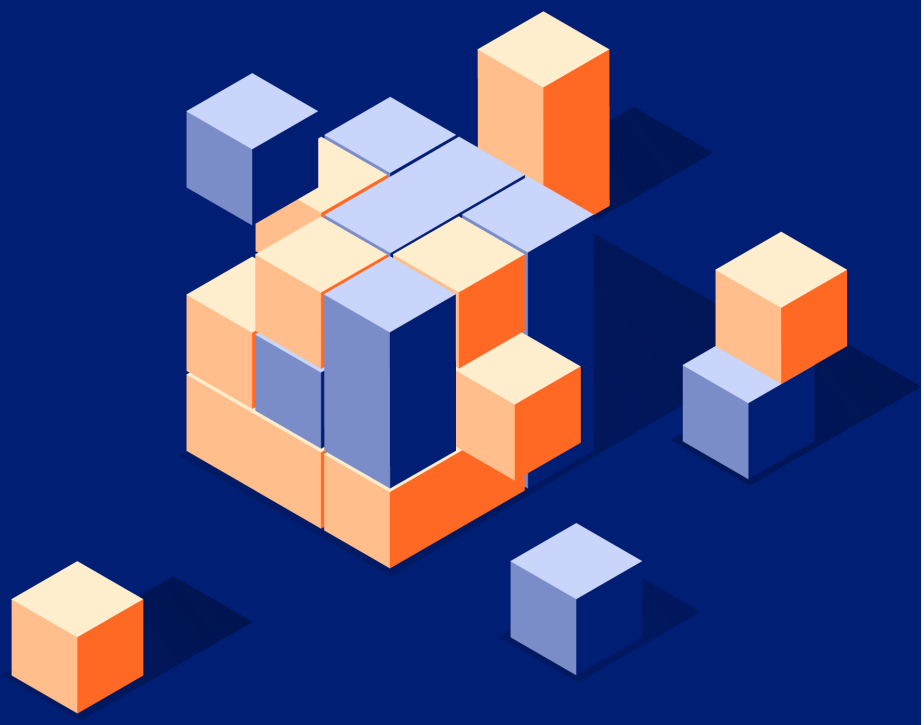
Queenstown-Lakes District Council

Demand Projections 2023-2053 Results



DOT Consulting

Demand Projections, Queenstown Lakes District, 2023-2053

Produced for Queenstown Lakes District Council by DOT loves Data

Contents

1 Executive summary

This report presents the demand projection results for population, households and dwellings, and rating units for Queenstown Lakes District Council (QLDC) and outlines the underlying methodologies and assumptions. The projections were produced by DOT Loves Data in order to support council officers and elected members in their plans for future growth. The goal is that these projections act as a tool when adopting an appropriate set of growth projections for determining planing regulations and funding, resources, and infrastructure in growth planning.

1.1 About the projections

Population projections were developed for 2023-2053 by age group and sex in five-year projection windows via a standard cohort component method. This is a deterministic method, meaning that the underling assumptions about fertility, mortality and migration determine the projections results. The Estimated Resident Population (ERP) count by age and sex at June 2018 is the population base, with the latest data available used for developing the underlying assumptions.

The population projections require the following inputs:

- the base population by age and sex
- assumptions regarding fertility rates and age at childbearing for females
- assumptions regarding life expectancy and survivorship by age and sex, and
- assumptions regarding migration rates by age and sex.

Household and dwelling projections require assumptions regarding:

- average household size and
- the ratio of population to dwellings

The visitor demand projections are based on historical patterns over time in visitor numbers, the relative proportions of different visitor types, and population growth. These are combined with the projected population results to make predictions about future visitor numbers. Forecasting visitor demand is difficult and error prone due to the wide range of influences on tourist numbers. The visitor projections should be interpreted as providing an indication of the possible future visitor population should historical patterns and a specific set of assumptions be met in the future. The inputs into the visitor projections are:

- historical annual guest nights in commercial accommodation
- assumptions regarding the proportion of visitors staying in accommodation units, private holiday homes and other visitor types (e.g. day visitors and those staying with friends and family)
- population projection results
- assumptions about the ratio of average to peak day visitors

Rating unit demand projections cover different types of residential and commercial rating units and visitor accommodation units. The projections also combine historical patterns of growth in each rating unit type and the relationship of this growth with population change. The rating unit projections require the following assumptions and inputs.

- the number of stay units for visitors
- the average number of guests per stay unit
- residential new-build building unit consents
- population projection results
- dwelling unit projections

1.1.0.1 Projection variants

Three projection variants were produced: high, medium and low, using corresponding variations to the input assumptions in order to generate each projection scenario.

These are deterministic projections, meaning that each projection variant represents a likely scenario should that specific set of assumptions be met.

1.2 Projection limitations

Projections are not forecasts or predictions of future populations. These projections are one tool for understanding possible future growth in the QLDC region and to inform long term planning. They are calculations of what will happen if specific assumptions about the demographic processes of fertility, mortality, and migration acting on the age structure of the population are met in the future. These assumptions are derived from past patterns. The projections provide information on plausible scenarios about future populations, not predictions of what the population will be, to help inform decision making.

Many other social and economic factors, that are not part of population projections, also influence population change, including central and local government policies, global economics, changing lifestyle factors and social norms and expectations. The relationships between these various factors are complex and difficult to predict far into the future. As a result of this complexity, the reliability of projections tends to decrease over time and as population size decreases, that is, there is greater uncertainty in population projections the further forward in time we go and for smaller area units compared to the district as a whole.

The release of the 2023 Census data in 2024 is expected to lead to some revisions to underlying assumptions. Timely revisions to the underlying assumptions and projections are alos particularly relevant in this era of post-covid recovery and very high migration where the underlying data is more variable than in the past.As a reuslt, T=the underlying assumptions that determine the projection results will be reviewed in 2024 and 2025 and the projections updated accordingly with the latest data.

1.2.0.1 High growth and capacity limitations

QLDC is a an area with high population growth, particularly in recent periods. It is also an area with complex geography that puts constraints of the land areas suitable for residential development. However, population projections are driven by demographic processes and do not attempt to account for shifts in regional planning policies or decisions that may change dramatically over time.

When using the projections as SA2 level, users should be aware than no adjustments for dwelling capacity have been made. This is so the projections can be used to assess current planning policies and requirements rather than trying to anticipate potential changes. For QLDC, should the demographic assumptions underlying these projections be met, the projected population of some SA2s will exceed current capacity limits. This would mean that any 'excess' population would either need to be accommodated elsewhere (where dwelling capacity was still available) or that a change in planning regulations would be required to meet this need. Assessment of population against capacity is outside the scope of population projections but can be modeled separately through scenario analysis and capacity modelling.

At the district level, all variants project a population-based demand for dwellings below the district's dwelling capacity limits based on current planning requirements. Under both the high and medium assumption variants, however, population-based demand for dwellings will be approaching current capacity limits for the district as a whole.

1.3 Key results

Under the medium projection variant:

- The total population (residents and visitors) on an average day is projected to rise to 113.8% to 150,082.

- The total population (residents and visitors) on a peak day is projected to rise to 119.2% to 217,462.
- The resident population is projected to nearly double to 100,558 (+ 97.14)%, however population growth slows over the course of the projection period.
- Over 18% of the population will be aged over 65 years in 2053, and some early signs of structural ageing are beginning to emerge.
- The visitor population on an average day is projected to increase by 158% to 49,524 in 2053, while the peak day population is projected to increase 142.5% to 116,904.
- The number of households (private residences occupied by residents) is projected to increase to 40,223 homes, up 105.03% from 2023.
- The total number of rating units is projected to increase 101.1% to 59,083 units in 2053.

1.3.1 Projection geographies

This report provides the high-level results for the district (Territorial Authority, TA), but projections were generated to each statistical area 2 (SA2) and the two wards/townships of Whakatipu and Wānaka.

The projections were developed based on 2022 statistical geographies. In October 2023, the latest estimated resident population as at 30 June 2023 was released by Statistics New Zealand based on 2023 statistical geographies. This update saw some substantial changes to the SA2 boundaries in the Queenstown Lakes District. In 2024, the Demand Projections will be updated with the latest assumption data and adjusted to the 2023 geographies. In the meantime, comparisons of SA2 population estimates using 2022 and 2023 geographies should be considered in light of the boundary changes and the understanding that for some SA2s there will be substantial differences in estimates between the two.

Initial projections at SA2 level are constrained to the output at TA level, by calculating population share for each element and prorating the total. The ward projections are generated by summing the constrained and adjusted SA2 outputs.

The Whakatipu ward consists of the following SA2s:

- 346000 Glenorchy
- 346200 Outer Wakatipu
- 347300 Kingston
- 347400 Arthurs Point
- 347500 Wakatipu Basin
- 347600 Queenstown Hill
- 347700 Warren Park
- 347800 Sunshine Bay-Fernhill
- 347900 Arrowtown
- 348000 Quail Rise
- 348100 Queenstown Central
- 348200 Queenstown East
- 348300 Frankton Arm
- 348400 Frankton
- 348500 Lake Hayes
- 348600 Kelvin Heights
- 348700 Shotover Country
- 348800 Lake Hayes Estate
- 348900 Jacks Point
- 346500 Inland water Lake Wakatipu

The Wānaka ward consists of the SA2s:

- 345900 Outer Wānaka
- 346400 Cardrona
- 346600 Wānaka Waterfront

- 346700 Wānaka North
- 346800 Wānaka West
- 346900 Albert Town
- 347000 Wānaka Central
- 347100 Lake Hawea
- 347200 Upper Clutha Valley
- 346100 Inland water Lake Wānaka
- 346300 Inland water Lake Hawea

2 Broader demographic context

The future New Zealand population is going to be larger and older. The national population is expected to grow over the next 40 years, albeit at a slowing rate (Statistics NZ, 2022c). Population ageing is occurring across large parts of New Zealand as a result of increased life expectancy and declining total fertility rates (Statistics NZ, 2022c; Jackson & Brabyn, 2017; The New Zealand Initiative, 2014). Approximately 40% of New Zealand's TA's are projected to experience natural decrease within the next 20 years (Jackson & Cameron 2018). The shift reflects higher proportions of the population at older ages. Population ageing generates challenges for a range of public policies, including those related to healthcare, housing, and the labour force.

Household composition is also changing, in part in response to population ageing and reduced fertility levels, although it is also influenced by changes in family formation and break-up, and ethnic diversity. Nationally, the number of one-person and couple-without-children households is increasing, leading to a reduction in average household size.

New Zealand is also experiencing a progressive downward trend in fertility levels, and a shift to having children later in life (Statistics NZ, 2022c), both of which are trends experienced internationally in most developed countries (The New Zealand Initiative, 2014). Life expectancy is also increasing nationally, but at a declining rate as we approach the natural limit of human life spans. Increased life expectancy and declining fertility rates will cause a slow down in population growth, as fewer people will be born each generation to reproduce and replace the population. An additional implication of which is that this feeds back into increasing the ratio of old to younger people in the population. For the country as a whole, population growth through natural increase will decline over the next few decades due to structural ageing. By the 2050s, deaths are expected to outnumber births (natural decrease). As a result, populations will be increasingly reliant on migration to stave off population decline. Slowing population growth and an ageing population will have wider societal effects, notably in labour markets.

While QLDC has the benefit of a younger population, it is also beginning to experiencing many of these processes leading to structural aging elsewhere. In addition to its unique position as a tourism hot spot, QLDC is in a relatively remote location with a unique topography, resulting in a unique set of forces and challenges for its economic and demographic growth.

Table 1: Total population Average day, 2023-2053, by variant, Queenstown Lakes District

	2023	2028	2033	2038	2043	2048	2053
High							
Pop	71,455	91,987.0	105,928.0	125,520.0	143,674.0	164,941.0	186,137.0
Change		20,532.0	13,941.0	19,592.0	18,154.0	21,267.0	21,196.0
Percent change (5 yrs)		28.7	15.2	18.5	14.5	14.8	12.9
Medium							
Pop	70,205	87,245.0	98,214.0	113,025.0	125,657.0	138,005.0	150,082.0
Change		17,040.0	10,969.0	14,811.0	12,632.0	12,348.0	12,077.0
Percent change (5 yrs)		24.3	12.6	15.1	11.2	9.8	8.8
Low							
Pop	68,578	80,778.0	89,516.0	100,469.0	108,310.0	116,731.0	123,822.0
Change		12,200.0	8,738.0	10,953.0	7,841.0	8,421.0	7,091.0
Percent change (5 yrs)		17.8	10.8	12.2	7.8	7.8	6.1

3 Total population projections summary

The total population projections for Queenstown Lakes District Council (QLDC) combines projections for resident population and visitor numbers. The total population is presented as the total number of people in the District on an average and peak day. For an area with a large visitor population this measure provides insight about the total population demand on and for local services and infrastructure.

Between 2023 and 2053 the total average day population is projected to increase 113.8% from 70,205 to 150,082 (Table 1).

The projected peak day population is projected to increase 119.2% from 99,220 in 2023 to 217,462 in 2053 (Table 2).

Whakatipu remains the largest ward by population, increasing from an average day population of 47,742 in 2023 to 95,313 in 2053 under the medium variant (Figure 1). However, Wānaka ward is projected to have proportionally higher growth in total population of 144% between 2023 and 2053 compared with 100% growth for Whakatipu Ward over the same period. The average day total Wānaka population is projected to grow from 22,463 in 2023 to 54,769 in 2053 under the medium variant.

In the Wānaka ward, the total average day population is dominated by residents who make up 86%-87% of the total population throughout the projection period . In the Whakatipu ward in contrast the resident population is a dominant but smaller component of the total average day population, comprising an estimated 67% of the population in 2023 and 58% of the population in 2058, suggesting that growth in overnight visitors, day visitors, and commuters will make up an increasing component of the total population of Whakatipu ward over the next 30 years.

4 Resident population projection results

An overview of the results for Queenstown Lakes District are provided below. As the latest estimated resident population (ERP) published by Statistics NZ 2022, we use the 2018 Census ERP as our baseline population

Table 2: Total population Peak day, 2023-2053, by variant, Queenstown Lakes District

	2023	2028	2033	2038	2043	2048	2053
High							
Pop	100,470	130,282.0	151,337.0	176,805.0	204,193.0	233,013.0	264,176.0
Change		29,812.0	21,055.0	25,468.0	27,388.0	28,820.0	31,163.0
Percent change (5 yrs)		29.7	16.2	16.8	15.5	14.1	13.4
Medium							
Pop	97,593	114,549.0	128,801.0	144,690.0	157,067.0	171,042.0	182,929.0
Change		16,956.0	14,252.0	15,889.0	12,377.0	13,975.0	11,887.0
Percent change (5 yrs)		17.4	12.4	12.3	8.6	8.9	6.9
Low							
Pop	99,220	124,137.0	141,077.0	161,070.0	180,544.0	199,106.0	217,462.0
Change		24,917.0	16,940.0	19,993.0	19,474.0	18,562.0	18,356.0
Percent change (5 yrs)		25.1	13.6	14.2	12.1	10.3	9.2

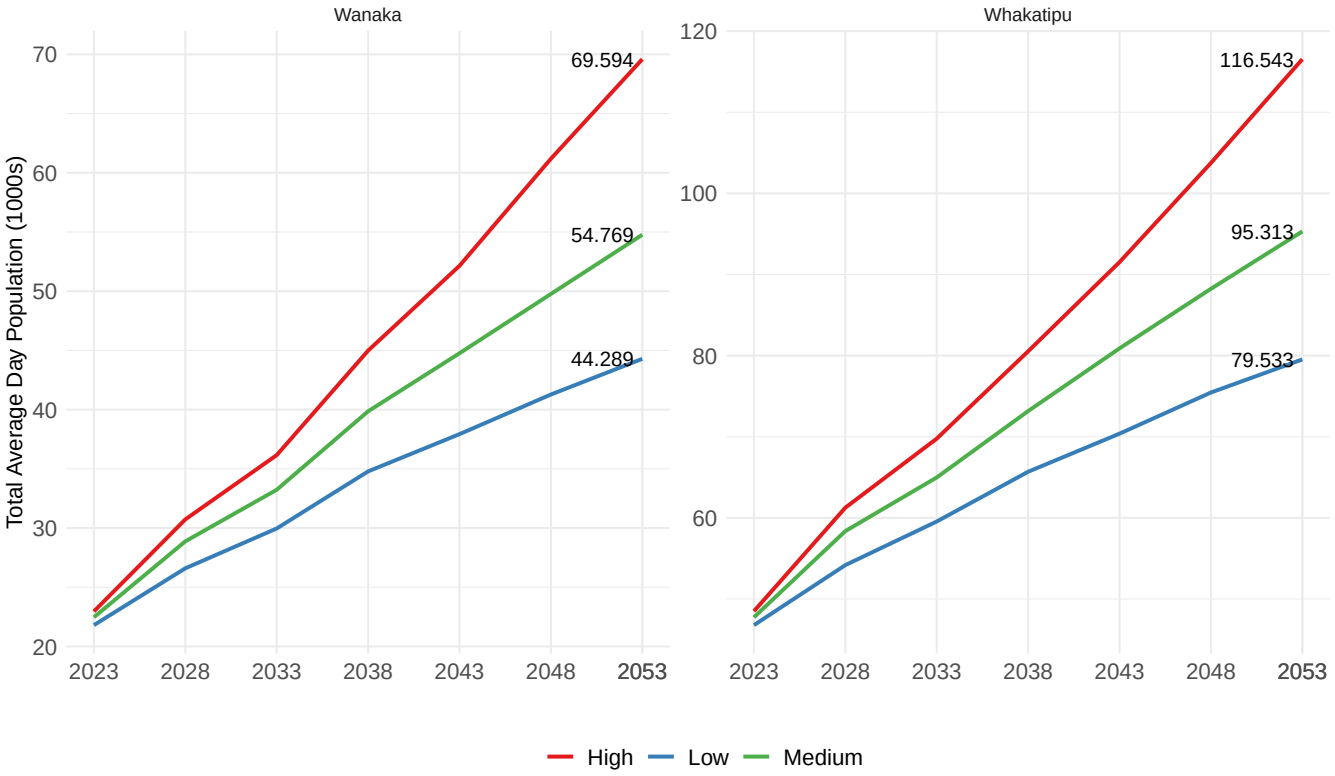


Figure 1: Total population projections, by variant and ward, 2023-2053

and project through to 2023, using the 2022 ERP to assess the projection against. Resident population is projected using the latest data to estimate assumptions for fertility, mortality and net migration by age and sex.

4.1 Total resident population

Figure 2 shows the overall projection results for Queenstown Lakes District (see also Table 3). In 2023, the resident population is projected to be 51,009. This compares with the 2022 estimate by statistics NZ of 49,500.

The resident population size of Queenstown Lakes District increases under all variants. Under the medium variant the population is projected to increase 97.1% from its estimated base of 51,009 in 2023 to 100,558 in 2053. Projected numbers under the high variant reach 127,877 in 2053 (+144.7%). Under the low variant, numbers reach 81,079 in 2053 (+64.2%). Figure 2 includes an illustrative "zero migration" scenario which highlights the importance of migration in the district's growth.

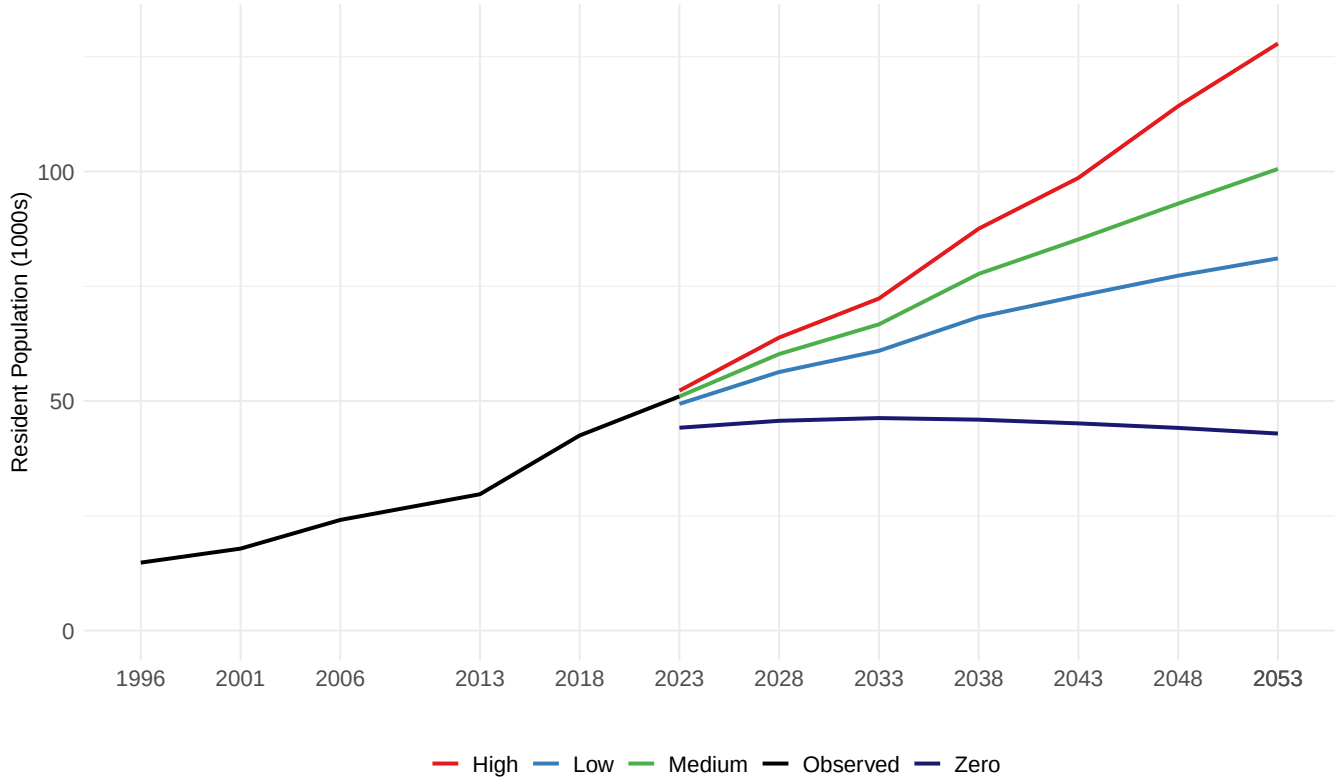


Figure 2: Resident population projections, by variant, 2023-2053, Queenstown Lakes District

By ward, both Wānaka and Whakatipu are projected to experience substantial growth under the medium variant (Figure 3). Wānaka shows the largest relative growth in resident population over the projection period, increasing 139% compared to 75% for Whakatipu. However, Whakatipu ward remains the larger of the two wards with a resident population of 58,519 in 2053 compared to a resident population of 42,039 for Wānaka.

4.2 Comparison with Statistics NZ projections

Figure 4 contrasts the DOT projections with those produced by Statistics NZ (2022c). DOT's projections are higher for each variant primarily due to higher net migration assumptions employed in the DOT model. DOT's

Table 3: Total resident population projections, by variant, 2023-2053, Queenstown Lakes District

	High			Medium			Low		
Year	**Pop**	**Change**	**Pct (an)**	**Pop**	**Change**	**Pct (an)**	**Pop**	**Change**	**Pct (an)**
2023	52,259	9,939	4.3	51,009	8,689	3.8	49,382	7,062	3.1
2028	63,830	11,571	4.1	60,238	9,229	3.4	56,328	6,946	2.7
2033	72,329	8,499	2.5	66,702	6,464	2.1	60,936	4,608	1.6
2038	87,540	15,211	3.9	77,701	10,999	3.1	68,280	7,344	2.3
2043	98,614	11,074	2.4	85,213	7,512	1.9	72,891	4,611	1.3
2048	114,237	15,623	3.0	93,014	7,801	1.8	77,307	4,416	1.2
2053	127,877	13,640	2.3	100,558	7,544	1.6	81,079	3,772	1.0

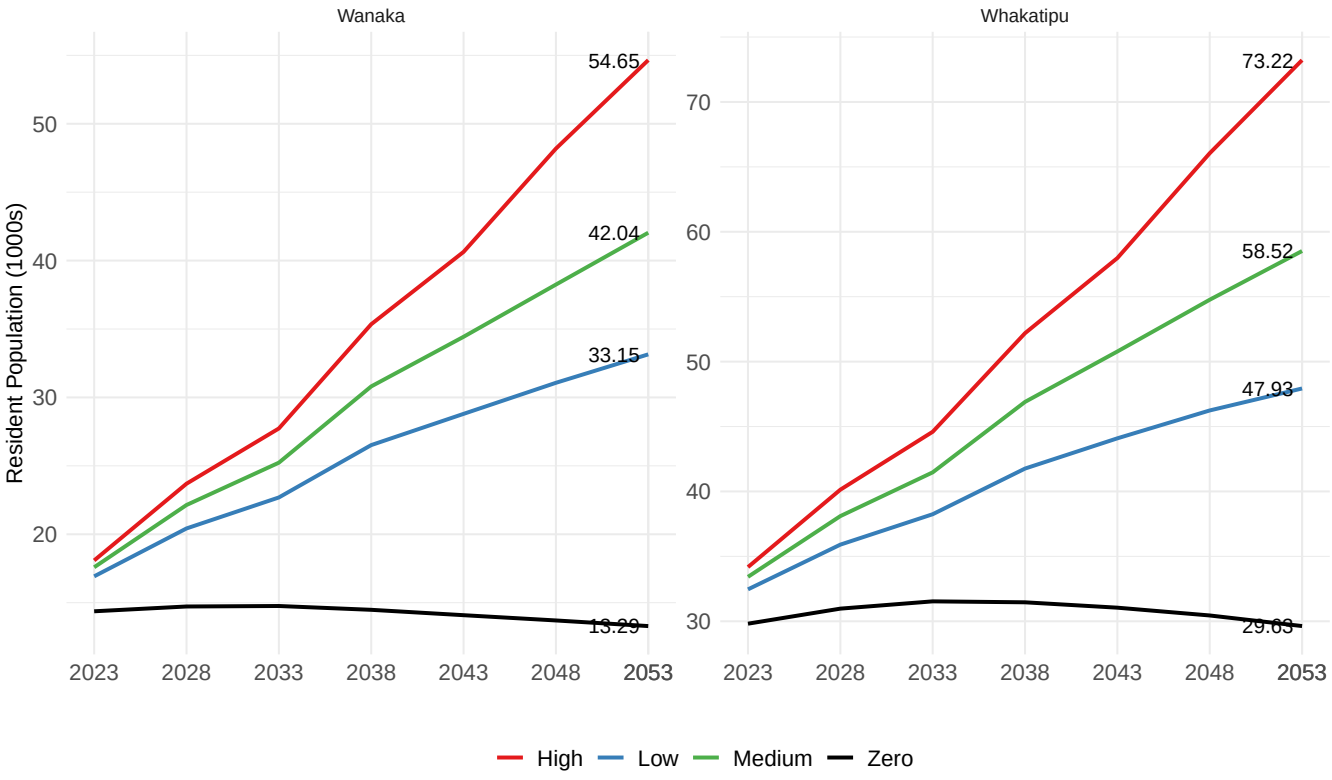


Figure 3: Resident population projections, by variant & ward, 2023-2053

projection methodology, using average migration rates, generates higher numbers of migrants than the pre-determined migration numbers used by Statistics NZ. All three variants use similar fertility and mortality assumptions as Statistics NZ (2022a).

Up to 2033, resident population numbers under the medium variant are similar, but slightly above Statistics NZ's high projection variant and the low projection variant results are comparable to Statistics NZ's medium variant. After 2033, the projections diverge more strongly. The projections reflect scenario's based on assumptions derived from past patterns rather than predictions of the future. If the region experiences high and cyclic migration levels and among age-groups similar to that experienced in the past then these are plausible scenarios. However the dynamics of migration are complex and changeable and it is important to revise these projections as new data becomes available.

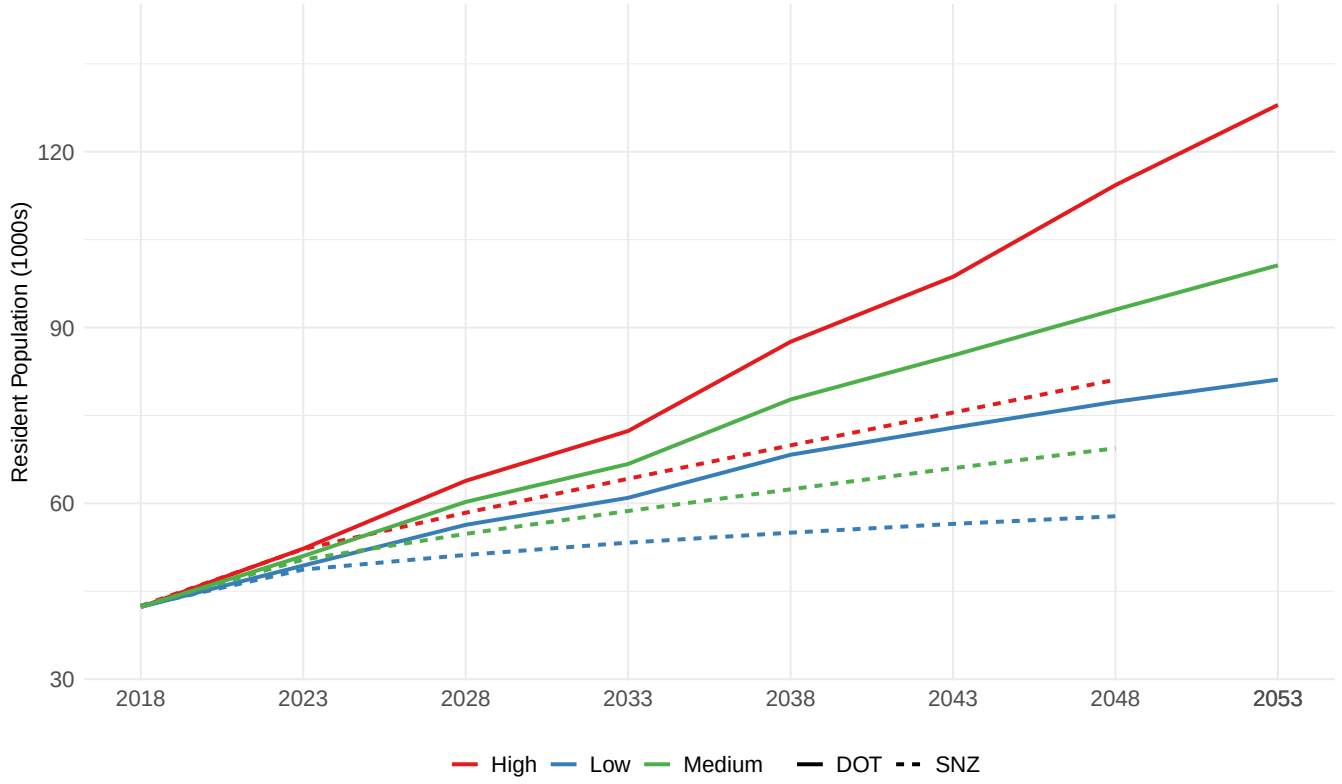


Figure 4: Comparison of DOT and Statistics New Zealand's population projections, by variant, 2023-2053, Queenstown Lakes District

4.3 Population change

Between 2001 and 2023 average annual growth rates ranged between 3.8% and 7.4%. The period 2013-2018 saw unusually high growth rates compared to long term patterns and it is unlikely that growth at this rate will continue for the duration of the projection period.

For all projection variants, population growth remains positive across the projection period, but growth slows over time. The growth in population between 2023-2053 (medium variant) equates to average annual growth of 2.3%.

Over the five years since the last census (2018) the population is estimated to have grown 3.9% per year. QLDC's projected population for 2023-2053 indicates relatively modest average annual growth rates in comparison to earlier periods (Figure 5, Table 3). For each five-year projection window average annual growth

ranges from 3.4% between 2023-2028 to 1.6% between 2048-2053 under the medium variant scenario. Under the high variant, annual growth rates range from 4.1% to 2.3% and for the low variant growth ranges between 2.7 % to 1% per year. The declines in growth rates over time for all three projection variants align with expectations of population ageing and reduced fertility levels.

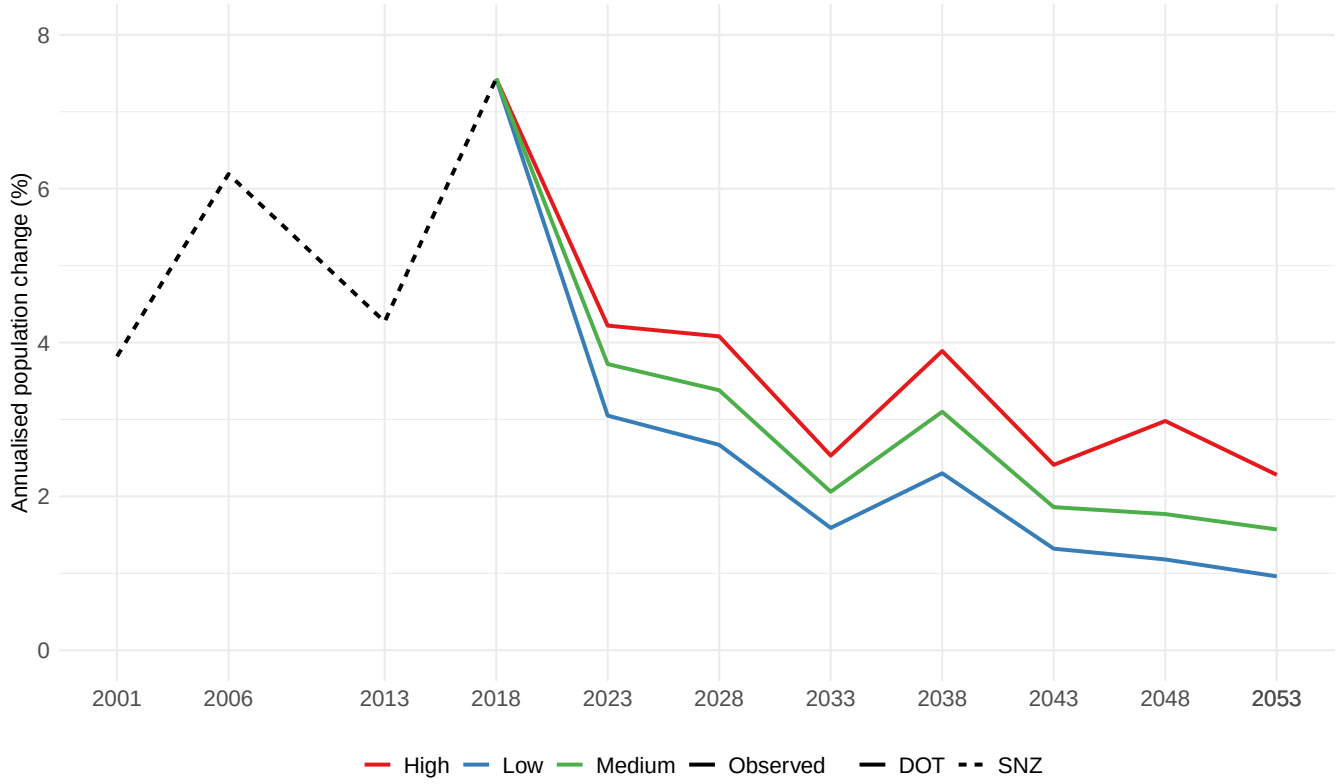


Figure 5: Annualised population change for 5-year periods ending, historic and projected, Queenstown Lakes District

4.4 Components of population change

The relative contributions of net migration and natural increase/decrease to QLDC's projected population growth varies across time and between projection variants (Figure 6 and Table 4). Net migration is the major contributor to the district's growth under all variants, with natural increase providing a minor but relatively stable contribution to population growth. Details of how the migration assumptions were derived can be seen in Section 8.

Under the medium variant, the generated number of migrants increases modestly within a cyclic migration pattern (Table 4), while the increases in net migration under the high variant are moderately more pronounced (Figure 6).

Net migration decreases after 2038 for the low projection variant, however there remains a positive net migration gain through to 2053. Strong declines in natural increase are also evident for the low variant after 2038.

Peak migration is among adults in their 20s. There is evidence of a shift in the peak migration age group from 20-24 years to 25-29 years between 2013-2018. Release of the 2023 census data in 2024 will indicate whether this shift continues or was a temporary effect of the extremely high migration in the 2013-2018 period. The strong inflow of net migration, especially among adults in or nearing their childbearing years, is a fundamental driver of the region's population growth, but it also helps delay structural aging. Both the

volume and age-structure of migrants has a positive effect on population growth in the district. Despite being one of the youngest populations in the country, however, signs of structural aging are emerging in the aging indices.

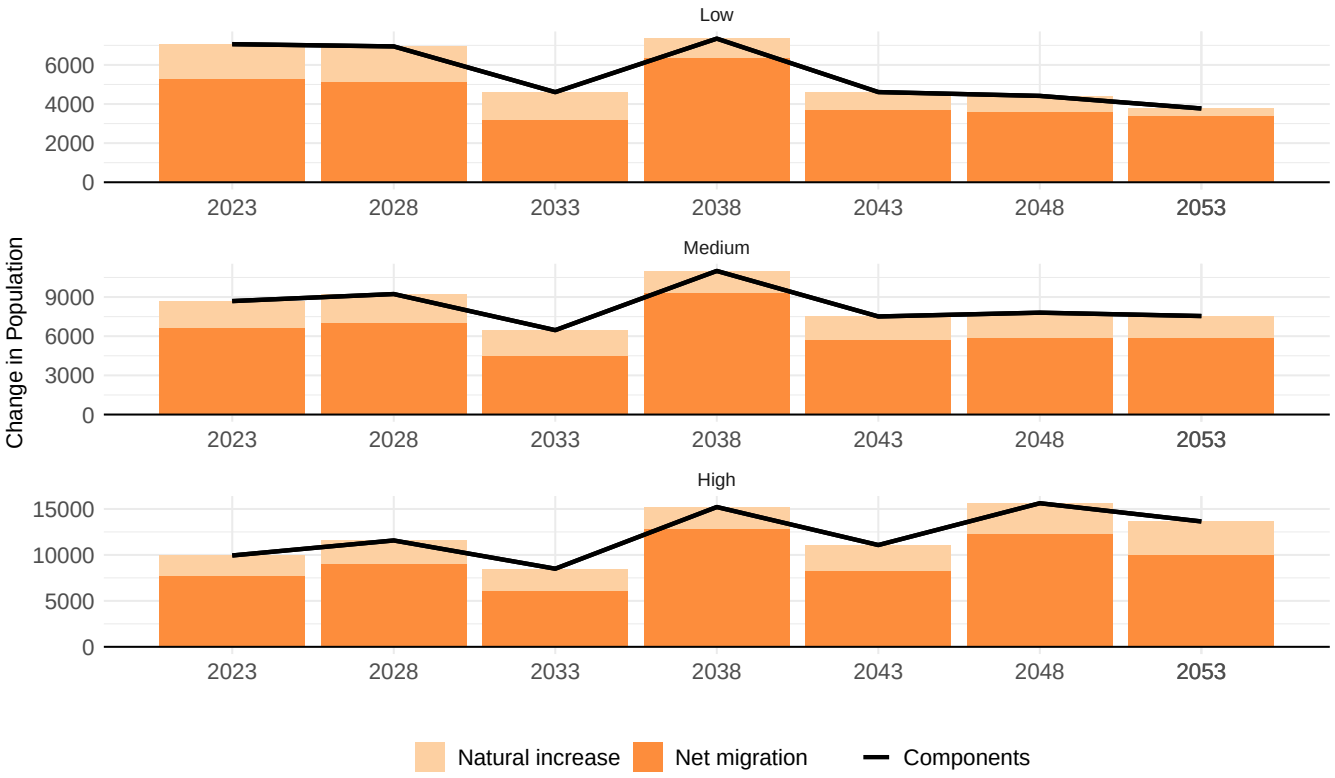


Figure 6: Components of population change, by variant, 2023-2053, Queenstown Lakes District

4.5 Age-Sex structure

In 2022, the population of Queenstown Lakes District ranked youngest out of 67 TAs with 11.1% of the population aged over 65 years (compared to 16.4% nationally). A population is considered to be approaching the end of natural increase once 20% or more of the population are aged over 65 years. This threshold is only projected to be crossed under the low projection variants (Figure 7). However, population ageing is evident from the trend in projected population numbers by broad age group (Table 5) and in ageing indices (Table 6).

Under the medium scenario, 18.02% of the population are projected to be aged 65 years and over in 2053. This rises to 20.5% under the low variant and decreases to 15.33 in the high variant scenario. Although the population is aging, QLDC will remain one of the younger populations in New Zealand, with Statistics NZs (2022c) projections indicating that the Queenstown Lakes population would be New Zealand's youngest population by this measure.

DOT's projected proportion of the population aged 65+ years falls below Stats NZ's projected values largely due to higher migration assumptions among younger age groups. The young age structure of net migration into the district has offset some the effects of structural aging seen in the rest of the New Zealand population.

Another indicator of an aging population reaching the end of natural increase is when the ratio of older people (65+ years) to children (0-14 years) moves above 1. In 2023 this ratio = 0.65. By 2053, this ratio is projected to increase under all variants, ranging from 1.97 (Low) to 1.07 (High), with a medium variant projection of 1.45 (Table 6).

Table 4: Components of Population Change

	2023	2028	2033	2038	2043	2048	2053
High							
Change in population	9,939	11,571	8,499	15,211	11,074	15,623	13,640
Net migration	7,685	8,981	6,026	12,793	8,210	12,211	9,948
Natural increase	2,254	2,590	2,473	2,418	2,864	3,412	3,692
	77.3	77.6	70.9	84.1	74.1	78.2	72.9
Natural increase (pct of pop. chg	22.7	22.4	29.1	15.9	25.9	21.8	27.1
Medium							
Change in population	8,689	9,229	6,464	10,999	7,512	7,801	7,544
Net migration	6,650	7,022	4,511	9,343	5,710	5,877	5,893
Natural increase	2,039	2,207	1,953	1,656	1,802	1,924	1,651
	76.5	76.1	69.8	84.9	76.0	75.3	78.1
Natural increase (pct of pop. chg	23.5	23.9	30.2	15.1	24.0	24.7	21.9
Low							
Change in population	7,062	6,946	4,608	7,344	4,611	4,416	3,772
Net migration	5,272	5,106	3,147	6,351	3,675	3,599	3,365
Natural increase	1,790	1,840	1,461	993	936	817	407
	74.7	73.5	68.3	86.5	79.7	81.5	89.2
Natural increase (pct of pop. chg	25.3	26.5	31.7	13.5	20.3	18.5	10.8

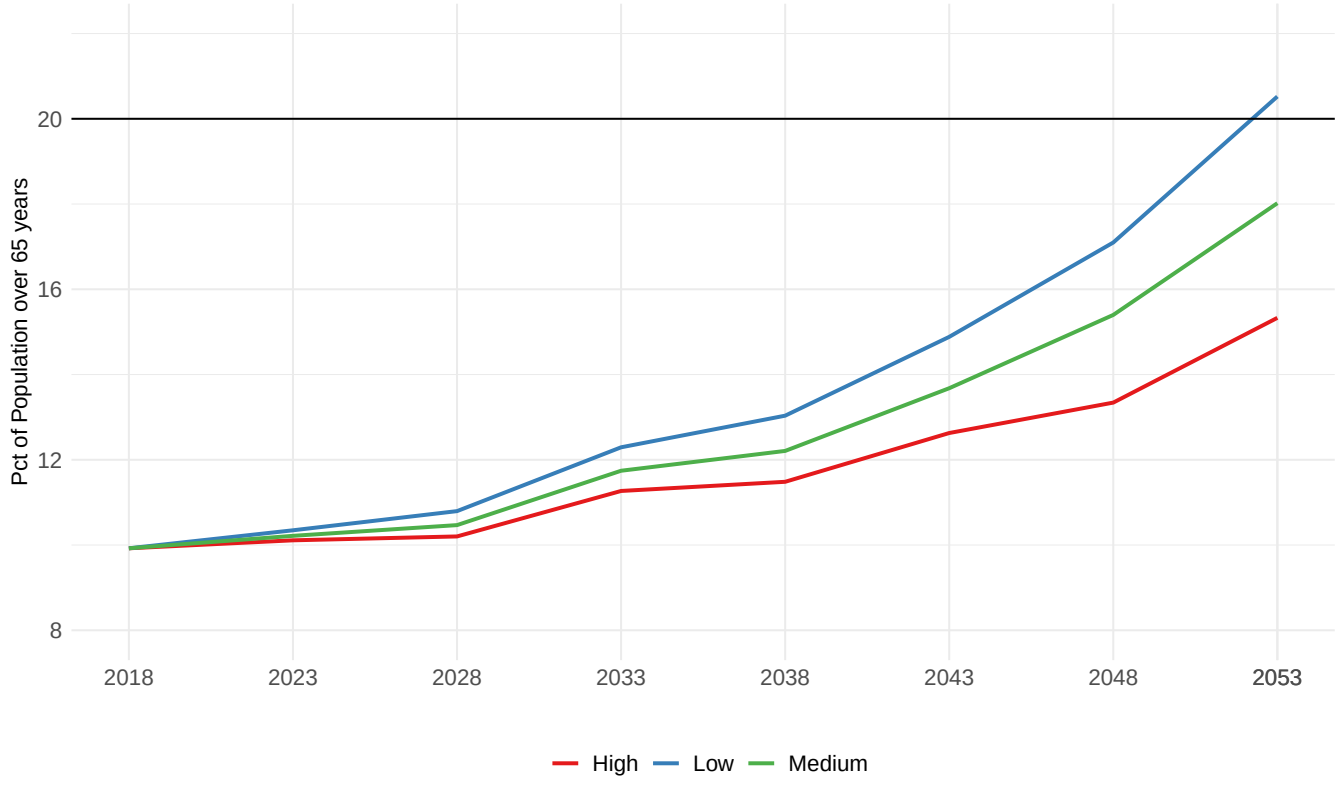


Figure 7: Percentage of population aged 65 years and over, by variant, 2023-2053, Queenstown Lakes District

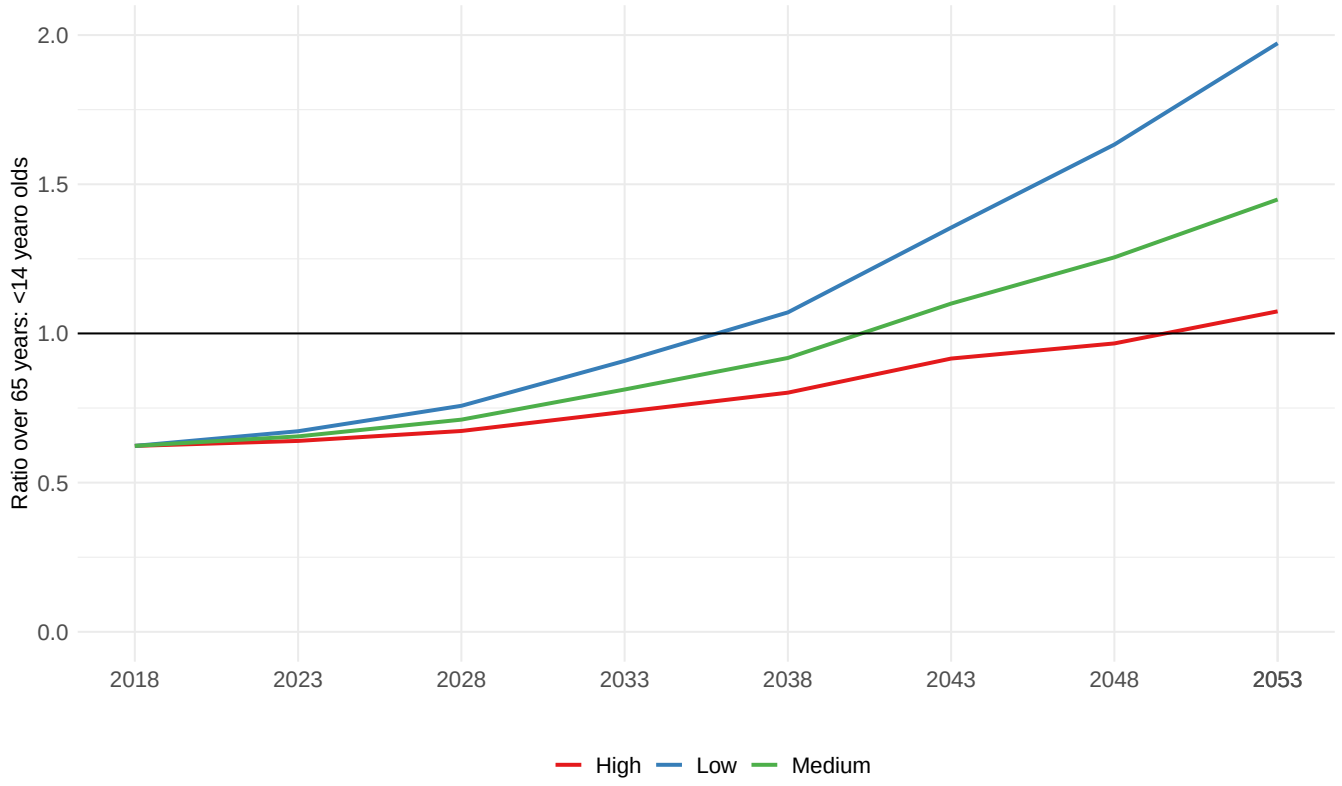


Figure 8: Ratio of population aged 65+ years to under 15 years, by variant, 2023-2053, Queenstown Lakes District

Table 5: Resident population by broad age group, by variant

	2023	2028	2033	2038	2043	2048	2053
High							
0-14	8,259	9,675	11,055	12,543	13,598	15,769	18,252
15-24	6,253	9,359	9,596	12,308	12,973	14,920	15,017
25-54	27,475	31,770	35,728	43,187	47,342	51,549	56,938
55-64	4,988	6,514	7,799	9,449	12,248	16,758	18,066
65-74	3,306	3,931	4,894	6,174	7,655	9,018	11,927
75+	1,978	2,581	3,257	3,879	4,798	6,223	7,677
Total	52,259	63,830	72,329	87,540	98,614	114,237	127,877
Medium							
0-14	7,956	8,868	9,646	10,336	10,596	11,413	12,507
15-24	5,949	8,487	8,577	10,414	10,628	10,625	10,491
25-54	26,972	30,270	33,171	38,548	40,808	41,322	43,492
55-64	4,921	6,307	7,475	8,917	11,525	15,331	15,947
65-74	3,272	3,841	4,736	5,858	7,197	8,456	10,975
75+	1,939	2,465	3,097	3,628	4,459	5,867	7,146
Total	51,009	60,238	66,702	77,701	85,213	93,014	100,558
Low							
0-14	7,600	8,028	8,250	8,314	8,009	8,094	8,436
15-24	5,542	7,582	7,609	8,685	8,525	8,169	7,604
25-54	26,298	28,565	30,458	34,005	34,708	33,575	34,122
55-64	4,833	6,072	7,128	8,376	10,800	14,251	14,277
65-74	3,224	3,740	4,561	5,525	6,730	7,831	10,154
75+	1,885	2,341	2,930	3,375	4,119	5,387	6,486
Total	49,382	56,328	60,936	68,280	72,891	77,307	81,079

Table 6: Population ageing indices, Queenstown Lakes District

	2018	2023	2028	2033	2038	2043	2048	2053
Pct of pop. in Key Reproductive Ages (20-39 yrs)								
High	41.09	38.80	36.31	32.55	32.80	33.30	33.18	31.47
Medium	41.09	38.62	35.63	31.28	31.17	31.63	30.78	28.66
Low	41.09	38.32	34.72	29.74	29.37	29.84	29.06	26.90
Pct of pop. aged 65 years and older								
High	9.92	10.11	10.20	11.27	11.48	12.63	13.34	15.33
Medium	9.92	10.22	10.47	11.74	12.21	13.68	15.40	18.02
Low	9.92	10.35	10.80	12.29	13.04	14.88	17.10	20.52
Ratio 65+ years: 14 years and under								
High	0.62	0.64	0.67	0.74	0.80	0.92	0.97	1.07
Medium	0.62	0.65	0.71	0.81	0.92	1.10	1.25	1.45
Low	0.62	0.67	0.76	0.91	1.07	1.35	1.63	1.97

A further sign that a population is reaching the limits of sustaining itself through natural increase is a reduction in the proportion of women in key reproductive ages (aged 20-39 years). This trend is evident across all three variants and is visible when comparing the age-sex structure in 2023 and projected for 2053 (Figure 9, Table 5). While the main reproductive age groups remain the largest segments of the population (and continue to grow in number), they will experience some of the largest reductions in population share over time. The proportions aged 65+ years are projected to increase substantially for all projection variants, but the overall age structures remains relatively similar by variant. Proportions of younger ages in 2053 are lowest under the low variant and highest under the high variant.

Figure 9: Population pyramids by age, sex and variant, 2023 vs 2053, Queenstown Lakes District

5 Visitor projections

Forecasting visitor numbers is extremely challenging due to the wide range of factors that influence a person's decision to travel. There remains considerable uncertainty about the future of tourism following the covid pandemic, although tourism numbers in the region have recovered substantially in the last two years. The visitor projections reported here should be considered illustrative scenarios that reflect possible visitor numbers should a set of underlying assumptions be met (see 8.2). 'Visitors' in these projections refers to tourists staying in commercial accommodation or in rented holiday homes, people visiting friends and family in the region and day visitors.

The baseline model for visitor projections is a time series forecast of guest nights in commercial accommodation that combines the projected resident population numbers into the model as an external predictor (Figure 10, and see Section 8 for more information) based on an observed historical relationship between visitor and resident population growth. This baseline model of guests in commercial accommodation is converted to an estimate of total visitor guest nights. These are based on a set of assumptions derived using recent data from accommodation and mobile phone data from MBIE, as well as listings and booking data from Airbnb. This data is used to generate ratios between commercial guest nights and guest nights in private residences, and for day and other visitors that can be applied to the baseline model forecast.

5.1 Visitors: Average day

Average day visitors are calculated by dividing the annual forecast for total visitor guest nights (or guest days) by 365. It is estimated there were 19,196 visitors on an average day in 2023. Average day visitors are projected to increase by 158% to 49,524 in 2053 under DOT's medium projection variant (Table 7). This increase in QLDC's projected average day visitor population reflects a relatively modest average annual growth

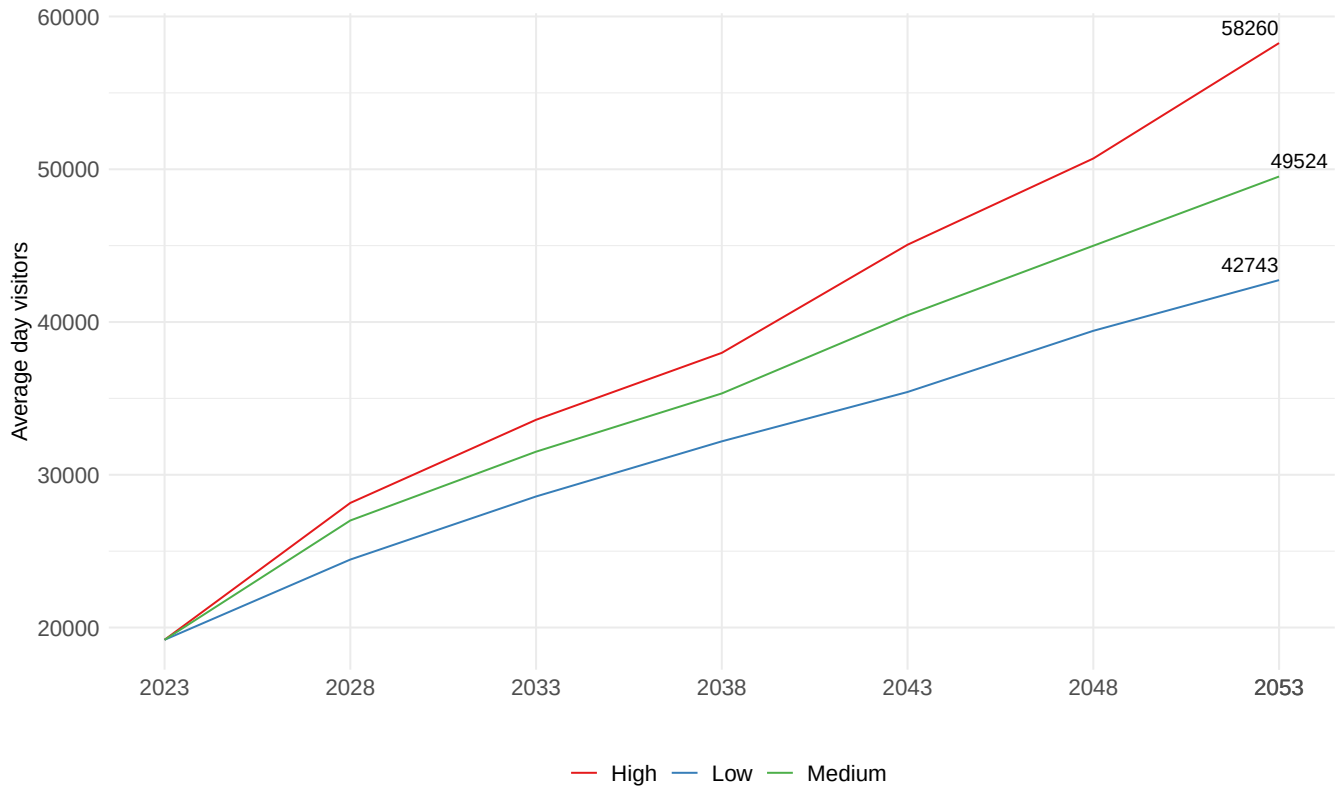


Figure 10: Average day visitors in commerical accommodation

rate of 3.2%. This growth is comparable, or slightly lower than that experienced by the region in the last 20 years (Figure 10).

Under the high variant scenarios average day visitor numbers grow 203.5% to 58,260 in 2053 (Figure 11). Under the low variant, growth is lower at 122.7%, resulting in a visitor population of 42,743 on an average day in 2053.

The majority (74.6%) of average day visitors are projected to stay in the Whakatipu Ward, although similar growth in visitor numbers per projection period is projected for Wānaka (Figure 12). Growth is strongest in the earlier part of the projections as the region under-goes the post-covid recovery in tourism numbers, with continued but more modest growth after 2028.

5.2 Peak day visitors

Peak day visitors are calculated using historic ratios of peak to average day visitors (see Section 8). A peak day is the busiest visitor day of the year and generally occurs over the Christmas/New Year period. For 2023 we estimate there were 48,211 visitors on a peak day in 2023. Peak day visitors are projected to increase by 142.5% to 116,904 in 2053 under our medium projection variant (Figure 13). This increase in QLDC's projected peak day visitor population reflects a relatively modest average annual growth rate of 3%. This growth is in line with growth in average day visitors as we assume a constant ratio between peak and average day visitors overs the projection period.

Under the High variant scenarios peak day visitor numbers grow 182.7% to 136,299 in 2053. This reduces to growth of 111.3% under the low variant resulting in a visitor population of 101,850 on a peak day in 2053.

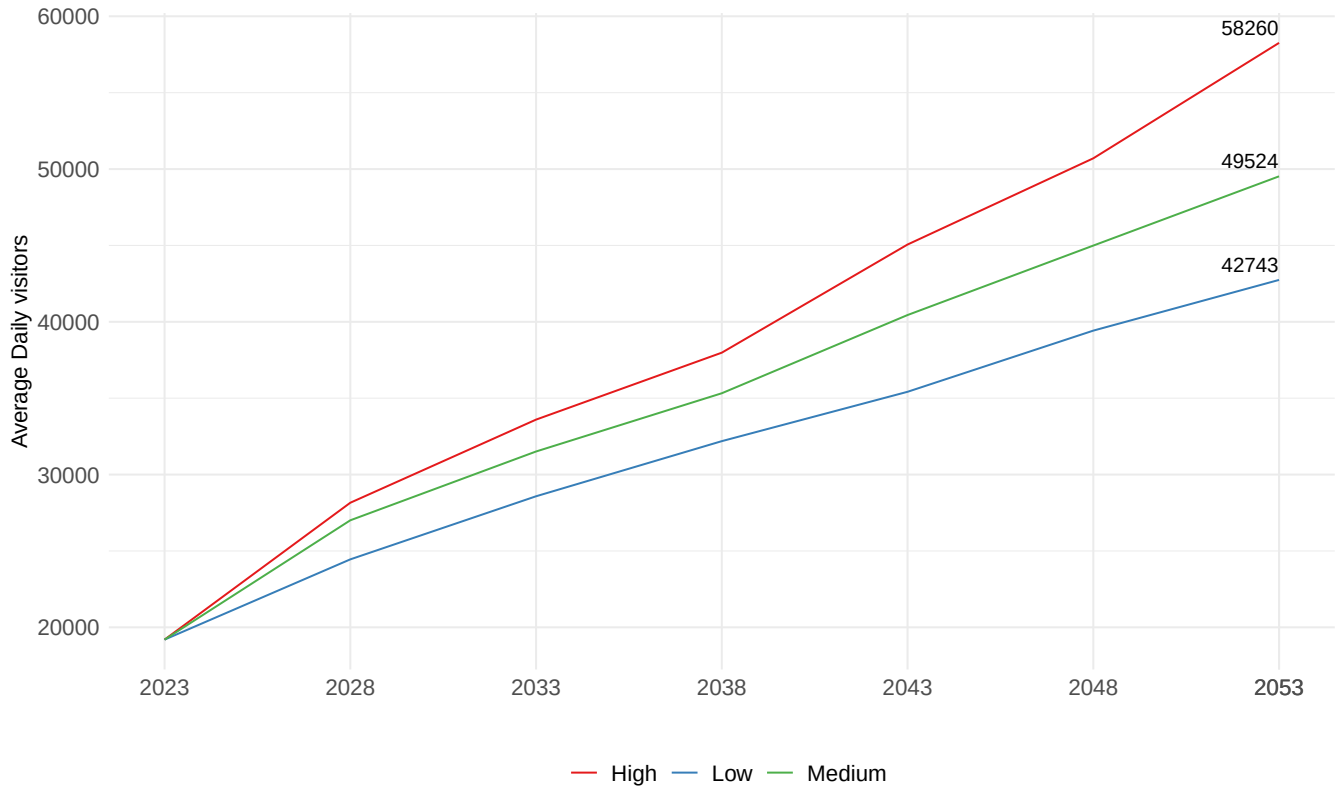


Figure 11: Average day visitors (total), Queenstown Lakes District

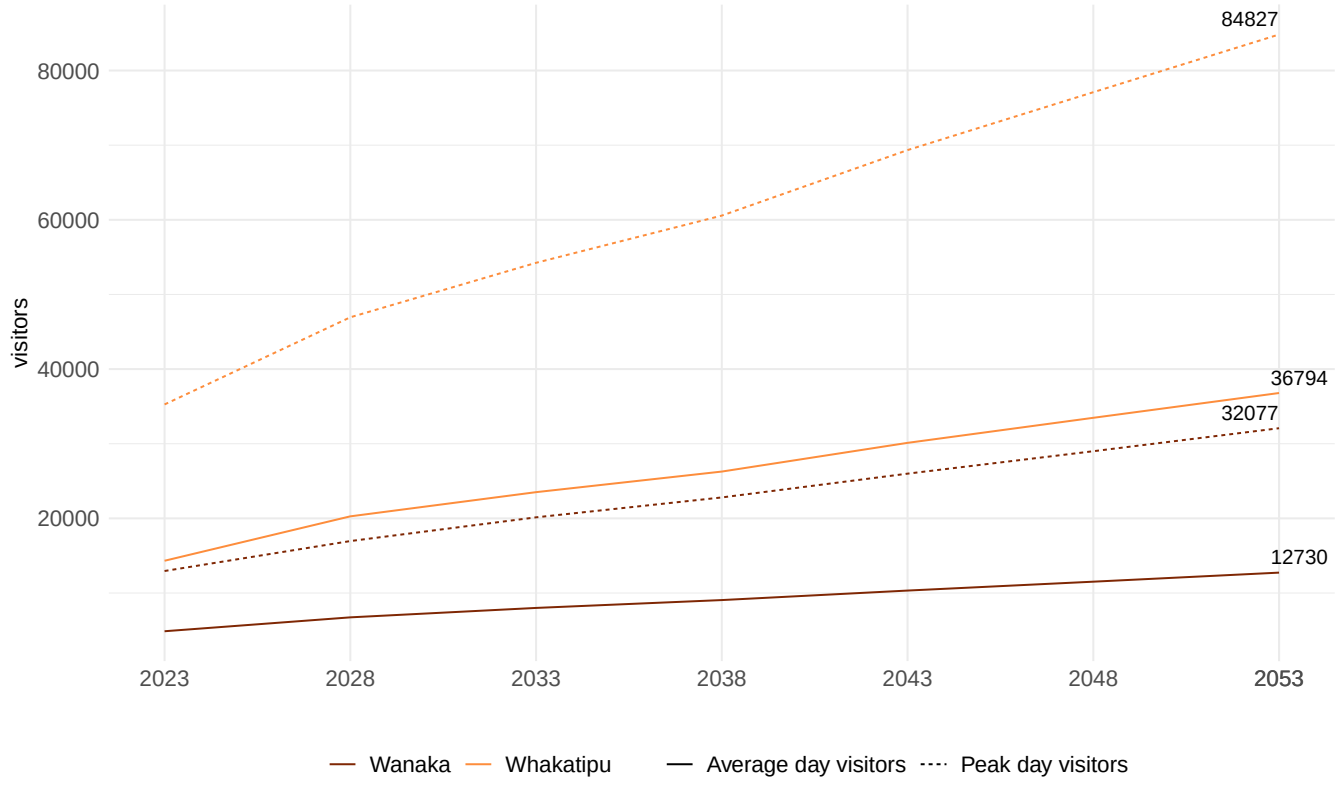


Figure 12: Average and Peak day visitors (medium variant), Whakatipu and Wānaka

Table 7: Average and Peak Day Visitor Population, 2023-2053, by variant, Queenstown Lakes District

	Average Day				Peak Day		
Year	Visitors	Change	Pct chg	.	Visitors	Change	Pct chg
High							
2023	19,196				48,211		
2028	28,157	8,961	146.7		66,452	18,241	137.8
2033	33,599	5,442	119.3		79,008	12,556	118.9
2038	37,980	4,381	113.0		89,265	10,257	113.0
2043	45,060	7,080	118.6		105,579	16,314	118.3
2048	50,704	5,644	112.5		118,776	13,197	112.5
2053	58,260	7,556	114.9		136,299	17,523	114.8
Medium							
2023	19,196				48,211		
2028	24,450	5,254	127.4		58,221	10,010	120.8
2033	28,580	4,130	116.9		67,865	9,644	116.6
2038	32,189	3,609	112.6		76,410	8,545	112.6
2043	35,419	3,230	110.0		84,176	7,766	110.2
2048	39,424	4,005	111.3		93,735	9,559	111.4
2053	42,743	3,319	108.4		101,850	8,115	108.7
Low							
2023	19,196				48,211		
2028	27,007	7,811	140.7		63,899	15,688	132.5
2033	31,512	4,505	116.7		74,375	10,476	116.4
2038	35,324	3,812	112.1		83,369	8,994	112.1
2043	40,444	5,120	114.5		95,331	11,962	114.3
2048	44,991	4,547	111.2		106,092	10,761	111.3
2053	49,524	4,533	110.1		116,904	10,812	110.2

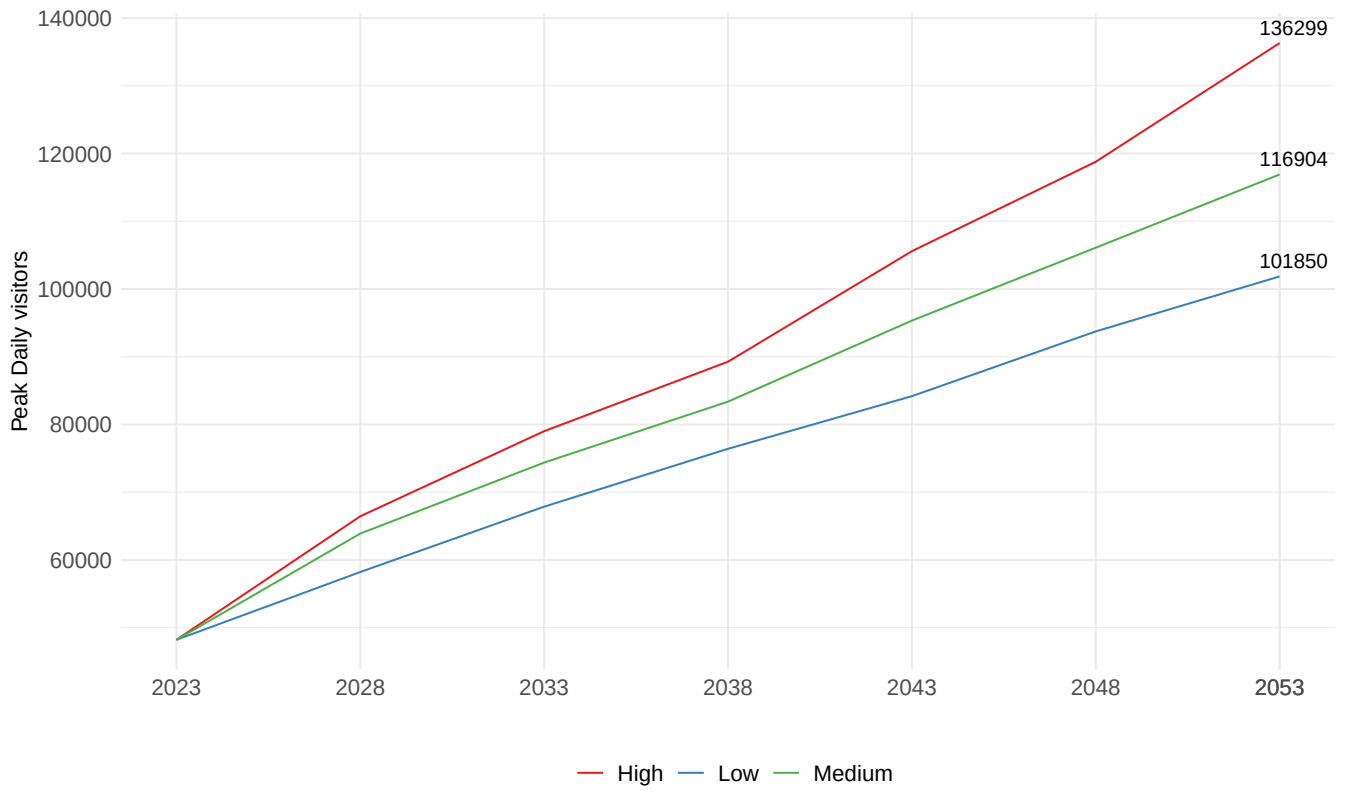


Figure 13: Peak day visitors (total), Queenstown Lakes District

5.3 Interpreting visitor numbers

In addition to the inherent uncertainty surrounding visitor projections it is important to note that these projections do not directly model possible changes to the nature and duration of visits. As the projections relate to guest nights rather than unique guests it would be possible to generate the same results with fewer tourists who stay for longer duration or more tourists who stay for shorter visits. These projections are therefore flexible scenarios that can be assessed in light of different tourism strategies for the region. Consideration was given to Queenstown Lakes' destination management plan and how this could impact tourist numbers. However given the plan is still in its formative stages and the lack of data around the impact of its proposed actions, this has not directly informed any of the scenarios.

These projections are estimates based on the available data and represent plausible scenarios for tourism to the district, however due to the inherent uncertainty in these projections they should be used cautiously and with consideration of the uncertaininty in the estimates, especially for more distant time periods.

These 2023-2053 visitor projections are comparable to previous projections but differ in forecasting slightly higher average day visitors (e.g. 49,524 compared to 39,850 visitors in 2053) and slightly lower peak day numbers (e.g. 116,904 compared to 119,550 visitors in 2053).

Please also note that the ward and SA2 projections do not sum to TA totals because visitors are likely to spend time in multiple sub-geographies within a single day.

6 Dwelling and Household projections

6.1 Residential Dwellings

The total number of private residences includes households, unoccupied dwellings and holiday homes. The dwelling projections are demand based and derived from the projected population and the dwelling ratio assumption, i.e. the number of people per dwelling. These projections reflect the required number of dwellings based on the projected population should assumptions about the dwelling ratio be met. They do not reflect current stock (see 7.1) or projected supply. The baseline for the projections is the 2018 Census dwelling count, adjusted for population growth to 2023.

Additional demand for dwellings is projected under all variants in order to maintain the assumed dwelling ratio (average number of people per private dwelling). This growth is primarily driven by population growth and decline in household size.

Demand for private dwellings is projected to increase by 97.1% between 2023 and 2053 for the medium variant (Figure 14, Table 8) if the assumed dwelling ratio of 2.02 is maintained. This equates to an additional 3,735 dwelling units in 2053, or `dw53` dwelling units in total.

Under the high variant, 63,300 dwellings are projected by 2053, compared to 40,135 under the low projection variant.

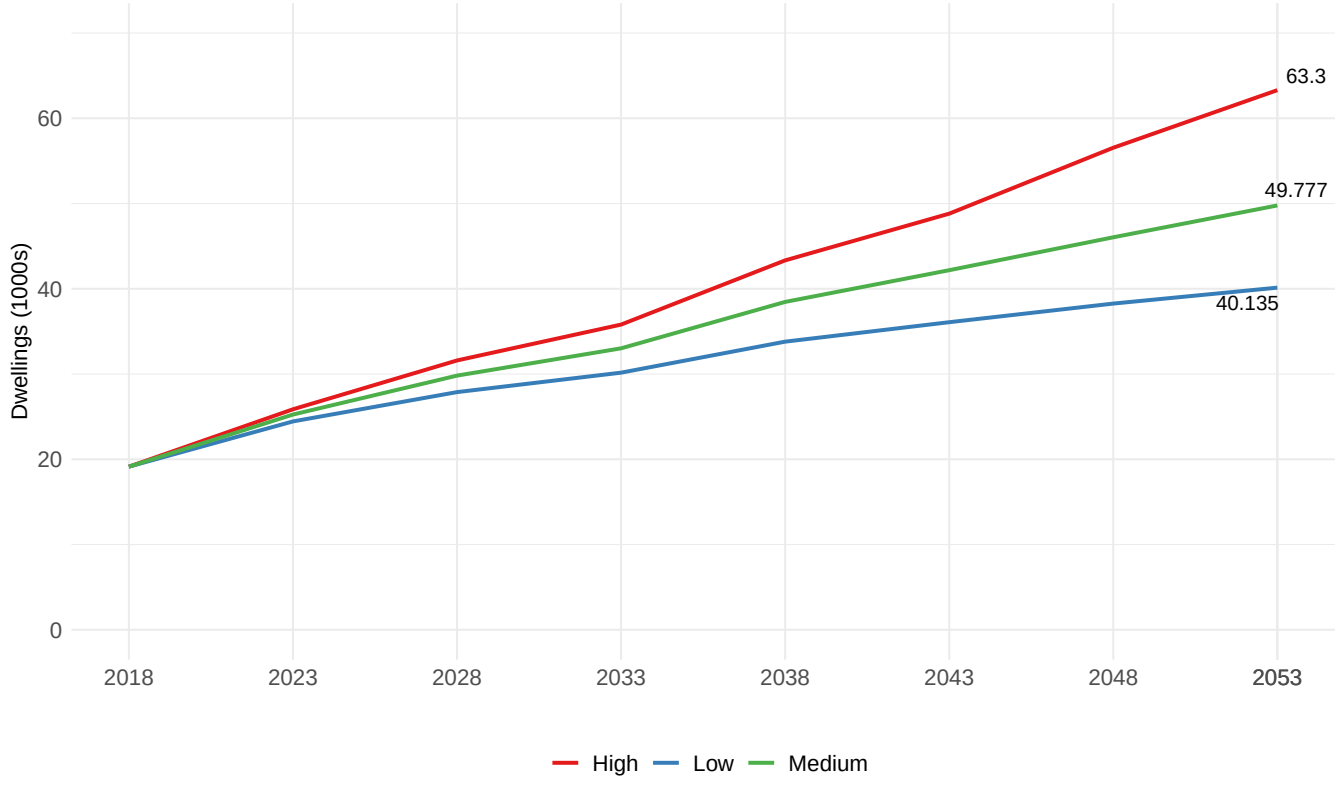


Figure 14: Private dwelling projections, by variant, 2023-2053, Queenstown Lakes District

For the Whakatipu ward, dwelling numbers are projected to increase from 15,109 in 2023 to 26,203 in 2053 under medium variant. This compares with an increase in private dwellings for Wānaka ward from in 2023 to 23,574 in 2053. This indicates stronger demand based growth in dwellings for the Wānaka ward, where dwelling numbers are projected to increase 232% over the 30 year projection period, compared to growth of 174% for the Whakatipu ward.

Table 8: Private dwelling projections, by variant, 2023-2053, Queenstown Lakes District

	2018	2023	2028	2033	2038	2043	2048	2053
High								
Projected units	19,137	25,868	31,596	35,803	43,333	48,815	56,548	63,300
Change	0	6,731.0	5,728.0	4,207.0	7,530.0	5,482.0	7,733.0	6,752.0
Change (pct)	0	35.2	22.1	13.3	21.0	12.7	15.8	11.9
Annualised % Change	0	6.2	4.1	2.5	3.9	2.4	3.0	2.3
Medium								
Projected units	19,137	25,250	29,818	33,018	38,462	42,181	46,042	49,777
Change	0	6,113.0	4,568.0	3,200.0	5,444.0	3,719.0	3,861.0	3,735.0
Change (pct)	0	31.9	18.1	10.7	16.5	9.7	9.2	8.1
Annualised % Change	0	5.7	3.4	2.1	3.1	1.9	1.8	1.6
Low								
Projected units	19,137	24,444	27,882	30,163	33,799	36,081	38,267	40,135
Change	0	5,307.0	3,438.0	2,281.0	3,636.0	2,282.0	2,186.0	1,868.0
Change (pct)	0	27.7	14.1	8.2	12.1	6.8	6.1	4.9
Annualised % Change	0	5.0	2.7	1.6	2.3	1.3	1.2	1.0

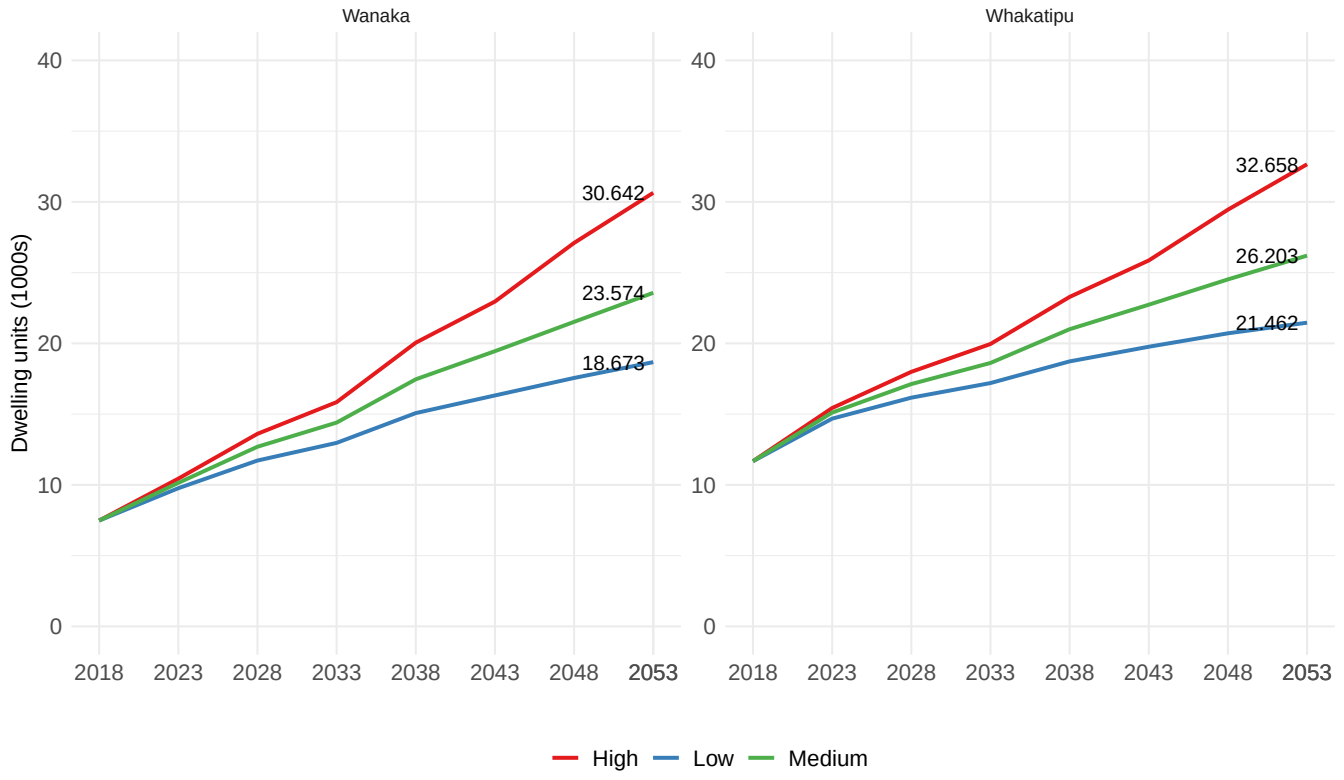


Figure 15: Rating unit projections, by variant and ward, 2023-2053, Queenstown Lakes District

6.2 Households

Households are private residences occupied by at least one or more people living in the district, and make up the majority of total private dwellings.

The household projections are demand driven based on the projected population combined with assumptions about average household size (see Section 8). They reflect the required number of households to house the projected resident population assuming assumptions about average household size are met.

Under the medium projection, the number of households (private dwellings occupied by residents) is projected to follows a similar pattern to households increasing 105% between 2023 and 2053 (Figure 16, Table 9) if the assumed future average household size is maintained. This equates to an additional 3,018 households in 2053, or 40,223 households in total. The rate of increase in households is greater than that of the population due to expected declines in average household size.

Under the low projection variants, the number of households are projected to increase 70.8% to 32,431 households. For the high projection variant, households are projected to increase 154.5% to 51,150 (Table 9, Figure 16).

Average household size is projected to decline slightly under all three variants, with the medium projection assuming a decline from 2.6 in 2023 to 2.5 in 2053.

6.3 Unoccupied dwellings (Holiday homes)

Unoccupied dwellings, primarily comprising of holiday homes, are forecast to increase to 9,554 in 2053 up from 5,632 in 2023 for the medium variant (Table 10). This compares with a projected number of unoccupied homes of 12,150 for the high variant and 7,704 for the low variant.

Table 9: Projected resident households, by variant, 2023-2053, Queenstown Lakes District

	2018	2023	2028	2033	2038	2043	2048	2053
High								
Projected units	13,719	20,099	24,550	27,818	33,669	39,445	45,694	51,150
Change	0	6,380.0	4,451.0	3,268.0	5,851.0	5,776.0	6,249.0	5,456.0
Change (pct)	0	46.5	22.1	13.3	21.0	17.2	15.8	11.9
Annualised % Change	0	7.9	4.1	2.5	3.9	3.2	3.0	2.3
Medium								
Projected units	13,719	19,618	23,168	26,680	31,080	34,085	37,205	40,223
Change	0	5,899.0	3,550.0	3,512.0	4,400.0	3,005.0	3,120.0	3,018.0
Change (pct)	0	43.0	18.1	15.2	16.5	9.7	9.2	8.1
Annualised % Change	0	7.4	3.4	2.9	3.1	1.9	1.8	1.6
Low								
Projected units	13,719	18,993	21,664	24,374	27,312	29,156	30,922	32,431
Change	0	5,274.0	2,671.0	2,710.0	2,938.0	1,844.0	1,766.0	1,509.0
Change (pct)	0	38.4	14.1	12.5	12.1	6.8	6.1	4.9
Annualised % Change	0	6.7	2.7	2.4	2.3	1.3	1.2	1.0

Table 10: Projected unoccupied dwellings, by variant, 2023-2053, Queenstown Lakes District

	2018	2023	2028	2033	2038	2043	2048	2053
High								
Projected units	5,418	5,769	7,046	7,985	9,664	9,370	10,854	12,150
Change	0	351.0	1,277.0	939.0	1,679.0	-294.0	1,484.0	1,296.0
Change (pct)	0	6.5	22.1	13.3	21.0	-3.0	15.8	11.9
Annualised % Change	0	1.3	4.1	2.5	3.9	-0.6	3.0	2.3
Medium								
Projected units	5,418	5,632	6,650	6,338	7,382	8,096	8,837	9,554
Change	0	214.0	1,018.0	-312.0	1,044.0	714.0	741.0	717.0
Change (pct)	0	4.0	18.1	-4.7	16.5	9.7	9.2	8.1
Annualised % Change	0	0.8	3.4	-1.0	3.1	1.9	1.8	1.6
Low								
Projected units	5,418	5,451	6,218	5,789	6,487	6,925	7,345	7,704
Change	0	33.0	767.0	-429.0	698.0	438.0	420.0	359.0
Change (pct)	0	0.6	14.1	-6.9	12.1	6.8	6.1	4.9
Annualised % Change	0	0.1	2.7	-1.4	2.3	1.3	1.2	1.0

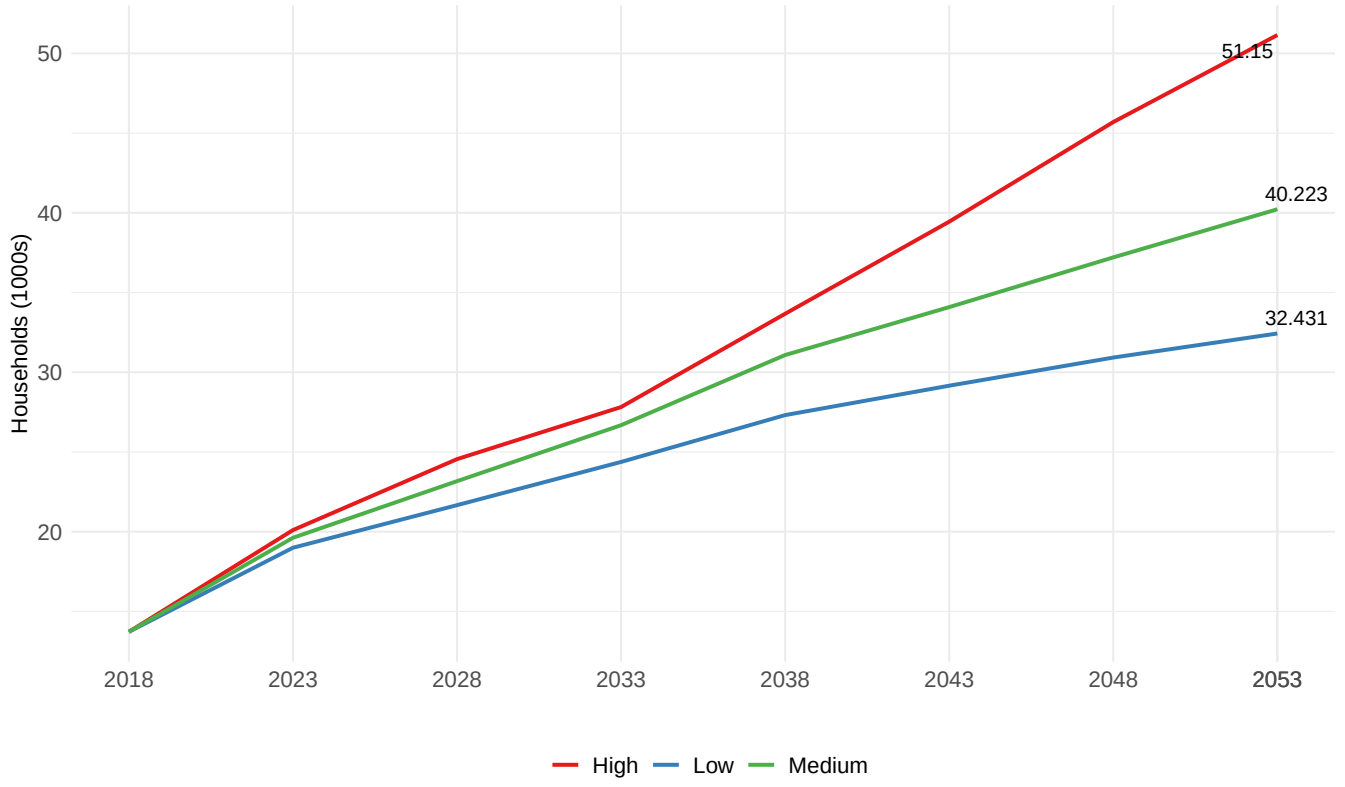


Figure 16: Household projections, by variant, 2023-2053, Queenstown Lakes District

while the number of holiday homes is projected to increase for QLDC as a whole, the proportion of unoccupied homes relative to total private dwellings is projected to decrease slightly as the resident population increases, from 22.3% in 2023 19.2% in 2053 (medium variant).

6.3.1 Interpreting change in projected household and dwelling numbers

Increases and decreases in the projected numbers represent changes in housing demand over the projection period based on household size and dwelling ratio expectations. That is, projected numbers indicate if additional or fewer households and dwellings are required to sustain the expected ratios for household size and dwellings, and do not represent an actual increase (new builds) or decline (destruction, abandonment, or re-purposing) in dwellings and households in the region. A projected increase in dwelling numbers signifies that additional dwellings will be required to maintain the stated people-to-dwellings ratio, while a decline in numbers signifies fewer dwellings will be required to maintain that ratio.

The differing proportions of occupied and unoccupied dwellings in each geographic area should be considered when interpreting projected dwelling numbers.

Household and dwelling numbers increase under all three variants due to a combination of population growth and population ageing. Population ageing typically sees a reduction in average household size, in part because there are fewer children per household, more people live as couples without children and, especially at older ages, more people live alone. Added to this is the growing tendency for people to have a second (holiday or weekend) home, especially at mid-older ages, which contributes to the relative increase in dwelling numbers. The latter is particularly important at SA2 level, where unoccupied dwelling rates vary dramatically.

7 Rating unit projections

The rating unit projections ar based on the assumption that past patterns of growth (and the relationship between this growth and change in population and visitor numbers) will continue into the future. However it should be noted that rating units are as much determined by council decisions and planning regulations as they are by past patterns, and the decisions of future councils and government are difficult to predict far into the future. The rating unit projections should be used with this understanding and the knowledge that no specific planning or land-use changes have been built into the model. The rating unit categories used in these projections are:

- Residential units (supply)
- Country dwelling units
- Visitor accommodation units
- Mixed-use accommodation units
- Commercial units
- Mixed-use commercial units
- Primary industry
- Hydro and Other
- Vacant units

Population, visitor and dwelling growth flows through to rating units, with the total number of rating units projected to increase to 59,083 in 2053 up from 29,387 in 2023 (Table 11). This is an increase of 101.1% over the 30 year projection period, or an annualised growth rate of 2.4% per year.

Rating units are dominated by residential rating units, which comprise 63% of ratings units in 2023 (residential and country dwelling categories combined). As a result, demand-based growth for private dwellings (linked to population) drives the growth in total rating unit numbers. However, growth is also projected in the two other major rating unit sub-categories, accommodation units and commercial units which are also tied to growth in the resident population (increased size of work-force, increased demand) and in the visitor population.

Total rating unit projections are derived from the sum of the projections for the separate ratings units categories. The major types (residential, visitor accommodation, commercial) are described in more detail below. No change in rating unit numbers is assumed for the primary industry, hydro, other and vacant unit categories.

7.1 Residential rating units

Residential rating units are equivalent to private residential dwellings, but represent a different type of housing projection. The residential rating unit projections differ from the private dwelling projections in that they are represent growth in the stock of houses rather than the population-based demand for houses. Residential rating unit projections assumes the supply of new houses is based on the historic relationship between house building and population growth. The residential rating unit have as their base (starting point) the current stock of residential rating units in 2023. Growth in new houses is modeled using building consents data and population, with the projected population used to project housing growth into the future. See the methodology section 8.4 for further details.

Residential rating units are projected to increase to 35,161 units under the medium variant, up from 16,735 between 2023 and 2053 (Figure 17). This is a total increase of 110.1%. Annualised over the 30 year projection this represents a growth rate of 2.5% per year.

Country dwellings are projected to increase from units to by 2053. Country dwellings have similar growth rates to residential rating units as both rating unit projections are based on the same population-derived

Table 11: Rating unit categories, 2023-2053, Medium variant, Queenstown Lakes District

	2023	2028	2033	2038	2043	2048	2053
Residential	16,735	20,030	22,754	26,312	29,359	32,280	35,161
Accommodation	3,392	5,232	5,797	6,500	7,507	8,327	8,450
Commercial	1,261	1,462	1,708	2,043	2,185	2,316	2,419
Country dwelling	2,180	2,609	2,964	3,428	3,825	4,205	4,580
Hydro	5	5	5	5	5	5	5
Mixed use accommodation	1,726	2,663	2,950	3,307	3,820	4,237	4,300
Mixed use commercial	87	101	118	141	151	160	167
Other	21	21	21	21	21	21	21
Primary industry	842	842	842	842	842	842	842
Vacant	3,138	3,138	3,138	3,138	3,138	3,138	3,138
Total rating units	29,387	36,103	40,297	45,737	50,853	55,531	59,083

growth rates.

7.2 Accommodation rating units

Demand for commercial accommodation units is driven by projected peak day visitor guest nights in commercial accommodation and our assumptions about the average number of guests per stay unit. The average number of guests per stay unit is assumed to be stable across the projection period, but to be higher on peak compared to average days. It is also assumed that the total demand for commercial stay units is met through both accommodation and mixed-use accommodation ratings units. Demand for holiday home rentals is considered separately within the residential property forecasts.

Under the medium projection variant, total demand for commercial accommodation stay units is expected to increase to 12,750 units in 2053, more than double the current stock of 5,118 ratings units in 2023 provided by accommodation and mixed-use accommodation rating unit types.

Most of this demand is met through growth in accommodation units, which are projected to increase to 8,450 units under the medium variant in 2053, up from 3,392 in 2023 (Figure: 18). Mixed-use accommodation is projected to increase to 4,300 units up from 1,726 units. For both rating types this reflects an average annual growth rate across the 30 year projection period of 0%. The ratio of commercial and mixed-use accommodation is assumed to remain constant across the projection period.

Growth in in accommodation units is present in both Whakatipu and Wānaka wards, but with the bulk of the demand based in the former. Approximately 80% of accommodation rating units are in the Whakatipu ward. The Wānaka ward, in contrast, has a higher ratio of private holiday home stay-units to commercial stay units.

7.3 Commercial rating units

Growth in commercial rating units is modeled by combining historical patterns of growth with projected working age population in a time series model.

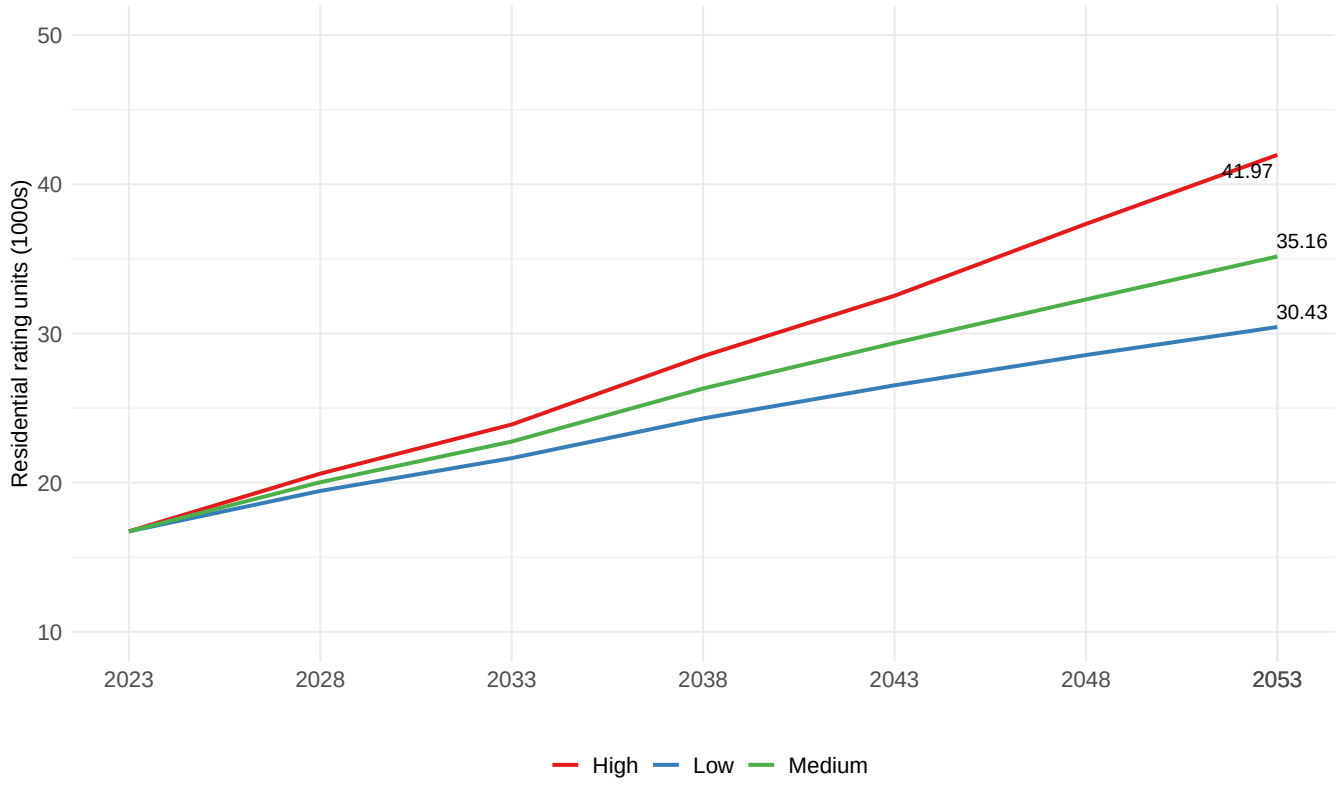


Figure 17: Residential rating unit projections, by variant, 2023-2053, Queenstown Lakes District

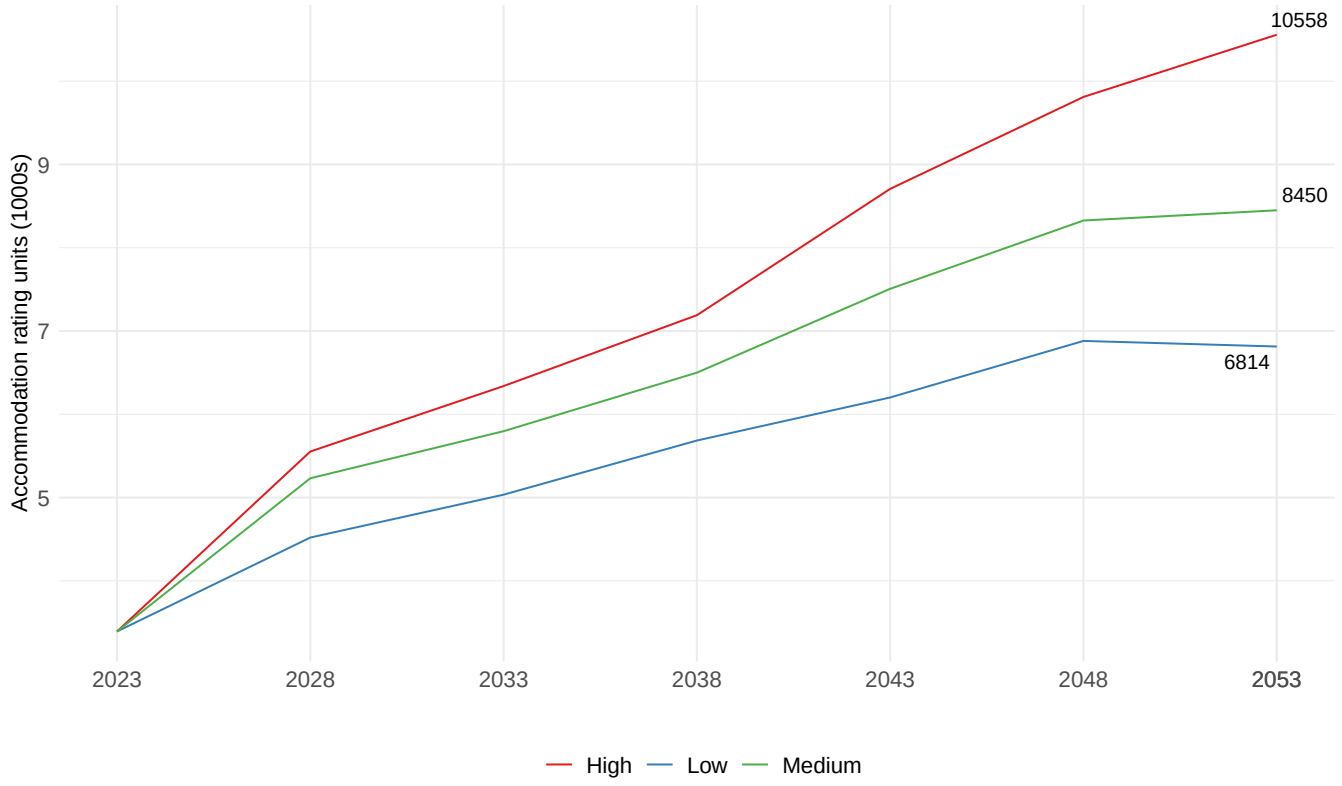


Figure 18: Accommodation units, projected demand, 2023-2053 Queenstown Lakes District

Commercial rating units are forecast to increase 91.8 % to 2,419 units in 2053 under the medium variant, up from 1,261 rating units in 2023 (Figure 19). When this growth is annualised, this equates to 2.2% per year. Although this results in slightly higher forecasts than previous projections (c.f 2,171 units in 2053 under the 2021 projection series), this growth is moderate relative to historical levels. The latest projected growth in rating units reported here compares to growth of 386% in the number of geographic business units between 2002 and 2022 reported by Statistics NZ's (Business Demography, 2022), equivalent to a rate of 7.0% growth per year.

Mixed-use commercial rating units are assumed to grow at the same rate as commercial rating units, up from 87 in 2023 to a projected 167 units in 2053.

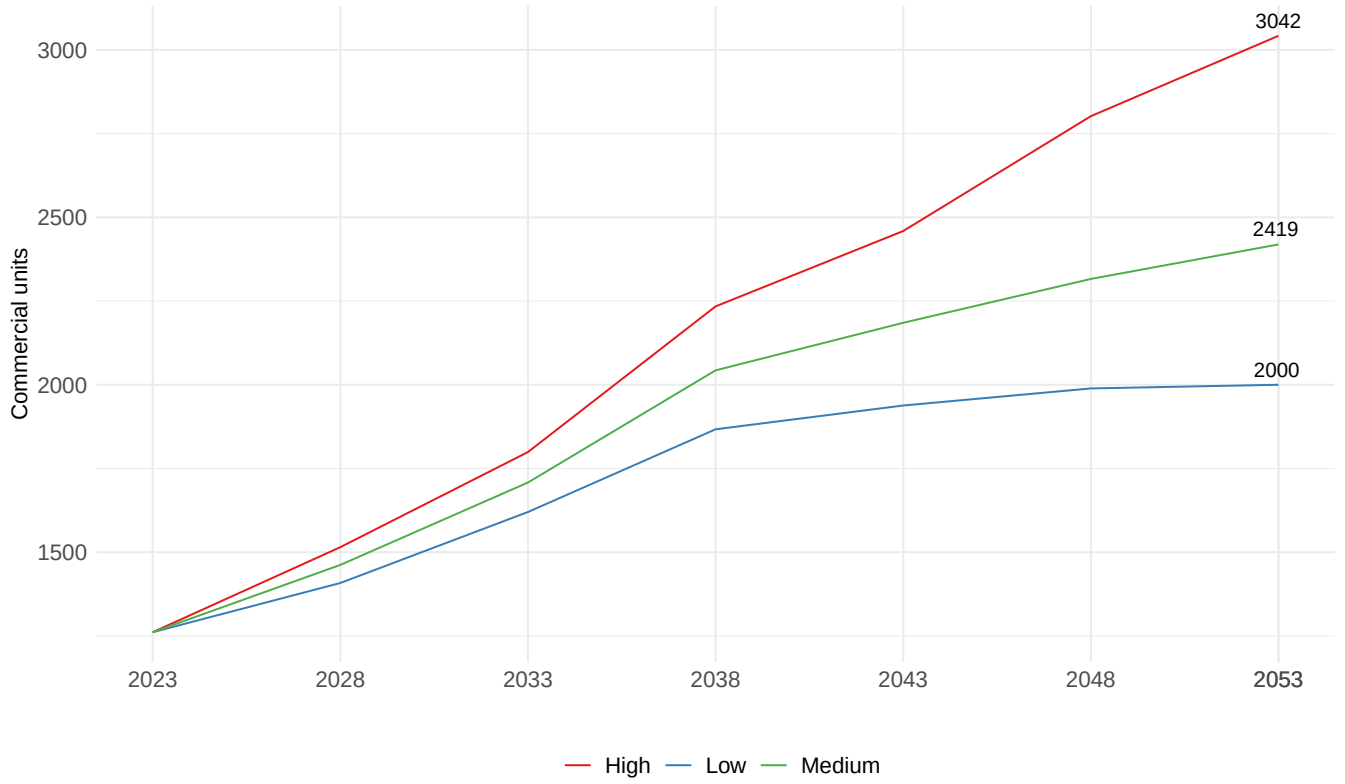


Figure 19: Projected commercial rating units, 2023-2053 Queenstown Lakes District

8 Assumptions and Methodology

Demand projections were developed for Queenstown Lakes District including the Whakatipu and Wānaka wards and the respective SA2s in five-year periods between 2023-2053. Projections for dwellings and households, visitors, and rating units are derived from an underlying projection of population by age and sex (i.e., demand from projected population change underpins trends in other projection types).

The population projections are derived using a standard cohort component method and involve constructing population projections for each sex and five-year age group using data and assumptions about population fertility (births), mortality (survivorship and life expectancy), and migration.

The projections are based on 2022 statistical geographies. SA2 results are summed to produce Ward level totals (see section 1.3.1 for more details on geographies). The initial approach for generating the baseline projections is the same for both the TA and SA2 projections (See section 8.1.1 for more details on the cohort component method). However, the initial SA2 projections are subsequently constrained to the TA total. The approach to constrain SA2 projections to the TA results, rather than sum up SA2s to derive the TA projections is adopted because small area projections tend to be more error prone than projections at higher geographies.

8.1 Population Projection assumption

8.1.1 Cohort component method

These population projections are generated using a cohort component method (CCM). To implement the projections using this methodology, DOT Loves Data developed R statistical code based on the methodology of Preston et. al (2006) using a modified version of the statistical code package "CCMP".

The population base used in the projections is the Estimated Resident Population (ERP) count by age and sex at June 2018, which is the latest published Census year. The latest Statistics NZ sub-national population estimates for June 2023, based on the 2018 Census count, can be used to provide an independent test of the first projection period (2018-2023).

A CCM approach projects the future population by first reproducing, then surviving, migrating and 'ageing' the base population in a stepwise manner, separately for males and females in five-year age groups. Each step is repeated for each five-year projection period using assumptions regarding future mortality, migration and fertility.

Births generated for the previous five-year period are assigned to the 'new' 0-4 years age group and each surviving age group is aged five years, i.e. those aged 0-4 years in the preceding period become the new 5-9 years cohort at t+5 years, where t represent the beginning of the projection period. The 'new' oldest age group (85+ years) is produced by summing survivors in the two upper age groups (80-84 years and 85+ years) from the previous five-year period. Migration by age-and sex is then added to the surviving and aged population.

To generate the population projections, four main inputs are required:

- the base population by age and sex
- assumptions regarding fertility rates and age at childbearing for females
- assumptions regarding life expectancy and survivorship by age and sex
- assumptions regarding migration rates by age and sex.

To generate the household and dwelling projections, two additional assumptions are required:

- Average household size (occupied private dwellings / usually resident population)
- Dwelling ratio (total private dwellings / estimated resident population)

Data for generating the base population, fertility and mortality assumptions, average household size and dwelling ratio were sourced from Statistics NZ. Migration assumptions were generated using a residual migration methodology incorporating Statistics NZ population, survivorship and births data. Three assumption variants (high, medium and low) were generated for each assumption type.

8.1.2 Fertility assumptions

Determining the number of births in each five-year period involves assumptions concerning the distribution of births (age at childbearing) and future fertility levels.

The number of births is projected by applying age-specific fertility rates (ASFR) for women in their reproductive years (aged 15-45 years) to the numbers of women at each age. The baseline distribution assumption is the average ASFR for each age group between 2019-2021, calculated at the TA level for Queenstown Lakes District using data published by Statistics NZ (2021a). The resulting number of births for each age-group of women is summed and then apportioned to each sex based on the sex ratio at birth: 105.5 males per 100 females.

While the distribution of births (maternal age-structure) remains constant, total levels of fertility vary over time based on assumed trends in the Total Fertility Rate (TFR). The TFR assumptions used in these projections are the subnational TFR projection assumptions developed by Statistics NZ (2022a) and available at TA and SA2s level for the periods 2023-2048. These are available as high, medium and low variants.

To develop fertility assumptions for the period 2048-2053 we draw on the national TFR assumptions developed by Statistics NZ out to 2078. This involves calculating the ratio of the subnational TFR assumption for each projection and area (SA2 and TA) in 2048 to that of the total New Zealand rate in 2048. This ratio is then applied to the national TFR rates for 2053 and 2053. This process is repeated for each assumption variant. The TFR assumptions are then used to weight the base ASFR rates for each projection period and each variant.

8.1.3 Mortality assumptions

Future patterns of mortality involve assumptions about the level of mortality (life expectancy at birth) and the distribution of deaths across age groups (survivorship by age). The effects of mortality are incorporated into the population projection by:

- Surviving each five-year age group by applying the probability of surviving from one age group to the next, separately by sex.
- Ageing survivors five years.

The probability of surviving from one age group to the next is drawn from subnational 'life tables' published by Statistics NZ (2021b). The most recent data at subnational level, for the periods 2017-2019, 2012-2014, and 2005-2007, indicate that the age-distribution of survivorship for both sexes has remained stable over this period. Deaths are concentrated in the upper ages, with some minor increases in survivorship in these upper age groups over recent years. As a result we use the most recent survivorship data by age and sex at subnational level (2017-2019) as the baseline survivorship assumption.

Minor increases in survivorship evident at older ages will likely continue, but at a decelerating rate, in step with small expected increases in life expectancy. Assumptions about future trends in life expectancy use Statistics NZ's latest published subnational life expectancy assumptions. These assumptions are available by sex for Queenstown Lakes District and their associated SA2s for the period 2023 to 2048 (Statistics NZ, 2022a) as three assumption variants: high, medium and low. National level assumptions have been published to 2073 (Statistics NZ, 2022b).

As for the fertility assumptions, to develop subnational assumptions for each variant for the periods 2048-2053 and 2053-2053, we calculate the ratio of the life expectancy assumption for each area to that of the New Zealand rate in 2048. This ratio is then applied (prorated) to the national rates for 2048 and 2053. These assumptions about future life expectancy are used to weight the baseline age distribution of survivorship over the projection period to generate the three variant assumptions.

8.1.4 Migration assumptions

The effects of migration are applied to the population by estimating age-sex-specific migration rates and applying these to the start population for each migration period.

DOT Loves Data use migration rates, rather than predetermined migration numbers, as this allows the model to generate the total number of migrants at each projection step by applying age- and sex-specific migration rates to the population. This contrasts with predetermining the numbers of migrants and applying these to the population throughout the projection period irrespective of scale and direction of population change. This ensures that migration numbers keep pace with the growth or decline of the population, rather than migrants becoming a larger portion of a declining population or a smaller proportion of a growing population.

As migration is a continuous process, we approximate this by assuming that half of the migrants for each projection period arrive at the start of the interval and are subject to the same fertility and mortality rates as the start population they have joined. The remaining half of migrants are added at the end of the migration period and aged-5 years.

The baseline age-sex profile for migration is drawn from past age-sex specific net migration rates for Queenstown Lakes District and each SA2. Past migration rates were modelled via a 'residual migration methodology' using a standard cohort component technique for the periods 1996-2001, 2001-2006, 2008-2013, 2013-2018 for each TA and SA2. For example, to estimate net migration between 2006 and 2013:

- Estimated Resident Population numbers by age and sex at the 2013 censuses are reproduced and survived to the subsequent census (2023). This results in an 'expected' population in the absence of migration.
- The difference between the expected and the observed populations in 2023 for each age-sex group is used to approximate the net migration age-sex profile.

For Queenstown Lakes district:

- The age profile of migrants is broadly stable across time periods with a large net gain of young adults (typically 15-30 year olds)
- A small-moderate net gain of children under 14 years and older adults (45-65 years)
- Occasional net loss of adults in their 30s
- Some variation in age-specific migration rates is present between time periods. Variation between periods is greatest for young to middle-aged adults
- 2013-2018 saw exceptionally high net migration gain overall, and especially among 20 to ~30 year olds.
- For the last 4-5 census cycles there has been a cyclic alternation between high and very high periods of migration.

The 2013-2018 period saw exceptionally high migration in many parts of New Zealand and especially for QLDC. It is unlikely, however, that migration at this level will continue unabated and recent data from Statistics NZ indicates net migration has reduced substantially from this high. DOT therefore proposes using the average rates for the 5-year periods from 1996-2001, 2001-2006, 2008-2013 as the medium assumption variant. DOT assumes that the period 2013-2018 represents an exception and including it in the baseline assumption skews the rates higher than long-term averages. The high variant captures a net migration scenario closer to that observed between 2013-2018.

Separate rates are generated for each TA and each SA2, with extreme SA2 rates constrained to the mean plus two standard deviations of the historical TA range.

To generate the high and low migration variant assumptions, we adjust the baseline (medium) migration variant to reflect some of the observed variation in net migration. On this basis, we propose adding and subtracting 20% to the rates for each age-sex group respectively to set the high and low projection variants. This approach also ensures consistency across projection variants, i.e. any one age-specific rate will always be lower in the low variant than the equivalent age-specific rate in the medium and high variants.

The available data to 2022 indicates that high net migration, as observed in the recent past for Queenstown Lakes District, is continuing but has reduced from the 2013-2018 high. To reflect this, the baseline rates are adjusted upwards for projections up to 2028.

Cyclic migration assumption

In constructing population projections for the Queenstown-Lakes District (QLDC), a cyclic migration assumption is employed to reflect the historically observed patterns of migration in the region. This approach accounts for the inherent fluctuations in migration, ensuring that the projections remain grounded in past trends. For example, historic estimates of total net migration for QLDC indicates the region experienced alternate periods of high and very high net migration (and an overall increasing trend) over the last 4 or 5 census cycles.

Moreover, although QLDC has very high historical rates of net migration (regardless of high-low cycles) it is unlikely these rates can continue unabated throughout the projection period due to a combination of both local and external constraints on future migration. By incorporating a cyclic migration assumption, the methodology can ground the migration assumptions in past evidence while avoiding the pitfall of extrapolating historically high migration rates into the future. This would result in unrealistic and inflated population growth estimates. In short, migration may be overestimated if migration rates are held constant. This cyclical approach to migration modeling, therefore, enables the projections to be more realistic, nuanced, and representative of the district's demographic dynamics.

The following steps are used to generate the cyclic pattern to migration: - Simulate the historical pattern of cyclic migration by scaling the base migration rate on alternative projection years at a ratio of between 0.5 and 0.7 from 2033 onwards. - Use an adjusted migration rate to 2028 reflecting higher current levels of net migration.

Note that the same migration rates in any two projection periods generate differing numbers of migrants in each period, with migrant numbers increasing as population increases and decreasing as population decreases.

Statistics New Zealand takes a conservative approach and assumes lower levels of net migration throughout the projection period, holding its projected migration numbers constant between 2028-2048, with a period of higher migration between 2023-2028. Their scenario assumes net migration rates becomes a smaller component of population as the population increases over time.

8.2 Visitor assumptions

Projecting visitor numbers is extremely challenging due to the wide-range of global and domestic drivers that influence people's propensity to travel. The visitor forecasts are therefore based on a number of assumptions and represent expected visitor numbers should those assumptions be met and historic patterns of visitor growth continue into the future.

8.2.1 Impacts of the COVID-19 pandemic

Visitor numbers are recovering from the impacts of the COVID-19 pandemic, although they appear to have not yet reached pre-2020 levels. It is unclear how quickly tourism levels will return to the pre-COVID-19 normal. Although recent data suggest a swift recovery, it is possible this represents a short-term effect from the release of pent-up demand within a longer and slower recovery. Both Queenstown and Wānaka show an almost identical pattern of recovery, with a larger share of visitors based in Queenstown. As at June 2023 annual guest nights were about 85% of their June 2019 values and monthly total visitors in January 2023 were 75% of the January 2019 visitors.

Given the impact of COVID-19 on visitor numbers DOT recommends building in variable recovery time-horizons into the projection variants. Under the low projection, we assume tourism does not recover to pre-COVID-19 levels until after 2028, under the medium variant recovery will be achieved by 2026, and under the high projection variant visitor numbers will exceed pre-COVID-19 levels by 2024.

8.2.2 Approach

Due to difficulties in forecast modelling following a structural break in an industry (i.e. the effect of the COVID-19 pandemic on tourism), DOT combines multiple models and assumptions to forecast visitor numbers into the future. The primary model is based on visitors in commercial accommodation and the output adjusted to capture visitors of other types.

Visitors are calculated at the TA level. At the SA2 level, total visitors allocated to SA2s based on their share of commercial accommodation, unoccupied dwellings .

Model 1: Forecast guest nights in commercial accommodation

- A correlation between population and visitor numbers over time was identified.
- Forecast annual guest nights for commercial accommodation using a time-series (ARIMAX) model with resident population as an external driver variable. Future projections are made using projected population as an external predictor variable
- MBIE's Accommodation Data Programme is the underlying data used in the model (MBIE's Monthly Unique Regional Population Estimates (MURPE), is an laternative data source but this data series began in 2019 and is disrupted from covid, although this will improve over time and may become a preferred alternative for modelling in future).

Model 2: Estimate guest nights for other visitor types as a ratio of guest nights in commercial accommodation

- This model is estimated using the last 12 months of MURPE data (where the effects of covid are least pronounced) and using a number of explicit assumptions and data from Airbnb for insight into private rental guest nights relative to commercial guest nights.

1) Calculate guest nights for visitors in private rentals (pGN) using data from Airbnb for the last 12 months and from the 2017 research report on Airbnb for QLDC

- Estimating the number of guest nights in private rentals is derived from past Airbnb research and estimates from recent airbnb listings and calendar data: pGN = pB * pGPU *pSL where B is the number of booked properties, GPU is the average guests per unit and SL is the average stay length. p reflects this related to guest staying in private rental holiday homes.
- Calculate the ratio (PC ratio) of private rental guest nights (pGN) to commercial guest nights (cGN) for all years with available data not severely impacted by Covid-19.
- Take the average of the calculated ratios from 2023 and 2017 as the baseline ratio for the forecasts. This ratio is assumed to remain static across the projection period.

2) Calculate the guest nights of "other" visitors e.g. those not staying in commercial accommodation or a private holiday home, and includes people staying with friends and family, or visiting for the day using MURPE data for the 12 months to July 2023:

- Estimate the number of "other" unique monthly visitors represented in the total MURPE visitor numbers by subtracting estimates of the number of guests in commercial accommodation and guests staying in private rented accommodation from the MURPE total unique visitors estimates.
- Calculate the number of unique visitors in private rental accommodation (pUV) by using estimates of total unit bookings and estimated guest per unit (pB * pGPU). AirBnb bookings are estimated from review counts and a ratio of 0.4 reviews per booking. Average guests per unit is calculated as 0.5*max persons per unit. This assumes half occupancy of a stay unit, on average (mean = 2 people per unit for both RTOs).
- Subtract guests in commercial accommodation and guests staying in private rented accommodation.

3) Convert unique "other" visitors to guest nights

- Assume other visitors have an average stay length (SL) halfway between that of commercial and private accommodation visitors (3 nights)
- Assume an annual growth rate for "other" visitors equal to the average annual growth rate for the projected population (pR).
- Estimate total annual guest nights for baseline year (2023).

Model 3: Tourism recovery adjustments

- As model 1 is built using pre-covid data the results represent forecasts without the effects of covid. To address this we adjust the model based on different recovery scenarios.
- For the low variant projection we assume tourism numbers do no recover until 2028, for the medium variant we assume recovery in 2026 and for the high projection variant we assume tourism returns to "normal" in 2024.

8.2.3 Average and peak day calculations

A peak day is the busiest visitor day of the year and generally occurs over the Christmas/New Year period.

- Average day total visitors = tGNannual / 365.
- Peak day visitors = average day visitors * peak:average day ratio.

The peak to average day ratio is derived from a combination of the MURPE data, accommodation data and historic ratios used in the projections. Past projections have used a ratio of 3 peak day to 1 average day visitors. The MURPE and Accommodation Programme data indicate lower ratios although these are based on differences between high and low months, which may mask some of the more extreme variability between high and low days. The average ratio for unique visitor counts is 1.45 for Queenstown and 1.7 for Wānaka, with maximum ratios of about 1.8 for Wānaka and 1.55 for Queenstown. Similar ratios are evident in the guest night data, with an average of 1.5 for the TA, 1.3 for Queenstown RTO and 2.1 for Wānaka (excluding the 2020 and 2021 years).

The data suggests that 1) a peak to average day ratio of 3 may overestimate the difference between average and peak day visitors and 2) that there is greater average to peak day variability in Wānaka than Queenstown wards.

In calculating the demand for accommodation units it is assumed that on peak days proportionally more visitors stay in non-commercial accommodation, that the average number of guest per stay unit is higher (3 persons rather than 2), and that over time private rentals and holiday homes will accommodate a larger share of the peak day demand.

8.3 Households and Dwellings assumptions

Future numbers of households and dwellings are projected based on the relationship between population numbers and assumptions about average household size and the dwelling ratio respectively. These projections reflect the expected numbers of households and dwellings assuming the assumptions about average household size and dwelling ratio are met.

8.3.1 Household assumptions

Household projections estimate the number of private occupied dwellings based on the ratio of resident population to average household size assumptions.

Past estimates of average household size are derived for each TA and SA2 from past census counts by dividing the Census Usually Resident Population (CURP) by the number of occupied private dwellings on census night (Statistics NZ, 2019), with adjustments for the data quality issues associated with the 2018 Census.

Average household size for Queenstown Lakes District has been declining since the 1990s in line with population ageing. The substantial increase in average household size reported for 2018 therefore appears anomalous. Given the data quality issues associated with the 2018 Census DOT proposes using the 2013 household size as the base assumption for all areas (TAs and SA2s). This results in a baseline average household size of 2.5 for Queenstown Lakes, which is expected to reduce to 2.4 people per household in.

Average household size assumptions for each projection variant over the projection period are then generated by modifying the base assumption in line with the high, medium, and low trends in subnational average household size assumptions (for both TAs and SA2s) published by Statistics NZ (2021b, 2022d) for the period 2018 to 2043. Beyond 2043, average household size is held constant between to 2053.

Projected household numbers for each projection period are then generated by applying the average household size ratio for each area to projected population numbers. The resulting projections represent the number of households required to maintain the projected household size ratio. The estimates in 2023 therefore reflect the expected demand at the start of the projections based on estimated resident population size and assumptions of average household size in 2023, derived from the Census data.

8.3.2 Dwelling assumptions

Dwellings are defined as occupied and unoccupied residential private dwellings in both urban and rural contexts. These are equivalent to the district's 'residential', country dwelling, lifestyle and rural residential dwellings, and multi-use residential dwellings.

Dwelling numbers are projected using the same approach as household numbers, but calculated using a different ratio, i.e., on assumptions about the number of people per dwelling (occupied and unoccupied).

For each TA and SA2, the past ratio of estimated resident population (ERP) to total number of dwellings (hereafter referred to as the dwelling ratio) was calculated for previous Census years 2001-2018. Dwelling count data for TAs and SA2s was sourced from Statistics NZ (2019). As total dwelling counts are considered by Statistics NZ to be of high quality, the 2018 ratio has been used as the base assumption.

Dwelling numbers for each projection variant are projected by applying the dwelling ratio assumption for each area to projected population numbers. Note only minor changes in the dwelling ratio are expected over the projection period and between the three projection variants.

As per the method for average household size, dwelling ratio assumptions for each projection variant were generated by modifying the base assumption according to the patterns indicated by Statistics NZ (2021b, 2022d) for the period 2018-2043 for each TA and SA2. Ratios are held constant between 2043 and 2053.

As the proportion of occupied dwellings to total dwellings has remained stable over time (Figure 13) we can use the trend in average household size to modify the base dwelling ratio over the projection period. Table 8 shows the resulting dwelling ratio assumptions for 2023-2053 for Queenstown Lakes District.

A projected increase in dwelling numbers will signify that additional dwellings will be required to maintain the stated people-to-dwellings ratio, while a decline in numbers signifies fewer dwellings will be required to maintain that ratio (not that there will be fewer dwellings in fact). The differing proportions of occupied and unoccupied dwellings in each geographic area should be considered when interpreting projected dwelling numbers.

8.3.2.1 Dwelling capacity and SA2 projections The district is a high growth region in an area with complex topography and geography. As a result, some SA2 areas are at or are projected to reach housing capacity during the projection period. For the district as a whole, population-based housing demand is not projected to exceed current capacity limits, although it does approach those limits under both the high and medium projection variants. The implication is that should the assumptions about fertility, mortality and migration be met for the district then population growth will either have to be redistributed to SA2s that have more substantial remaining housing capacity or that planning requirements for many SA2s will need to change to accommodate demand. This may have implications for the relative growth of the Wānaka and Whakatipu wards, depending where extra dwelling capacity is realised.

8.4 Rating unit assumptions

A ratings unit is typically a portion of land with a separate certificate of title and is classified based on land use or dwelling type. Historical time series data for ratings units counts by type is not available. As a result, traditional time series models is not be possible and projections are instead generated using historical trends derived from related data sets. The rating unit projections do not incorporate any specific changes to

Baseline rating unit numbers for each type are based on the latest data provided by QLDC. Separate projection trends were developed for each rating unit type.

Rating unit categories are aggregated for projection purposes. The proposed categories for forecasting rating units are:

- Residential Rating units (Households and Dwellings)
- Country Dwelling units (units less than 10 hectares, located in a Rural Zones (some exclusions apply), which are used exclusively for Residential purposes)
- Accommodation units
- Commercial units
- Mixed-use accommodation
- Mixed-use commercial
- Primary Industry
- Other / Vacant / Hydro/ Electric

8.4.1 Residential and country dwelling units

Residential rating units provide an alternative view of housing growth to the dwelling and household projections. Whereas the dwelling and household projection reflect population driven housing demand, the residential rating unit projections have as a starting point the current stock of residential dwelling units and are projected using a time series model of housing growth (from historical building consents data from Statistics NZ) and population growth. The model is generated at the TA level and forecasts the number of new houses. Three forecasts are then generated from the model using the population projection variants,

with projected change in population as an exogenous variable in the model. The model results are then added to the 2023 starting point (current stock) of residential rating units.

The time-series model is also the basis for generating the projected number of country dwelling units. The percentage change between projection periods is calculated from the housing growth model and this growth rate is then applied to the 2023 stock of country dwellings.

The residential and country dwelling projections are then down-scaled to SA2 level by apportioning the share of the TA total in each projection period based on the SA2's 2023 share of TA rating unit total for that rating unit category type.

8.4.2 Accommodation units

Commercial visitor accommodation supply has been slightly affected by the COVID-19 pandemic. Data from MBIE and Statistics NZ indicate a delayed (2022) but relatively minor reduction in the number of commercial accommodation establishments following the pandemic. The reduction in the number of establishments only reduced supply to levels seen in 2018-2019 and the latest data from 2023 indicates accommodation numbers may already be recovering. As a result DOT does not propose any bespoke post COVID-19 recovery assumption scenarios for the projection of commercial accommodation.

DOT used demand-based projections that are derived from projected visitor numbers and recent patterns in the number of visitors per stay-unit. The commercial accommodation projections reflect the number of rating units required to meet projected visitor demand and were calculated as follows:

- Calculate the baseline average number of guests per stay-unit. This value is assumed to remain constant across the projection period.
- Forecast the annual number of visitors (guest nights staying in commercial accommodation) and calculate the peak and average day.
- Divide the projected number of peak day guests staying in commercial accommodation by the 'guests per stay unit' for each projection variant to calculate the required number of stay-units.
- The total demand for accommodation stay units is shared between accommodation and mixed-use accommodation units based on their relative share in 2023, which is assumed to remain constant across the projection period.

8.4.3 Commercial rating units

Forecasting growth in commercial and industrial units combines a supply and demand approach. Projection are based on the historical trend in employment growth and working age population. The projection approach involved:

-A time series model of business growth using Business Demography data from Statistics NZ and projected working age population as an independent predictor variable. -High and low variants models for commercial rating units are generated using the high and low variant projected working age population in the underlying models. -Calculate the average annual growth rate for each projection period in geographic units from this model. -Apply this percent change growth rate to the current baseline number of Commercial and mixed use commercial ratings units.

In this approach we assume

- Business growth is more hampered by available workforce than resident population.
- Employees come from outside the area so the resident population is less relevant.

9 References

Jackson, N & L Braebyn, 2017. 'The mechanisms of subnational population growth and decline in New Zealand 1976-2013, Policy Quarterly 13 Supplementary Issue, pgs 22-36

Jackson, N & MP Cameron, 2018. 'The unavoidable nature of population ageing and the ageing-driven end of growth - an update for New Zealand', Population Ageing, 11: 239. https://doi.org/10.1007/s12062-017-9180-8

Jeram, J, 2014. " Empty Nests, Crowded Houses Building For An Ageing Population", The New Zealand Initiative

Statistics New Zealand, 2022a, Subnational population projection assumptions: 2018(base)–2048 update. Update Dec 2022. Retrieved from http://www.stats.govt.nz

Statistics New Zealand, 2022b, National population projection assumptions, 2022(base)-2073, Jul 2022. Retrieved from http://www.stats.govt.nz

Statistics New Zealand, 2022c, Subnational population projections: 2018(base)–2048 update. Update Dec 2022. Retrieved from http://www.stats.govt.nz

Statistics New Zealand, 2022d, Subnational population estimates (2022 Boundaries). Update June 2022. Retrieved from http://www.stats.govt.nz

Statistics New Zealand, 2021a, Live births by area, regional councils, and age of mother (Annual-Dec), Retrieved from http://www.stats.govt.nz

Statistics New Zealand, 2021b, Subnational period life tables: 2017–2019. Retrieved from http://www.stats.govt.nz

Statistics New Zealand, 2021c, Subnational household projections, by household type, 2018(base)-2043.. Retrieved from http://www.stats.govt.nz