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Queensland Treasury



Queensland Government population projections:

Methodology for local government areas

2011 edition



Queensland Government

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1. Introduction

1.1 Background

Queensland Government population projections for local government areas (LGAs), statistical divisions (SDs) and the state are revised twice every five years, in line with the Australian Bureau of Statistics (ABS) Census of Population and Housing cycle. This 2011 edition of the projections is largely an update of the 2008 edition, utilising similar base data and updated assumptions and taking account of more recent population data and planning and development intelligence.

This paper provides details of the process employed by the Office of Economic and Statistical Research (OESR), during 2010 and early 2011, to arrive at the 2011 edition of Queensland Government population projections for LGAs. Details of the methodology underlying the state projections are given in the report *Queensland Government population projections: methodology, assumptions and scenarios for Queensland, 2011 edition*.

Population projections are estimates of future population levels if assumptions concerning demographic trends were to prevail. Population projections are not forecasts or predictions, as social and economic factors underlying the components of population change may vary over time.

The 2011 population projections for LGAs in Queensland provide a range of population estimates to 2031, reflecting current expert knowledge. While the medium series projections are considered to be the most likely population outcomes, unforeseen circumstances may result in other population futures. The low and high series projections represent the likely lower and upper limits to population growth outcomes throughout the projection years.

1.2 Different methodology for Indigenous local government areas

In recognition of their distinct characteristics, Queensland's 17 LGAs with predominantly Indigenous populations were projected separately. These 17 LGAs (listed in Table 3.1) are referred to as Indigenous LGAs in this report while the remaining 58 LGAs with predominantly non-Indigenous populations are referred to as non-Indigenous LGAs.

The Indigenous LGAs were treated separately because the demographic characteristics of Aboriginal and Torres Strait Islander communities are significantly different to the non-Indigenous population in Queensland. Projections in these areas are complicated by the small populations and a paucity of reliable information (including registrations of births and deaths and other administrative records) on which to base assumptions. The 2011 edition of the Queensland Population Projections is the first to comprehensively include these LGAs.

Information regarding the procedure followed to produce the population projections for the 58 non-Indigenous LGAs is given in Section 2 of this report while details of the projection process for the Indigenous LGAs is provided in Section 3.

2. Non-Indigenous local government areas

2.1 Stakeholder input

Various consultation strategies were conducted to improve the quality of the 2011 population projections. A project advisory group contributed to the state and SD level projections, while a survey of local governments and other regional stakeholders contributed to the LGA projections. Additionally, a number of agencies with knowledge of Indigenous communities and populations were consulted separately.

2.1.1 Local government survey

To assist in determining the distribution of Queensland's projected population growth across SDs, OESR surveyed all Queensland local governments in mid 2010. A web-based survey sought commentary on existing population projections and detailed information related to significant upcoming commercial, industrial and residential projects that could be expected to have an impact on population growth in each LGA. The survey questions were tailored to suit the diverse range of LGAs across the state. A similar survey was also distributed to Queensland Government and non-government agencies in regional Queensland.

The surveys elicited a good response rate from a wide range of LGAs and other stakeholders. Survey data were included in the LGA level population projections on the basis that larger shares of population growth were allocated to those areas in which significant projects are planned to occur.

2.2 Queensland Government projection methodology

The Queensland Government's state and SD level population projections are generated first, to provide target figures with which aggregated LGA projections must agree. Local government area populations are projected separately and constrained to the SD figures. While the state, SD and LGA projections are produced using separate models, the two processes are conducted concurrently and feed into each other throughout.

LGA population projections were prepared using a combination of the following methodologies:

- a ratio share method employed to prepare initial projections of total persons for each LGA; and
- a multi-region cohort component model used to produce projections by age and sex.

LGA projections take into account long-term trends in the primary components of population change (natural increase and migration) and many secondary factors, including the effects of major residential developments and major employment generating projects. The influences of short-term activities or unusual events (such as natural disasters or short-term changes in economic conditions) are not modelled.



Migration input data for all models were drawn from the 2006 Census. As such, modelling was run using the Australian Standard Geographical Classification (ASGC) 2006 and subsequently converted to ASGC 2008 (which reflects the current SD and LGA structure).

2.2.1 Projecting the total population

The low, medium and high series population projections have been prepared using a ratio share model. A similar procedure has been utilised to prepare Queensland Government population projections for more than a decade. The methodology involves estimating each LGA's future population based on its past share of the encompassing SD population and its past share of the SD's growth (or decline).

Calculations are based on the average of a number of time points, weighted to give greater emphasis to more recent observations. A weighted average of the SD population share and SD population change share is used to minimise the possible impact of share volatility in any one year. In general, since share of SD population change tends to fluctuate more dramatically over time, greater emphasis is placed on the share of SD population. If additional information, such as on planned major residential developments, is available it is also incorporated.

2.2.2 Projecting the age and sex profile

A multi-region cohort model was used to prepare the age and sex projections in five-year cohorts and for five-year intervals until 2031 for Queensland's LGAs. The model applies assumptions about three components of population change (fertility, mortality and migration) to a base LGA population (as at 30 June 2006). The total results for each LGA were constrained to those generated by the ratio share method.

A detailed analysis of spatial variations in fertility in Queensland enabled all LGAs to be clustered into one of 28 fertility profiles based on fertility rates by age of mother for the years 2005 to 2008. The assumed age-specific fertility rates for each cluster were trended in line with the assumed age-specific fertility trends for each SD.

The mortality assumptions adopted at the LGA level are based on those adopted for the state and SD projections. However, unlike the state and SD level assumptions, which vary by single year cohorts and by single year intervals until 2056, the LGA projections reflect assumed death rates for five-year cohorts and in five-year intervals until 2031. The SD mortality assumptions were applied to all LGAs within the SD, with some adjustment up or down where the sum of projected LGA deaths did not match closely with SD totals.

Preparation of migration assumptions for each Queensland LGA (or part LGA) involved use of life table survival rate analysis¹ for the periods 1996–2001 and 2001–2006. Age-specific migration profiles for each LGA (or part LGA) were derived by comparing changes in realised population totals with those expected to survive (based on realised births and deaths). Some modification to the profiles was made to better reflect post-censal estimates of population age structure, and to eliminate spurious numbers resulting from the low number of movers in

¹ Shryock, H.S., Siegel, J.S. and associates (1971). *The Methods and Materials of Demography*, US Bureau of Census, Department of Commerce, Washington DC. pp. 452–455, 630–632

smaller LGAs. The rates were also compared with those derived from analysis of 2006 Census data for changes in usual residence from 2001 to 2006.

Finalisation of the projections involved a comprehensive evaluation of the resulting age–sex projections for each LGA (and part LGA). Where necessary, adjustments were made to migration and fertility profiles to account, for example, for anomalies introduced by the cohort (generational) effect of irregular birth, death or migration patterns in particular years or for particular age or sex groups. Analysis of the levels of natural increase and net migration implied by the LGA totals used as constraints for the age–sex projections led to a re-appraisal of those totals for some LGAs. In this way the ratio-share and cohort component methods were used interactively to achieve consistency between the various components of population change at each geographic level.

2.2.3 Low and high series age and sex projections

The preparation of low and high series projections by five-year age groups and sex for LGAs is not made using the same model as for the medium series. Instead, a spreadsheet-based approach is used, to ensure that all projected age–sex groups for every projection year and every LGA are consistently equal to or lower (for the low series) or higher (for the high series) than the corresponding population in the medium series.

The medium series age–sex projection provides the base data. Then, for each LGA, the figures are incremented (for the high series) or decreased (for the low series) by a calculated amount for each year, age group and sex. This amount is based on each LGA's share of the SD population and the difference between the medium series SD projection and the high or low series SD projection for each year, age group and sex.

The results are adjusted to sum simultaneously to the LGA total projection and the SD age–sex projections for that series.



3. Indigenous local government areas

3.1 Background

There are 17 LGAs in Queensland where more than half the usual resident population self-identified as Aboriginal or Torres Strait Islander at the 2006 Census. This section contains a collection of background information relevant to projecting the populations of these 17 LGAs, referred to as Indigenous LGAs in this report.

Current measures indicate that there are distinct differences in birth, death and migration patterns of Aboriginal and Torres Strait Islander people compared with non-Indigenous people. Additionally, there are significant quality issues related to census counts and other demographic data regarding Aboriginal and Torres Strait Islander populations. There is also a lack of time series data on information such as housing growth and major employment projects, to establish their use as indicators of population change in Indigenous LGAs. For these reasons, the methodology used by Queensland Government to project the population for non-Indigenous LGAs cannot be applied to the Indigenous LGAs.

Populations for the Indigenous LGAs ranged from around 260 to 4,700 persons in 2006. It is estimated that in 16 of these areas, Aboriginal or Torres Strait Islander people constituted more than 85 per cent of their usual residents. In total, more than 90 per cent of the population of these LGAs are Indigenous (see Table 3.1).

Table 3.1: Estimated resident population, Indigenous local government areas, Queensland, June 2006

Local government area	Estimated resident population	Estimated Indigenous population	
	number	number	%
Aurukun (S)	1,129	1,064	94.2
Cherbourg (S)	1,225	1,195	97.6
Doomadgee (S)	1,170	1,100	94.0
Hope Vale (S)	842	792	94.1
Kowanyama (S)	1,101	1,036	94.1
Lockhart River (S)	599	543	90.7
Mapoon (S)	256	223	87.1
Mornington (S)	1,121	1,035	92.3
Napranum (S)	908	856	94.3
Northern Peninsula Area (R)	2,138	1,950	91.2
Palm Island (S)	2,145	2,073	96.6
Pormpuraaw (S)	644	577	89.6
Torres (S)	3,496	2,596	74.3
Torres Strait Island (R)	4,713	4,343	92.1
Woorabinda (S)	918	871	94.9
Wujal Wujal (S)	348	329	94.5
Yarrabah (S)	2,558	2,505	97.9
Total	25,311	23,088	91.2

(R) Regional council (S) Shire council

Source: ABS 3218.0, *Regional Population Growth, Australia, 2010*; and OESR synthetic population estimates by Indigenous status, statistical local area

3.2 Stakeholder input

Wide consultation with stakeholders was used to gain information regarding the current and anticipated future populations of the Indigenous LGAs and possible methods of projecting their populations.

In mid 2010, OESR surveyed all Queensland LGAs, including the Indigenous LGAs, plus a number of Queensland Government and non-government agencies in regional Queensland. Information was sought regarding upcoming significant projects which could potentially affect future population numbers (refer to section 2.1.1).

In addition, OESR consulted specifically with representatives from the following organisations regarding the projections for the predominantly Indigenous LGAs:

- OESR Indigenous Statistics Unit
- Queensland Department of Health, Health Systems Strategy Branch, Aboriginal and Torres Strait Islander Health Unit
- Queensland Centre for Population Research (QCPR)
- Centre for Aboriginal Economic Policy Research (CAEPR)
- Queensland Department of Communities (Aboriginal and Torres Strait Islander Partnerships).

Further, a workshop on projecting Indigenous populations in Queensland was conducted with interested stakeholders in Cairns in late September 2010. Representatives from the following state and federal departments and organisations attended and contributed to shaping the preliminary projections:

- Aboriginal and Torres Strait Islander Partnerships
- Commonwealth Department of Families and Housing, Community Services and Indigenous Affairs (Indigenous Coordination Centre)
- Department of Communities (including the Indigenous Housing and Homelessness Program)
- Department of Education and Training
- Department of Employment, Economic Development and Innovation
- Department of Local Government and Planning
- Department of Public Works/Q Build/Indigenous Works
- Family Responsibilities Commission
- James Cook University
- Queensland Health (including Cairns Public Health Unit)
- Queensland Police Service
- Wet Tropics Management Authority.

3.3 Queensland Government projection methodology

Projecting the population in Indigenous LGAs combines the problems associated with undertaking projections for small areas with those pertaining to projecting the population for discrete Indigenous communities. Difficulties in producing projections for small areas involve excessive volatility in both the base population and in measures of the components of population change – migration, births and deaths. To some extent these can be addressed by



adopting assumptions derived from analysis of larger areas. However, for Indigenous LGAs, the assumptions that would be used to project the Indigenous population at a state and regional level are themselves difficult to formulate due to a lack of reliable data. This problem is not limited to Queensland – similar problems are experienced at the Australian level and in other countries where projections of indigenous communities have been attempted.

The 2011 edition of the Queensland Government population projections is the first to include all the Indigenous LGAs. The methodology used to project their populations is regarded by OESR as experimental. OESR welcomes feedback on these projections and intends to work toward improving the methodology, assumptions and data used for future projections of Indigenous LGAs.

3.3.1 Projecting the total population

The approach undertaken to project the total populations of the Indigenous LGAs was to develop three series of initial projections for each LGA, then to compare and consolidate them, and then provide them in draft form to persons with relevant knowledge and expertise for comment.

Method A

The first set of draft projections was produced by simple extrapolation of the population change that is indicated by ABS estimated resident population (ERP) figures since 2001. This series was unconstrained by projections at higher levels of geography, so it could potentially produce improbable outcomes. However, this series was a useful indicator of relative change based on current trends.

Method B

The second set of draft projections was produced by extrapolation of the share of population change at SD level that is indicated by ERPs since 2001. This series was unconstrained to a degree (as the shares were unconstrained), although the projected populations were limited by the SD projections.

Method C

A third set of draft projections was produced based on the regional projections by the Centre for Aboriginal Economic Policy Research (CAEPR) (see <http://caepr.anu.edu.au/system/files/Publications/WP/CAEPRWP56.pdf>). The rate of growth in the Indigenous population in the respective Indigenous Region, from the CAEPR projections, was applied to each Indigenous statistical local area (SLA). This series was unconstrained by the SD projections so it could potentially produce improbable outcomes. However, this series was a useful indicator of potential outcomes in each LGA based on expert views about the expected growth in the Indigenous population. The CAEPR projections were chosen rather than the ABS projections (see Australian Bureau of Statistics, *Experimental Estimates and Projections, Aboriginal and Torres Strait Islander Australians, 1991 to 2021*, cat. no. 3238.0, 2009) because of concerns about the large net migration losses assumed for Mount Isa and Torres Strait in the ABS projections.

Consultation with the stakeholders listed in Section 3.2 was used to refine the projections, by applying adjustment factors to the projected growth implied by Method C. Finally, additional minor adjustments were made to ensure the figures fitted within the overall program of LGA projections for Queensland and the constraints imposed by the broader projection series.

For most of the Indigenous LGAs, the final medium series projection lies between that produced by the CAEPR-based growth rates (Method C) and those resulting from historical trends (an average of methods A and B). The low and high series projections were subsequently produced, to represent the minimum and maximum future population levels that are considered likely. The difference between the low and high series is an indication of the uncertainty of the medium series projection results.

Note that only the growth rates for total persons were derived from the process described above. The specific fertility and mortality assumptions from the CAEPR projections were not used in the Queensland Government projections for Indigenous LGAs.

3.3.2 Projecting the age and sex profile

All Indigenous LGAs combined

In order to prepare projections by age and sex for each Indigenous LGA, a projection was first made for the combined population of all of the Indigenous LGAs. Age-specific fertility rates, survival rates and migration rates were needed for the combined LGAs.

Fertility rates were calculated from birth counts for the years 2005–2009 from the Queensland Health Perinatal Data Collection (QHPDC), coded by mother's place of usual residence. Registered births data were also available but not used, one reason being the more volatile nature of birth registration numbers in these communities. The most recent registrations data included a significant number of registrations of births that actually occurred in previous years, indicating an undercount in previous registrations data. A comparison of perinatal data and birth registrations to both school enrolments and ERP by age indicated perinatal data were a plausible data source. Fertility rates for the combined Indigenous LGAs calculated using perinatal data were about 50 per cent higher than those calculated using registered Indigenous births.

Mortality assumptions were based on age-specific survival rates calculated using the Queensland Indigenous life tables developed by the ABS². Life expectancy of Aboriginal and Torres Strait Islander people is lower than that for non-Indigenous Queenslanders.

These two data sets were also used to calculate an aggregate age–sex net migration profile, by comparing the 2006 ERP estimates by age and sex with those for 2001, allowing for ageing, births and deaths.

The fertility, mortality and net migration age–sex profiles were all assumed constant through to 2031. For each projection year, the projected population, by age and sex, was forced to sum to the total projected population of all the Indigenous LGAs combined.

The projected age structure within the Indigenous LGAs was calculated using a statewide mortality profile. This may underestimate mortality in the remote areas as chronic disease tends to increase with remoteness. However, it is the best measure of Indigenous mortality available. On the other hand, mortality could have been overestimated by the projection methodology of keeping the mortality profile constant for all years to 2031, which contrasts to the assumption of increasing life expectancies in Queensland generally. In addition, there is a

² Australian Bureau of Statistics, *Experimental Life Tables for Aboriginal and Torres Strait Islander Australians, 2005–2007*, cat. no. 3302.0.55.003, 2009



small proportion of the population within these LGAs that is non-Indigenous, so the use of Indigenous life expectancies for their total population tends to overestimate total mortality rates.

In remote areas where services do not exist to support an ageing population, elderly citizens may have to move to urban centres to access health care services. As the population ages and the number of elderly increases, it is uncertain if future migration rates for the age group 65 years or more will continue to be similar to current trends. Should out-migration from remote Indigenous LGAs increase, the current projections may be too high. This situation applies to all remotely located LGAs, whether the population is predominantly Indigenous or non-Indigenous.

Individual Indigenous LGAs

For the individual Indigenous LGAs, initial projections of age and sex were made by applying the same fertility, mortality and net migration profiles used for the combined Indigenous LGA population projection described above. Consideration was given to the use of LGA-specific fertility profiles, but the data on births by age of mother for individual LGAs proved to be too volatile for this purpose.

The projected population by age and sex for each LGA was then forced to sum to the total population projected for that LGA in each projection year. In addition, the projected populations by age and sex for each LGA were adjusted so that, across all Indigenous LGAs, each age–sex group summed to the respective projection for the combined Indigenous LGAs.

The resulting age–sex projection profiles were then compared with the 2001 and 2006 age–sex profiles for each LGA. In some LGAs there were distinct age–sex population profiles in 2001 and 2006, resulting from outflows of persons of school age, and returns after the completion of schooling. In these cases the net migration profile was adjusted to better reflect this distinctive pattern. The age–sex projections for all Indigenous LGAs were then re-run with the same constraints as before.

3.3.3 Low and high series age and sex projections

To gain the low and high age and sex series for the Indigenous LGAs the same methodology is used as for non-Indigenous LGAs (see Section 2.2.3), except that instead of constraining to the low or high SD projections, they are constrained to a low or high age–sex projection calculated for the combined Indigenous LGAs. This approach is similar to that taken for the medium series age–sex projections for Indigenous LGAs.

For the medium series combined Indigenous LGA age–sex projection, it was assumed that fertility and mortality would remain constant. No specific assumptions were made about overseas and interstate migration, as only a net migration age–sex profile was used. To develop low and high age–sex projections for combined Indigenous LGAs, the same mortality profile was used, but fertility rates were assumed to decrease (low series) or increase (high series) by 5 per cent over the period 2006–2031. Any remaining differences between the series were assumed to be due to lower and higher migration rates.

3.4 Overseas experience with projecting Indigenous populations

In several overseas countries, projections of population by race and/or ethnicity are made at a range of geographical levels. These include population projections by age, sex, race and Hispanic origin produced by the United States Census Bureau (see <http://www.census.gov/population/www/projections/>).

In the United Kingdom, the Greater London Authority makes regular projections of the population in 10 ethnic groups for boroughs of London. The most recent series of these data, released in August 2009, makes projections to 2031 based on the 2001 Census (see <http://www.lho.org.uk/Download/Public/15148/1/DMAG%20Briefing%202009-08%20R2008%20Low%20Ethnic%20Group%20Population%20Projections.pdf>).

Statistics New Zealand makes population projections for four ethnic groups: European, Maori, Pacific and Asian (see http://www.stats.govt.nz/browse_for_stats/population/estimates_and_projections/national-ethnic-population-projections-info-releases.aspx).

Queensland Government Population Projections, 2011 edition

Projection results

- Queensland Government population projections to 2056: Queensland and statistical divisions, 2011 edition
- Queensland Government population projections to 2031: local government areas, 2011 edition

Background papers

- Queensland Government population projections: methodology, assumptions and scenarios for Queensland, 2011 edition
- Queensland Government population projections: methodology for local government areas, 2011 edition
- Queensland Government population projections: background research, 2011 edition

The population projections reports and data tables can be found at the Office of Economic and Statistical Research website: www.oesr.qld.gov.au/population-projections.