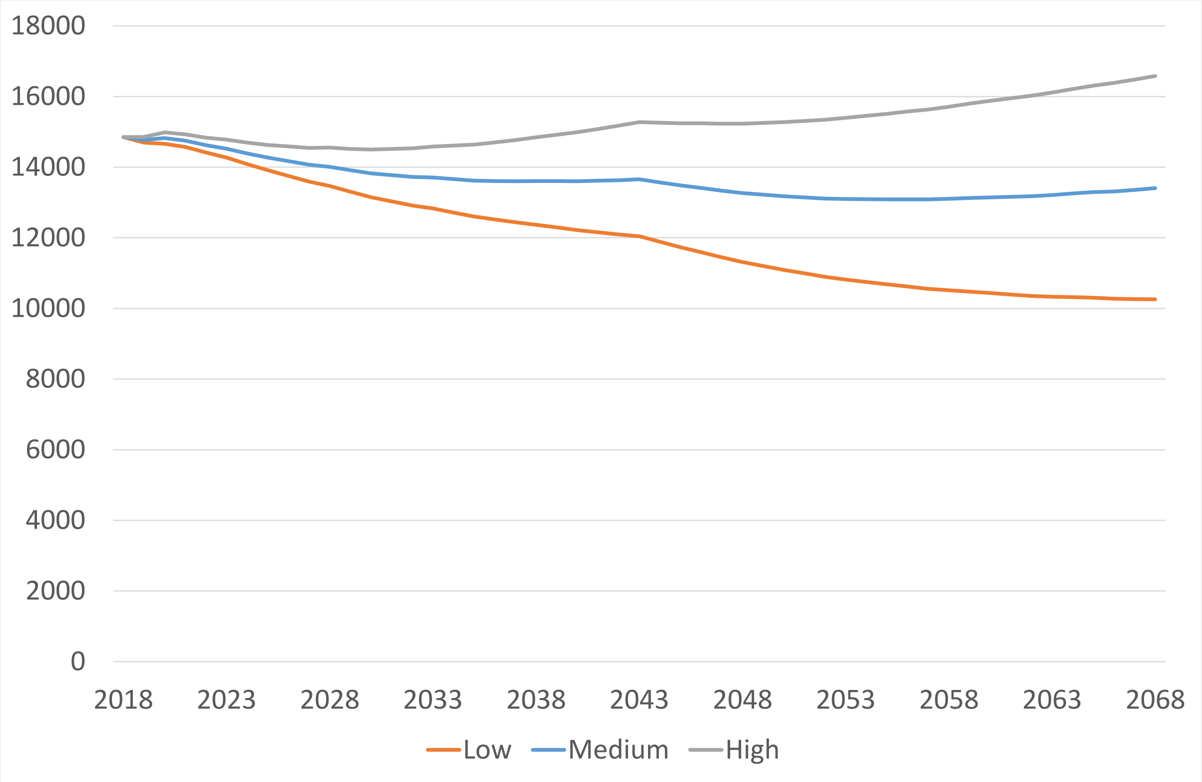


Figure 12: High-variant family and household projections for Thames-Coromandel District, 2018-2068



The labour force projections for Thames-Coromandel District are shown in Figure 13. The estimated labour force in June 2018 is 14,849. In the medium-variant projection, the labour force decreases through most of the projection period, falling to 13,405 in 2068. In the low-variant projection, the labour force decreases more consistently throughout the projection period, falling to 10,259 in 2068. In the high-variant projection, the labour force increases throughout the projection period, reaching 16,583 in 2068.

Figure 13: Labour force projections for Thames-Coromandel District, 2018-2068



4.2 Population, Family and Household, and Labour Force Projections for Hauraki District

Figure 14 presents the 2018-base population projections for Hauraki District to 2068, along with historical population estimates from Statistics New Zealand back to 1996. The 2018-base Statistics New Zealand (SNZ) projections are also included for comparison.

The June 2018 population estimate (base population) for Hauraki District is 20,600. Under the medium-variant population projection scenario, the population increases throughout the projection period, reaching 25,221 in 2068. The medium-variant projection shows lower growth than the recent experience of Hauraki District, but this reflects the much lower projection international migration flows. The annualised projected population growth over the period 2018-2038 of 0.35% per year is somewhat lower than the 0.50% annualised growth experienced over the period 1996-2018, again reflecting the much lower projected international migration. Under the low-variant scenario, the population increases to a peak of 20,996 in 2023 before declining to 20,523 in 2068. Under the high-variant scenario, the population increases throughout the projection period, reaching 29,970 in 2068. In comparison, the SNZ 2018-base medium-variant projection is similar to the high-variant projection for much of the projection period, but then falls away after the early-2030s, with the SNZ low-variant similar to the Waikato medium-variant scenario only until the mid-2020s.

Figure 14: Population projections for Hauraki District, 2018-2068

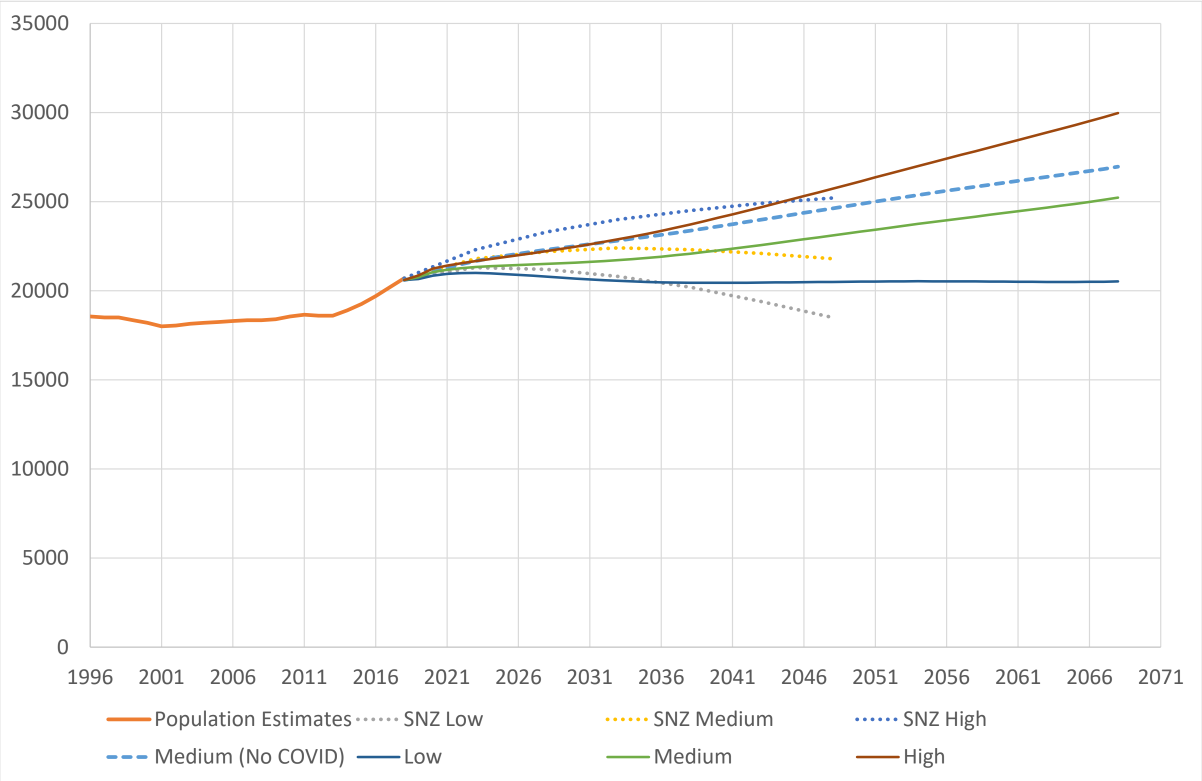
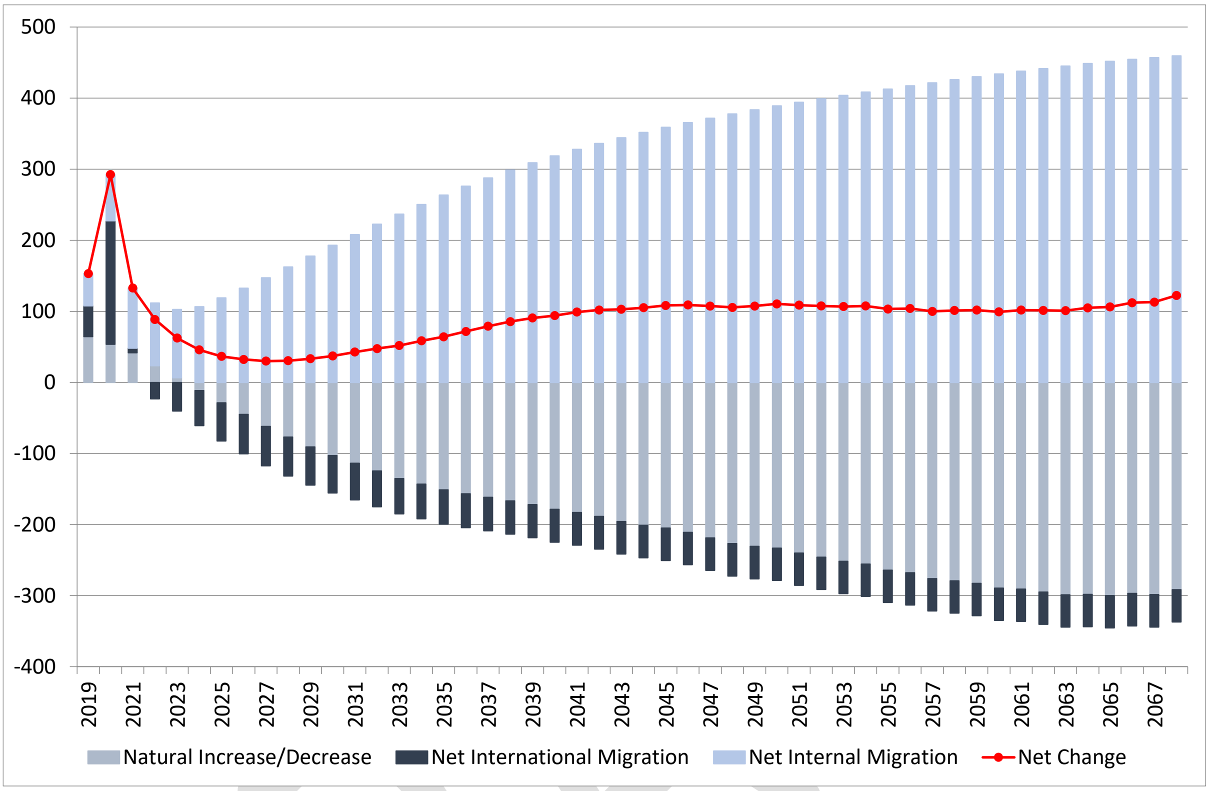


Figure 15 disaggregates the components of population change for Hauraki District over the period 2019-2068 for the medium-variant population projection. As previously noted, net population change in the medium-variant projection scenario is positive throughout the projection period. This is made up of net inward internal migration (more in-migration from the rest of New Zealand than out-migration), offset by natural decrease (more deaths than births), and net outward international migration (more out-migration to overseas than in-migration from overseas). The initial bump in population from the historically high net international migration at the national level can clearly be seen in the first two years of the projections, but is quickly eliminated by the coronavirus border closures and the resulting substantial decrease in international migration flows. The growing contribution of net internal migration reflects mainly spill-over growth from surrounding faster growing TAs.

Figure 15: Projected components of population change for Hauraki District, medium-variant projection, 2014-2063



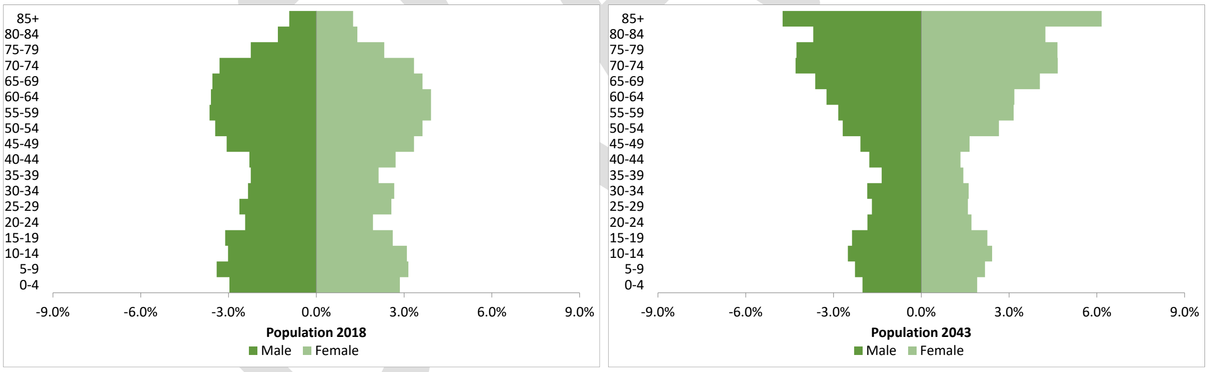
The spill-over growth from net internal migration for Hauraki District is clearly shown in Table 3, which summarises the largest sources and destinations of inward and outward internal migrants respectively, for Hauraki District in 2043 (being the middle of the projection period) for the medium-variant population projection. The largest flows in and out of the district can be attributed to Auckland and Hamilton City, as well as Waikato District and Tauranga City, all of which are large population centres in close proximity to Hauraki District. The inward migration from each of those TAs except Tauranga City is larger than the outward flow, suggesting that the nearby cities are generally projected to be a substantial source of net internal migration for Hauraki District.

Table 3: Top sources and destinations of internal migration for Hauraki District, 2043

Source	Number		Destination	Number
Auckland	823		Auckland	432
Hamilton	98		Hamilton	89
Waikato	79		Tauranga	83
Tauranga	73		Waikato	68
Matamata-Piako	54		Thames-Coromandel	58
Thames-Coromandel	50		Matamata-Piako	57
Western Bay of Plenty	46		Western Bay of Plenty	54
Waipa	25		Waipa	26
Rotorua	25		Rotorua	24
Whangarei	15		Christchurch	16

The age structure of Hauraki District is also the oldest in the region and continues ageing rapidly, as shown in Figure 16. In 2018, 23.3 percent of the population are aged 65 years and over, and this is projected to increase to 44.4 percent by 2043. This old age profile leads to the natural decrease shown in the previous figure.

Figure 16: Age-sex structure for Hauraki District, 2018 and 2043 (medium-variant projection)



The medium-variant family and household projection (by type) for Hauraki District is shown in Figure 17. The estimated number of total households in June 2018 is 8,093. In terms of total households, the projection closely follows the medium-variant population projection, with the total number of households increasing throughout the projection period, reaching 10,698 in 2068. The number of two-parent families declines fairly consistently over the projection period, while the number of one-parent families initially declines, before increasing again after 2035. Couples without children and one-person households increase throughout the projection period. The low-variant and high-variant family and household projection (by type) for Hauraki

District are shown in Figures 18 and 19 respectively. In terms of total households, the low-variant projection closely follows the low-variant population projection, with the total number of households increasing throughout the projection period, reaching 8,924 in 2068. The high-variant projection closely follows the high-variant population projection, with the total number of households throughout the projection period, reaching 12,478 in 2068. The relative size of the families and households by type are similar in the low-variant and high-variant projections to those in the medium-variant projection.

The labour force projections for Hauraki District are shown in Figure 20. The estimated labour force in June 2018 is 10,268. In the medium-variant projection, the labour force decreases to a trough of 10,106 in 2030, before increasing to eventually reach 11,316 in 2068. In the low-variant projection, the labour force decreases through most of the projection period, falling to 8,905 in 2068. In the high-variant projection, the labour force increases throughout the projection period, reaching 13,748 in 2068.

Figure 17: Medium-variant family and household projections for Hauraki District, 2018-2068

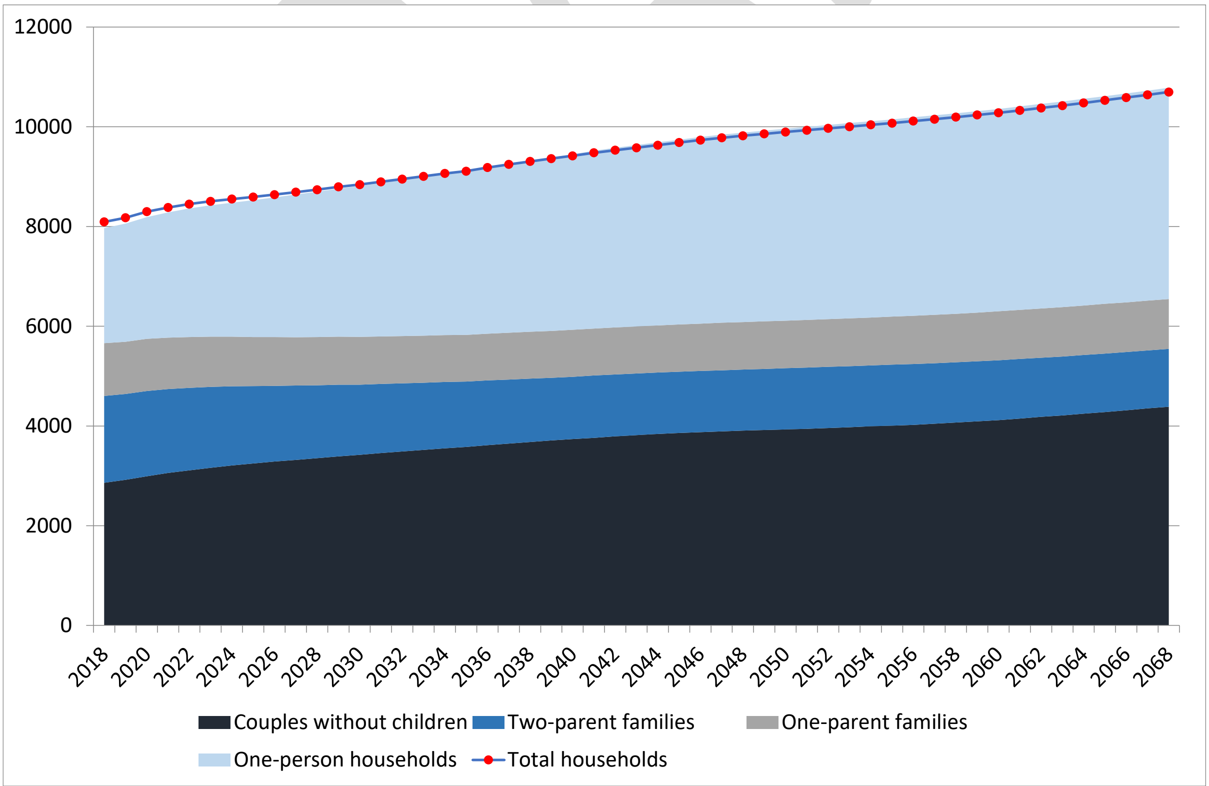


Figure 18: Low-variant family and household projections for Hauraki District, 2018-2068

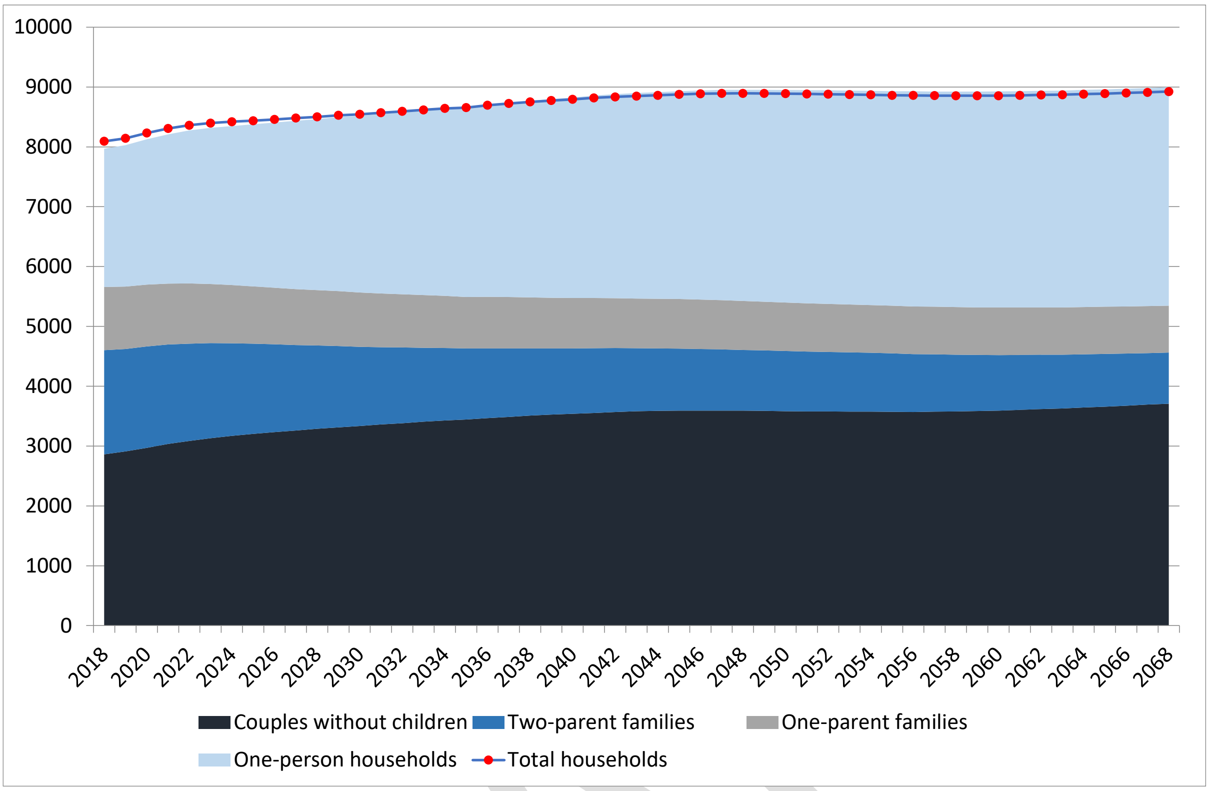


Figure 19: High-variant family and household projections for Hauraki District, 2018-2068

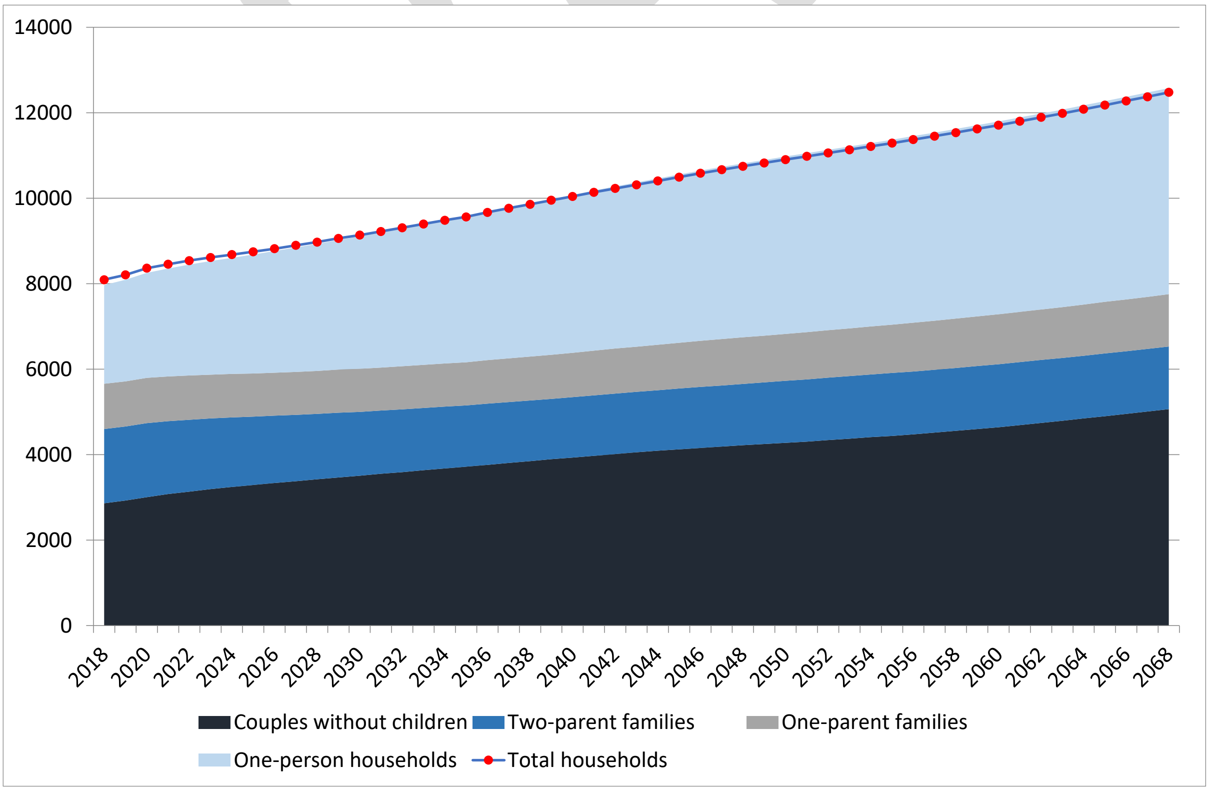
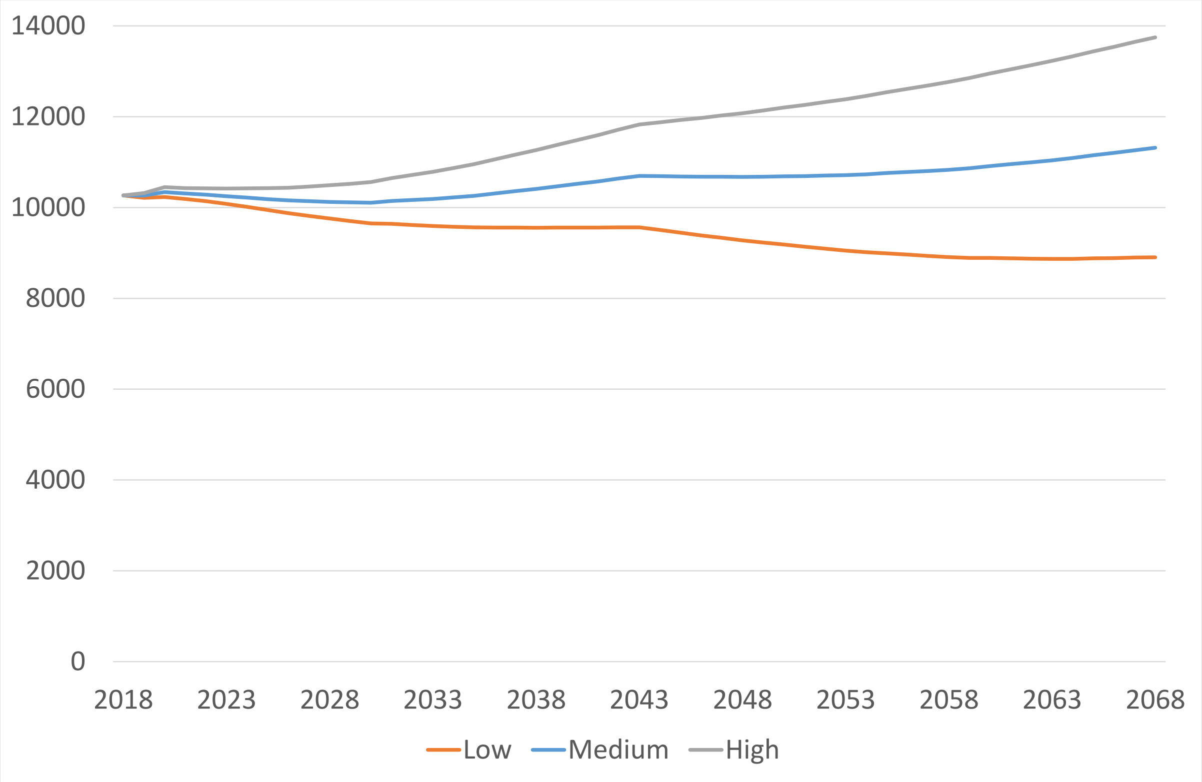


Figure 20: Labour force projections for Hauraki District, 2018-2068



4.3 Population, Family and Household, and Labour Force Projections for Waikato District

Figure 21 presents the 2018-base population projections for Waikato District to 2068, along with historical population estimates from Statistics New Zealand back to 1996. The 2018-base Statistics New Zealand (SNZ) projections are also included for comparison.

The June 2018 population estimate (base population) for Waikato District is 78,200. Under the medium-variant population projection scenario, the population increases throughout the projection period, reaching 120,684 in 2068. The medium-variant projection shows lower growth than the recent experience of Waikato District, but this reflects the much lower projection international migration flows. The annualised projected population growth over the period 2018-2038 of 1.20% per year is somewhat lower than the 1.87% annualised growth experienced over the period 1996-2018, again reflecting the much lower projected international migration. Under the low-variant scenario, the population increases throughout the projection period, reaching 99,229 in 2068. Under the high-variant scenario, the population increases throughout the projection period, reaching 142,269 in 2068. In comparison, the SNZ 2018-base medium-variant projection is similar to the high-variant projection, with the SNZ low-variant somewhat lower than the Waikato medium-variant scenario.

Figure 21: Population projections for Waikato District, 2018-2068

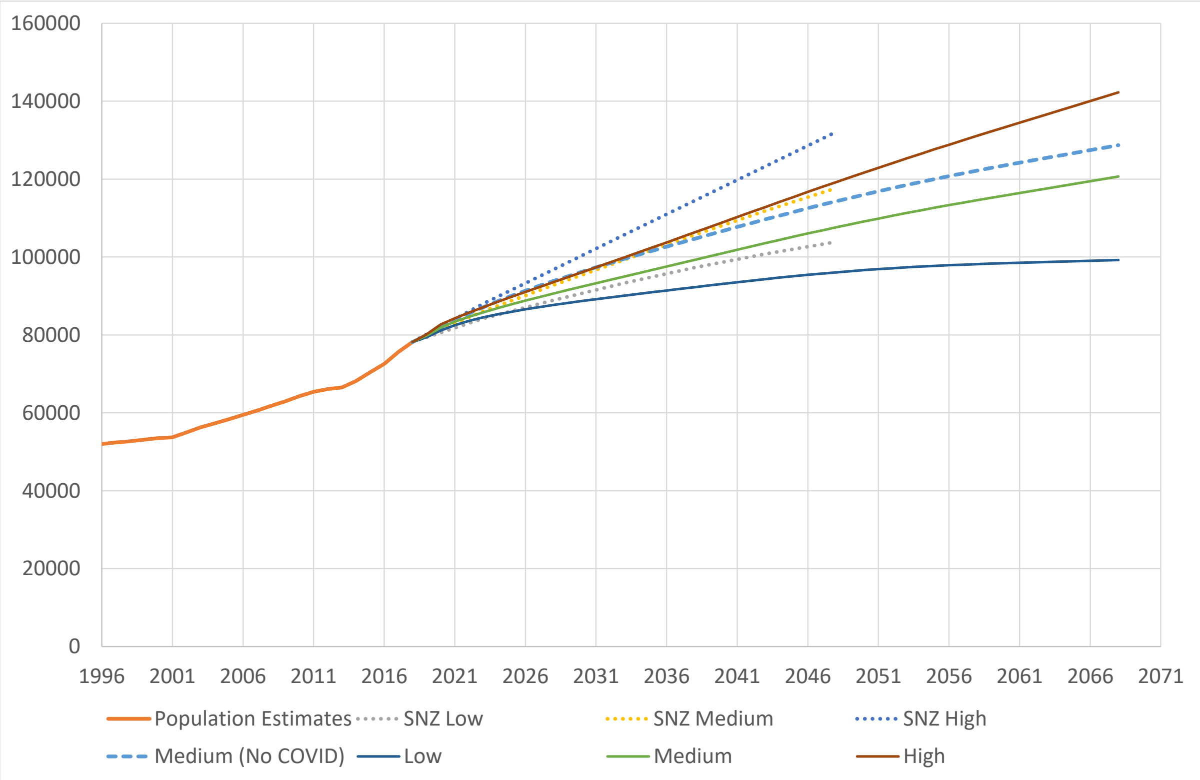


Figure 22 disaggregates the components of population change for Waikato District over the period 2019-2068 for the medium-variant population projection. As previously noted, net population change in the medium-variant projection scenario is positive throughout the projection period. This is made up of net inward internal migration (more in-migration from the rest of New Zealand than out-migration) and natural increase (more births than deaths) up to 2054 (after which there is natural decrease – more deaths than births), and net outward international migration (more out-migration to overseas than in-migration from overseas). The initial bump in population from the historically high net international migration at the national level can clearly be seen in the first two years of the projections, but is quickly eliminated by the coronavirus border closures and the resulting substantial decrease in international migration flows.

Figure 22: Projected components of population change for Waikato District, medium-variant projection, 2019-2068

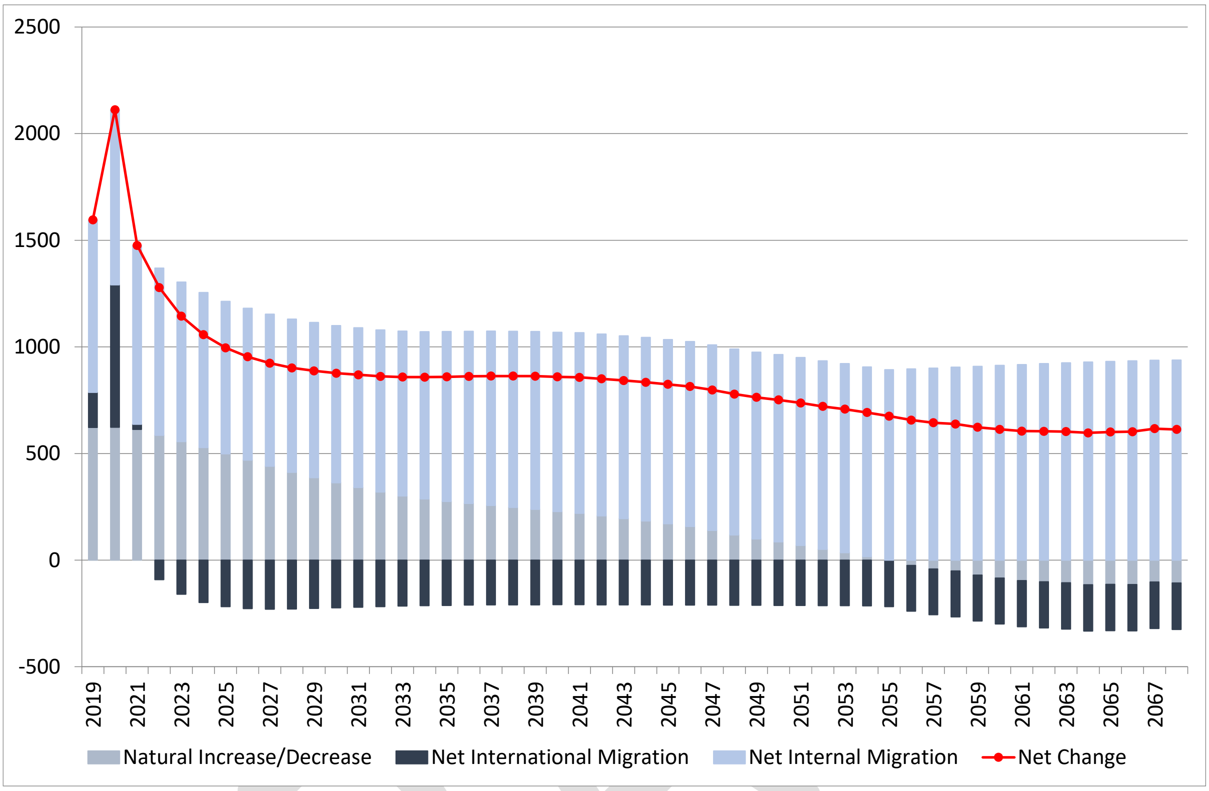


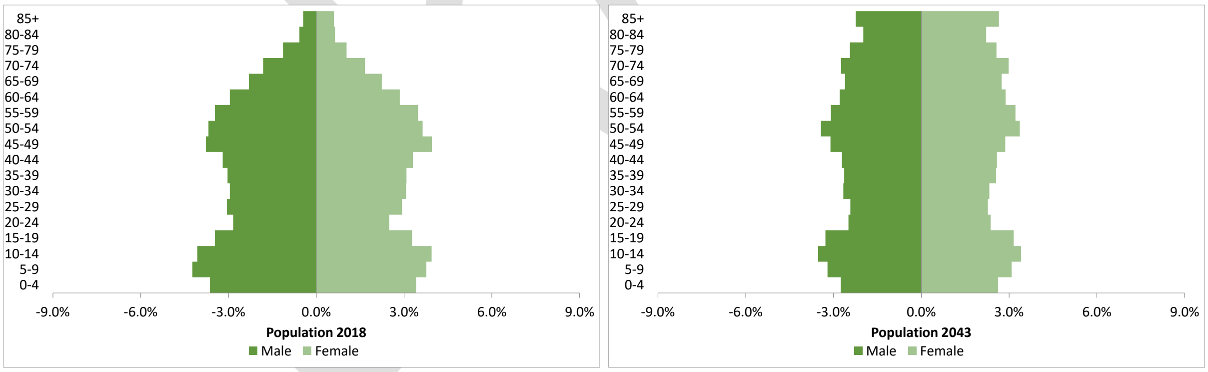
Table 4 summarises the largest sources and destinations of inward and outward internal migrants respectively, for Waikato District in 2043 (being the middle of the projection period) for the medium-variant population projection. The largest flows in and out of the district can be attributed to Auckland, Hamilton City, and Waipa District, all of which are large population centres in close proximity to Waikato District. The inward migration from Auckland is larger than the outward flow, suggesting that Auckland is projected to be a substantial source of net internal migration for Waikato District. In contrast, the outward migration is larger than the inward flow for Hamilton City and Waipa District, suggesting that Waikato District is a net donor of migrants to those TAs.

Table 4: Top sources and destinations of internal migration for Waikato District, 2043

Source	Number		Destination	Number
Auckland	3358		Auckland	2043
Hamilton	1051		Hamilton	1114
Waipa	187		Waipa	229
Tauranga	142		Tauranga	188
Matamat- Piako	122		Matamata Piako	148
Hauraki	68		Hauraki	79
Rotorua	66		Rotorua	76
Western Bay of Plenty	53		Western Bay of Plenty	73
Whangarei	52		Christchurch	65
Thames-Coromandel	48		Thames Coromandel	64

The age structure of Waikato District is much younger than either Thames-Coromandel or Hauraki Districts, as shown in Figure 23. In 2018, 12.5 percent of the population are aged 65 years and over, and this is projected to increase to 25.2 percent by 2043. This young age profile leads to the natural increase that is shown through most of the projection period in the previous figure.

Figure 23: Age-sex structure for Waikato District, 2018 and 2043 (medium-variant projection)



The medium-variant family and household projection (by type) for Waikato District is shown in Figure 24. The estimated number of total households in June 2018 is 25,769. In terms of total households, the projection closely follows the medium-variant population projection, with the total number of households increasing throughout the projection period, reaching 42,841 in 2068. The number of one-parent and two-parent families increase fairly consistently over the projection period, as does the number of couples without children and one-person households.

The low-variant and high-variant family and household projection (by type) for Waikato District are shown in Figures 25 and 26 respectively. In terms of total households, the low-variant projection closely follows the low-variant population projection, with the total number of households increasing throughout the projection period, reaching 35,623 in 2068. The high-variant projection closely follows the high-variant population projection, with the total number of households throughout the projection period, reaching 50,063 in 2068. The relative size of the families and households by type are similar in the low-variant and high-variant projections to those in the medium-variant projection.

The labour force projections for Waikato District are shown in Figure 27. The estimated labour force in June 2018 is 43,465. In the medium-variant projection, the labour force increases throughout the projection period, reaching 66,682 in 2068. In the low-variant projection, the labour force increases throughout the projection period, reaching 54,194 in 2068. In the high-variant projection, the labour force increases throughout the projection period, reaching 79,199 in 2068.

Figure 24: Medium-variant family and household projections for Waikato District, 2018-2068

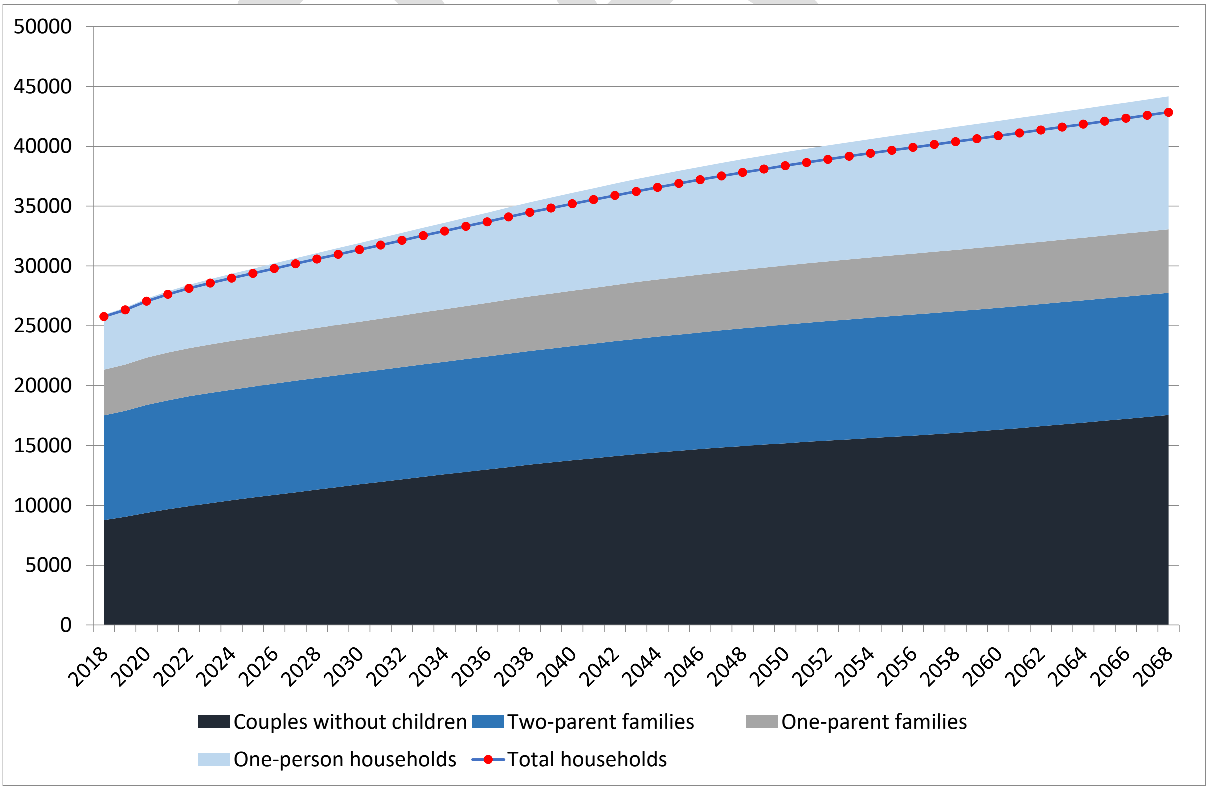


Figure 25: Low-variant family and household projections for Waikato District, 2018-2068

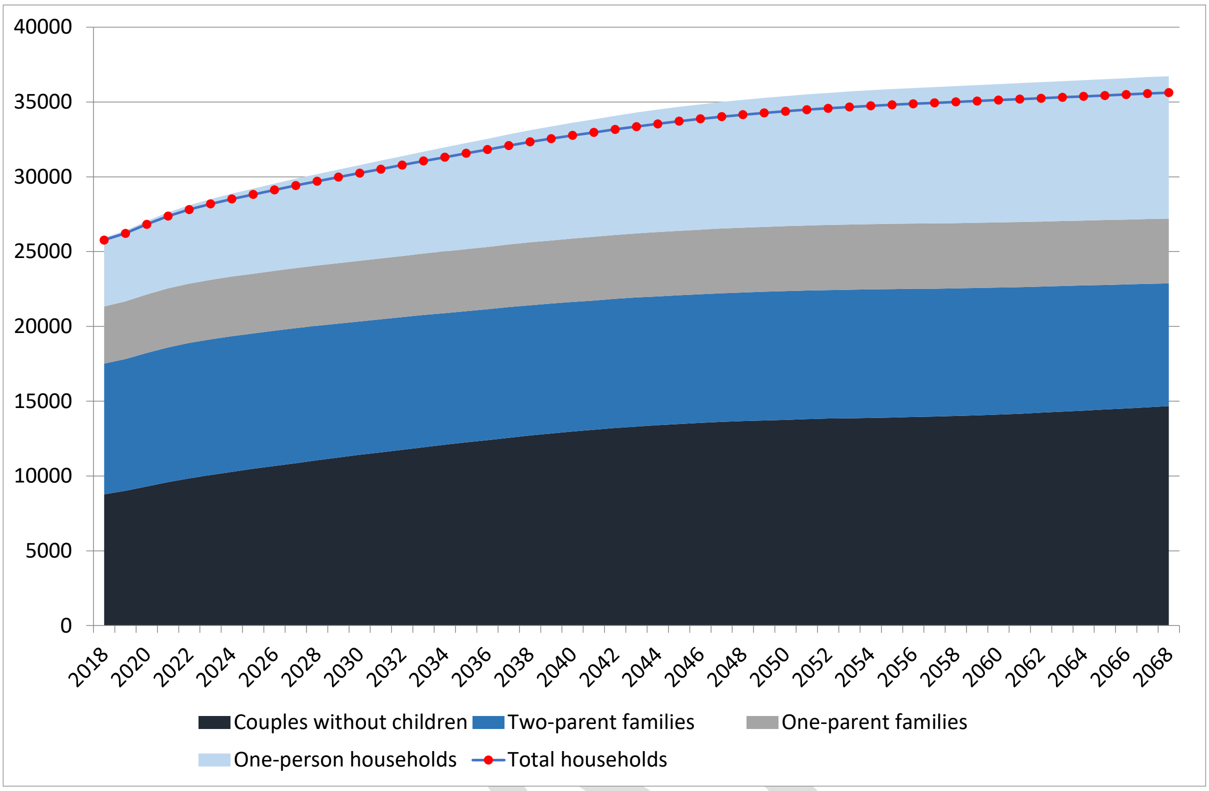


Figure 26: High-variant family and household projections for Waikato District, 2018-2068

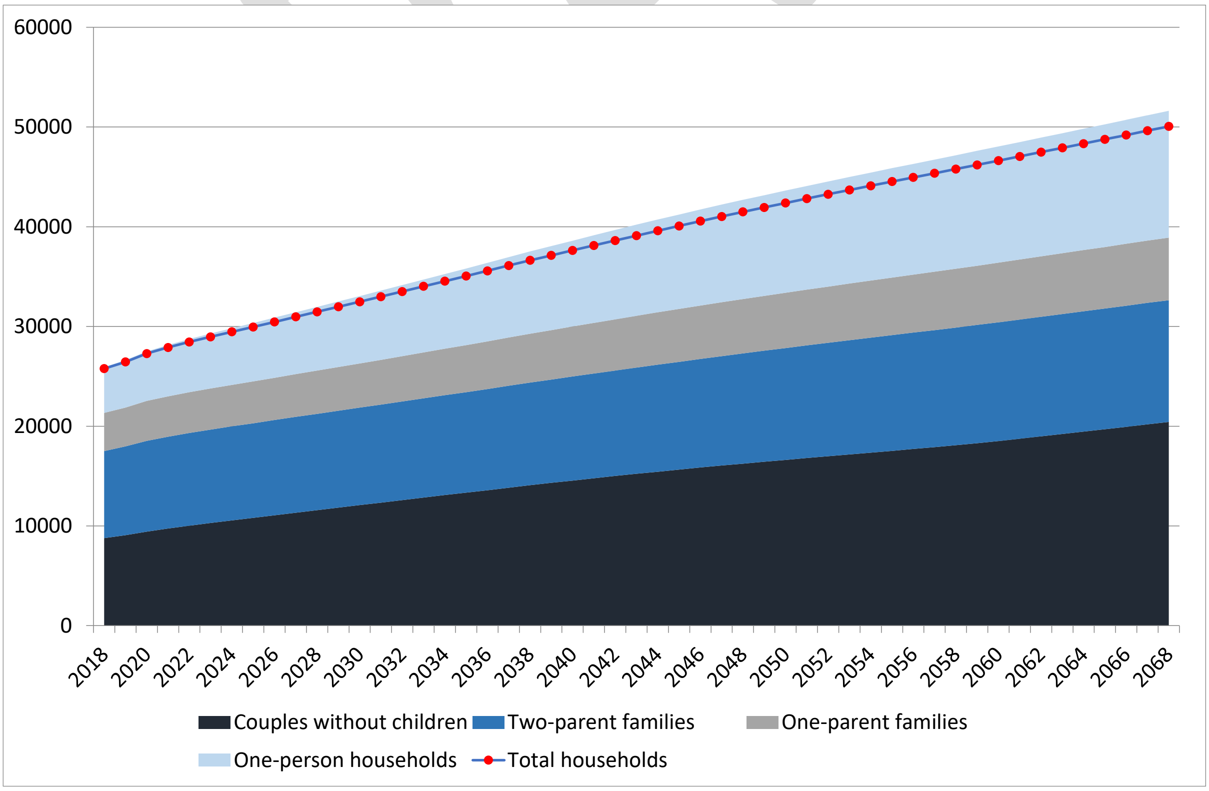
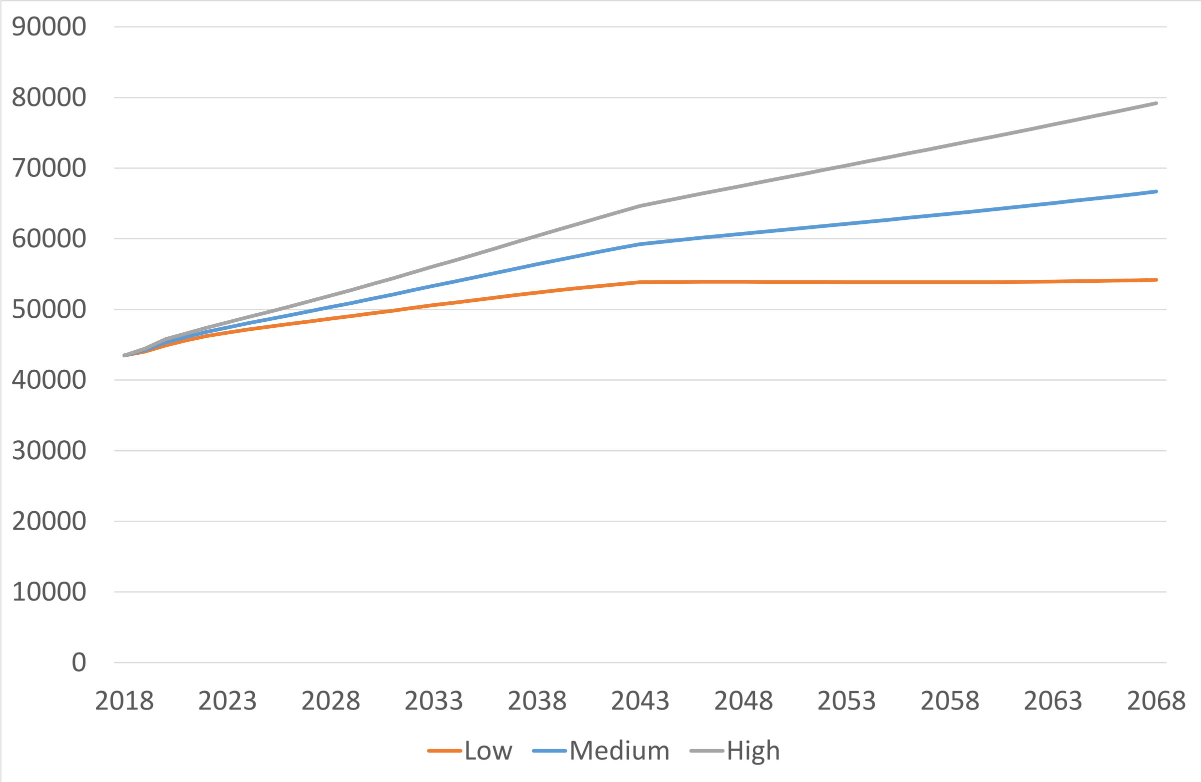


Figure 27: Labour force projections for Waikato District, 2018-2068



4.4 Population, Family and Household, and Labour Force Projections for Matamata-Piako District

Figure 28 presents the 2018-base population projections for Matamata-Piako District to 2068, along with historical population estimates from Statistics New Zealand back to 1996. The 2018-base Statistics New Zealand (SNZ) projections are also included for comparison.

The June 2018 population estimate (base population) for Matamata-Piako District is 35,300. Under the medium-variant population projection scenario, the population increases throughout the projection period, reaching 44,866 in 2068. The medium-variant projection shows lower growth than the recent experience of Matamata-Piako District, but this reflects the much lower projection international migration flows. The annualised projected population growth over the period 2018-2038 of 0.54% per year is slightly lower than the 0.70% annualised growth experienced over the period 1996-2018, again reflecting the much lower projected international migration. Under the low-variant scenario, the population increases to a peak of 36,488 in 2045 before declining to 36,236 in 2068. Under the high-variant scenario, the population increases throughout the projection period, reaching 53,639 in 2068. In comparison, the SNZ 2018-base medium-variant projection is very similar to the Waikato medium-variant projection, with the SNZ low-variant somewhat lower than the Waikato low-variant scenario, particularly after the early 2030s.

Figure 28: Population projections for Matamata-Piako District, 2018-2068

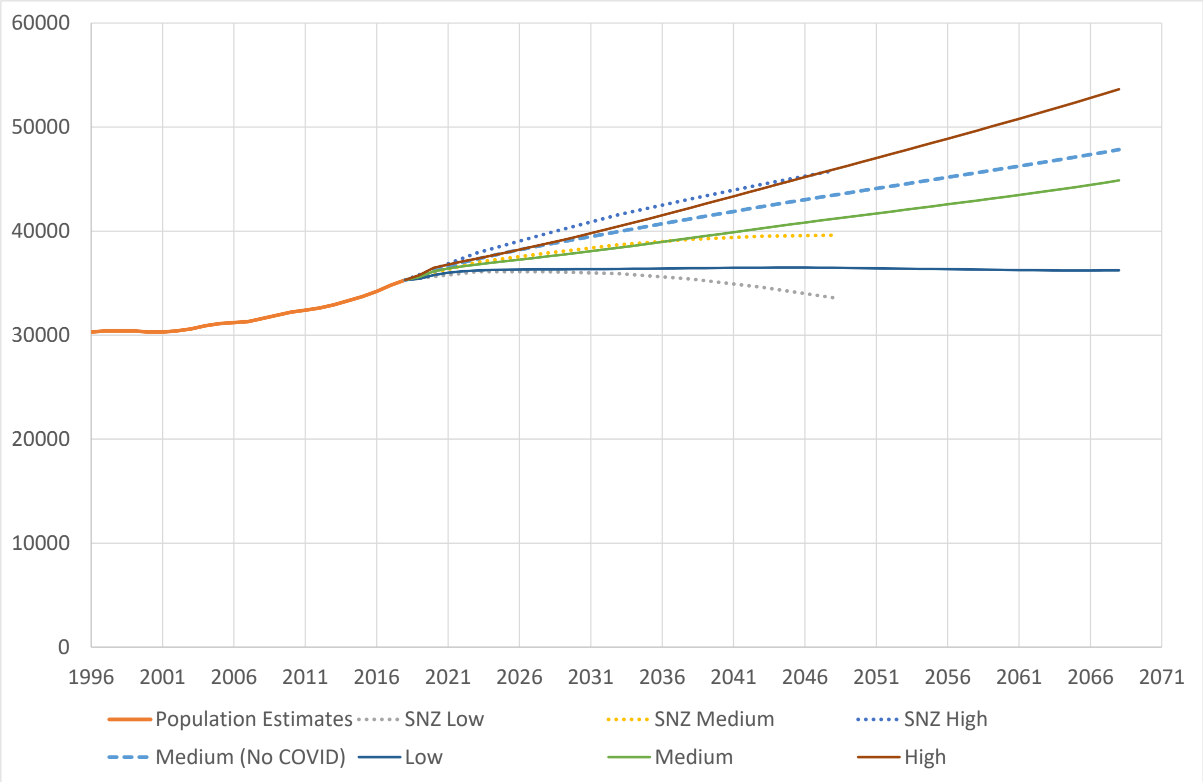


Figure 29 disaggregates the components of population change for Matamata-Piako District over the period 2019-2068 for the medium-variant population projection. As previously noted, net population change in the medium-variant projection scenario is positive throughout the projection period. This is made up of net inward internal migration (more in-migration from the rest of New Zealand than out-migration) and natural increase (more births than deaths) up to 2035 (after which there is natural decrease – more deaths than births), and net outward international migration (more out-migration to overseas than in-migration from overseas). The initial bump in population from the historically high net international migration at the national level can clearly be seen in the first two years of the projections, but is quickly eliminated by the coronavirus border closures and the resulting substantial decrease in international migration flows. The growing contribution of net internal migration reflects mainly spill-over growth from surrounding faster growing TAs.

Figure 29: Projected components of population change for Matamata-Piako District, medium-variant projection, 2019-2068

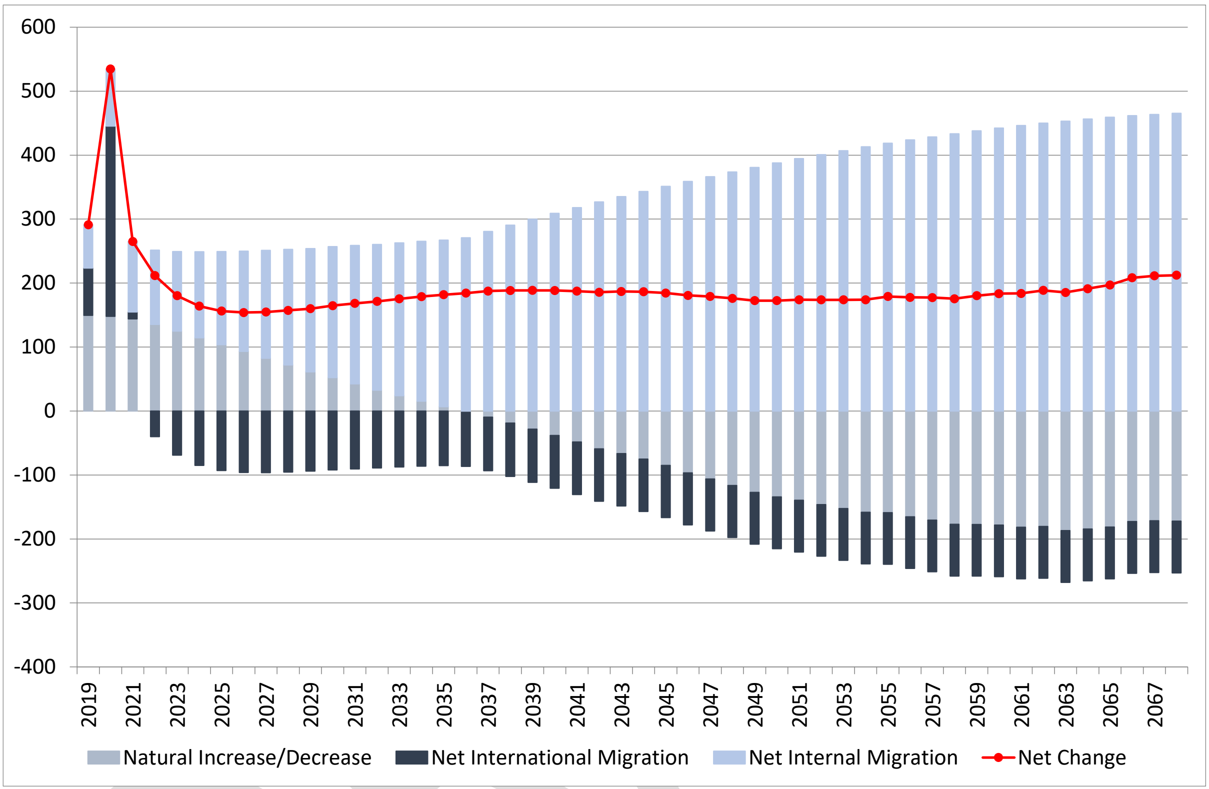


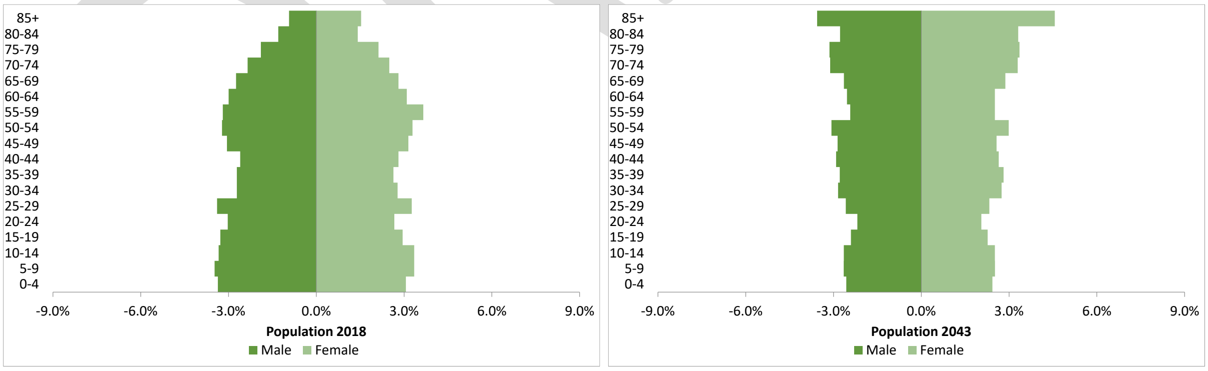
Table 5 summarises the largest sources and destinations of inward and outward internal migrants respectively, for Matamata-Piako District in 2043 (being the middle of the projection period) for the medium-variant population projection. The largest flows in and out of the district can be attributed to Auckland, Hamilton City, and Tauranga City, all of which are large population centres in close proximity to Matamata-Piako District. The inward migration flows from Auckland and Hamilton City are larger than the outward flows, suggesting that Auckland and Hamilton are projected to be a substantial source of net internal migration for Matamata-Piako District. In contrast, the outward migration is larger than the inward flow for Tauranga City, suggesting that Matamata-Piako District is a net donor of migrants to Tauranga.

Table 5: Top sources and destinations of internal migration for Matamata-Piako District, 2043

Source	**Number**		**Destination**	**Number**
Auckland	694		Auckland	349
Hamilton	290		Hamilton	254
Tauranga	170		Tauranga	186
Waikato	148		Waipa	144
Waipa	143		Western Bay of Plenty	131
Western Bay of Plenty	116		Waikato	122
Rotorua	62		Rotorua	59
Hauraki	57		Hauraki	54
South Waikato	41		South Waikato	37
Thames-Coromandel	27		Thames Coromandel	30

The age structure of Matamata-Piako District is moderately old compared with other TAs in the Waikato, but ages relatively quickly, as shown in Figure 30. In 2018, 19.6 percent of the population are aged 65 years and over, and this is projected to increase to 32.6 percent by 2043. The initially young age profile keeps natural increase positive through the early period of the projections, as shown in the previous figure.

Figure 30: Age-sex structure for Matamata-Piako District, 2018 and 2043 (medium-variant projection)



The medium-variant family and household projection (by type) for Matamata-Piako District is shown in Figure 31. The estimated number of total households in June 2018 is 13,205. In terms of total households, the projection closely follows the medium-variant population projection, with the total number of households increasing throughout the projection period, reaching

18,608 in 2068. The number of one-parent families increases fairly consistently over the projection period, as does the number of couples without children and one-person households. The number of two-parent families remains relatively stable. The low-variant and high-variant family and household projection (by type) for Matamata-Piako District are shown in Figures 32 and 33 respectively. In terms of total households, the low-variant projection closely follows the low-variant population projection, with the total number of households increasing throughout the projection period, reaching 15,404 in 2068. The high-variant projection closely follows the high-variant population projection, with the total number of households throughout the projection period, reaching 21,844 in 2068. The relative size of the families and households by type are similar in the low-variant and high-variant projections to those in the medium-variant projection.

Figure 31: Medium-variant family and household projections for Matamata-Piako District, 2018-2068

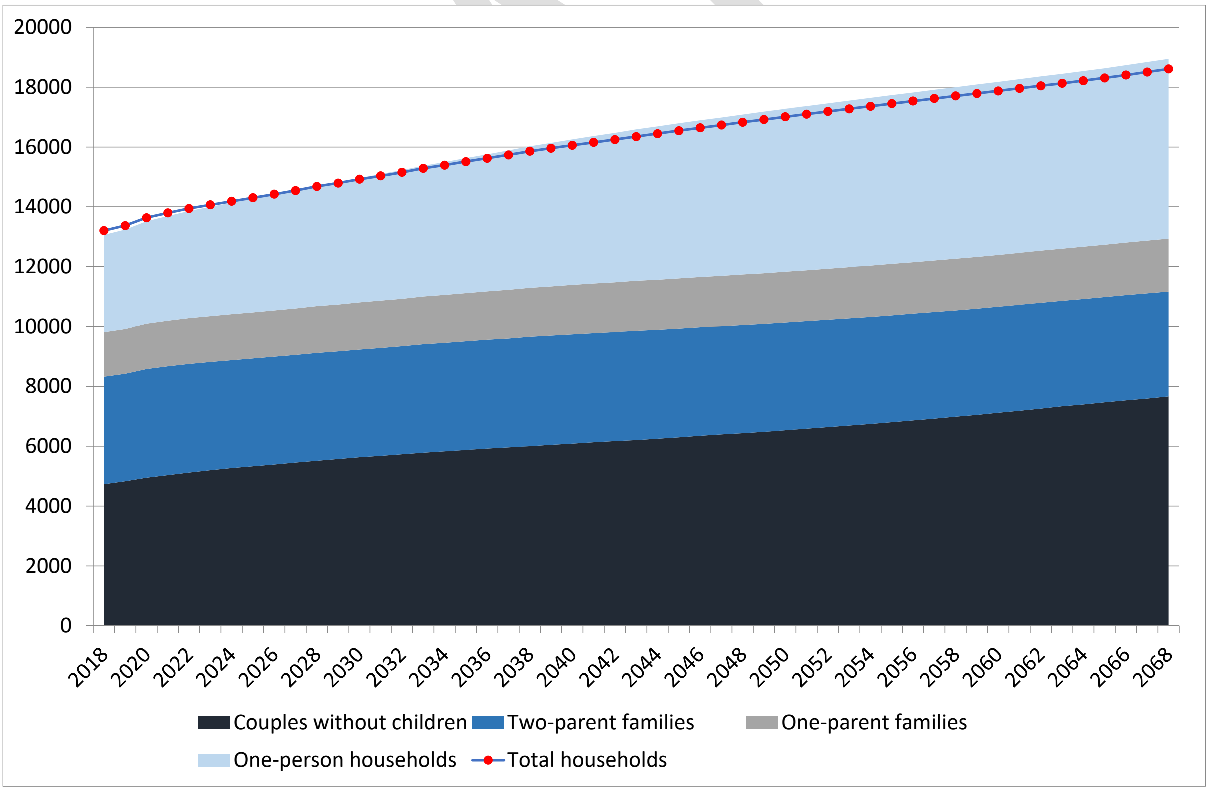


Figure 32: Low-variant family and household projections for Matamata-Piako District, 2018-2068

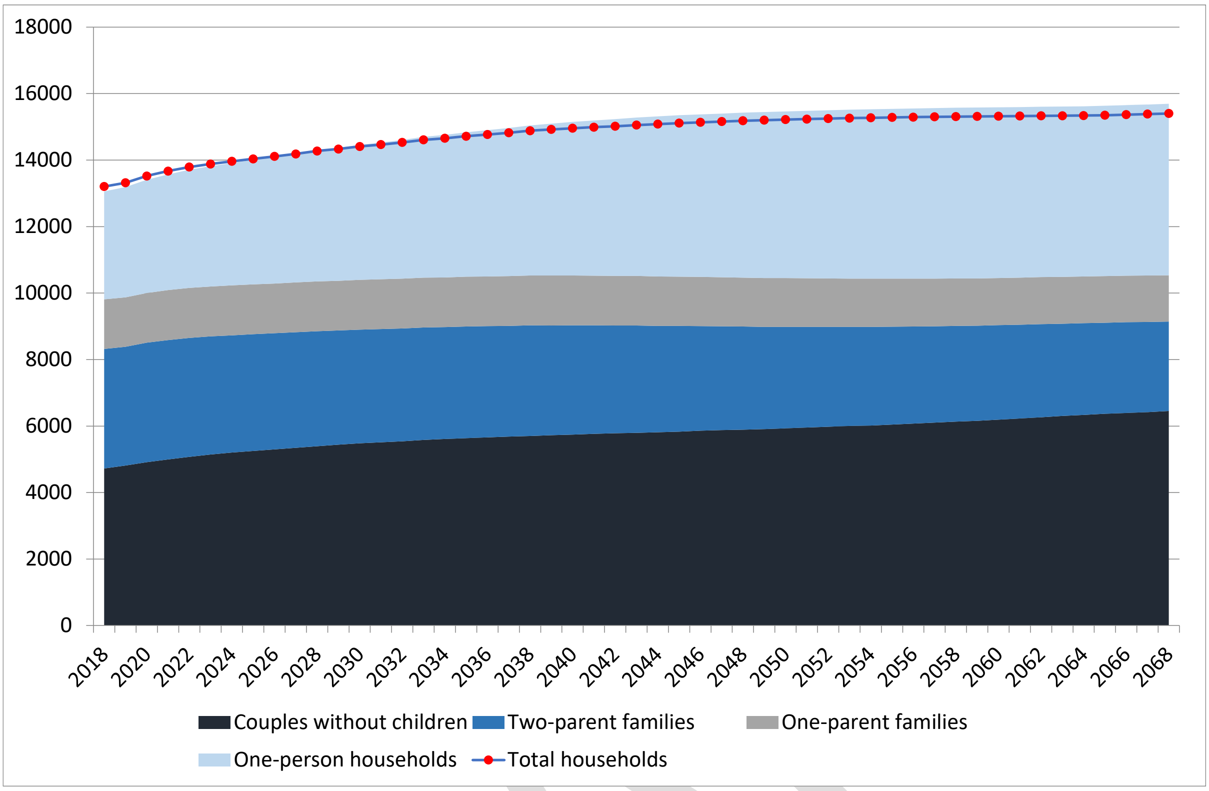
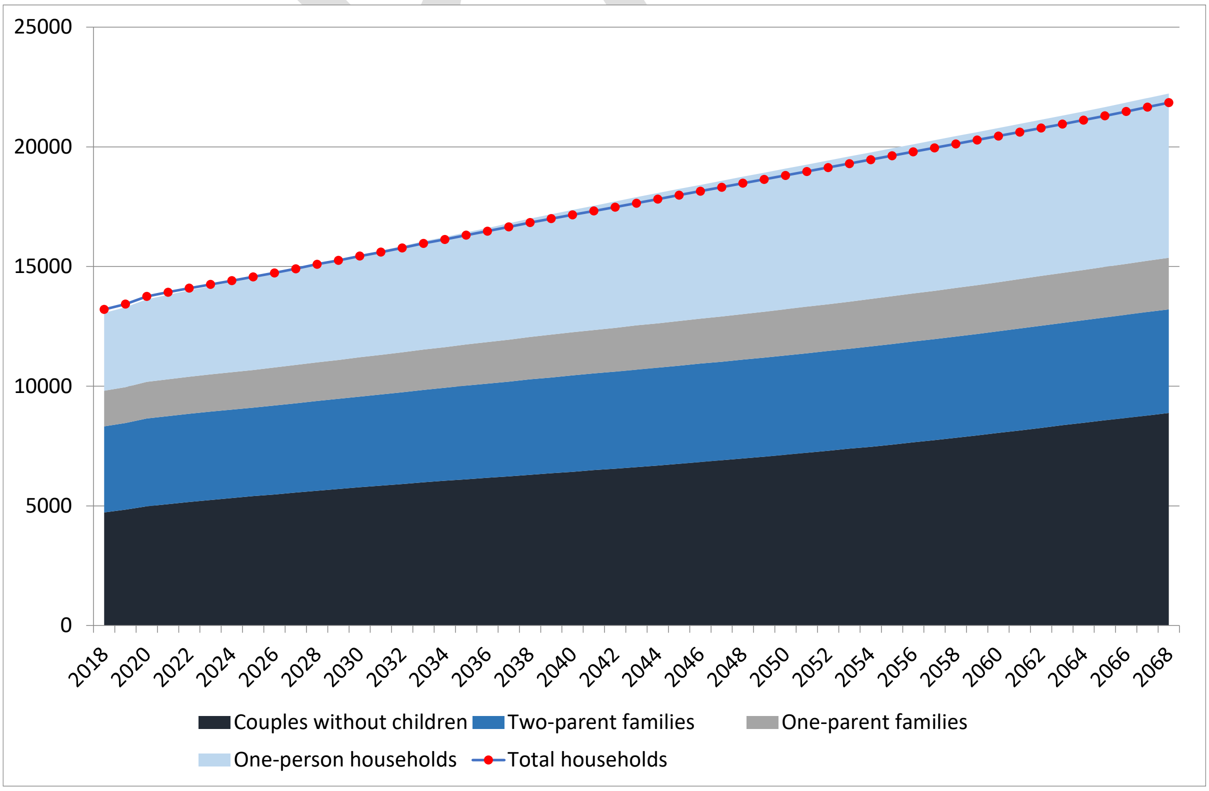
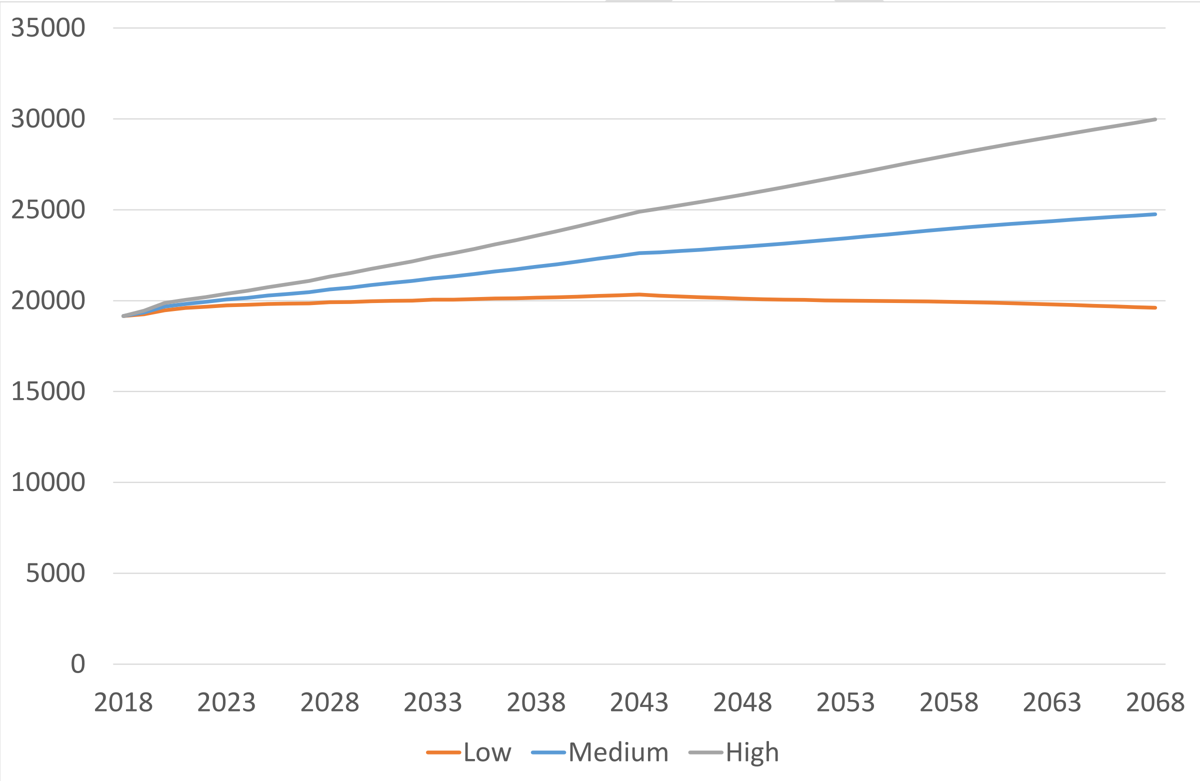


Figure 33: High-variant family and household projections for Matamata-Piako District, 2018-2068



The labour force projections for Matamata-Piako District are shown in Figure 34. The estimated labour force in June 2018 is 19,150. In the medium-variant projection, the labour force increases throughout the projection period, reaching 24,757 in 2068. In the low-variant projection, the labour force increases to a peak of 20,332 in 2043 before declining to 19,607 in 2068. In the high-variant projection, the labour force increases throughout the projection period, reaching 29,975 in 2068.

Figure 34: Labour force projections for Matamata-Piako District, 2018-2068



4.5 Population, Family and Household, and Labour Force Projections for Hamilton City

Figure 35 presents the 2018-base population projections for Hamilton City to 2068, along with historical population estimates from Statistics New Zealand back to 1996. The 2018-base Statistics New Zealand (SNZ) projections are also included for comparison.

The June 2018 population estimate (base population) for Hamilton City is 168,600. Under the medium-variant population projection scenario, the population increases throughout the projection period, reaching 264,198 in 2068. The medium-variant projection shows lower growth than the recent experience of Hamilton City, but this reflects the much lower projection international migration flows. The annualised projected population growth over the period 2018-2038 of 1.25% per year is lower than the 1.82% annualised growth experienced over the period 1996-2018, again reflecting the much lower projected international migration. Under the low-variant scenario, the population increases throughout the projection period, reaching 216,661 in 2068. Under the high-variant scenario, the population increases throughout the projection period, reaching 312,161 in 2068. In comparison, the SNZ 2018-base medium-variant projection is very similar to the Waikato medium-variant projection, with the SNZ high-variant slightly higher than the Waikato high-variant scenario, and the SNZ low-variant slightly lower than the Waikato low-variant scenario.

Figure 35: Population projections for Hamilton City, 2018-2068

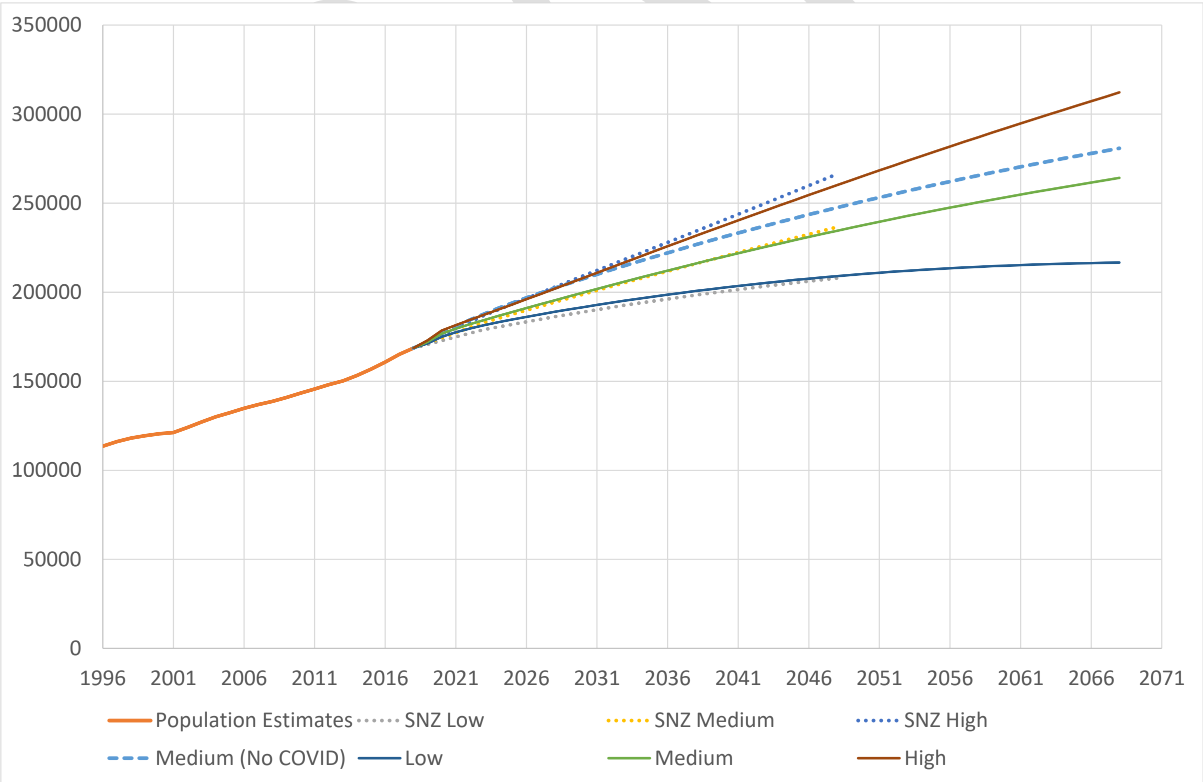


Figure 36 disaggregates the components of population change for Hamilton City over the period 2019-2068 for the medium-variant population projection. As previously noted, net population change in the medium-variant projection scenario is positive throughout the projection period. This is made up of net inward internal migration (more in-migration from the rest of New Zealand than out-migration) and natural increase (more births than deaths), offset by a small amount of net outward international migration (more out-migration to overseas than in-migration from overseas) throughout most of the projection period. The initial bump in population from the historically high net international migration at the national level can clearly be seen in the first two years of the projections, but is quickly eliminated by the coronavirus border closures and the resulting substantial decrease in international migration flows.

Figure 36: Projected components of population change for Hamilton City, medium-variant projection, 2019-2068

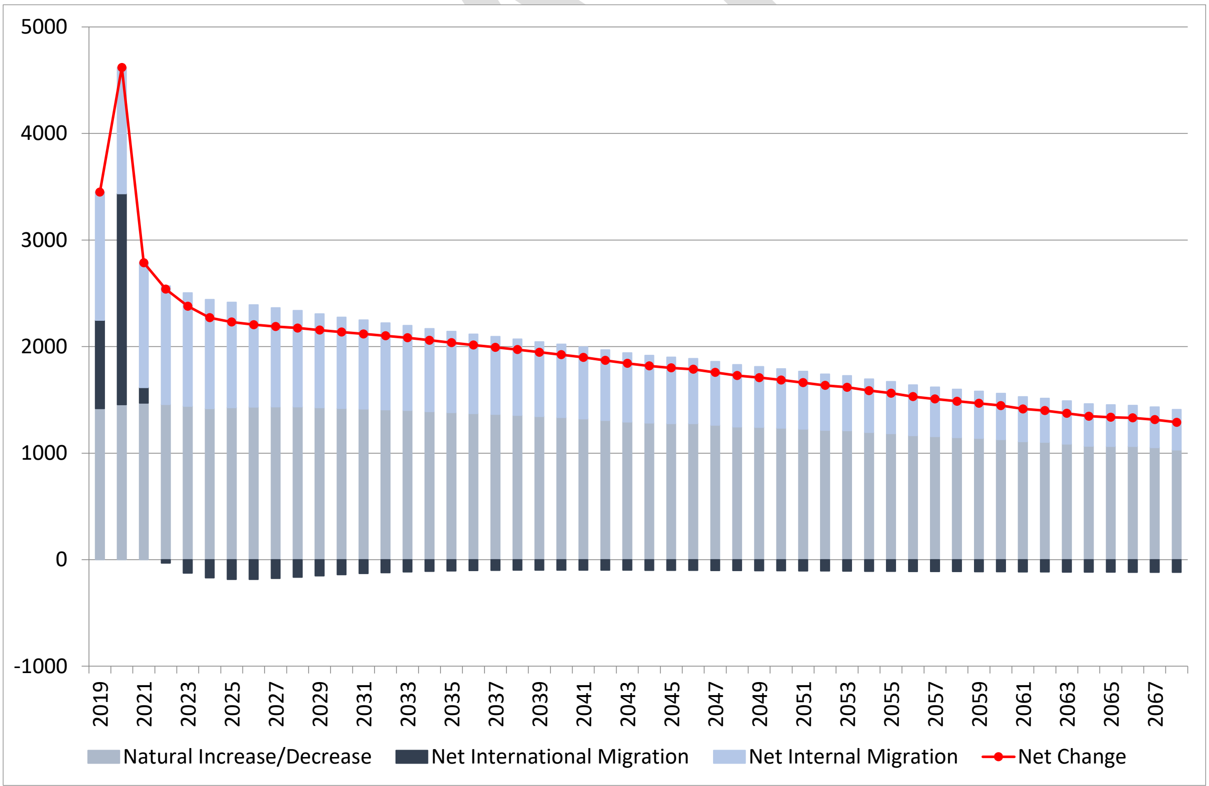


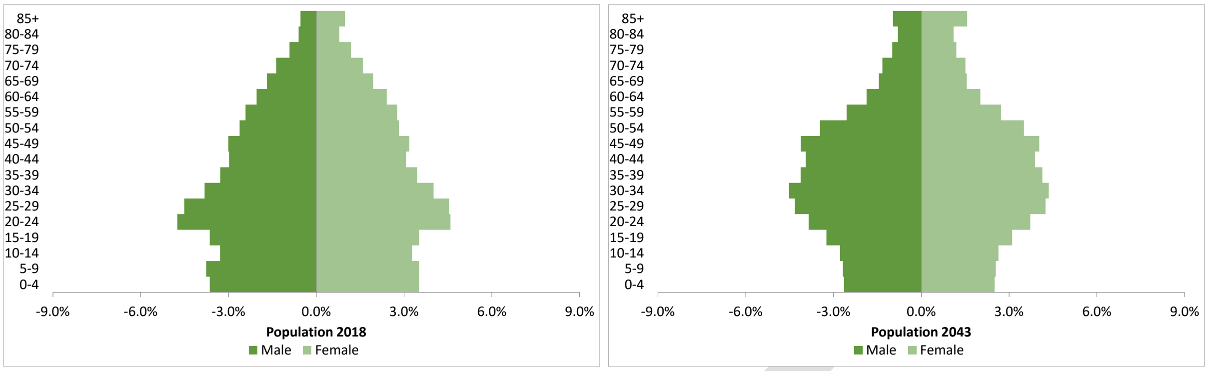
Table 6 summarises the largest sources and destinations of inward and outward internal migrants respectively, for Hamilton City in 2043 (being the middle of the projection period) for the medium-variant population projection. The largest flows in and out of the district can be attributed to Auckland, Waikato Distict, and Waipa District, all of which are in close proximity to Hamilton City. The inward migration flows from Auckland and Waikato Distict are larger than the outward flows, suggesting that Auckland and Waikato District are projected to be a substantial source of net internal migration for Hamilton City. In contrast, the outward migration is larger than the inward flow for Waipa District, suggesting that Hamilton City is a net donor of migrants to Waipa District.

Table 6: Top sources and destinations of internal migration for Hamilton City, 2043

Source	**Number**		**Destination**	**Number**
Auckland	3288		Auckland	1887
Waikato	1114		Waipa	1254
Waipa	1089		Waikato	1051
Tauranga	409		Tauranga	513
Matamata Piako	254		Matamata Piako	290
Rotorua	202		Rotorua	217
Western Bay of Plenty	156		Western Bay of Plenty	201
Wellington	117		Christchurch	149
Whangarei	107		Taupo	123
Taupo	102		Whangarei	122

The age structure of Hamilton City is the youngest in the region in 2018, and remains relatively young throughout the projection period, as shown in Figure 37. In 2018, 11.6 percent of the population are aged 65 years and over, and this is projected to slightly increase to 12.5 percent by 2043. This low degree of ageing keeps natural increase positive through the early period of the projections, as shown in the previous figure.

Figure 37: Age-sex structure for Hamilton City, 2018 and 2043 (medium-variant projection)



The medium-variant family and household projection (by type) for Hamilton City is shown in Figure 38. The estimated number of total households in June 2018 is 57,479. In terms of total households, the projection closely follows the medium-variant population projection, with the total number of households increasing throughout the projection period, reaching 102,962 in 2068. The number of one-parent and two-parent families increases fairly consistently over the projection period, as does the number of couples without children and one-person households. The low-variant and high-variant family and household projection (by type) for Hamilton City are shown in Figures 39 and 40 respectively. In terms of total households, the low-variant projection closely follows the low-variant population projection, with the total number of households increasing throughout the projection period, reaching 85,690 in 2068. The high-variant projection closely follows the high-variant population projection, with the total number of households throughout the projection period, reaching 120,325 in 2068. The relative size of the families and households by type are similar in the low-variant and high-variant projections to those in the medium-variant projection.

The labour force projections for Hamilton City are shown in Figure 41. The estimated labour force in June 2018 is 92,473. In the medium-variant projection, the labour force increases throughout the projection period, reaching 165,877 in 2068. In the low-variant projection, the labour force increases to a peak of 137,332 in 2060 before declining to 135,450 in 2068. In the high-variant projection, the labour force increases throughout the projection period, reaching 196,462 in 2068.

Figure 38: Medium-variant family and household projections for Hamilton City, 2018-2068

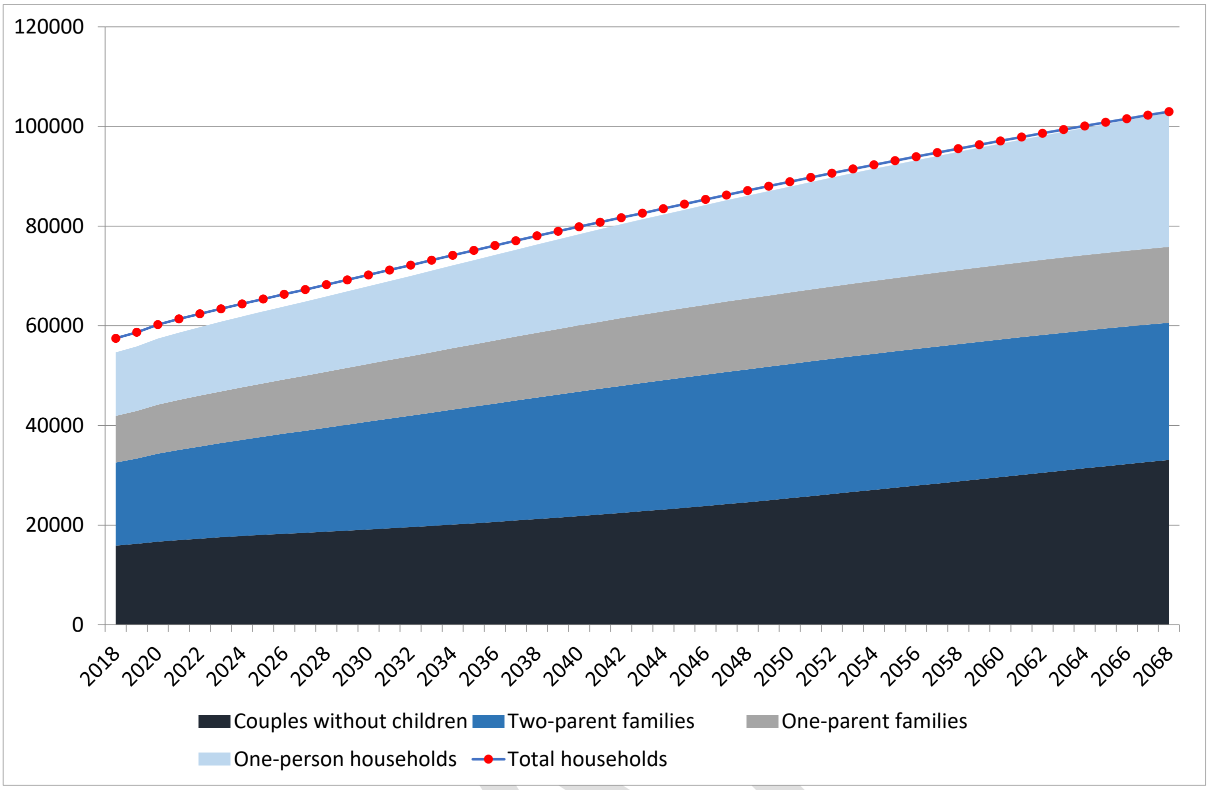


Figure 39: Low-variant family and household projections for Hamilton City, 2018-2068

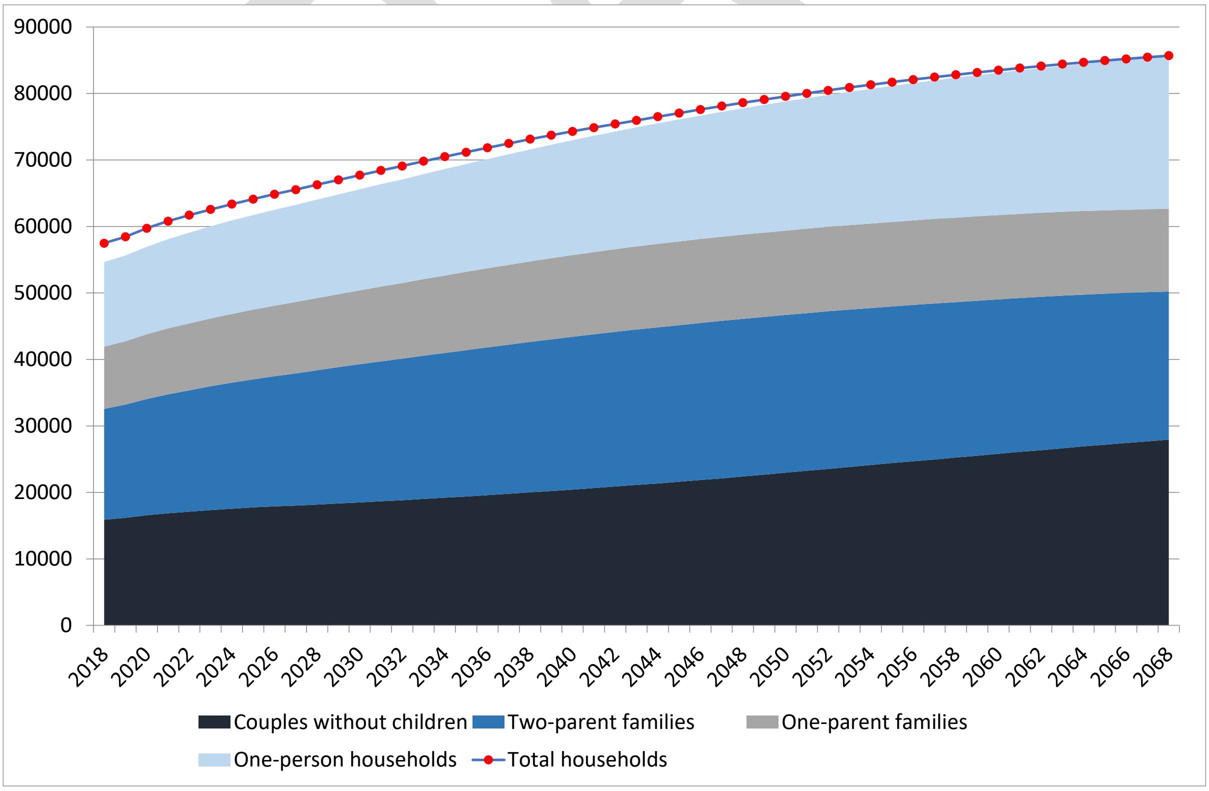


Figure 40: High-variant family and household projections for Hamilton City, 2018-2068

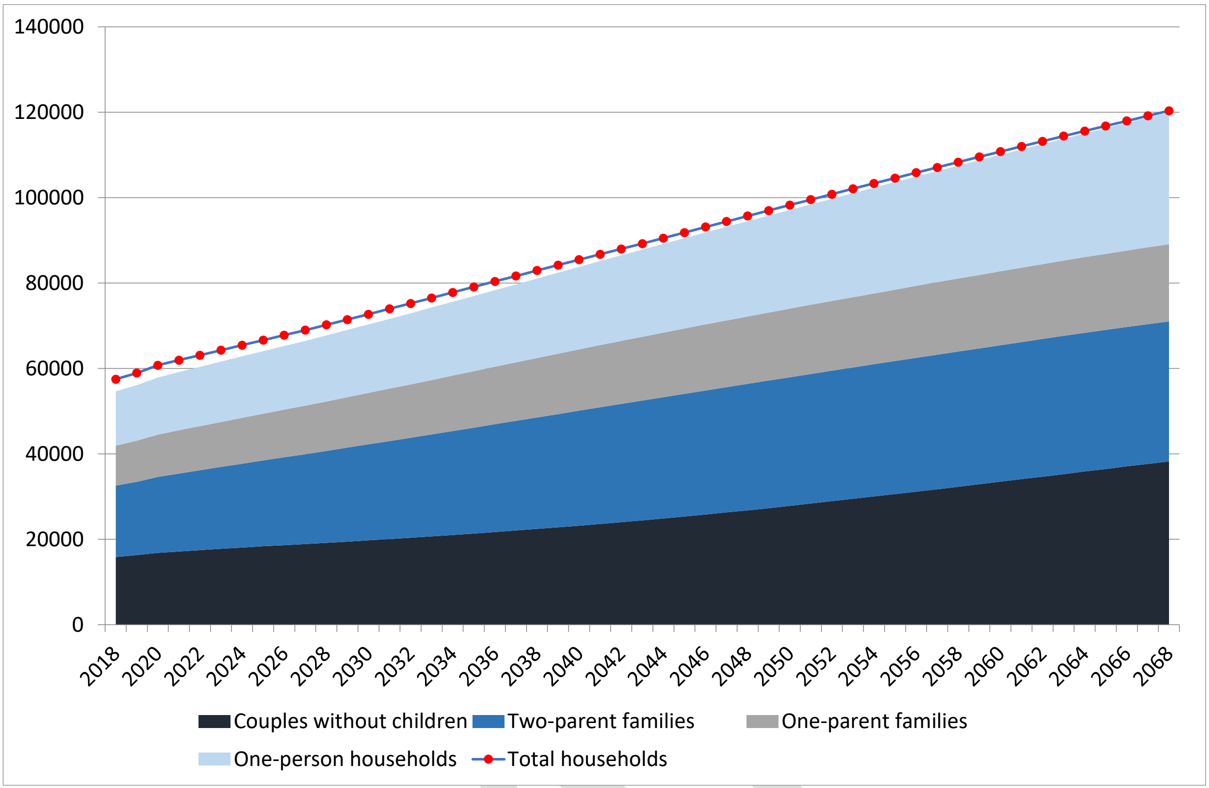
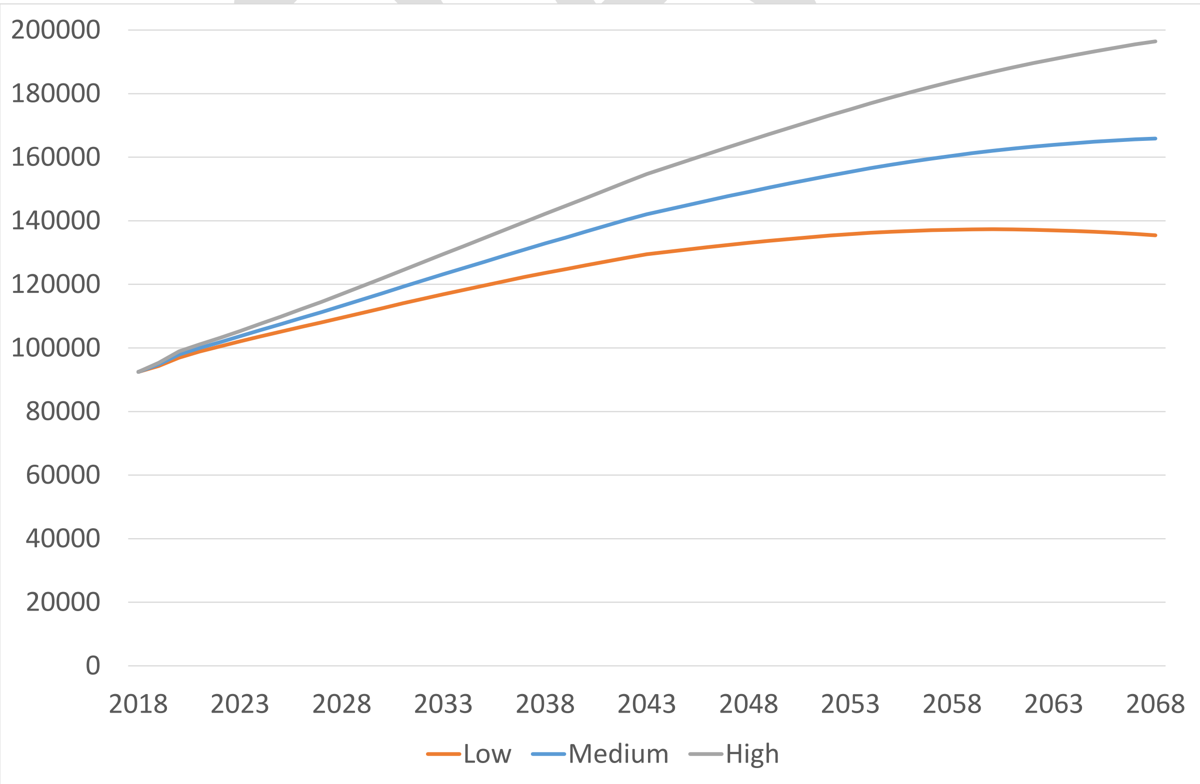


Figure 41: Labour force projections for Hamilton City, 2018-2068



4.6 Population, Family and Household, and Labour Force Projections for Waipa District

Figure 42 presents the 2018-base population projections for Waipa District to 2068, along with historical population estimates from Statistics New Zealand back to 1996. The 2018-base Statistics New Zealand (SNZ) projections are also included for comparison.

The June 2018 population estimate (base population) for Waipa District is 55,000. Under the medium-variant population projection scenario, the population increases throughout the projection period, reaching 77,090 in 2068. The medium-variant projection shows lower growth than the recent experience of Waipa District, but this reflects the much lower projection international migration flows. The annualised projected population growth over the period 2018-2038 of 0.89% per year is substantially lower than the 1.65% annualised growth experienced over the period 1996-2018, again reflecting the much lower projected international migration. Under the low-variant scenario, the population increases throughout the projection period, reaching 62,549 in 2068. Under the high-variant scenario, the population increases throughout the projection period, reaching 91,836 in 2068. In comparison, the SNZ 2018-base medium-variant projection is slightly lower than the Waikato medium-variant projection, with the SNZ high-variant somewhat higher than the Waikato high-variant scenario, and the SNZ low-variant very similar to the Waikato low-variant scenario.

Figure 43 disaggregates the components of population change for Waipa District over the period 2019-2068 for the medium-variant population projection. As previously noted, net population change in the medium-variant projection scenario is positive throughout the projection period. This is made up of net inward internal migration (more in-migration from the rest of New Zealand than out-migration) and natural increase (more births than deaths) up to 2038 (after which there is natural decrease – more deaths than births), and net outward international migration (more out-migration to overseas than in-migration from overseas). The initial bump in population from the historically high net international migration at the national level can clearly be seen in the first two years of the projections, but is quickly eliminated by the coronavirus border closures and the resulting substantial decrease in international migration flows.

Figure 42: Population projections for Waipa District, 2018-2068

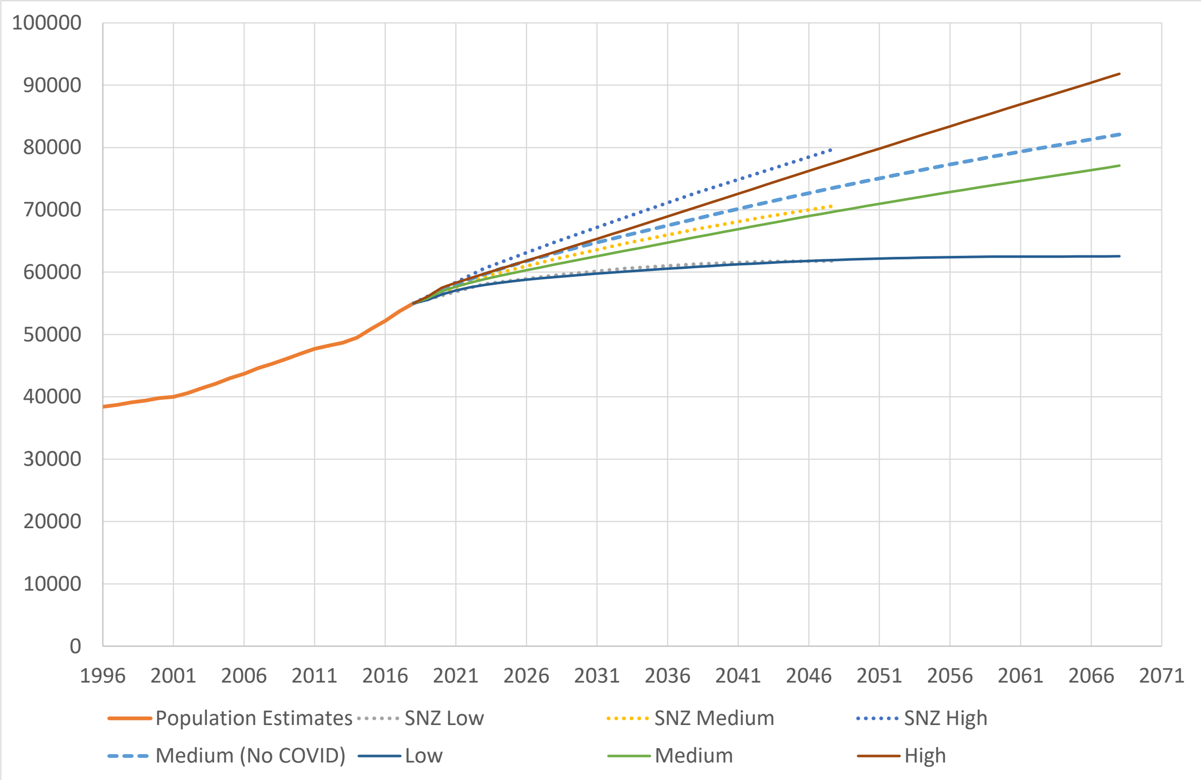


Figure 43: Projected components of population change for Waipa District, medium-variant projection, 2019-2068

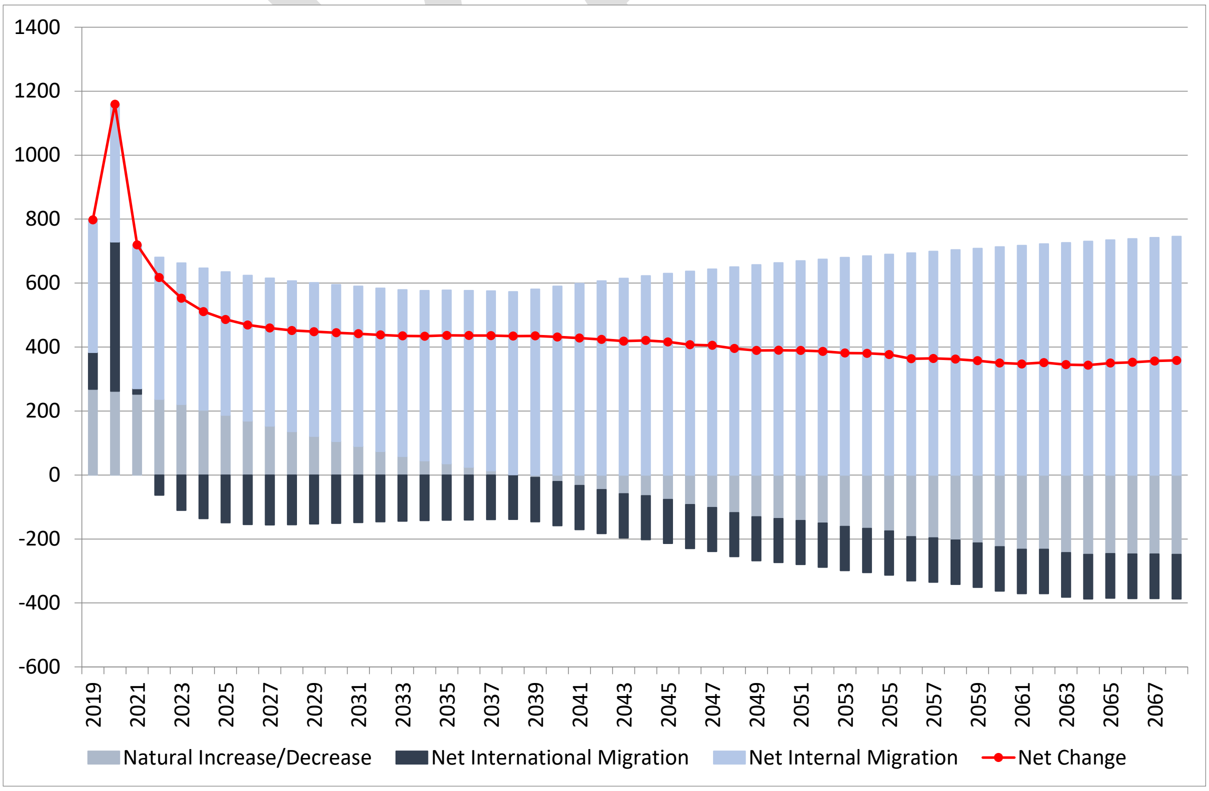


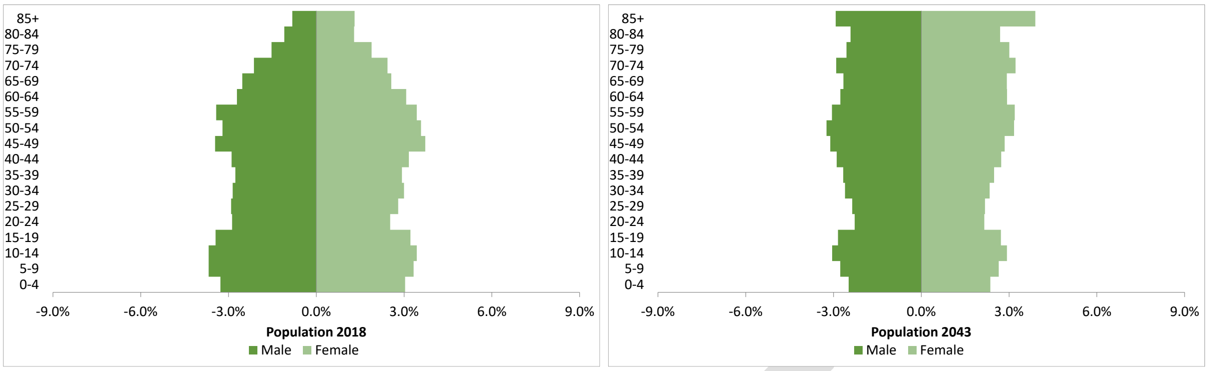
Table 7 summarises the largest sources and destinations of inward and outward internal migrants respectively, for Waipa District in 2043 (being the middle of the projection period) for the medium-variant population projection. The largest flows in and out of the district can be attributed to Hamilton City, Auckland, and Waikato Distict, all of which are large population centres in close proximity to Waipa District. The inward migration from each of those TAs is larger than the outward flow, suggesting that the nearby cities are projected to be a substantial source of net internal migration for Waipa District.

Table 7: Top sources and destinations of internal migration for Waipa District, 2043

Source	**Number**		**Destination**	**Number**
Hamilton	1254		Hamilton	1089
Auckland	953		Auckland	475
Waikato	229		Waikato	187
Tauranga	153		Tauranga	166
Matamata-Piako	144		Matamata Piako	143
Rotorua	85		Rotorua	79
South Waikato	73		Western Bay of Plenty	66
Otorohanga	64		South Waikato	66
Western Bay of Plenty	59		Otorohanga	58
Taupo	43		Christchurch	46

The age structure of Waipa District is moderately old compared with other TAs in the Waikato, but ages relatively quickly, as shown in Figure 44. In 2018, 17.6 percent of the population are aged 65 years and over, and this is projected to slightly increase to 29.2 percent by 2043. This fastest rate of ageing explains the shift from natural increase to natural decrease shown in the previous figure.

Figure 44: Age-sex structure for Waipa District, 2018 and 2043 (medium-variant projection)



The medium-variant family and household projection (by type) for Waipa District is shown in Figure 45. The estimated number of total households in June 2018 is 20,163. In terms of total households, the projection closely follows the medium-variant population projection, with the total number of households increasing throughout the projection period, reaching 30,107 in 2068. The number of one-parent and two-parent families increases fairly consistently over the projection period, as does the number of couples without children and one-person households. The low-variant and high-variant family and household projection (by type) for Waipa District are shown in Figures 46 and 47 respectively. In terms of total households, the low-variant projection closely follows the low-variant population projection, with the total number of households increasing throughout the projection period, reaching 24,811 in 2068. The high-variant projection closely follows the high-variant population projection, with the total number of households throughout the projection period, reaching 35,446 in 2068. The relative size of the families and households by type are similar in the low-variant and high-variant projections to those in the medium-variant projection.

The labour force projections for Waipa District are shown in Figure 48. The estimated labour force in June 2018 is 30,664. In the medium-variant projection, the labour force increases throughout the projection period, reaching 42,918 in 2068. In the low-variant projection, the labour force increases to a peak of 35,417 in 2043 before declining to 34,232 in 2068. In the high-variant projection, the labour force increases throughout the projection period, reaching 51,696 in 2068.

Figure 45: Medium-variant family and household projections for Waipa District, 2018-2068

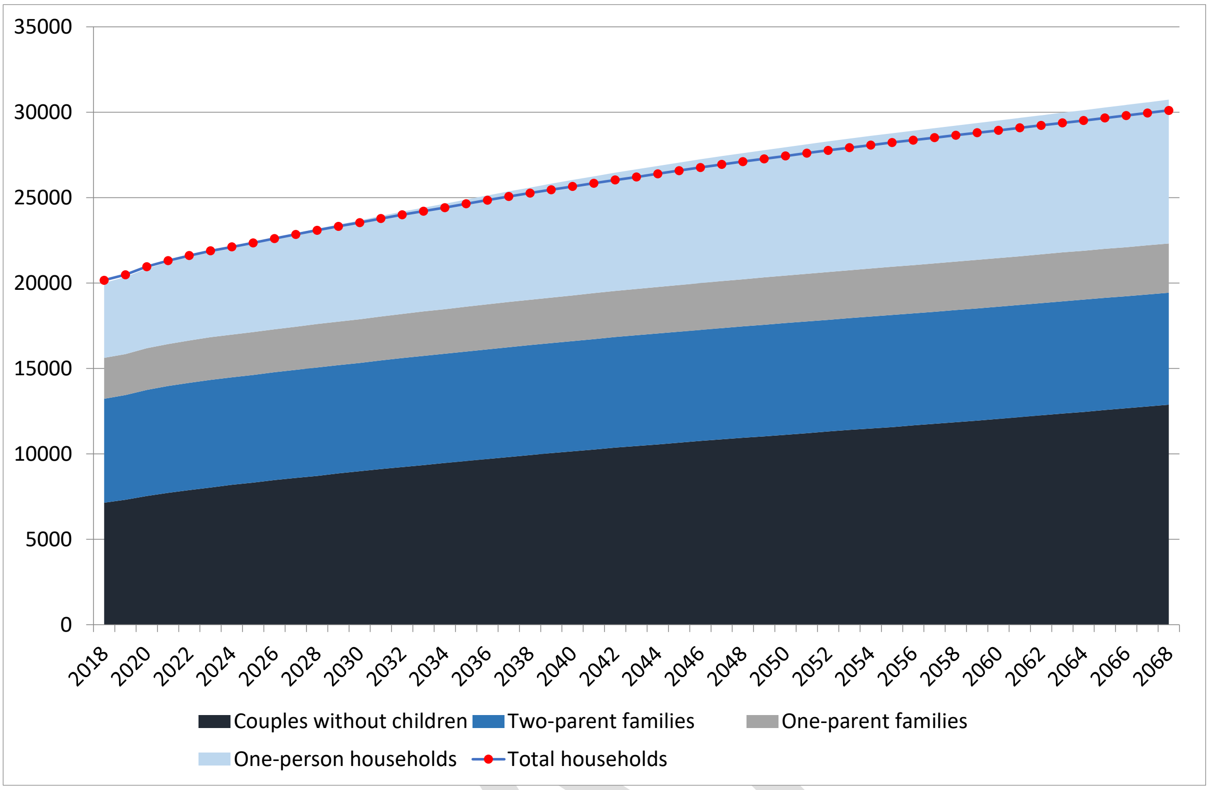


Figure 46: Low-variant family and household projections for Waipa District, 2018-2068

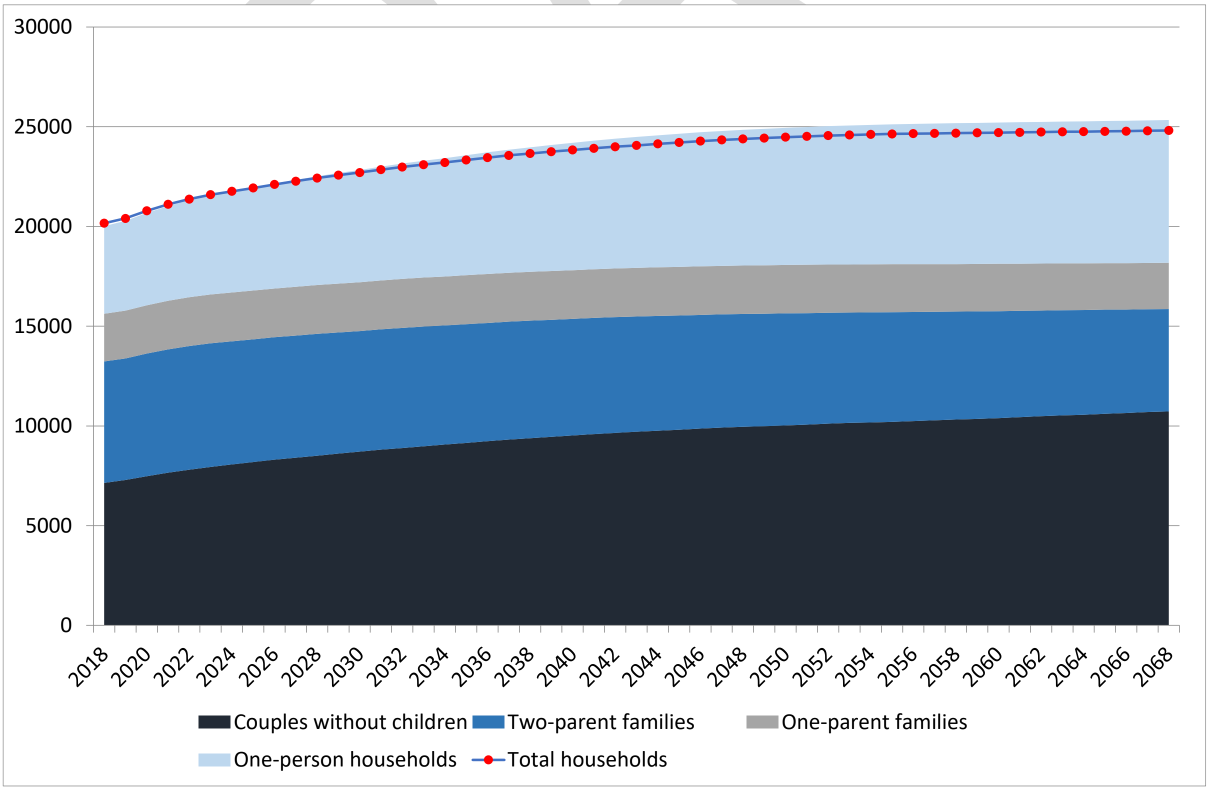


Figure 47: High-variant family and household projections for Waipa District, 2018-2068

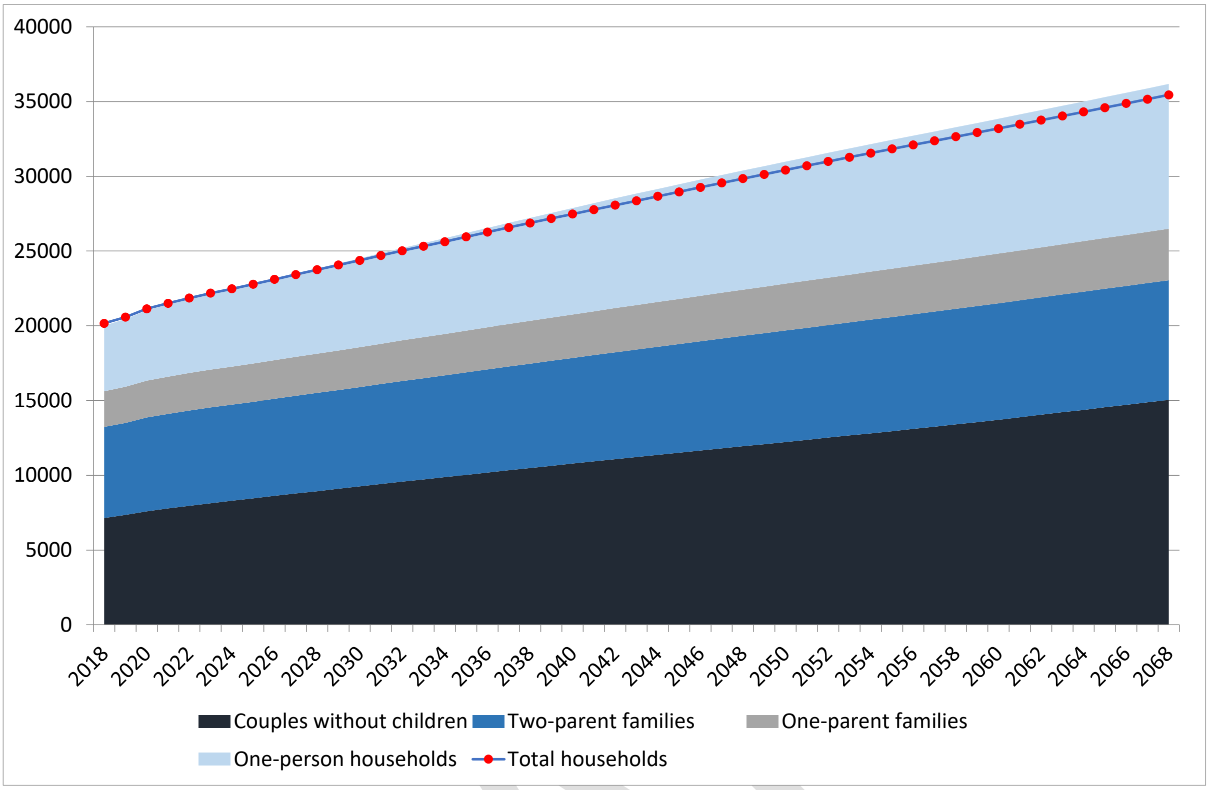
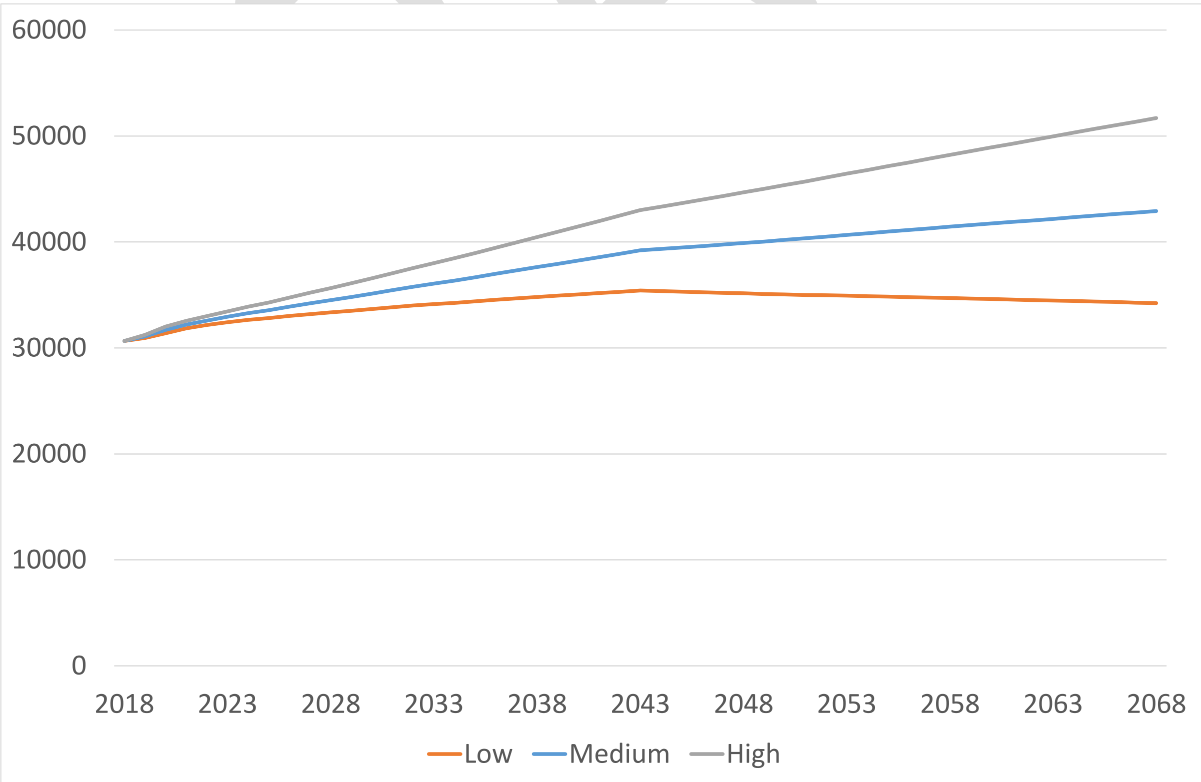


Figure 48: Labour force projections for Waipa District, 2018-2068



4.7 Population, Family and Household, and Labour Force Projections for Otorohanga District

Figure 49 presents the 2018-base population projections for Otorohanga District to 2068, along with historical population estimates from Statistics New Zealand back to 1996. The 2018-base Statistics New Zealand (SNZ) projections are also included for comparison.

The June 2018 population estimate (base population) for Otorohanga District is 10,500. Under the medium-variant population projection scenario, the population increases throughout the projection period, reaching 13,968 in 2068. The medium-variant projection shows higher growth than the recent experience of Otorohanga District, more closely reflecting the TA's experience since 2006. The annualised projected population growth over the period 2018-2038 of 0.63% per year is somewhat lower than the 0.24% annualised growth experienced over the period 1996-2018. Under the low-variant scenario, the population increases throughout the projection period, reaching 11,339 in 2068. Under the high-variant scenario, the population increases throughout the projection period, reaching 16,640 in 2068. In comparison, the SNZ 2018-base medium-variant projection is similar to the medium-variant projection for much of the projection period, but then falls away after the early-2030s, with the SNZ high-variant slightly higher than the Waikato high-variant, and the low-variant similar to the Waikato low-variant scenario only until the mid-2020s.

Figure 50 disaggregates the components of population change for Otorohanga District over the period 2019-2068 for the medium-variant population projection. As previously noted, net population change in the medium-variant projection scenario is positive throughout the projection period. This is made up of net inward internal migration (more in-migration from the rest of New Zealand than out-migration) and natural increase (more births than deaths), offset by net outward international migration (more out-migration to overseas than in-migration from overseas). The initial bump in population from the historically high net international migration at the national level can clearly be seen in the first two years of the projections, but is quickly eliminated by the coronavirus border closures and the resulting substantial decrease in international migration flows.

Figure 49: Population projections for Otorohanga District, 2018-2068

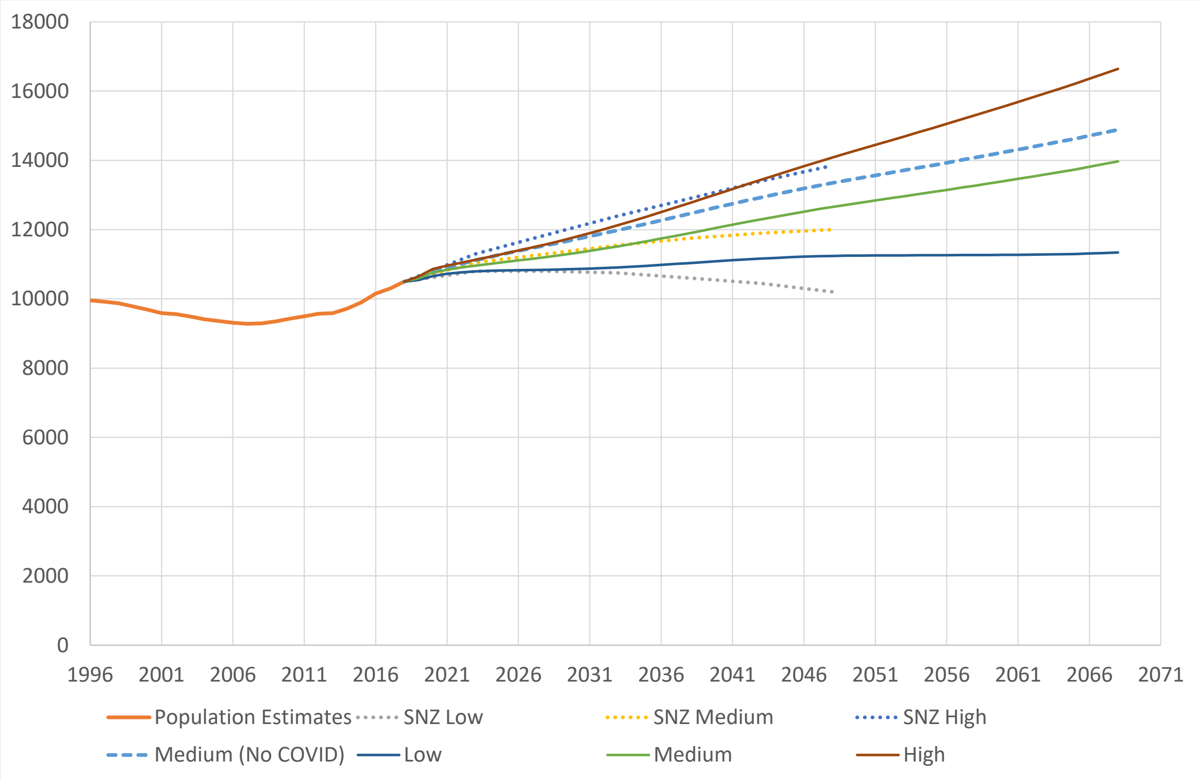


Figure 50: Projected components of population change for Otorohanga District, medium-variant projection, 2019-2068

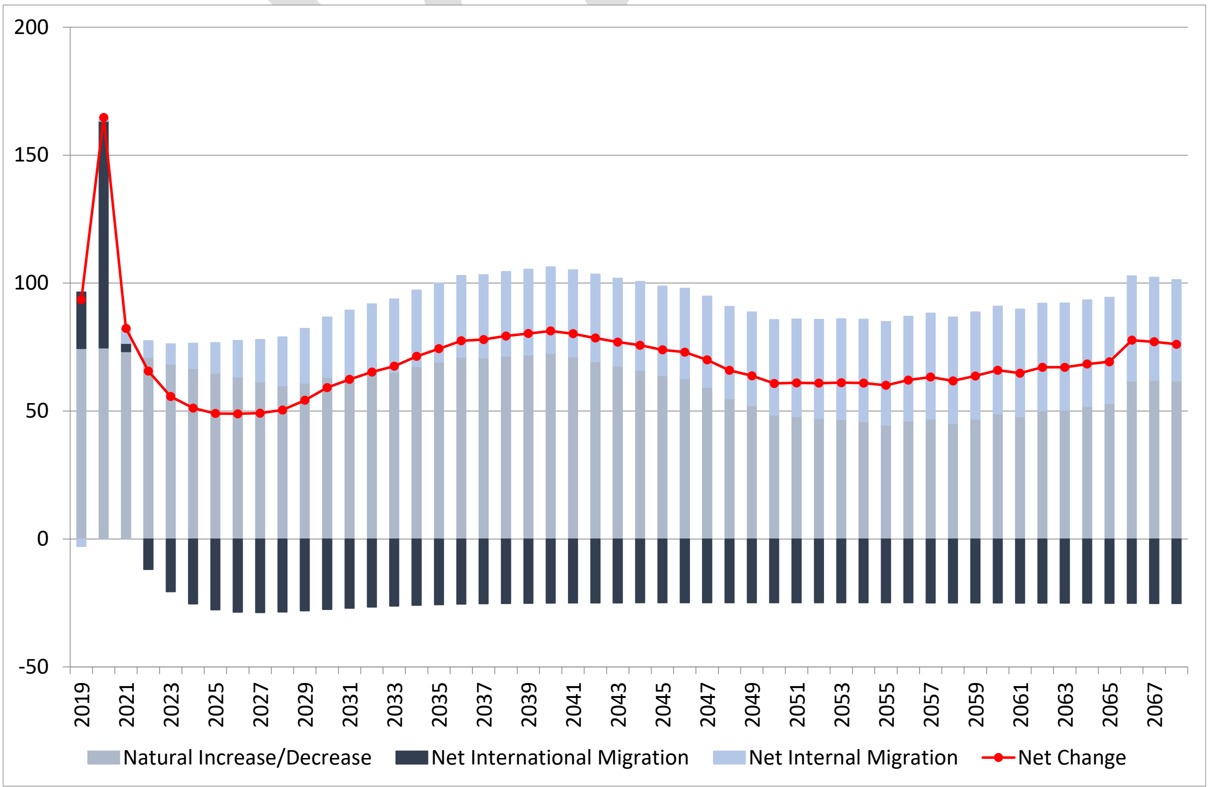


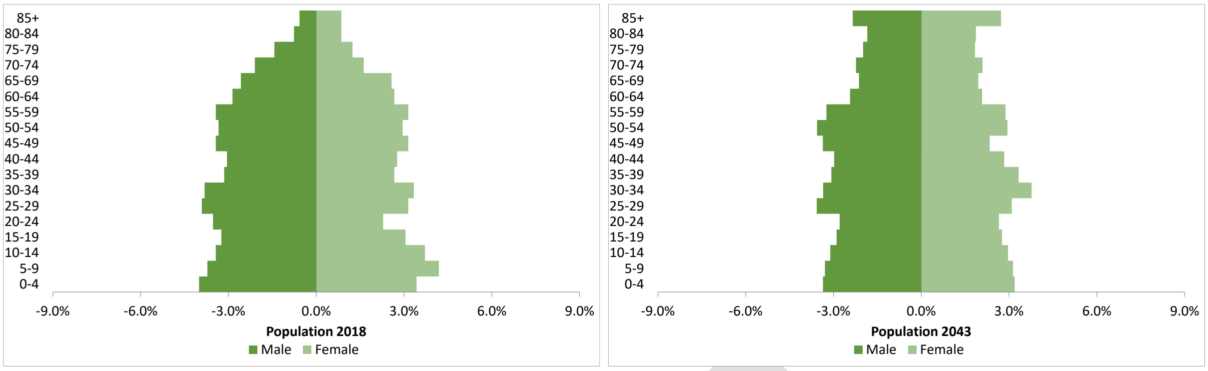
Table 8 summarises the largest sources and destinations of inward and outward internal migrants respectively, for Otorohanga District in 2043 (being the middle of the projection period) for the medium-variant population projection. The largest flows in and out of the district can be attributed to Auckland, Hamilton City, and Waipa Distict, all of which are large population centres in relatively close proximity to Otorohanga District. The inward migration from Auckland and Hamilton City are larger than the outward flows, suggesting that Auckland and Hamilton City are projected to be a substantial source of net internal migration for Otorohanga District. In contrast, the outward migration is larger than the inward flow for Waipa District, suggesting that Otorohanga District is a net donor of migrants to Waipa District

Table 8: Top sources and destinations of internal migration for Otorohanga District, 2043

Source	**Number**		**Destination**	**Number**
Auckland	171		Auckland	94
Hamilton	70		Hamilton	68
Waipa	58		Waipa	64
Waikato	34		Waikato	31
Tauranga	25		Tauranga	30
Taupo	18		Taupo	21
Rotorua	16		Rotorua	17
South Waikato	14		South Waikato	14
Waitomo	12		Waitomo	13
Matamata-Piako	10		Western Bay of Plenty	12

The age structure of Otorohanga District is amongst the most youthful in the Waikato Region and remains relatively young, as shown in Figure 51. In 2018, 14.6 percent of the population are aged 65 years and over, and this is projected to slightly increase to 21.0 percent by 2043. This slow rate of population ageing explains why the district remains in natural increase throughout the projection period, as shown in the previous figure.

Figure 51: Age-sex structure for Otorohanga District, 2018 and 2043 (medium-variant projection)



The medium-variant family and household projection (by type) for Otorohanga District is shown in Figure 52. The estimated number of total households in June 2018 is 3,632. In terms of total households, the projection closely follows the medium-variant population projection, with the total number of households increasing throughout the projection period, reaching 5,285 in 2068. The number of one-parent and two-parent families increases fairly consistently over the projection period, as does the number of couples without children and one-person households. The low-variant and high-variant family and household projection (by type) for South Waikato District are shown in Figures 53 and 54 respectively. In terms of total households, the low-variant projection closely follows the low-variant population projection, with the total number of households increasing throughout the projection period, reaching 4,369 in 2068. The high-variant projection closely follows the high-variant population projection, with the total number of households throughout the projection period, reaching 6,211 in 2068. The relative size of the families and households by type are similar in the low-variant and high-variant projections to those in the medium-variant projection.

The labour force projections for Otorohanga District are shown in Figure 55. The estimated labour force in June 2018 is 5,742. In the medium-variant projection, the labour force increases throughout the projection period, reaching 8,148 in 2068. In the low-variant projection, the labour force increases throughout the projection period, reaching 6,593 in 2068. In the high-variant projection, the labour force increases throughout the projection period, reaching 9,721 in 2068.

Figure 52: Medium-variant family and household projections for Otorohanga District, 2018-2068

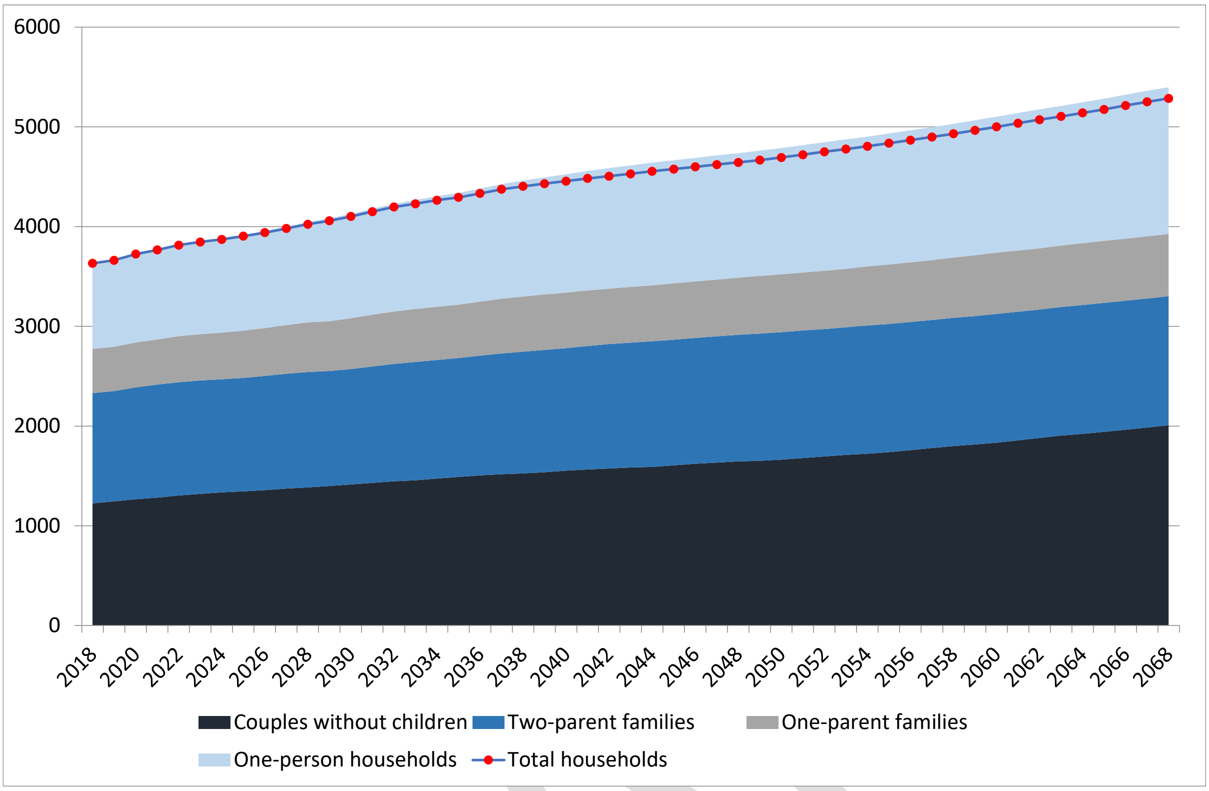


Figure 53: Low-variant family and household projections for Otorohanga District, 2018-2068

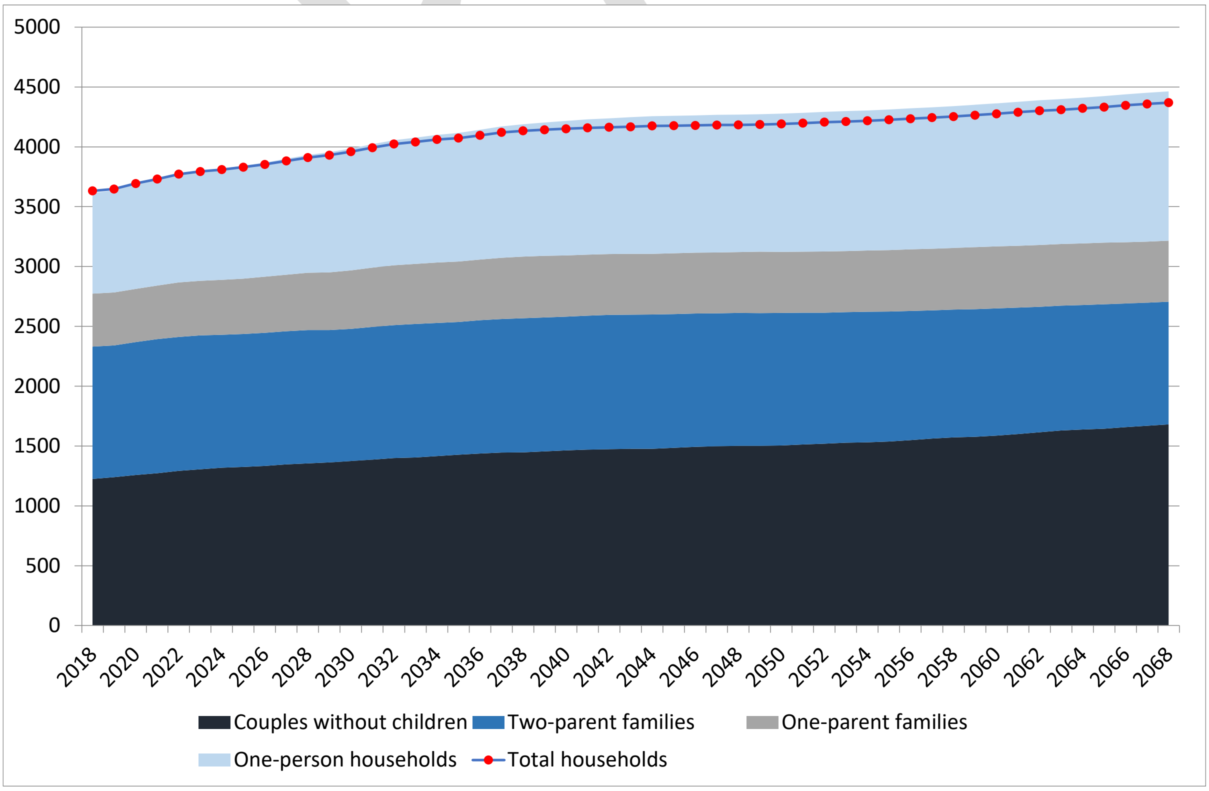


Figure 54: High-variant family and household projections for Otorohanga District, 2018-2068

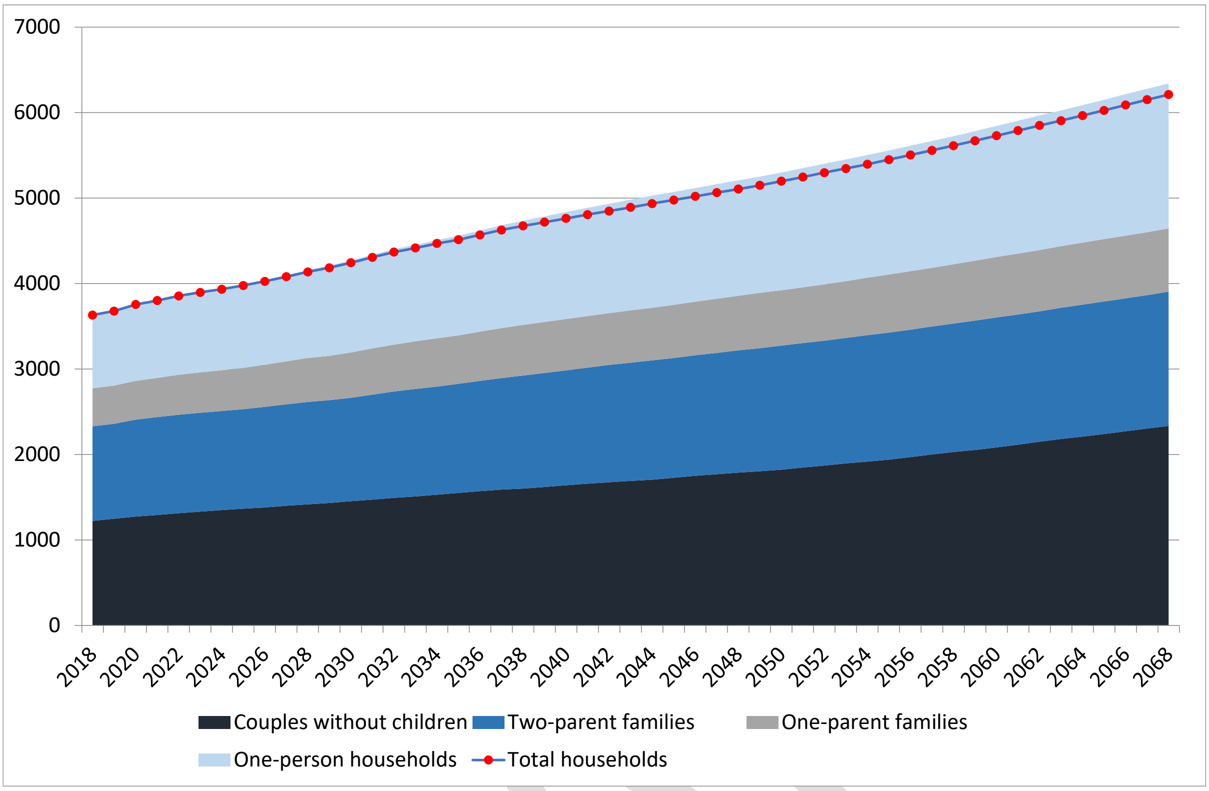
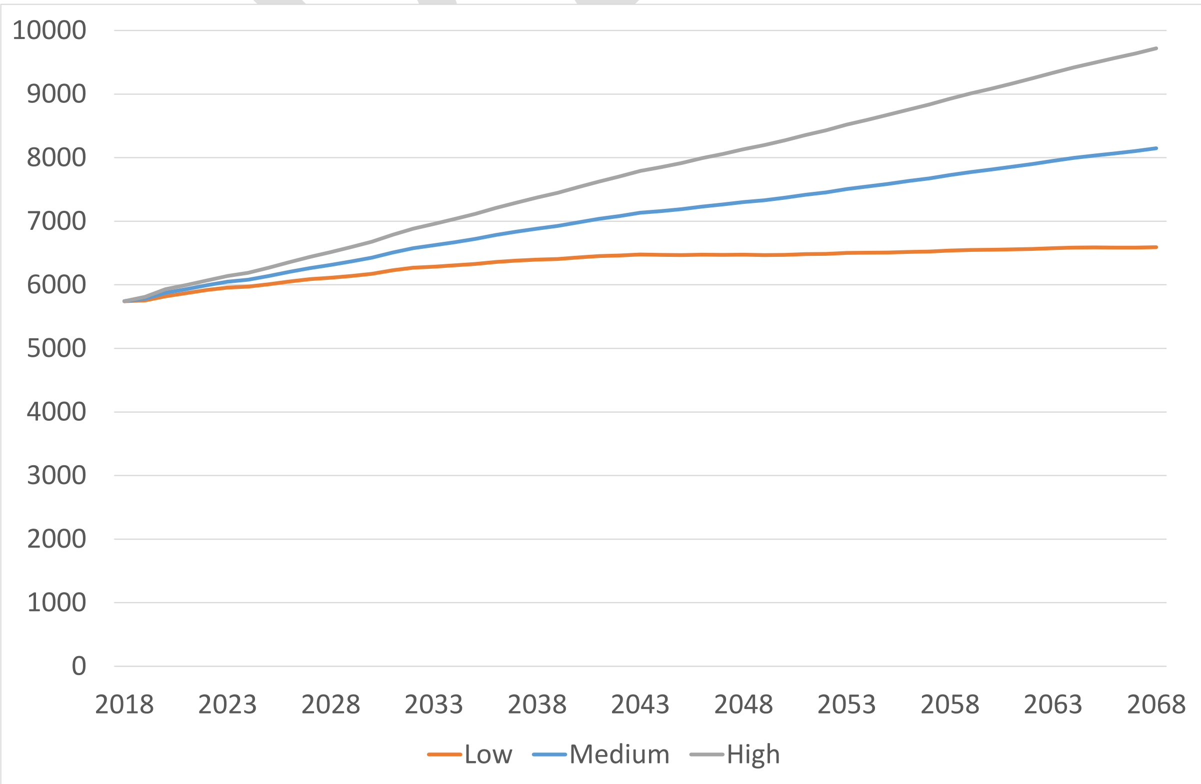


Figure 55: Labour force projections for Otorohanga District, 2018-2068



4.8 Population, Family and Household, and Labour Force Projections for South Waikato District

Figure 56 presents the 2018-base population projections for South Waikato District to 2068, along with historical population estimates from Statistics New Zealand back to 1996. The 2018-base Statistics New Zealand (SNZ) projections are also included for comparison.

The June 2018 population estimate (base population) for South Waikato District is 24,900. Under the medium-variant population projection scenario, the population initially declines, reaching a trough of 24,750 in 2030, then increases throughout the remainder of the projection period, reaching 28,617 in 2068. The medium-variant projection shows higher growth than the recent experience of South Waikato District, more closely reflecting the TA's experience since 2006. The annualised projected population growth over the period 2018-2038 of 0.04% per year is somewhat lower than the -0.18% annualised growth experienced over the period 1996-2018. Under the low-variant scenario, the population decreases to a trough of 22,989 in 2061, before increasing to eventually reach 23,066 in 2068. Under the high-variant scenario, the population increases throughout the projection period, reaching 34,289 in 2068. In comparison, the SNZ 2018-base medium-variant and high-variant projections are higher than the Waikato high-variant projection for much of the projection period, but then the SNZ medium-variant falls away after the late-2030s, with the SNZ low-variant is similar to the Waikato medium-variant until the mid-2030s, before falling away.

Figure 57 disaggregates the components of population change for South Waikato District over the period 2019-2068 for the medium-variant population projection. As previously noted, net population change in the medium-variant projection scenario is initially negative, but then becomes positive from 2031, and remains positive throughout the remainder of the projection period. This is made up of natural increase (more births than deaths), offset by net outward international migration (more out-migration to overseas than in-migration from overseas). Net outward internal migration (more out-migration to the rest of New Zealand than in-migration) gradually reverses, to become net inward internal migration from 2038, as the district benefits from some spill-over growth from the rest of the region. The initial bump in population from the historically high net international migration at the national level can clearly be seen in the first two years of the projections, but is quickly eliminated by the coronavirus border closures and the resulting substantial decrease in international migration flows.

Figure 56: Population projections for South Waikato District, 2018-2068

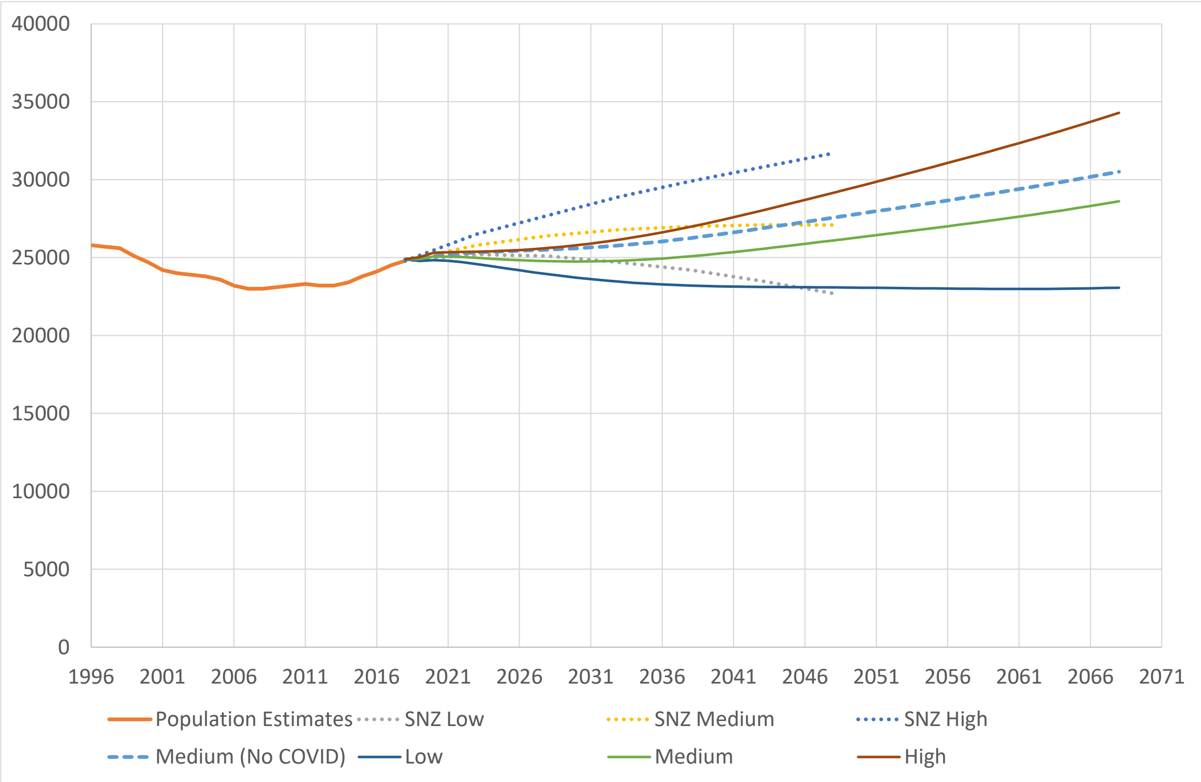


Figure 57: Projected components of population change for South Waikato District, medium-variant projection, 2019-2068

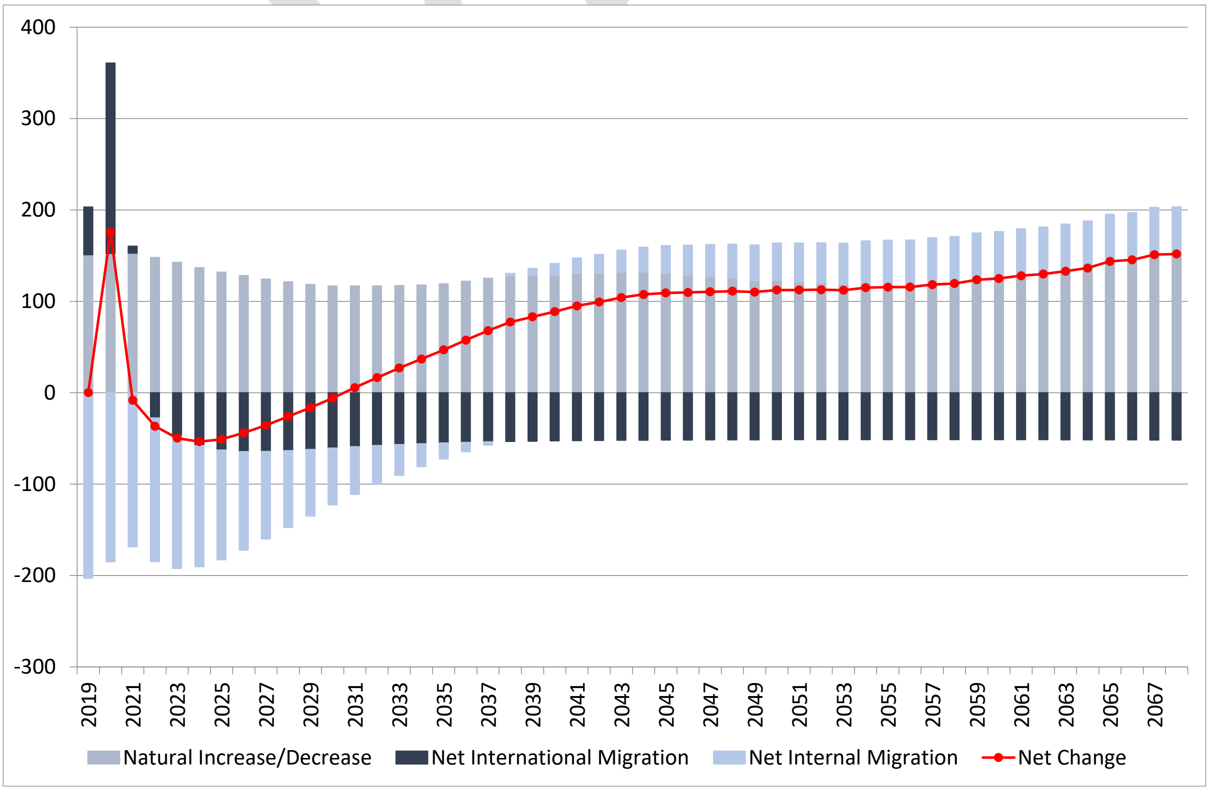


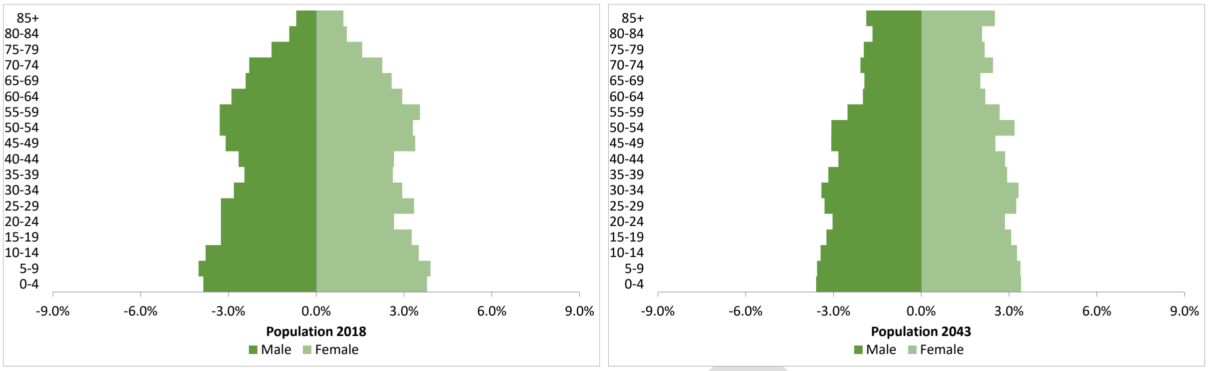
Table 9 summarises the largest sources and destinations of inward and outward internal migrants respectively, for South Waikato District in 2043 (being the middle of the projection period) for the medium-variant population projection. The largest flows in and out of the district can be attributed to Auckland, Rotorua District, Hamilton City, and Tauranga City, all of which are large population centres in relatively close proximity to South Waikato District. The inward migration from Auckland and Hamilton City are larger than the outward flows, suggesting that Auckland and Hamilton City are projected to be a substantial source of net internal migration for South Waikato District. In contrast, the outward migration is larger than the inward flow for Rotorua District and Tauranga City, suggesting that South Waikato District is a net donor of migrants to Rotorua District and Tauranga City.

Table 9: Top sources and destinations of internal migration for South Waikato District, 2043

Source	**Number**		**Destination**	**Number**
Auckland	270		Auckland	150
Rotorua	117		Rotorua	121
Hamilton	89		Tauranga	87
Tauranga	72		Hamilton	86
Waipa	66		Waipa	73
Western Bay of Plenty	47		Western Bay of Plenty	59
Taupo	44		Taupo	51
Matamata Piako	37		Matamata Piako	41
Waikato	27		Waikato	25
Wellington	17		Christchurch	19

The age structure of South Waikato District is moderately old compared with other TAs in the Waikato, but does not age as rapidly as other populations in the region, as shown in Figure 58. In 2018, 16.2 percent of the population are aged 65 years and over, and this is projected to slightly increase to 20.8 percent by 2043. This slow rate of population ageing explains why the district remains in natural increase throughout the projection period, as shown in the previous figure.

Figure 58: Age-sex structure for South Waikato District, 2018 and 2043 (medium-variant projection)



The medium-variant family and household projection (by type) for South Waikato District is shown in Figure 59. The estimated number of total households in June 2018 is 8,815. In terms of total households, the projection closely follows the medium-variant population projection, with the total number of households initially declining, reaching a trough of 8,807 in 2027, then increases throughout the remainder of the projection period, reaching 10,504 in 2068. The number of one-parent families increases fairly consistently over the projection period, as does the number of couples without children and one-person households. The number of two-parent families remains fairly constant over time. The low-variant and high-variant family and household projection (by type) for South Waikato District are shown in Figures 60 and 61 respectively. In terms of total households, the low-variant projection closely follows the low-variant population projection, with the total number of households initially declining, reaching a trough of 8,449 in 2052, then increases throughout the remainder of the projection period, reaching 8,639 in 2068. The high-variant projection closely follows the high-variant population projection, with the total number of households throughout the projection period, reaching 12,397 in 2068. The relative size of the families and households by type are similar in the low-variant and high-variant projections to those in the medium-variant projection.

Figure 59: Medium-variant family and household projections for South Waikato District, 2018-2068

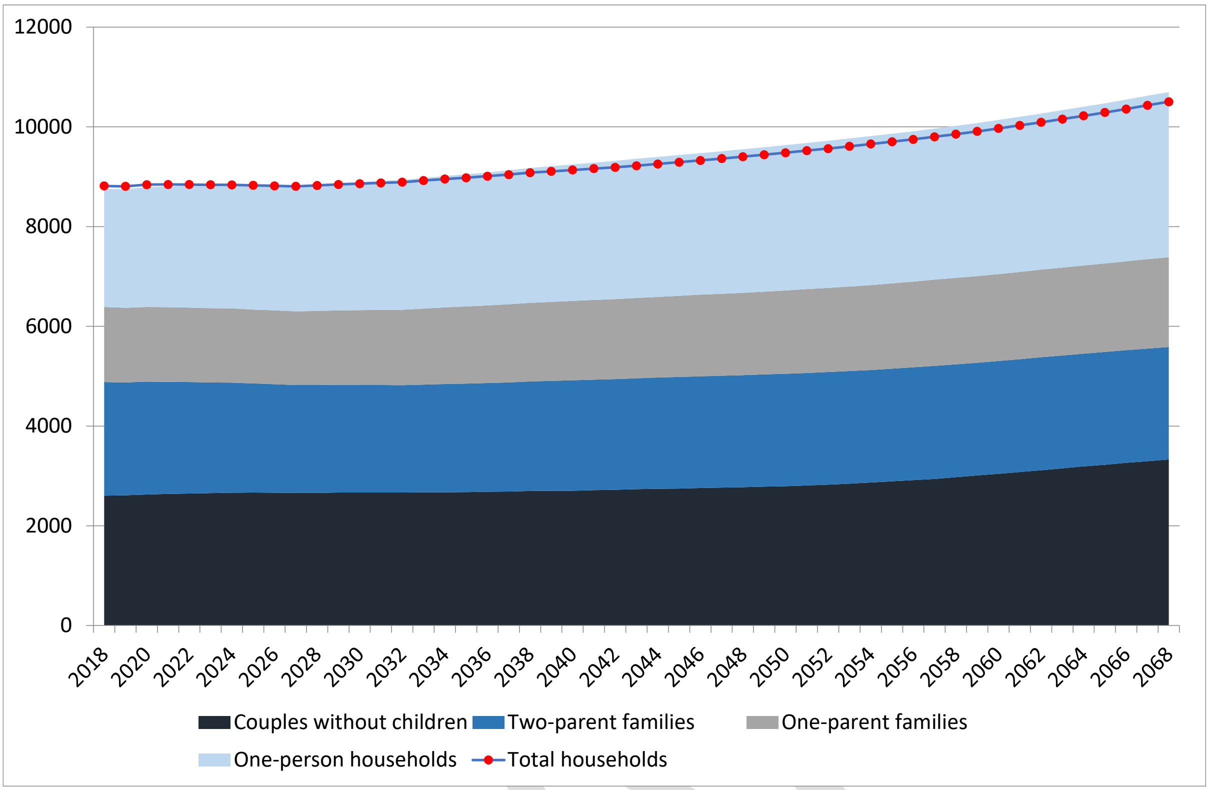


Figure 60: Low-variant family and household projections for South Waikato District, 2018-2068

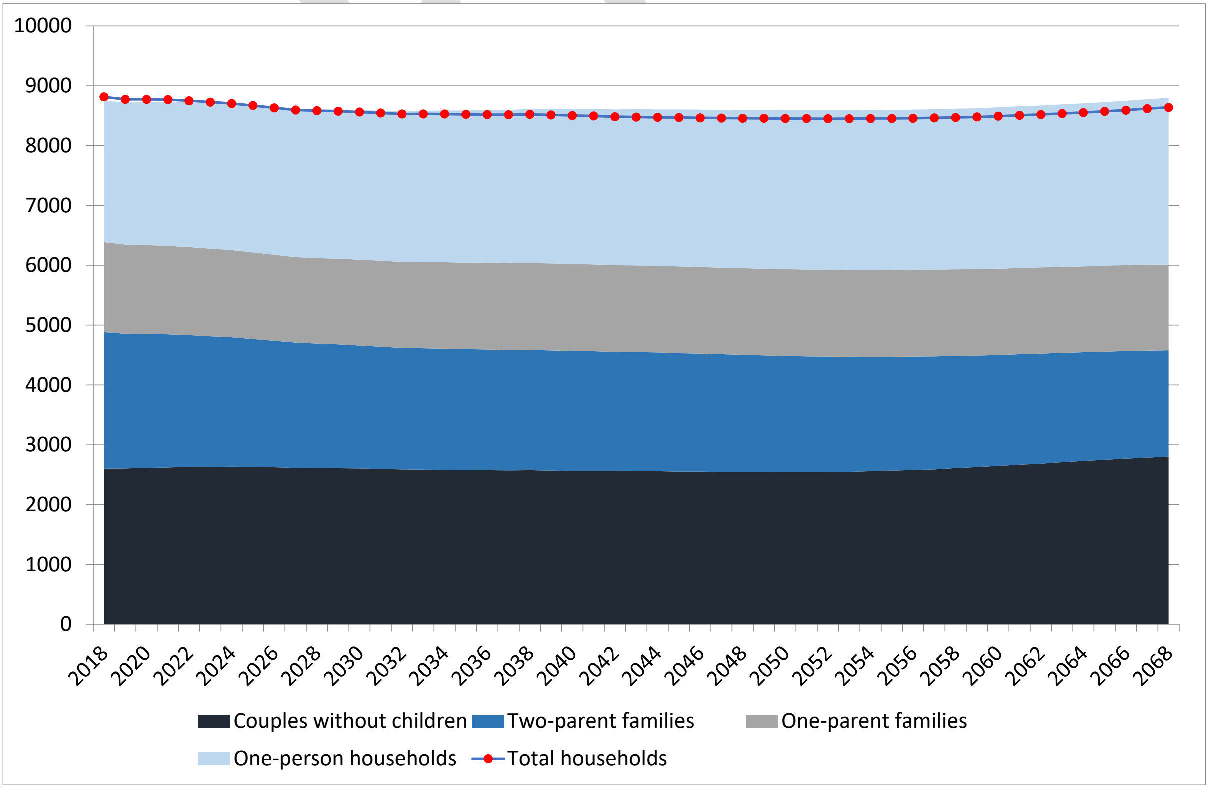
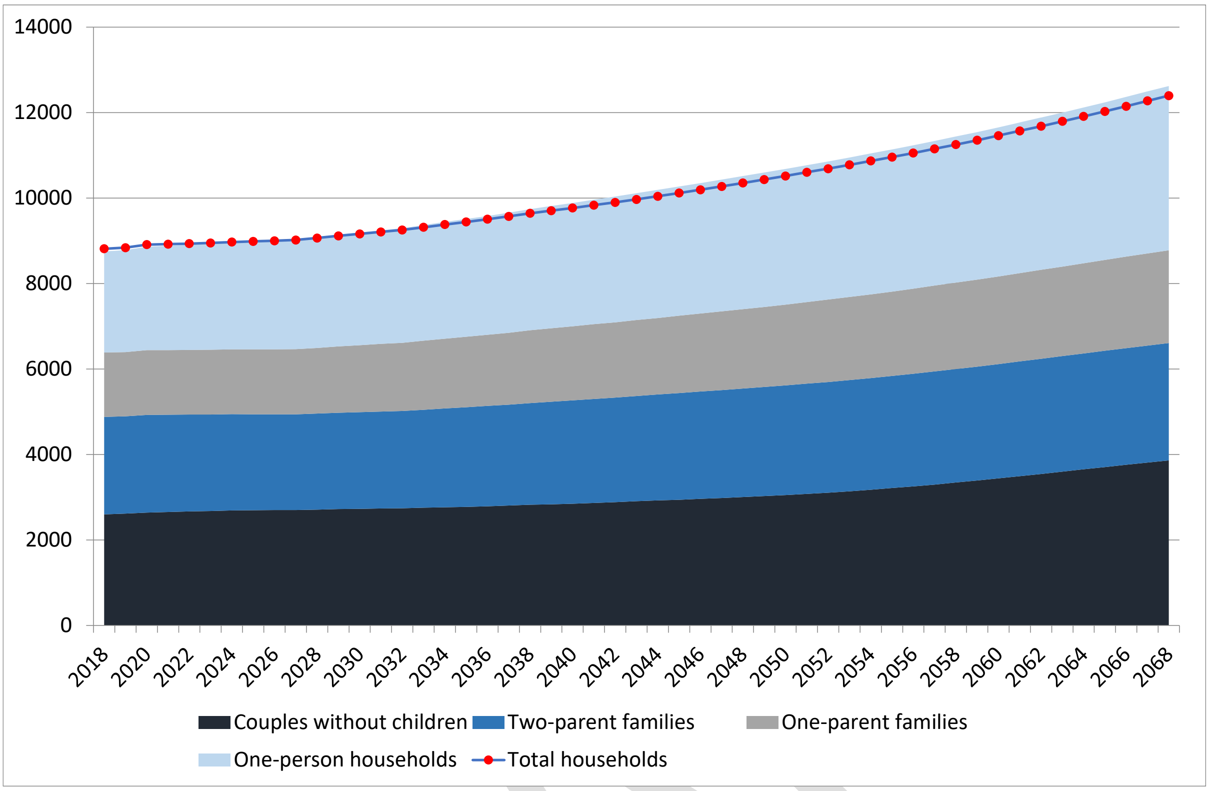
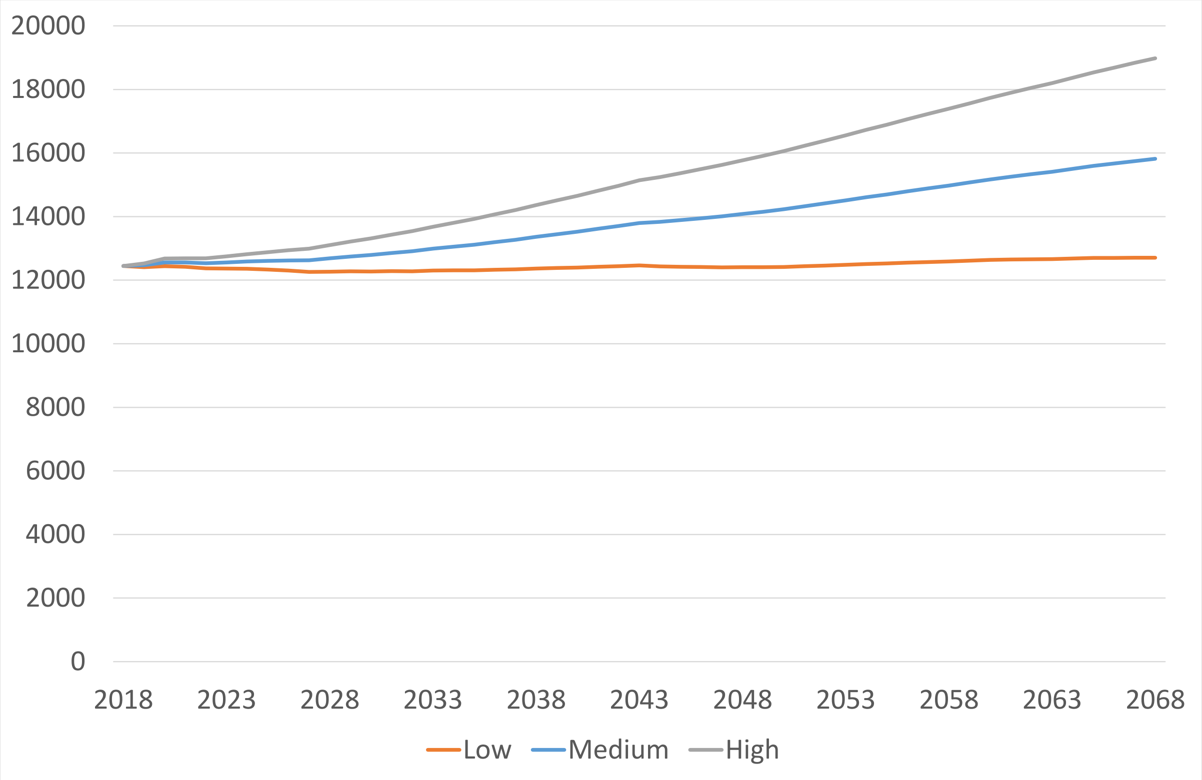


Figure 61: High-variant family and household projections for South Waikato District, 2018-2068



The labour force projections for South Waikato District are shown in Figure 62. The estimated labour force in June 2018 is 12,445. In the medium-variant projection, the labour force increases throughout the projection period, reaching 15,818 in 2068. In the low-variant projection, the labour force initially declines, reaching a trough of 12,261 in 2027, then increases throughout the remainder of the projection period, reaching 12,704 in 2068. In the high-variant projection, the labour force increases throughout the projection period, reaching 18,983 in 2068.

Figure 62: Labour force projections for South Waikato District, 2018-2068



4.9 Population, Family and Household, and Labour Force Projections for Waitomo District

Figure 63 presents the 2018-base population projections for Waitomo District to 2068, along with historical population estimates from Statistics New Zealand back to 1996. The 2018-base Statistics New Zealand (SNZ) projections are also included for comparison.

The June 2018 population estimate (base population) for Waitomo District is 9,630. Under the medium-variant population projection scenario, the population initially declines, reaching a trough of 9,371 in 2034, then increases throughout the remainder of the projection period, reaching 10,384 in 2068. The medium-variant projection shows very similar growth to the recent experience of Waitomo District. The annualised projected population growth over the period 2018-2038 of -0.13% per year is very similar to the -0.17% annualised growth experienced over the period 1996-2018. Under the low-variant scenario, the population decreases to a trough of 8,386 in 2062, before recovering to 8,401 in 2068. Under the high-variant scenario, the population increases throughout the projection period, reaching 12,404 in 2068. In comparison, the SNZ 2018-base medium-variant projection is similar to the Waikato high-variant projection until the early 2030s, before falling away, while the SNZ low-variant is similar to the Waikato low-variant until the mid-2030s, before falling away.

Figure 63: Population projections for Waitomo District, 2018-2068

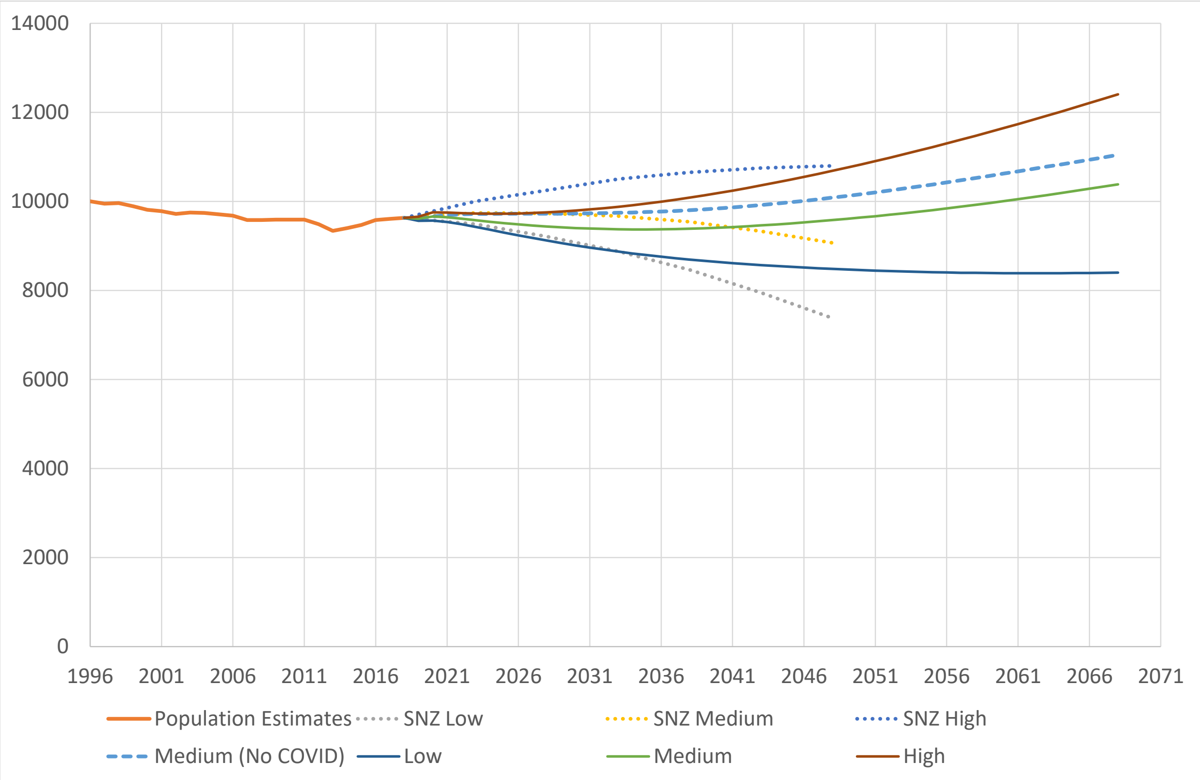


Figure 64 disaggregates the components of population change for Waitomo District over the period 2019-2068 for the medium-variant population projection. As previously noted, net population change in the medium-variant projection scenario is initially negative, but then becomes positive from 2036, and remains positive throughout the remainder of the projection period. This is made up of natural increase (more births than deaths), offset by net outward international migration (more out-migration to overseas than in-migration from overseas). Net outward internal migration (more out-migration to the rest of New Zealand than in-migration) gradually reverses, to become net inward internal migration from 2034, as the district benefits from some spill-over growth from the rest of the region. The initial bump in population from the historically high net international migration at the national level can clearly be seen in the first two years of the projections, but is quickly eliminated by the coronavirus border closures and the resulting substantial decrease in international migration flows.

Figure 64: Projected components of population change for Waitomo District, medium-variant projection, 2019-2068

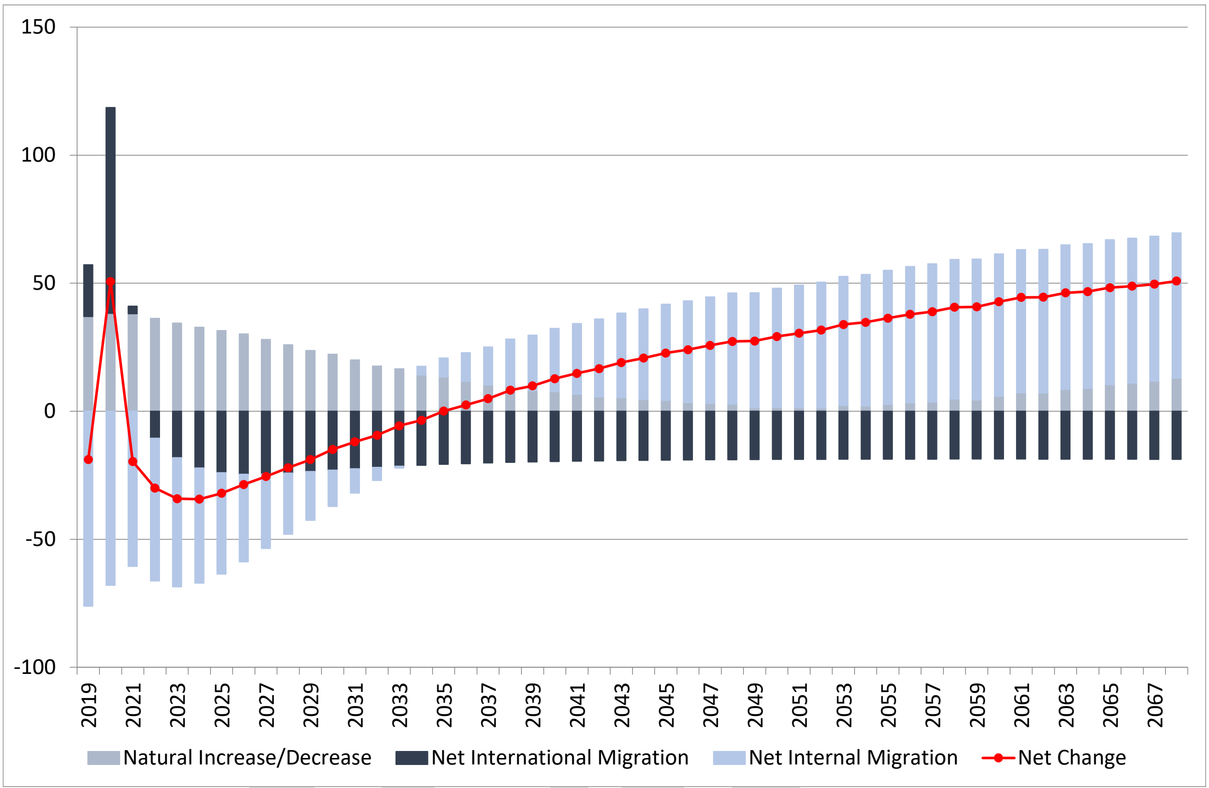


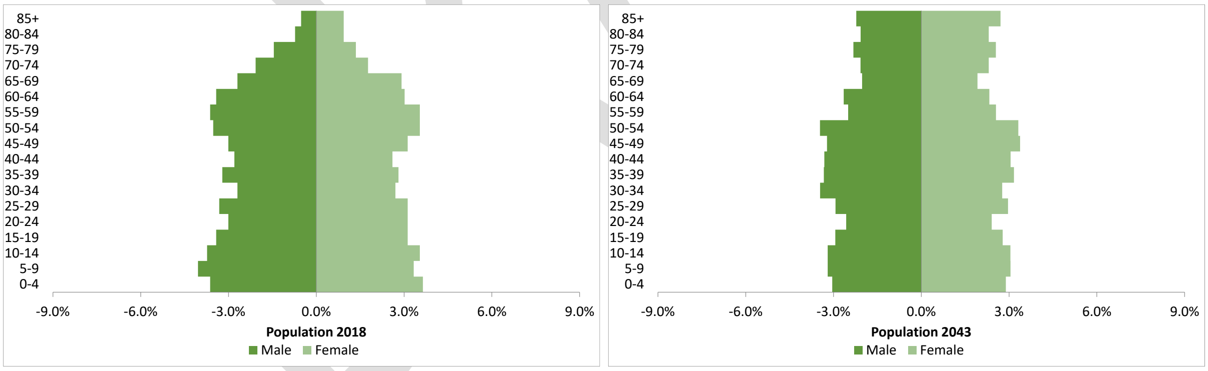
Table 10 summarises the largest sources and destinations of inward and outward internal migrants respectively, for Waitomo District in 2043 (being the middle of the projection period) for the medium-variant population projection. The largest flows in and out of the district can be attributed to Auckland, Hamilton City, and Tauranga City, all of which are large population centres in relatively close proximity to Waitomo District. The inward migration from Auckland and Hamilton City are larger than the outward flows, suggesting that Auckland and Hamilton City are projected to be a substantial source of net internal migration for Waitomo District. In contrast, the outward migration is larger than the inward flow for Tauranga City, suggesting that Waitomo District is a net donor of migrants to Tauranga City.

Table 10: Top sources and destinations of internal migration for Waitomo District, 2043

Source	Number		Destination	Number
Auckland	127		Auckland	68
Hamilton	39		Hamilton	36
Tauranga	16		Tauranga	19
Waipa	15		Taupo	16
Taupo	15		Waipa	16
Waikato	13		New Plymouth	16
Otorohanga	13		Otorohanga	12
New Plymouth	13		Waikato	11
Rotorua	11		Rotorua	11
Wellington	9		Christchurch	9

The age structure of Waitomo District is also amongst the most youthful in the Waikato Region, but ages relatively quickly, as shown in Figure 65. In 2018, 15.4 percent of the population are aged 65 years and over, and this is projected to slightly increase to 22.5 percent by 2043. The initially young age profile explains why the district remains in natural increase throughout the projection period, as shown in the previous figure.

Figure 65: Age-sex structure for Waitomo District, 2018 and 2043 (medium-variant projection)



The medium-variant family and household projection (by type) for Waitomo District is shown in Figure 66. The estimated number of total households in June 2018 is 3,503. In terms of total households, the projection closely follows the medium-variant population projection, with the total number of households increases throughout most of the projection period, reaching 4,071 in 2068. The number of one-parent and two-parent families remains fairly constant over the projection period, while the number of couples without children and one-person households increases throughout the projection period. The low-variant and high-variant family and household projection (by type) for South Waikato District are shown in Figures 67 and 68 respectively. In terms of total households, the low-variant projection closely follows the low-variant population projection, with the total number of households fluctuating over time on a slightly downward trend, reaching 3,367 in 2068. The high-variant projection closely follows the high-variant population projection, with the total number of households throughout the projection period, reaching 4,784 in 2068. The relative size of the families and households by type are similar in the low-variant and high-variant projections to those in the medium-variant projection.

Figure 66: Medium-variant family and household projections for Waitomo District, 2018-2068

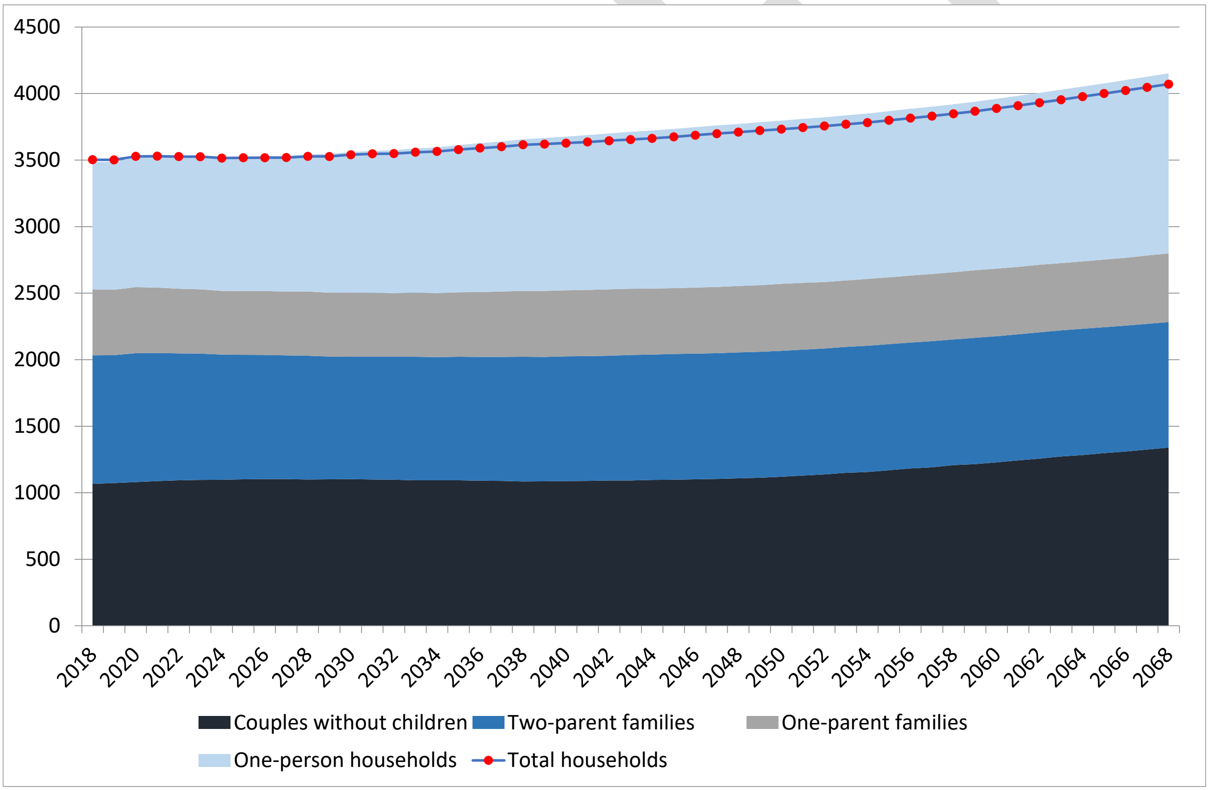


Figure 67: Low-variant family and household projections for Waitomo District, 2018-2068

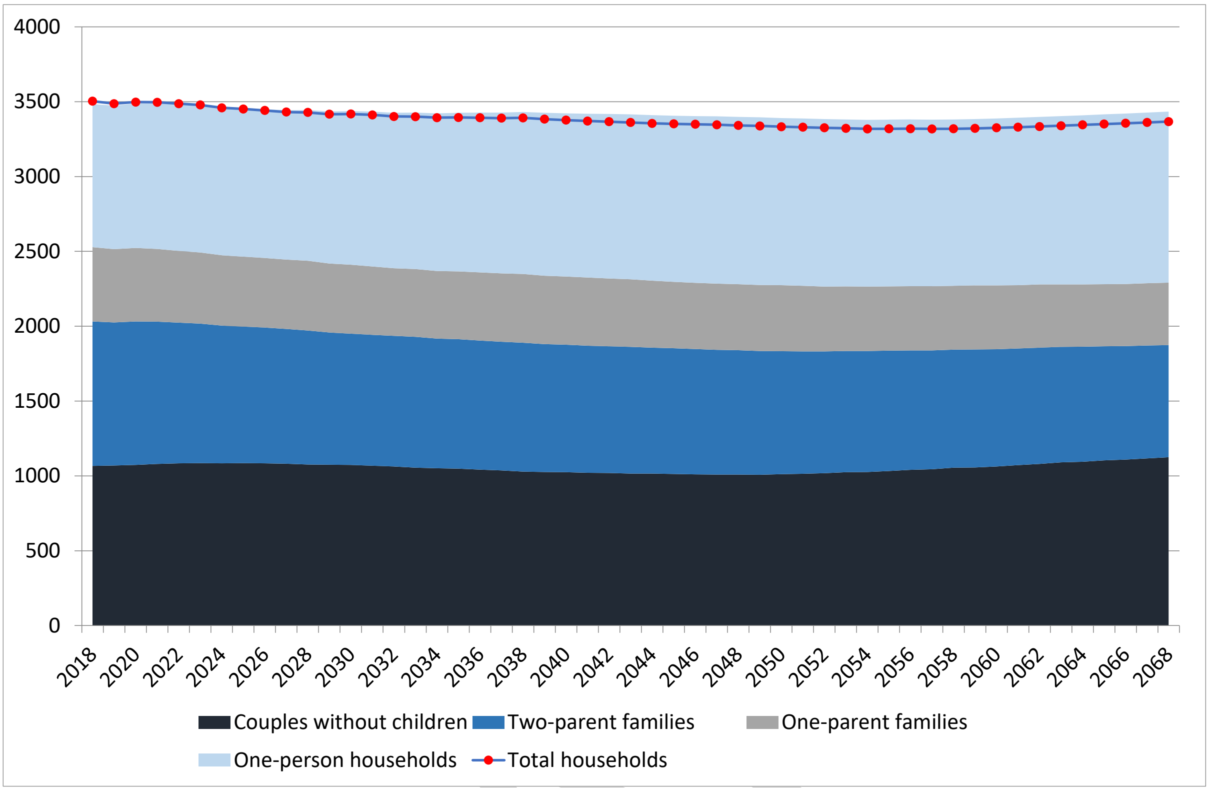
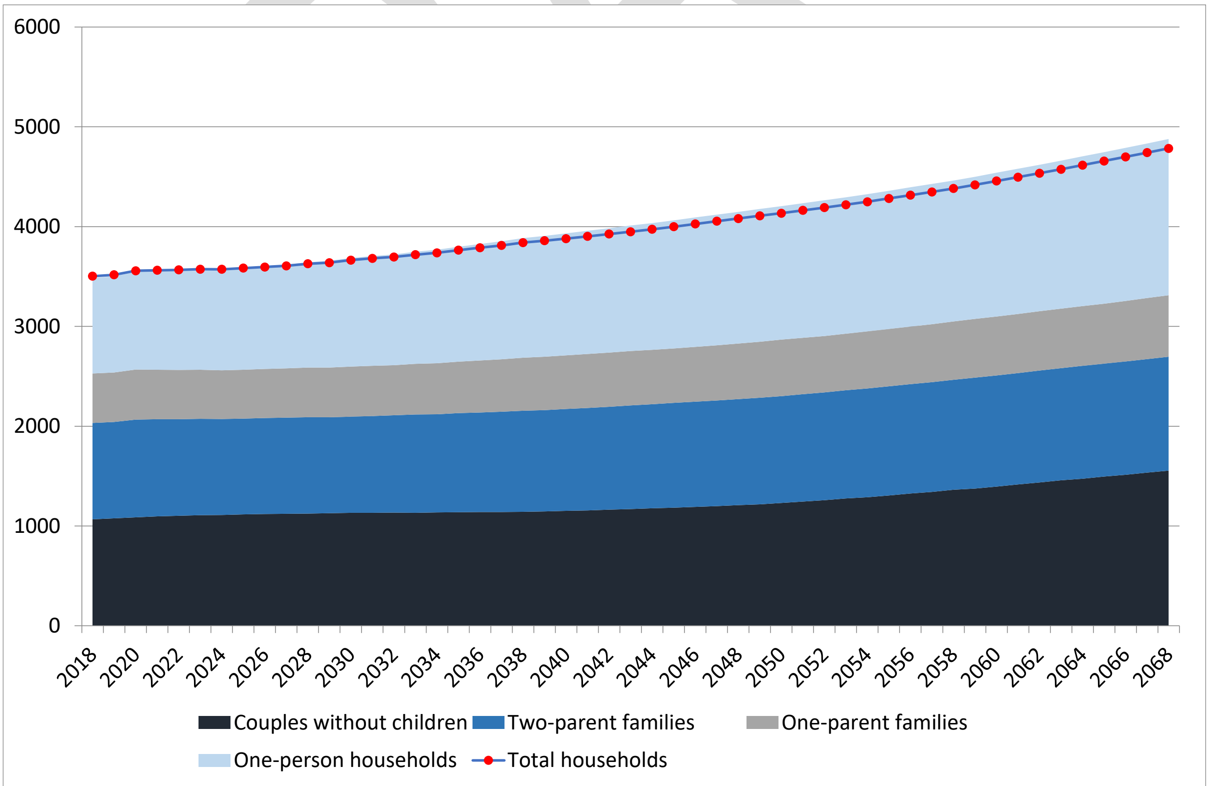
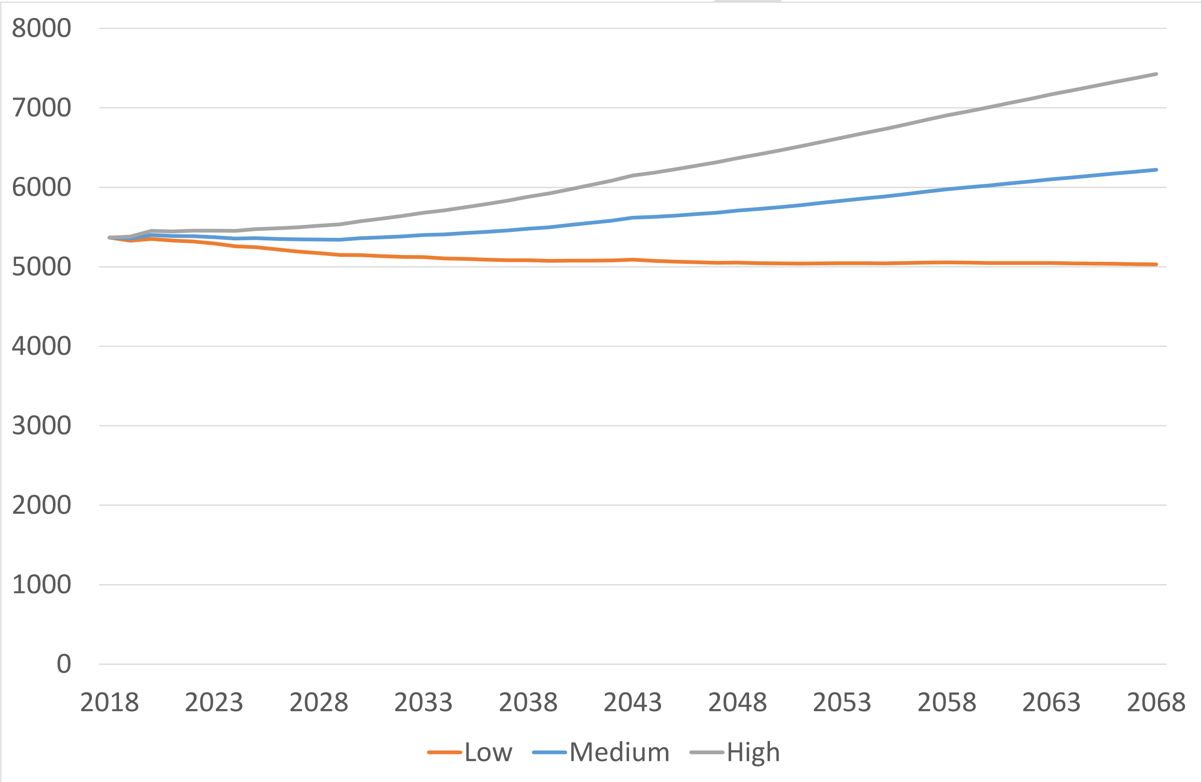


Figure 68: High-variant family and household projections for Waitomo District, 2018-2068



The labour force projections for Waitomo District are shown in Figure 69. The estimated labour force in June 2018 is 5,367. In the medium-variant projection, the labour force initially declines, reaching a trough of 5,341 in 2029, then increases throughout the remainder of the projection period, reaching 6,221 in 2068. In the low-variant projection, the labour force declines throughout of the projection period, reaching 5,030 in 2068. In the high-variant projection, the labour force increases throughout the projection period, reaching 7,427 in 2068.

Figure 69: Labour force projections for Waitomo District, 2018-2068



4.10 Population, Family and Household, and Labour Force Projections for Taupo District

Figure 70 presents the 2018-base population projections for Taupo District to 2068, along with historical population estimates from Statistics New Zealand back to 1996. The 2018-base Statistics New Zealand (SNZ) projections are also included for comparison.

The June 2018 population estimate (base population) for Taupo District is 38,600. Under the medium-variant population projection scenario, the population increases throughout the projection period, reaching 46,129 in 2068. The medium-variant projection shows much lower growth than the recent experience of Taupo District, but this reflects the much lower projection international migration flows. The annualised projected population growth over the period 2018-2038 of 0.39% per year is very similar to the 0.91% annualised growth experienced over the period 1996-2018. Under the low-variant scenario, the population decreases throughout the projection period, falling to 37,084 in 2068. Under the high-variant scenario, the population increases throughout the projection period, reaching 55,361 in 2068. In comparison, the SNZ 2018-base medium-variant projection is similar to the Waikato high-variant projection until the early 2030s, before falling away, while the SNZ low-variant is similar to the Waikato low-variant throughout the projection period.

Figure 70: Population projections for Taupo District, 2018-2068

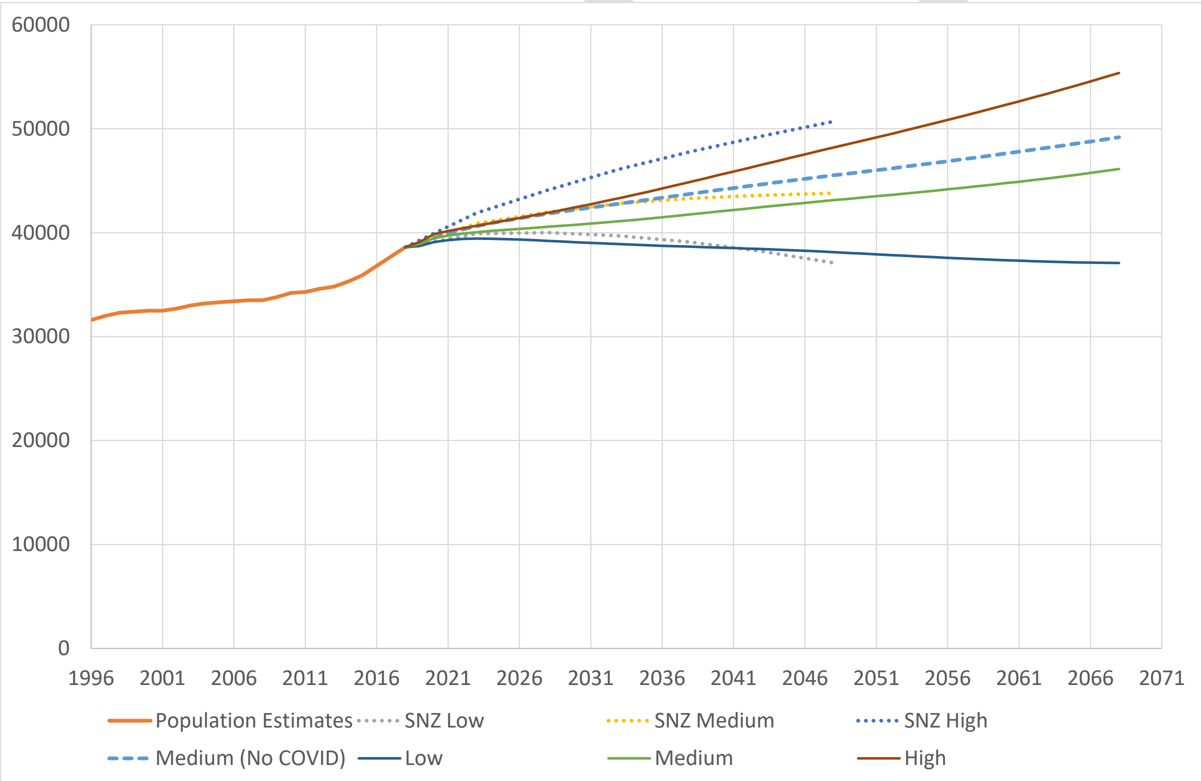


Figure 71 disaggregates the components of population change for Taupo District over the period 2019-2068 for the medium-variant population projection. As previously noted, net population change in the medium-variant projection scenario is positive throughout the projection period. This is made up of net inward internal migration (more in-migration from the rest of New Zealand than out-migration) and natural increase (more births than deaths) up to 2035 (after which there is natural decrease – more deaths than births), and net outward international migration (more out-migration to overseas than in-migration from overseas). The initial bump in population from the historically high net international migration at the national level can clearly be seen in the first two years of the projections, but is quickly eliminated by the coronavirus border closures and the resulting substantial decrease in international migration flows

Figure 71: Projected components of population change for Taupo District, medium-variant projection, 2019-2068

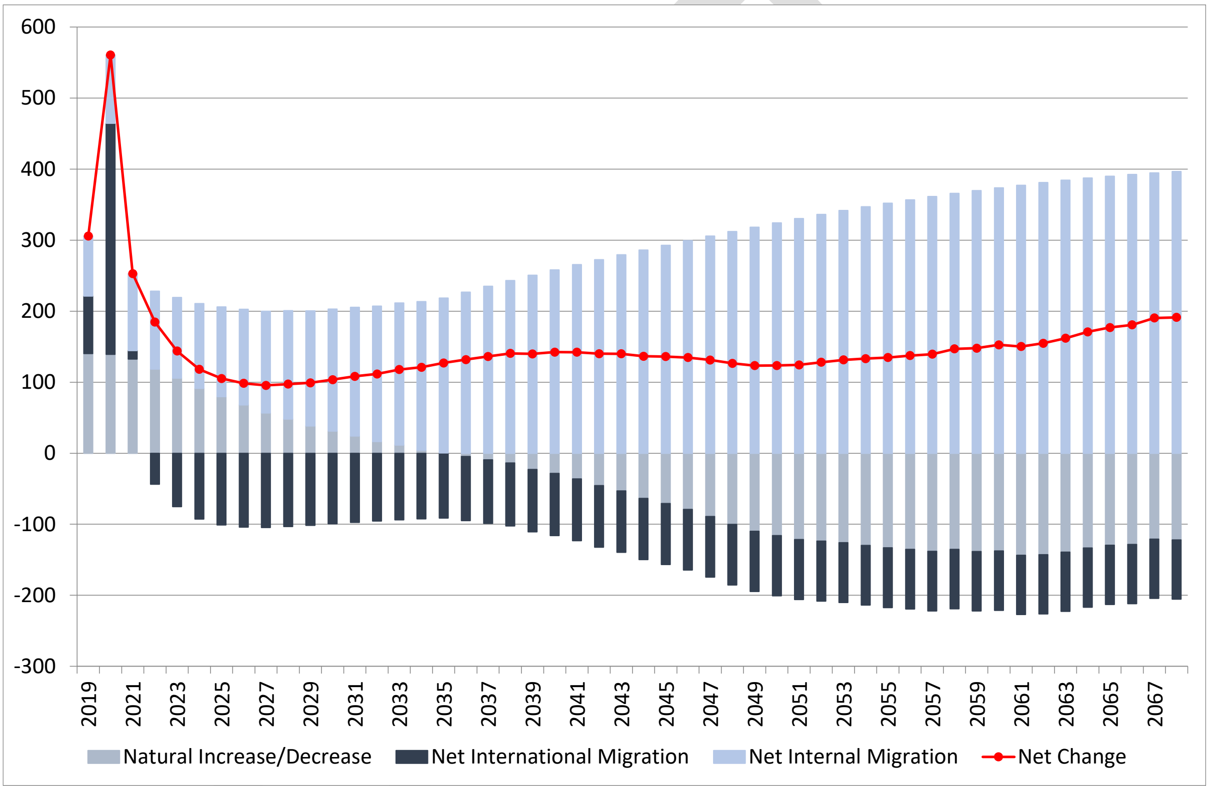


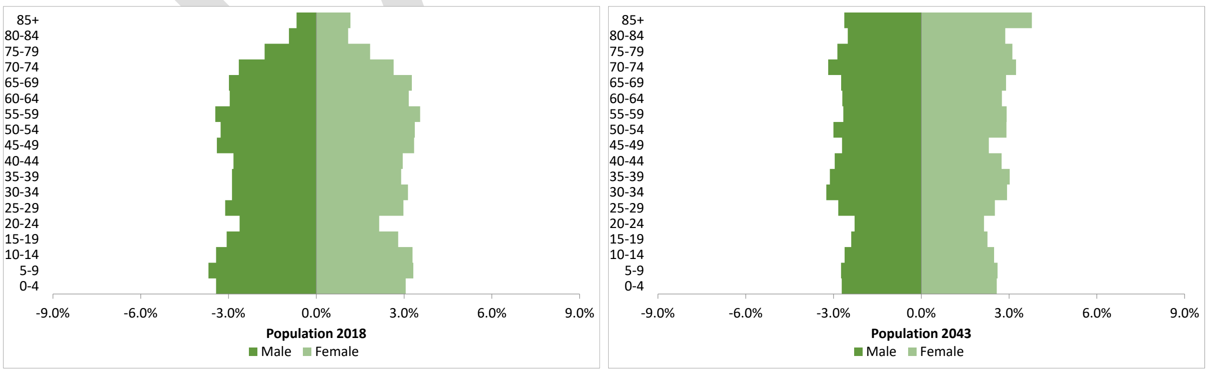
Table 11 summarises the largest sources and destinations of inward and outward internal migrants respectively, for Taupo District in 2043 (being the middle of the projection period) for the medium-variant population projection. The largest flows in and out of the district can be attributed to Auckland, Rotorua District, Hamilton City, and Tauranga City, all of which are large population centres in relatively close proximity to Taupo District. The inward migration from Auckland, Rotorua District, and Hamilton City are larger than the outward flows, suggesting that Auckland, Rotorua District, and Hamilton City are projected to be a substantial source of net internal migration for Taupo District. In contrast, the outward migration is larger than the inward flow for Tauranga City, suggesting that Taupo District is a net donor of migrants to Tauranga City.

Table 11: Top sources and destinations of internal migration for Taupo District, 2043

Source	Number		Destination	Number
Auckland	520		Auckland	249
Rotorua	170		Rotorua	153
Hamilton	123		Tauranga	103
Tauranga	99		Hamilton	102
Hastings	78		Hastings	84
Whakatane	51		Whakatane	48
South Waikato	51		Christchurch	47
Wellington	51		Palmerston North	45
Waipa	45		South Waikato	44
Waikato	44		Waipa	43

The age structure of Taupo District is moderately old compared with other TAs in the Waikato, but ages relatively quickly, as shown in Figure 72. In 2018, 19.0 percent of the population are aged 65 years and over, and this is projected to slightly increase to 29.8 percent by 2043. This relatively fast rate of ageing explains the shift from natural increase to natural decrease shown in the previous figure.

Figure 72: Age-sex structure for Taupo District, 2018 and 2043 (medium-variant projection)



The medium-variant family and household projection (by type) for Taupo District is shown in Figure 73. The estimated number of total households in June 2018 is 14,356. In terms of total households, the projection closely follows the medium-variant population projection, with the total number of households increases throughout the projection period, reaching 18,367 in 2068. The number of one-parent families increases throughout the projection period, as does the number of couples without children and one-person households. The number of two-parent families decreases throughout the projection period. The low-variant and high-variant family and household projection (by type) for South Waikato District are shown in Figures 74 and 75 respectively. In terms of total households, the low-variant projection closely follows the low-variant population projection, with the total number of households increasing to a peak of 15,554 in 2038 before declining to 15,345 in 2068. The high-variant projection closely follows the high-variant population projection, with the total number of households throughout the projection period, reaching 21,974 in 2068. The relative size of the families and households by type are similar in the low-variant and high-variant projections to those in the medium-variant projection.

Figure 73: Medium-variant family and household projections for Taupo District, 2018-2068

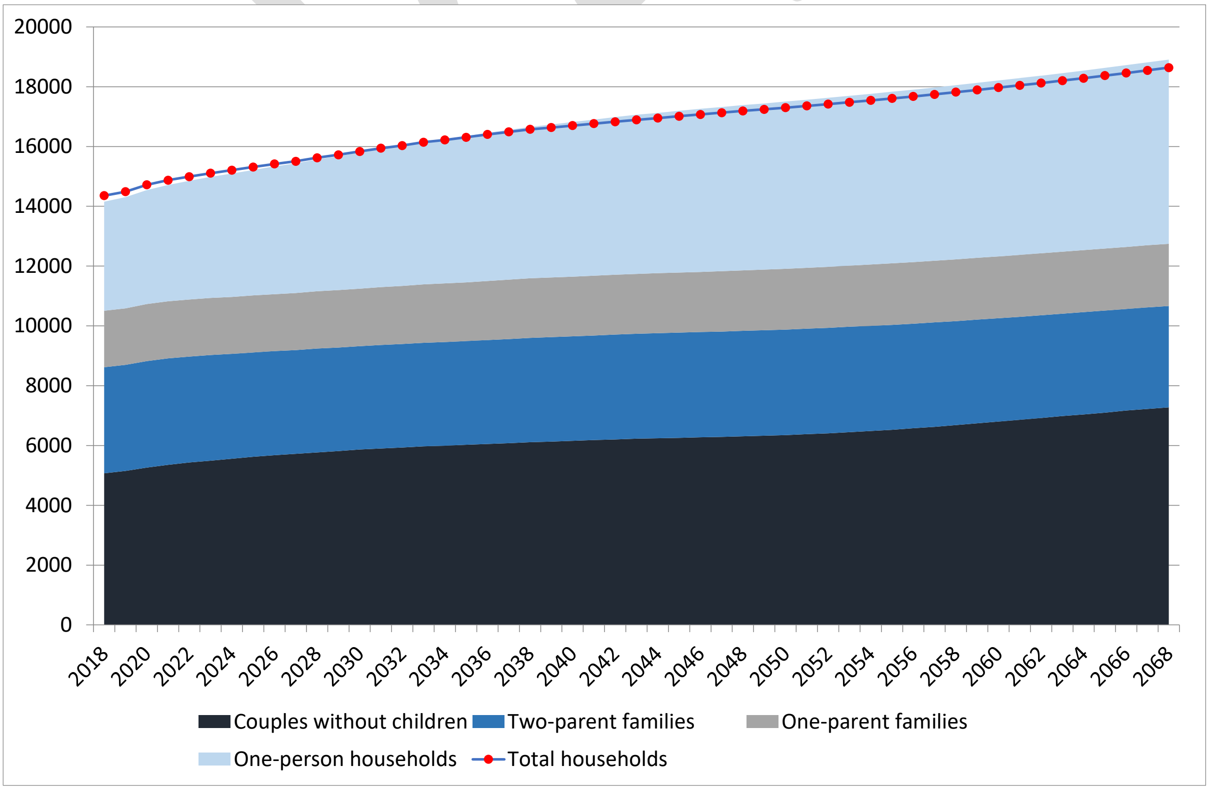


Figure 74: Low-variant family and household projections for Taupo District, 2018-2068

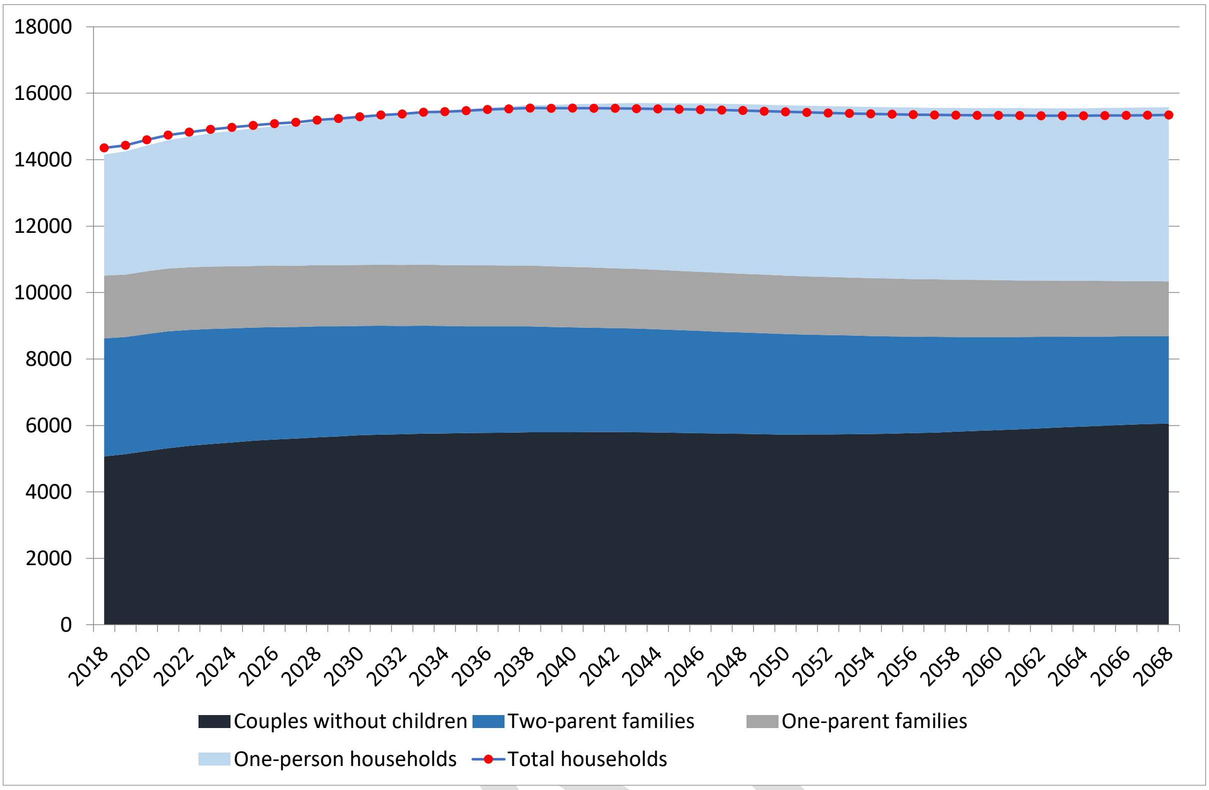
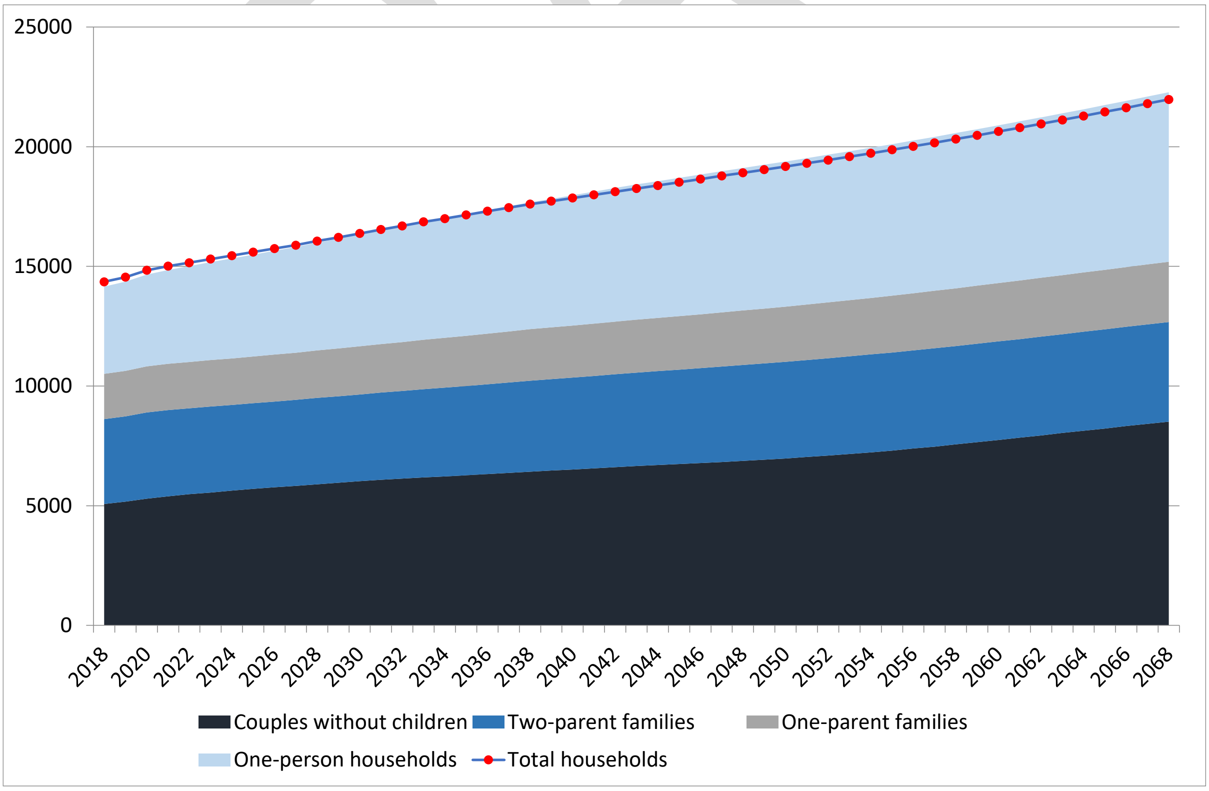
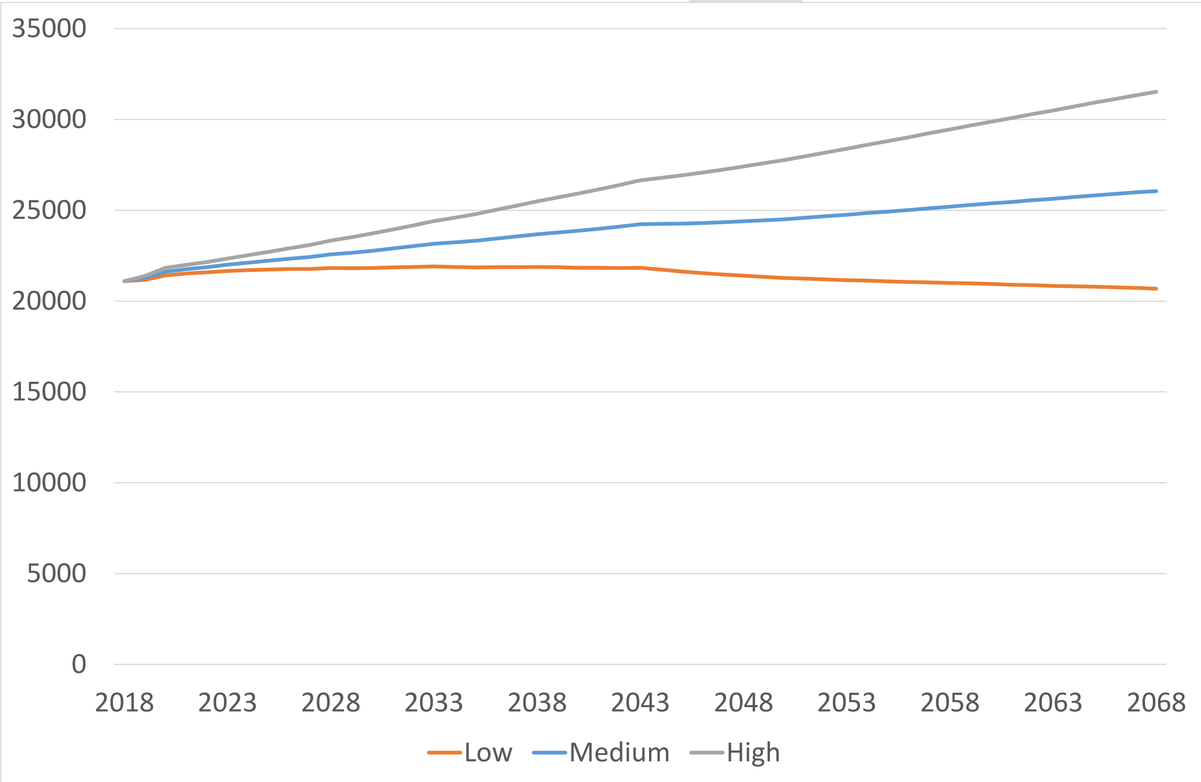


Figure 75: High-variant family and household projections for Taupo District, 2018-2068



The labour force projections for Taupo District are shown in Figure 76. The estimated labour force in June 2018 is 21,092. In the medium-variant projection, the labour force increases throughout the projection period, reaching 26,061 in 2068. In the low-variant projection, the labour force increases to a peak of 21,908 in 2033 before declining to 20,687 in 2068. In the high-variant projection, the labour force increases throughout the projection period, reaching 31,526 in 2068.

Figure 76: Labour force projections for Taupo District, 2018-2068



4.11 Total Population Projection for the Waikato Region

Figure 77 presents the 2018-base population projections for the Waikato Region as a whole, generated by summing the projections for all component TAs within each variant, with some adjustments for the different boundaries (see Section 2.1 for details). The 2018-base Statistics New Zealand (SNZ) projections are also included for comparison.

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