

# Measuring Housing Demand in Hawaii, 2015-2025



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### EXECUTIVE SUMMARY

The goal of this report is to quantify long-range housing demand in Hawaii for the 2015-2025 period. Housing demand projections in this report are designed to show how long-run sustainable demand for housing will develop in Hawaii over the ten year period.

The model presented in this study projects housing demand for the period of 2015 to 2025 using the variables of projected population growth, visitor growth, and vacancy rates. It is important to note that Hawaii's housing supply is not included in this study. Housing supply is impacted by factors including the supply of land available for development, financing for residential projects, and the permitting process, which are outside of the model used in this study. A complete analysis of Hawaii's housing market should take into account the housing shortage or surplus prior to 2015, in addition to our housing demand projection.

Assumptions for the two main components that influence demand for new housing include the following:

- 1. The number of new households that will be formed in the state how many more people will need places to live in the state by 2025; and,
- 2. The number of vacant housing units in the state and the rate of change how many additional housing units will be needed to support a healthy market turnover.

Our projections for housing demand are based on the current economic and demographic trends and assumptions about how these trends will drive demand for new housing units. The forecast projects demand for an additional 64,700 to 66,000 housing units, during the 2015-2025 period.

In looking at the counties, prior research has found that the population of the neighbor islands is projected to grow significantly faster than that of Honolulu. This affects household formation, which is central to assessing housing demand. By 2025, Hawaii County's population will grow by 29 percent, Maui County's by 25 percent, and Kauai County will grow by 19 percent. In contrast to strong growth for the neighbor islands, the population in Honolulu County is projected to grow by only 8 percent.

The forecasted demand for additional housing units by county is 25,847 units for Honolulu, 19,610 for Hawaii, 13,949 for Maui, and 5,287 for Kauai during the 2015-2025 period.

The continued decline in the number of younger households will also influence housing demand. The number of older households is expected to continue increasing, as life expectancy increases in the state on average. These demographic trends will affect demand and choice of housing.

#### I. Introduction

The housing sector in Hawaii has been undergoing a transition and rebalancing following the Great Recession of 2008. It has been able to bounce back from the recession, even though the supply of new housing units has remained constrained. Prices reached all-time highs in 2014, although the number of the housing units offered for sale is still well below the 2005 peak.

As economic recovery takes hold both in Hawaii and the nation, it is important to investigate what drives demand for housing and how this will impact the future housing market. The projections in this report are based on assumptions regarding household growth, composition, and geographic distribution in the state (based on DBEDT's Long Range Forecasts<sup>1</sup>). The size and age of households are also important for the housing demand forecast.

The methodology for measuring demand for housing in Hawaii is built on two basic elements. *The first element assesses housing growth and how it accommodates household growth, which is the primary driver of housing demand.* Among the other drivers of housing demand discussed in this report are the following: total population growth, changes in the number of military personnel in the state, migration from other states and immigration from abroad. In addition to these factors, other issues, specific to Hawaii, are analyzed, such as number of visitors and foreign investment in real estate.

*The second element of the methodology analyzes demand for vacant housing units*. This measure of demand quantifies the need for additional second homes and vacant units for rent or sale that accommodate the normal turnover of a larger housing stock. The forecast includes future demand for second homes and homes for occasional use, along with normal demand for vacant homes needed for a healthy market turnover. This analysis looks at how the vacant housing segment is impacted by changes in the age distribution of the population.

In addition to housing demand, housing supply issues are also examined, including their impact on market equilibrium. The housing supply issues analyzed in this report are building permit data, housing prices, and changes in housing inventory.

The main objective of this report is to measure future housing demand in the state and in the counties based on historic and current trends in the housing sector. In order to quantify future housing demand, this report largely uses the methodology described by Belsky<sup>2</sup> and Berson<sup>3</sup>. These studies provide quantitative guidance and methodology for using current data to forecast future housing demand. Other studies that were used to frame this report include DBEDT's

<sup>&</sup>lt;sup>1</sup> DBEDT 2040 Series Report, <u>http://dbedt.hawaii.gov/economic/economic-forecast/2040-long-range-forecast</u>

<sup>&</sup>lt;sup>2</sup> Eric S. Belsky, Bogardus Drew, R., McCue, D. "Projecting the Underlying Demand for New Housing Units: Inferences from the Past, Assumptions about the Future", Joint Center for Housing Studies, Harvard University, November 2007 (W07-7).

<sup>&</sup>lt;sup>3</sup> David Berson, Lereah, D., Merski, P., Nothaft, F., Seiders, D. "America's Home Forecast: The Next Decade for Housing and Mortgage Finance", The Homeownership Alliance, 2003

recent report on Kakaako<sup>4</sup> and the *Hawaii Housing Planning Study*, 2011<sup>5</sup>. Both of these reports provide an overview of the housing sector, especially regarding housing supply constraints.

At the national level, Scopelliti examined housing within the context of consumer expenditures, residential construction employment, housing-related industries, and prices for household items and commodities<sup>6</sup>. This study looks at the impact of these factors before, during, and after the recession.

Finally, important generational issues, which affect demand for housing are discussed in "Ageing and Asset Prices." The author examines how population ageing affects asset prices and concludes that ageing will lower house prices substantially over the next forty years, both internationally and in the United States. This is based on the assumption that, as older households downsize, there will not be sufficient demand from younger households to replace them. The author points out that the lack of demand from the younger segment is due to a lower number of younger households coupled with the fact that these households tend to be smaller in size<sup>7</sup>. On the other hand, another study asserts that a certain section of housing will actually grow because of ageing, as older affluent buyers demand second homes and recreational property. This is based on an analysis of the net worth of older individuals, who tend to be wealthier and more mobile than previous generations.<sup>8</sup>

In addition to the introduction and conclusions, this report consists of three major parts. Section II analyzes the current status of the housing sector in Hawaii, focusing on factors that affect supply and demand. It analyzes housing demand drivers in Hawaii based on historic trends.

Section III presents the forecasts for the demand in the housing sector based on the number of households in the state by 2025. The methodology in this section is based on approaches described by Belsky and Berson.

Section IV discusses detailed projections for each of Hawaii's counties. The projections for counties follow the same pattern as for the state and use the same methodology.

<sup>&</sup>lt;sup>4</sup> Kakaako, Urban Core Living, DBEDT, June 2014

<sup>&</sup>lt;sup>5</sup> Hawaii Housing Planning Study, 2011, SMS Research for Hawaii Housing Finance and Development Corp., Nov 2011

<sup>&</sup>lt;sup>6</sup> Housing: Before, During and After the Great Recession, D. Scopelliti, US Bureau of Labor Statistics, 9/2014

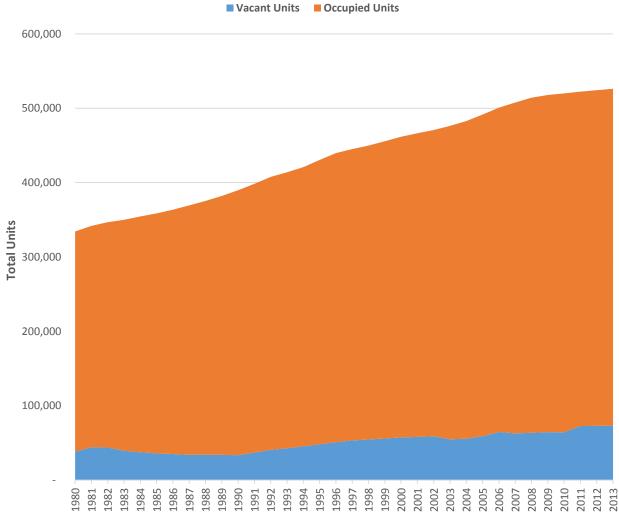
<sup>&</sup>lt;sup>7</sup> Ageing and Asset Prices, E. Takats, BIS Working Paper No. 318, 8/2010

<sup>&</sup>lt;sup>8</sup> Changes in US Family Finances from 2010 to 2013: Evidence from the Survey of Consumer Finances, J. Bricker at al, US Federal Reserve Board of Governors, Federal Reserve Bulletin, 9/2014, Vol. 100, No.4

### II. Current Status of the Housing Sector in Hawaii

This section analyzes the current environment and recent developments for housing supply and demand.

As the economy recovered from the recession between 2009 and 2013, the housing supply expanded at a slower pace than historic trends. In the 1980s, the available housing inventory expanded by an average of just under 6,000 units per year. In the 1990s, it increased to nearly 7,000 units per year. It remained at about this level in the years prior to the recession (expanding by about 6,500 units per year between 2000 and 2008). However, even though housing prices recovered after the recession, the supply of additional housing units has been low, at only about 2,400 units per year between 2009 and 2013. Figure 2.1 shows the increase in housing stock in Hawaii between 1980 and 2013.



#### Figure 2.1: Housing Stock in Hawaii, 1980 – 2013

Source: State of Hawaii Databook

#### **General Housing Demand and Supply Dynamics**

In order to understand Hawaii's housing situation, the increase in Hawaii's housing stock needs to be compared with the population increase over time. The figure below highlights the expansion of housing supply in the late 1980s and early 2000s, compared with annual population growth. The graph shows an increasing gap between annual population growth and housing supply growth. The result of this increasing gap has been continued housing price increases, leading to an unbalanced market.

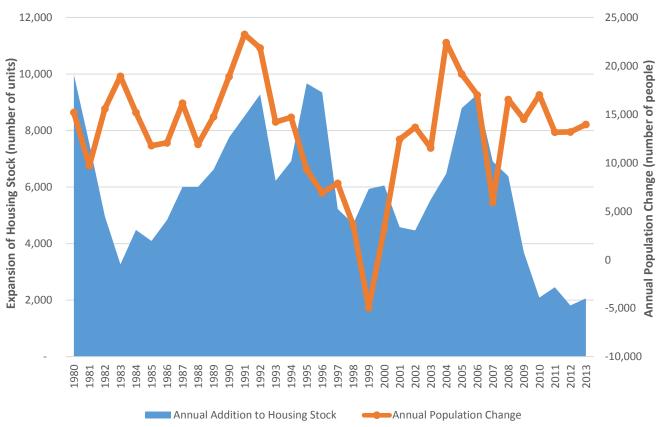


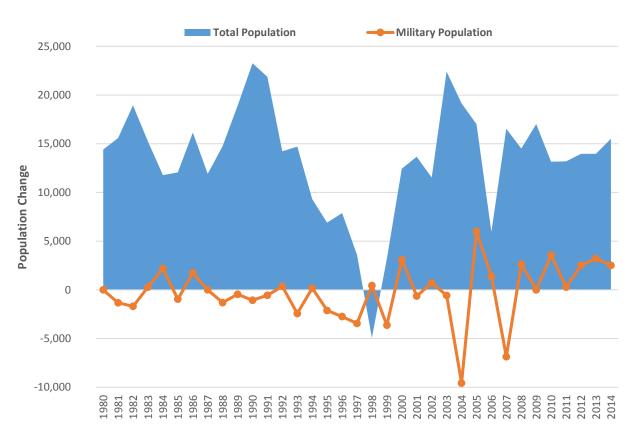
Figure 2.2: Annual Increase in Housing Units and Population Change in Hawaii, 1980 – 2013

Source: US Census Bureau (American Community Survey)

During the second half of the 1990s, Hawaii's population grew at a slower rate than during the first half, increasing at just 0.35 percent per year on average between 1995 and 2000 (the state's population actually decreased by about 5,000 people in 1998). One of the reasons for the slower population growth was an economic slowdown. In addition, there was a decline in housing prices, after foreign investors reduced their investments in the Hawaii economy (especially after the recession in Japan in 1990s). The investment withdrawal had a direct impact on the housing sector and the number of units sold decreased (see Figure 2.8).

In addition to population growth, other demand drivers include the military presence, domestic migration and immigration from abroad, and foreign investment in real estate in Hawaii.

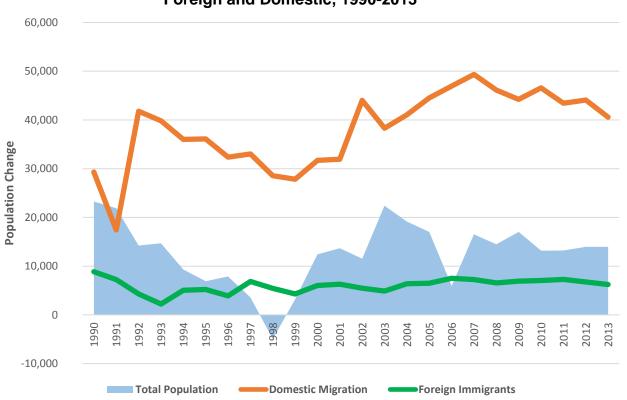
Figure 2.3 analyzes the **change in the number of the military personnel** in the state, compared with the annual change in the state's total population. After continued decreases in the 1980s, 1990s, and in the mid-2000s, the state has experienced a more sustained inflow of military personnel after 2009. This is partially due to the federal shift in military policy – the administration's so-called "pivot to Asia".





**Migration** (more precisely, intended residents to Hawaii) is one of the most important contributors to the state's population growth, with an influx of people from other states and abroad. Figure 2.4 shows that the number of foreigners who intend to become permanent residents in Hawaii has been steady, increasing from 5,400 people per year on average in the 1990s to about 6,600 people per year over the past decade. However, domestic intended residents in Hawaii had a stronger increase, from about 32,000 people per year in the 1990s to above 43,000 per year on average since 2002. After reaching a high of over 49,000 people in 2007, the number of new residents from the mainland has been decreasing, although it is still above 40,000 people per year. The reason for the relatively low overall population growth in Hawaii is the high number of residents leaving the state, in spite of the high numbers of domestic intended residents. However, accurate data on the number of people leaving the state for permanent residence in other states is not available before 2006.

Source: State of Hawaii Databook





Source: State of Hawaii Databook

Another important driver of housing demand is the increase in the number of residential rental units being used as vacation rentals. The number of visitors to the state has increased faster than the number of additional hotel rooms. Hotel rates have been increasing and hotel vacancies are low. There is evidence that local residential housing units are increasingly catering to visitors, either full or part time. Since the number of hotels and resort developments have largely plateaued, there is potential for an additional income stream for residential property owners. According to the Hawaii Tourism Authority, "...the popularity and demand for alternative accommodations have grown rapidly over the years. If all of the identified units were available for visitor use at the same time, these units would account for up to 25 percent of Hawaii's total lodging inventory. In comparison, hotel units make up approximately 50 percent of visitor accommodations mix, condo-hotels represent 12.0 percent and timeshares at 12.1 percent. The estimate for total lodging units available statewide is 88,041."<sup>9</sup> In spite of a sharp increase in the average number of visitors per day, supply has remained fairly flat. (Figure 2.5)

<sup>&</sup>lt;sup>9</sup> Hawaii Tourism Authority, "HTA releases study on vacation rental units across the Hawaiian Islands", December 2014

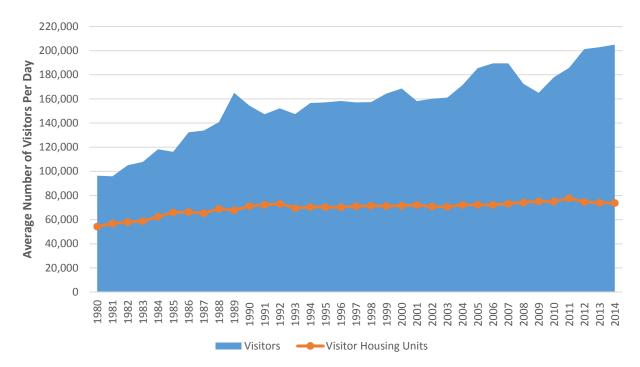


Figure 2.5: Visitors in Hawaii and Change in Visitor Housing Inventory, 1980-2014

Source: State of Hawaii Databook and Hawaii Tourism Authority (2014 Visitor Plant Inventory)

Foreign buyers are yet another source of increased demand for housing in the local real estate market. This data is difficult to track because fair housing laws make it almost impossible to accurately identify a buyer's nationality. There is no comprehensive data on either the amounts spent or what proportion of properties that were purchased by foreigners. In addition, often the buyer's identity may be concealed since many of the most expensive properties are purchased and sold through middlemen and limited liability companies. However, the National Association of Realtors estimates that foreign buyers of properties in Hawaii accounted for 3.6 percent of all homes sold in 2012. Furthermore, in 2013, Hawaii properties were the second most popular for the Japanese buyers and the fourth most popular for the Canadian buyers<sup>10</sup>. It is important to note that Canadians purchase the largest amount of real estate of all foreigners. This increased demand from foreign buyers exerts additional price pressures on the housing sector, since often foreign buyers are not income-constrained and, in many cases, buy properties with cash.

<sup>&</sup>lt;sup>10</sup> National Association of Realtors, <u>http://www.realtor.org/sites/default/files/2013-profile-of-international-home-buying-activity-2013-06.pdf</u>

#### Real Estate Market Conditions – Measures of Demand and Supply

Historically, the homeownership rate in Hawaii has increased from approximately 50 percent in 1986 to above 60 percent between 2004 and 2007. As a result of the recession, the homeownership rate in Hawaii fell to about 55 percent in 2011. However, as the economy has recovered, the home ownership rate has been increasing (Figure 2.6).

After the Great Recession, there was a temporary shift from owning to renting that was caused by a variety of factors. First, stricter mortgage lending and down payment requirements made it difficult for first time buyers to purchase a home. Second, job losses during the recession kept buyers away from the market. Third, as the economy recovered, home prices increased at a rapid pace pricing many potential home buyers out of the market. This in turn resulted in sustained rental price increases. While home ownership rates have recently increased, they are still below the pre-recession level.

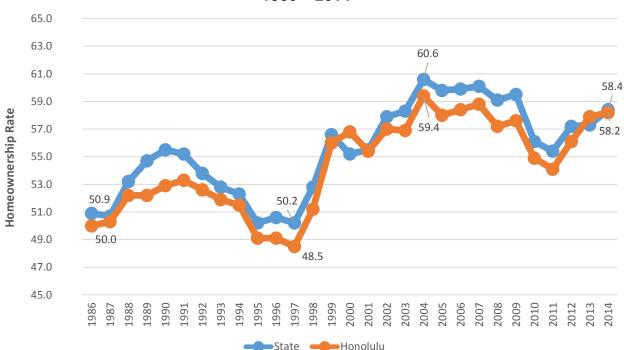


Figure 2.6: Homeownership Rate for the State and Honolulu 1986 – 2014

Source: State of Hawaii Databook

**Demand Side Measures – Prices and Number of Units Sold.** Among all Hawaii counties, Honolulu County accounts for a majority of real estate sales. According to the Honolulu Board of Realtors, over the past 20 years, the number of available units for sale in the Honolulu Metro Area increased by 3.5 percent on average per year. However, during the past five years (2009 – 2013), the average increase was 4.4 percent per year, almost a full percentage point higher than the 20 year average. During the period analyzed, 1996 was the slowest year in the real estate market in Honolulu County, while 2004 and 2005 marked all-time record numbers of single family homes and condominiums sold. The growth in the number of units sold, between the bottom of the market in 1996 and the peak in 2005, was 269 percent for single family homes and 402 percent for condominiums. Honolulu County's housing market cooled off during the Great Recession, as elsewhere in the United States. However, beginning in 2010, the market has started a sustained and broad recovery.

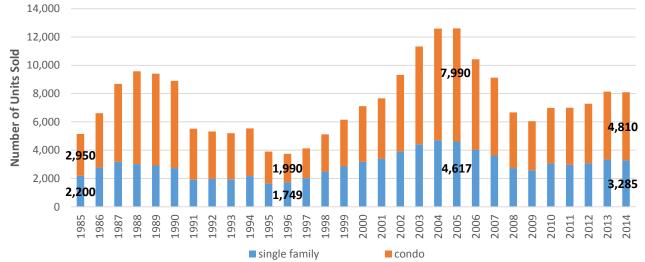


Figure 2.7: Number of Real Estate Units Sold per Year in Honolulu County 1985-2014

Because of constrained supply and increased demand in the Honolulu metro area, housing prices reached an all-time high in 2014, surpassing the previous record set in 2005. However, in contrast to the previous housing peaks, the number of units for sale in 2014 has not matched the previous highs of 2004 and 2005, when both the number of units for sale and prices were at record highs<sup>11</sup>. Wages and incomes have not been growing as fast as housing prices, making it harder to afford real estate in Hawaii, especially for younger and lower-income households.

As the charts below indicate, real estate prices in Honolulu County have been increasing at a rapid pace since 2010.

Source: Honolulu Board of Realtors

<sup>&</sup>lt;sup>11</sup> Honolulu Board of Realtors, <u>http://www.hicentral.com/</u>

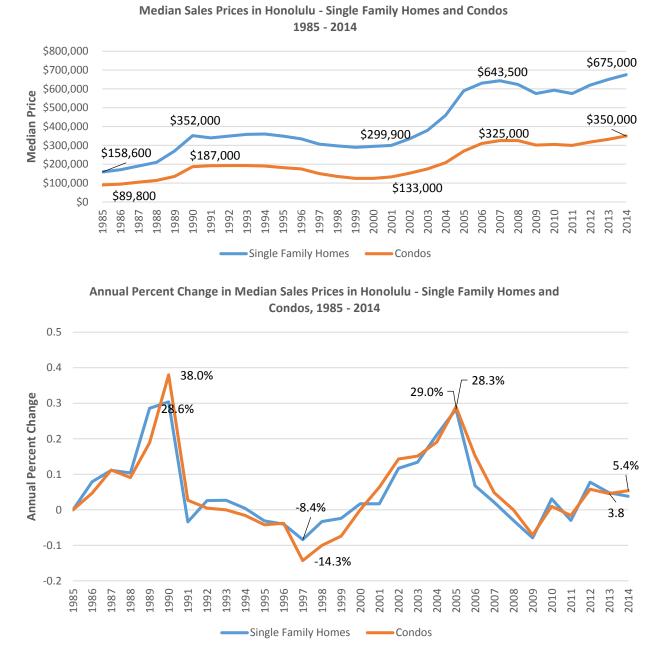


Figure 2.8: Median Sales Price and Annual Percent Change in Median Sales Price in Honolulu County, 1985 – 2014

Source: Honolulu Board of Realtors

#### Supply Side Measures – Housing Starts as a Predictor of the Future Housing Market.

During the recovery period, the value of total building permits increased, while the number of building permits increased and then slightly decreased. This is partially due to the fact that residential construction has not been expanding as fast as housing demand after the Great Recession, pushing prices up to record highs.

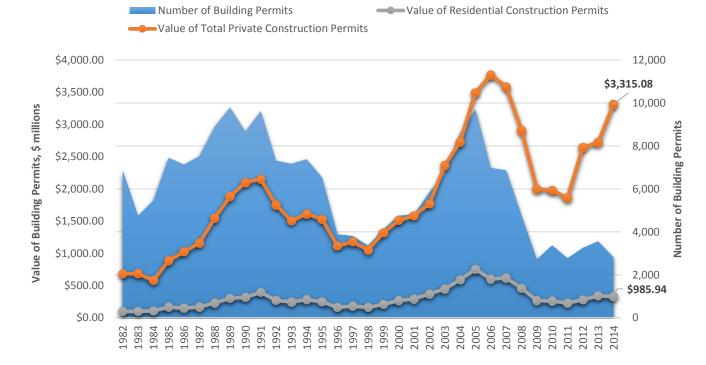


Figure 2.9: Total Number and Value of Building Permits in Hawaii, 1982 - 2014

Source: County Building Departments

The permit data for residential construction by itself is not as encouraging as total building permits (Figures 2.10 and 2.11). There has not been a sustained increase in private residential construction, which is required to increase the housing supply. Given current prices and demand, there is considerable potential for growth in residential construction. However, supply side constraints could mitigate this growth.

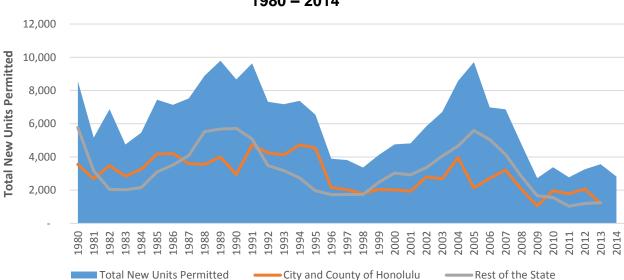


Figure 2.10: Private Residential Construction – Total New Units Permitted, 1980 – 2014

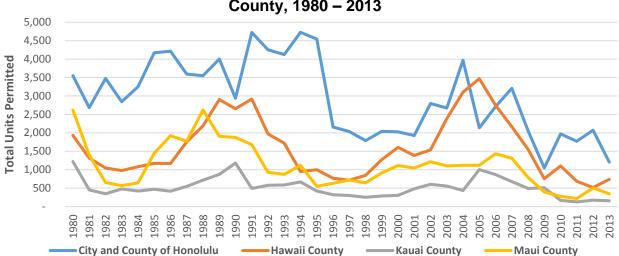
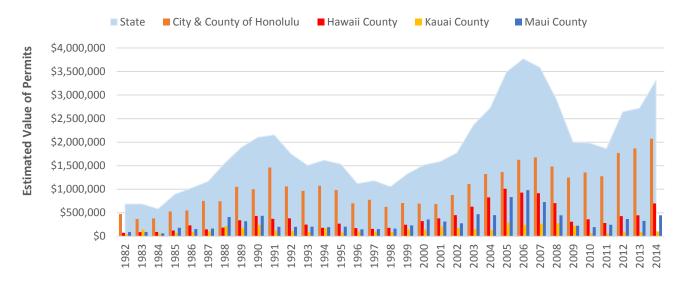


Figure 2.11: Private Residential Construction – Total New Units Permitted by County, 1980 – 2013

Source: County Building Departments

The graph below analyzes the estimated value of private building construction permits in Hawaii, comparing Honolulu to the neighbor islands. Private building construction has been slow to take off after the Great Recession, especially in the harder hit Maui and Hawaii Counties.





Source: County Building Departments

*In summary*, due to continued population growth, Hawaii's current housing market is unbalanced. This arises from constrained housing supply on the one hand coupled with increasing demand from population growth on the other. If supply trails demand, the market responds with price increases. Housing prices reached record highs in 2014, surpassing previous records set in 2005 and this has led to decreased affordability for Hawaii residents.

### III. Measuring Future Housing Demand

This section presents methods and projections for Hawaii housing demand over the next decade.

The population of Hawaii has been increasing at about 1 percent per year since 2000, with households forming at a somewhat slower rate of around 0.8 percent per year on average.

The projected long-run demand for a total of about 64,700 new housing units in Hawaii is based largely on assumed increase in the number of households by the year 2025. This forecast depends on changes in social and economic factors, expected migration and immigration, and expected changes in the size and age distribution of the adult population.

### The components underlying the housing demand projections are the projected net household growth and the demand for vacant housing.

**1. Additional Housing Units Needed to Accommodate Household Growth.** The first component of housing demand – net household growth – is the largest of the three components. As the number of households increase, additional units are needed to house them. Household growth is the total number of new households minus the number of households dissolved (broken up or eliminated) over a period of time. Households form for various reasons including young adults moving away from home, divorces which split existing households and new migrants setting up residence. Reductions in the number of households occur as households dissolve due to death or family members being placed into institutional care. Some other examples of household dissolution are when residents migrate to another state or out of the country. The number of households can also decline when households merge due to financial and/or family circumstances. For example, when adult children move back home with their parents or when elderly adults move in with their adult children.

*Household growth is not the same as population growth*, even though the two are correlated. The number of households increases when population increases, but not always at the same rate. It is not the increase in the overall population, but the increase and changes in the composition of the adult population, which drives changes in the number of households. Households are crucial for projecting housing demand, because it is households that are the primary driver for housing demand. Population overall may continue to increase due to higher birth rates and lower mortality, but that increase has a smaller impact on housing demand than household growth. The household growth forecast is based on the actual recorded change in the number of households over the past 10 years, 2003-2013, when the number of households increased by an annual average of 0.73 percent over the ten-year period. Applying this growth rate results in a total additional 53,500 new households in Hawaii by 2025.

Figure 3.1 shows ten-year changes in household growth in Hawaii between 1980 and 2013. The trend shows a slowdown in household formation, especially in the most recent periods (2002-2012 and 2003-2013). For additional information and details and population and households, see Appendix A, Tables A1 and A2.

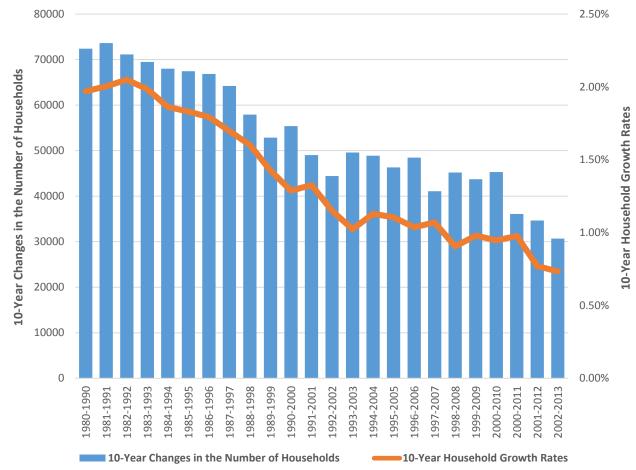


Figure 3.1: Ten-Year Changes in Household Growth in Hawaii, 1980 – 2013

Source: US Census Bureau and DBEDT

Using an econometric model to estimate the number of households in the state by 2025,

yields a similar result. The model's central scenario predicts a slightly higher total of 54,200 new households by 2025 (varying between a high of 68,800 and a low of 41,100 new households in state). The model examines the change in the number of households against the change in the number of total population and the expected household size in Hawaii. Household size in Hawaii averages 2.9 persons per household –between a high of 3.11 for 2013 and a low of 2.8 in 2009. The model is based on the central assumption that the change in the number of households is primarily a function of total population growth in the state and of the household size. Figure 3.2 plots the forecasts of the econometric model.

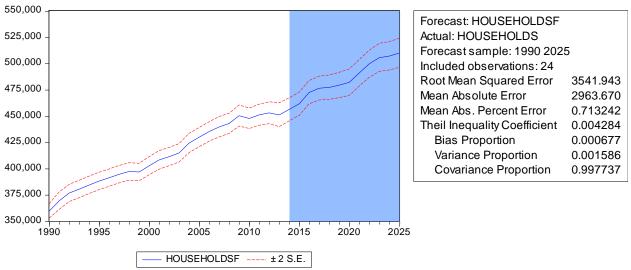


Figure 3.2: Projected Household Growth in Hawaii, 2014 – 2025

For full details and the results of the model, see Appendix B.

2. Additional Housing Units Needed for Normal Housing Turnover. The second component of new housing demand – demand for vacant units – is a combination of three separate projections: a) demand for vacant for-sale properties, b) demand for vacant for-rent properties, and c) demand for second and occasional use homes.

A) **Demand for vacant for sale units** is directly related to the absolute number of additional households. In order to estimate the rate of increase of vacant units, a 'natural vacancy rate' needs to be determined.

The natural vacancy rate is the rate that occurs when markets are in balance, that is when prices and rents are not falling or rising faster than either income and construction costs. When markets are in balance, the number of vacant units for sale or for rent divided by the number of households plus vacant units is called the natural vacancy rate<sup>12</sup>.

Recent vacancy rates (between 2007 and 2013) may reflect markets that were not in equilibrium and therefore may not be a good representation of the natural vacancy rate. Data shows that the time period when the housing markets (both rental and for sale) in Hawaii were in balance was in the late 1980s to early 1990s. Therefore, a conservative assumption is that the natural vacancy rate in the for-sale market is 1.2 percent, which is the average of 1988-1992, as shown in Table 3.1.

<sup>&</sup>lt;sup>12</sup> Eric S. Belsky, Bogardus Drew, R., McCue, D. "Projecting the Underlying Demand for New Housing Units: Inferences from the Past, Assumptions about the Future", Joint Center for Housing Studies, Harvard University, November 2007 (W07-7).

Vacancy rate base years	Published State Homeowner Vacancy Rate	Projected Owner Household Growth, 2015-2025	Projected Change in Vacant Owner Unit Demand, 2015-2025
1988 - 1992	1.20%	31,296	376
2005-2008	1.30%	31,296	313
2010-2014	2.00%	31,296	626

#### Table 3.1: Projected Demand for Vacant For-Sale Units, 2015-2025

Source: DBEDT, calculations based on methods used by the Harvard Center for Housing Studies

**B)** Demand for vacant units available for rent is similar to the demand for vacant units for sale. It is also directly related to the absolute number of additional households in the state. As mentioned above, the housing sector in Hawaii was determined to be in equilibrium in the late 1980s – early 1990s. Therefore, the natural vacancy rate for the rental market in Hawaii is 6.19 percent, which was observed during this timeframe.

The natural vacancy rate can decrease over time. For example, if fewer units are required for market turnover or if households shift their preferences to renting rather than owning a house. The rate may also increase if more properties are concentrated with fewer property owners or investors, as larger entities use their market power to maximize rents rather than maximizing supply.

Table 3.2 shows how future demand can vary based on the assumed natural vacancy rate.

Vacancy rate base years	Published State Rental Vacancy Rate	Projected Renter Household Growth, 2015-2025	Projected Change in Vacant for Rent Unit Demand,
1988 - 1992 2005-2008	6.19% 6.03%	22,202 22,202	2015-2025 <b>1,373</b> <b>1,783</b>
2010-2014	9.22%	22,202	2,047

Table 3.2: Projected Demand for Vacant For-Rent Units, 2015-2025

*C) Demand for second and occasional use homes* is related to the age distribution of the population and to changes in household wealth and preferences of each generation. Projecting second home demand is based on household projections by age and on additional assumptions about how households of different ages are likely to own second homes. Second homes include homes held for recreation or vacation, homes used for employment-related reasons, homes occupied temporarily by a household with a usual residence elsewhere, and second homes used for other purposes. Recent changes in employment patterns, population age distribution, living arrangements, and wealth have all contributed to the change in demand for second homes. Studies have shown that the propensity for second home ownership increases with wealth and

age<sup>13</sup>. Ageing baby boomers and increasing wealth may lead to continued growing demand for second homes, as shown in Figure 3.3 below.

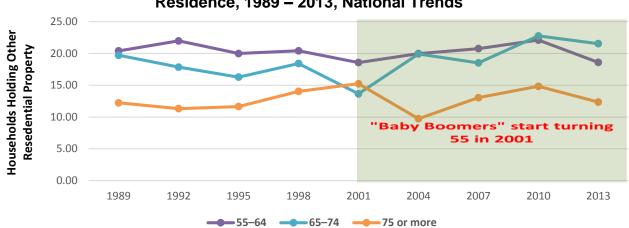


Figure 3.3: Older Households Holding Residential Property Other than Primary Residence, 1989 – 2013, National Trends

This projection conservatively assumes that only changes in age distribution of the Hawaii population will affect new demand for second homes at the lower of the two rates observed in 2004 and 2013 for each age group. These tendencies are based on the US Federal Reserve's Survey of Consumer Finances (SCF). Applying the national trends to estimate Hawaii's second home ownership by age will translate into demand for at least 9,200 additional second housing units by 2025 (Table 3.3). The data for the expected changes among households by age are based on DBEDT's Long-Range Forecasts.<sup>14</sup>

		SCF 2nd	SCF 2nd	Projected	Projected	Projected
	Projected	Homes per	Homes per	Growth in	Growth in	Growth in 2nd
Age of	Household	Household,	Household,	2nd Home	2nd Home	Home
Householder	Growth	at National	at National	Demand,	Demand	Demand
		Rates in	Rates in	2015-2025 at	2015-2025	2015-2025 at
		2004	2013	2004 rates	at 2013	the lowest of
					rates	2004 or 2013
under 25	-305	5.11%	4.56%	-16	-14	-16
25-44	-6,363	7.25%	7.07%	-461	-450	-461
45-64	30,643	18.09%	17.24%	5,542	5,282	5,446
65+	29,523	14.83%	16.94%	4,577	5,001	4,540
Total	53,498			9,642	9,820	9,509

Table 3.3: Projected Demand in Seasonal and Other Second Homes, 2015-2025

Source: DBEDT, rates calculated using 2013 Survey of Consumer Finances, US Federal Reserve; based on US Federal Reserve's *Survey of Consumer Finances*, 2013

Source: US Federal Reserve, 2013 Survey of Consumer Finances

<sup>&</sup>lt;sup>13</sup> For example, discussion of the results of the 2013 Survey of Consumer Finances, US Federal Reserve, 2013 Survey of Consumer Finances

<sup>&</sup>lt;sup>14</sup> DBEDT 2040 Series Report, <u>http://dbedt.hawaii.gov/economic/economic-forecast/2040-long-range-forecast</u>

Actual demand for second homes in Hawaii could be much higher, due to the attraction of Hawaii from high wealth individuals from across the US and abroad.

Applying these rates to the projected growth in households produces a conservative projection of a total 11,195 additional on-market vacant units needed to satisfy the demand based on the projected increase in households by 2025. However, the projections depend on the time period selected to reflect market equilibrium. Revisions to these projections could be required if there is a continued shift to renting or additional barriers to owning a home. If a greater number of households continue to rent rather than own, due to income or housing supply constraints, this may change the type of housing units that will be in demand.

The table below summarizes the outlook for housing demand in Hawaii, based on the projection of household growth (summing up projections from Tables 3.1, 3.2, and 3.3). This outlook is split into three possible scenarios: baseline, middle, and aggressive growth.

	Baseline Scenario	Middle Scenario	Aggressive Scenario	
Vacant for Sale	313	376	626	
Vacant for Rent	1,373	1,783	2,047	
Second Homes	9,509	9,642	9,820	
Total	11,195	11,701	12,493	

#### Table 3.4: Estimated Demand for Vacant Units, 2015-2025

Source: DBEDT, calculations based on methods used by the Harvard Center for Housing Studies

In order to bring the markets to balance when the actual number of vacant units is different from sustainable demand, price and production adjustments should regulate the market naturally. For example, a shortage of vacant units will increase rents, which provides an incentive to supply more rental units.

An alternative method for estimating total demand for new housing is to analyze the *ratio of household growth to residential unit completions.* This method could be used by applying the projection of household growth to determine total housing unit completions needed over the forecast period. The ratio of completions to household growth is measured over ten year periods starting with 1986 (1986-1996, 1987-1997, 1988-1998, etc.). The ratios in Hawaii ranged from 1.16 to 1.63. Nationally, the ratios over the same ten year periods were tighter, between 1.30 and 1.45. The ratio method of estimating housing demand is not as precise as the modelling method that accounts for factors such as different types of vacancies. The projections of new housing demand estimated by this approach roughly match the ones derived from the model using assumptions for growth and vacancies. The number by which the total housing stock changed annually is used as an approximation of total housing unit completions in the state. Table 3.6 below summarizes the findings of projecting housing demand by using this alternative approach.

	Growin to nousing	Growth to Housing Onit Completions					
	Average Completions- to-Household Growth Ratio	Projected Number of New Households	Units Needed for 2015-2025				
1986-2011	1.32	53,498	70,810				
1986-2000	1.25	53,498	66,795				
1996-2011	1.45	53,498	77,601				

### Table 3.5: Projecting Future Housing Demand Using the Ratio of Household Growth to Housing Unit Completions

Source: Hawaii State Databook and County Building Departments

A conservative estimate of the completions-to-household growth ratio is 1.25, representing the period when housing markets were roughly in balance. This is the average for the ten year periods starting with 1986 (see Appendix Table A3 for complete data on the ratios). These periods include housing expansion in late 1980s and early 1990s, as well as the long housing market downturn in the middle of 1990s. Using this method and the ratio to forecast new housing demand corresponds to a realistic projection of the growth in the sustained long-run demand of 66,800 units in Hawaii by 2025. This estimate is higher than the conservative baseline scenario of 64,700 units, which is the sum of household growth and net new vacant unit demand.

Table 3.6 compares these two different approaches. The alternative simple ratio of completions approach yields higher projections, with the difference growing larger under the more aggressive scenarios.

Table 3.6: Summary Projectio	Baseline Scenario	Middle Scenario	Aggressive Scenario
Household Growth	53,498	53,498	53,498
Change in Vacant Unit Demand	11,195	11,601	12,493
Total	64,693	65,099	65,991
By Ratio of Completions to Household Growth	66,795	70,810	77,601

#### Table 3.6: Summary Projections of Future Housing Demand for Hawaii, 2015-2025

Source: DBEDT, calculations based on methods suggested by the Harvard Center for Housing Studies

*In summary of this section*, it is important to highlight that these housing projections are for long-run sustainable demand for housing. This demand is based on the forecasted growth in households, which incorporates Hawaii's long-range demographic changes in the population.

### IV. Projected Housing Demand – Hawaii Counties

As discussed above, projections for underlying demand for housing units in the counties of Hawaii will be based on the same assumptions of household growth. Household growth is forecast to be the lowest in Honolulu County, which has the lowest projected growth rate of 8 percent by 2025. The other three counties will have substantially higher growth rates, with Hawaii County (29 percent), Maui County (25 percent) and Kauai County (19 percent)<sup>15</sup>. Since general population growth is correlated with household growth, projections of the total number of households formed in the City and County of Honolulu reflect this.

Table 4.1 projects demand for vacant for sale units (just as Table 3.1 does for the state). The homeowner vacancy rate in the City and County of Honolulu is lower than the neighbor island rate and is close to historic lows (Table 4.1):

# Table 4.1: Projected Demand for Vacant For-Sale Units,City and County of Honolulu, 2015-2025

Vacancy rate base years	Published County Homeowner Vacancy Rate	Projected Owner Household Growth, 2015-2025	Projected Change in Vacant Owner Unit Demand, 2015-2025
1988 - 1992	0.80%	12,043	96
2001-2004	1.20%	12,043	145
2010-2013	1.00%	12,043	120

Source: DBEDT, calculations based on methods used by the Harvard Center for Housing Studies

Although the City and County of Honolulu rental vacancy rate has increased over the last three years, it is still well below the similar rate of the neighbor islands:

## Table 4.2: Projected Demand for Vacant For-Rent Units,City and County of Honolulu, 2015-2025

Vacancy rate base years	Published County Rental Vacancy Rate	Projected Renter Household Growth, 2015-2025	Projected Change in Vacant for Rent Unit Demand, 2015-2025
1988 - 1992	4.40%	9,011	396
2001-2004	5.50%	9,011	496
2010-2013	6.60%	9,011	595

Source: DBEDT, calculations based on methods used by the Harvard Center for Housing Studies

As with the statewide projection, households will form faster for older adults. Most of the growth in households will be concentrated in the groups aged 45 and older. (Table 4.3).

<sup>&</sup>lt;sup>15</sup> See Long Range Forecasts, DBEDT, DBEDT 2040 Series Report, <u>http://dbedt.hawaii.gov/economic/econ</u>

## Table 4.3: Projected Demand for Seasonal and Other Second Homes, 2015- 2025:City and County of Honolulu

Age of Householder	Projected Household Growth	SCF 2nd Homes per Household, at National Rates in 2004	SCF 2nd Homes per Household, at National Rates in 2013	Projected Growth in 2nd Home Demand, 2015-2025 at 2004 rates	Projected Growth in 2nd Home Demand 2015-2025 at 2013 rates	Projected Growth in 2nd Home Demand 2015- 2025 at the lowest of 2004 or 2013
under 25	-332	5.11%	4.56%	-17	-15	-15
25-44	-10,096	7.25%	7.07%	-731	-713	-713
45-64	14,878	18.09%	17.24%	2,691	2,565	2,565
65+	16,605	14.83%	16.94%	2,462	2,813	2,462
Total	21,055			4,404	4,649	4,299

Source: DBEDT, calculations based on methods used by the Harvard Center for Housing Studies; based on US Federal Reserve's *Survey of Consumer Finances*, 2013

The combined table presents the range of estimates for demand for vacant units in the City and County of Honolulu results in a total of between 4,800 and 5,400 units needed for vacant demand by 2025 (Table 4.4):

### Table 4.4: Estimated Demand for Vacant Units,City and County of Honolulu, 2015-2025

	Baseline Scenario	Middle Scenario	Aggressive Scenario
Vacant for Sale	96	120	145
Vacant for Rent	396	496	595
Second Homes	4,299	4,404	4,649
Total	4,792	5,020	5,388

Source: DBEDT, calculations based on methods used by the Harvard Center for Housing Studies

Combining both approaches for the City and County of Honolulu results in a total of between 25,800 and 26,400 housing units by 2025. The simpler ratio method yields higher results (Table 4.5).

## Table 4.5: Estimated Housing Demand for the City and County of Honolulu,2015-2025

	Baseline Scenario	Middle Scenario	Aggressive Scenario
Household Growth	21,055	21,055	21,055
Change in Vacant Unit Demand	4,792	5,020	5,388
Total	25,847	26,075	26,443
By Ratio of Completions to Household Growth	26,288	27,868	30,541

Source: DBEDT, calculations based on methods suggested by the Harvard Center for Housing Studies

#### Projected Housing Demand, 2015-2025 – Hawaii County

The owner vacancy rate for Hawaii County has been low, although it increased significantly in recent years, as shown in Table 4.6:

Vacancy rate base	Published County	Projected Owner	Projected Change in
years	Homeowner Vacancy	Household Growth,	Vacant Owner Unit
	Rate	2015-2025	Demand, 2015-2025
1990	1.50%	10,639	160
2000	1.90%	10,639	202
2010-2013	3.20%	10,639	340

# Table 4.6: Projected Demand for Vacant For-Sale Units,Hawaii County, 2015-2025

Source: DBEDT, calculations based on methods used by the Harvard Center for Housing Studies

Hawaii County's rental vacancy rate varied between 7.6 percent in 2000 to around 10 percent (both in 1990 and in 2013), as shown in Table 4.7:

## Table 4.7: Projected Demand for Vacant For-Rent Units,Hawaii County, 2015-2025

Vacancy rate base	Published County	Projected Renter	Projected Change in
years	Rental Vacancy Rate	Household Growth,	Vacant for Rent Unit
	, i	2015-2025	Demand, 2015-2025
1990	10.30%	5,653	582
2000	7.60%	5,653	430
2010-2013	10.20%	5,653	577

Source: DBEDT, calculations based on methods used by the Harvard Center for Housing Studies

The total population for Hawaii County is projected to increase by 29 percent by 2025. As indicated above, most of the household growth is projected to occur among the groups aged 45 and above, with decreases among younger households (Table 4.8):

### Table 4.8: Projected Demand in Seasonal and Other Second Homes, 2015- 2025,Hawaii County

Age of Householder	Projected Household Growth	SCF 2nd Homes per Household, at National Rates in 2004	SCF 2nd Homes per Household, at National Rates in 2013	Projected Growth in 2nd Home Demand, 2015-2025 at 2004 rates	Projected Growth in 2nd Home Demand 2015-2025 at 2013 rates	Projected Growth in 2nd Home Demand 2015-2025 at the lowest of 2004 or 2013
under 25	-77	5.11%	4.56%	-3.93	-3.50	-4
25-44	-824	7.25%	7.07%	-59.66	-58.19	-60
45-64	10,098	18.09%	17.24%	1,826.19	1,740.67	1,741
65+	7,094	14.83%	16.94%	1,051.74	1,201.73	1,052
Total	16,292			2,814	2,881	2,729

Source: DBEDT, calculations based on methods used by the Harvard Center for Housing Studies; based on US Federal Reserve's *Survey of Consumer Finances*, 2013

Combining the estimates for vacant housing demand results in a demand of approximately 3,300 to 3,800 additional vacant housing units needed in Hawaii County by 2025.

# Table 4.9: Range of Estimates: Demand for Vacant Units,Hawaii County, 2015-2025

	Baseline Scenario	Middle Scenario	Aggressive Scenario
Vacant for Sale	160	202	340
Vacant for Rent	430	577	582
Second Homes	2,729	2,814	2,881
Total	3,318	3,593	3,803

Source: DBEDT, calculations based on methods used by the Harvard Center for Housing Studies

Combining all parts of the forecast results in a total demand of between 19,600 and 20,100 additional housing units (or up to 23,600 if using the ratio of completions to household growth):

#### Table 4.10: Estimated Housing Demand for Hawaii County, 2015-2025

	Baseline Scenario	Middle Scenario	Aggressive Scenario
Household Growth	16,292	16,292	16,292
Change in Vacant Unit Demand	3,318	3,593	3,803
Total	19,610	19,885	20,095
By Ratio of Completions to Household Growth	20,341	21,564	23,632

Source: DBEDT, calculations based on methods suggested by the Harvard Center for Housing Studies

#### Projected Housing Demand, 2015-2025 – Kauai County

Kauai County's rental vacancy rate varied between 4.6 percent in 1990 to around 18 percent in 2013. This probably reflects the recent growth in the number of seasonal and vacation units (Table 4.12). The published homeowner vacancy rate has also increased on Kauai, as shown in Table 4.11:

## Table 4.11: Projected Demand for Vacant For-Sale Units,Kauai County, 2015-2025

Vacancy rate base years	Published County Homeowner Vacancy Rate	Projected Owner Household Growth, 2015-2025	Projected Change in Vacant Owner Unit Demand, 2015-2025
1988 - 1992	0.70%	2,760	19
2001-2004	1.20%	2,760	33
2010-2013	3.30%	2,760	91

Source: DBEDT, calculations based on methods used by the Harvard Center for Housing Studies

## Table 4.12: Projected Demand for Vacant For-Rent Units,Kauai County, 2015-2025

Vacancy rate base	Published County	Projected Renter	Projected Change in
years	Rental Vacancy Rate	Household Growth,	Vacant for Rent Unit
		2015-2025	Demand, 2015-2025
1990	4.30%	1,659	71
2000	6.10%	1,659	101
2010-2013	17.95%	1,659	298

Source: DBEDT, calculations based on methods used by the Harvard Center for Housing Studies

The total population for Kauai County is projected to increase by 19 percent by 2025. As mentioned above, most of the household growth is projected to occur among the groups aged 45 and above, with decreases among younger households (Table 4.13):

## Table 4.13: Projected Demand in Seasonal and Other Second Homes, 2015- 2025,Kauai County

Age of Householder	Projected Household Growth	SCF 2nd Homes per Household, at National Rates in 2004	SCF 2nd Homes per Household, at National Rates in 2013	Projected Growth in 2nd Home Demand, 2015-2025 at 2004 rates	Projected Growth in 2nd Home Demand 2015-2025 at 2013 rates	Projected Growth in 2nd Home Demand 2015-2025 at the lowest of 2004 or 2013
under 25	-20	5.11%	4.56%	-1	-1	-1
25-44	-708	7.25%	7.07%	-51	-50	-51
45-64	2,749	18.09%	17.24%	497	474	474
65+	2,395	14.83%	16.94%	355	406	355
Total	4,419			800	829	777

Source: DBEDT, calculations based on methods used by the Harvard Center for Housing Studies; based on US Federal Reserve's *Survey of Consumer Finances*, 2013

Combining the estimates for vacant housing demand results in a demand of approximately 900 to 1,200 additional vacant housing units needed in Kauai County by 2025:

#### Table 4.14: Range of Estimates: Demand for Vacant Units, Kauai County, 2015-2025

	Baseline Scenario	Middle Scenario	Aggressive Scenario		
Vacant for Sale	19	33	91		
Vacant for Rent	71	101	298		
Second Homes	777	800	829		
Total	868	935	1,218		

Source: DBEDT, calculations based on methods used by the Harvard Center for Housing Studies

Combining all parts of the forecast, results in a total demand of between 5,300 and 5,600 additional housing units for Kauai County by 2025 (or up to 6,400 if using the ratio of completions to household growth):

#### Table 4.15: Estimated Future Housing Demand for Kauai County, 2015-2025

	Baseline Scenario	Middle Scenario	Aggressive Scenario
Household Growth	4,419	4,419	4,419
Change in Vacant Unit Demand	868	935	1,218
Total	5,287	5,354	5,637
By Ratio of Completions to Household Growth	5,517	5,849	6,410

Source: DBEDT, calculations based on methods suggested by the Harvard Center for Housing Studies

#### Projected Housing Demand, 2015-2025 – Maui County

Similar to Kauai County, Maui County's rental vacancy rate jumped from 7.2 percent in 2000 to above 26 percent in 2013. This jump highlights the recent increase in the number of seasonal and vacation units (Table 4.17). The county's homeowner vacancy rate has remained low and stable, as shown in Figure 4.16:

Wadi Coulity, 2015-2025				
Vacancy rate base years	Published County Homeowner Vacancy Rate	Projected Owner Household Growth, 2015-2025	Projected Change in Vacant Owner Unit Demand, 2015-2025	
1988 - 1992	1.50%	6,665	100	
2001-2004	1.20%	6,665	80	
2010-2013	1.55%	6,665	103	

## Table 4.16: Projected Demand for Vacant For-Sale Units,Maui County, 2015-2025

Source: DBEDT, calculations based on methods used by the Harvard Center for Housing Studies

### Table 4.17: Projected Demand for Vacant For-Rent Units,Maui County, 2015-2025

Vacancy rate base	Published County	Projected Renter	Projected Change in
years	Rental Vacancy Rate	Household Growth,	Vacant for Rent Unit
		2015-2025	Demand, 2015-2025
1990	9.90%	4,846	480
2000	7.20%	4,846	349
2010-2013	26.05%	4,846	1,262

Source: DBEDT, calculations based on methods used by the Harvard Center for Housing Studies

The total population for Maui County is projected to increase by 25 percent by 2025. As mentioned above, most of household growth is projected to occur among the groups aged 45 and above, with decreases among younger households (Table 4.18):

## Table 4.18: Projected Demand for Seasonal and Other Second Homes, 2015- 2025,Maui County

		SCF 2nd	SCF 2nd	Projected	Projected	Projected
	Projected	Homes per	Homes per	Growth in 2nd	Growth in	Growth in 2nd
Age of	Household	Household, at	Household, at	Home	2nd Home	Home
Householder	Growth	National	National	Demand,	Demand	Demand
		Rates in 2004	Rates in 2013	2015-2025 at	2015-2025	2015-2025 at
				2004 rates	at 2013	the lowest of
					rates	2004 or 2013
under 25	-60	5.11%	4.56%	-3	-3	-3
25-44	-1,525	7.25%	7.07%	-111	-108	-111
45-64	7,596	18.09%	17.24%	1,356	1,292	1,292
65+	5,785	14.83%	16.94%	830	949	830
Total	11,795			2,072	2,130	2,008

Source: DBEDT, calculations based on methods used by the Harvard Center for Housing Studies; based on US Federal Reserve's *Survey of Consumer Finances*, 2013

Combining the estimates for vacant housing demand results in a demand of approximately 2,400 to 3,500 additional vacant housing units needed in Maui County by 2025:

### Table 4.19: Range of Estimates: Demand for Vacant Units,Maui County, 2015-2025

	Baseline Scenario	Middle Scenario	Aggressive Scenario
Vacant for Sale	80	100	103
Vacant for Rent	349	480	1,262
Second Homes	2,008	2,072	2,130
Total	2,437	2,652	3,496

Source: DBEDT, calculations based on methods used by the Harvard Center for Housing Studies

Combining all parts of the forecast, results in a total demand of between 14,000 and 15,000 additional housing units for Maui County by 2025 (or up to 16,700 if using the ratio of completions to household growth):

#### Table 4.20: Estimated Future Housing Demand for Maui County, 2015-2025

	Baseline Scenario	Middle Scenario	Aggressive Scenario
Household Growth	11,512	11,512	11,512
Change in Vacant Unit Demand	2,437	2,652	3,496
Total	13,949	14,164	15,008
By Ratio of Completions to Household Growth	14,373	15,237	16,698

Source: DBEDT, calculations based on methods suggested by the Harvard Center for Housing Studies

### V. Conclusion

The projected long-run estimate of demand for total new housing units in Hawaii is 64,700 to 66,000, for the 2015-2025period. The forecasts in this report are of sustainable long-run **demand** for additional housing units based on the current fundamentals and not for estimated actual future construction of housing units.

The underlying fundamental demand for new housing does not equal the amount of new construction that will actually be completed over a period of time because the housing sector in the state is often either oversupplied or undersupplied. In other words, even though there is demand for units to be built, this projection does not mean that they will actually be built due to various constraints.

Hawaii's housing market remains unbalanced due to constrained supply on the one hand, and increasing demand on the other hand. Housing prices reached new all-time highs in 2014<sup>16</sup> and this new record surpassed the previous record set in 2005. High housing prices should increase residential construction activity in the state. However, we do not yet see this in the data.

There are many unpredictable events that may alter future housing demand. These include a downturn in the state's economy, which may result in a greater number of people leaving the state. State and federal policy changes regarding housing could also increase or decrease demand. Finally, changes in the timing of housing cycles could lead to different outcomes in both the supply and demand for housing.

It is important to note that Hawaii's housing supply is not included in this study. Housing supply is impacted by factors including the supply of land available for development, financing for residential projects, and the permitting process, which are outside of the model used in this study. A complete analysis of Hawaii's housing market should take into account the housing shortage or surplus prior to 2015 in addition to our housing demand projection.

An area for future research could be estimating the impact of income inequality on housing choice and access to housing in Hawaii. Even though Hawaii continues to have some of the lowest levels of inequality in the nation at present, it is a state where most of the income growth is taking place among those in the top 1 percent of the income distribution<sup>17</sup>. Incomes have not been growing as fast as housing prices, making it harder for residents both to afford to buy real estate in Hawaii and to rent. Higher housing costs lower consumption by the people in middle and lower income groups and lead to lower tax receipts for the state<sup>18</sup>. These are just some of the possible issues that could be explored in greater detail regarding future demand for housing in Hawaii.

<sup>&</sup>lt;sup>16</sup> Honolulu Board of Realtors; <u>http://www.hicentral.com/pdf/market-press-releases/2014/MPR-June2014.pdf</u>

<sup>&</sup>lt;sup>17</sup> <sup>17</sup> EARN: "The Increasingly Unequal States of America: Income Inequality by State, 1917 to 2011", Sommellier, E., and Mark Price, 2/19/2014

<sup>&</sup>lt;sup>18</sup> Inequality and the narrowing of the tax base – too reliant on the few, The Economist, 9/18/2014

## APPENDIX A:

Year	Number of	Total	Annual Percent	Annual Percent	Average
	Households	Population	Change, Population	Change, Households	Household Size
1993	378,068	1,172,838	1.23%	0.81%	3.10
1994	381,119	1,187,536	1.25%	0.81%	3.12
1995	386,318	1,196,854	0.78%	1.36%	3.10
1996	391,202	1,203,755	0.58%	1.26%	3.08
1997	396,008	1,211,640	0.66%	1.23%	3.06
1998	400,927	1,215,233	0.30%	1.24%	3.03
1999	402,084	1,210,300	-0.41%	0.29%	3.01
2000	403,240	1,175,755	-2.85%	0.29%	2.92
2001	411,647	1,188,615	1.09%	2.08%	2.89
2002	415,479	1,208,537	1.68%	0.93%	2.91
2003	419,441	1,221,885	1.10%	0.95%	2.91
2004	427,673	1,227,008	0.42%	1.96%	2.87
2005	430,007	1,238,158	0.91%	0.55%	2.88
2006	432,632	1,247,951	0.79%	0.61%	2.88
2007	439,685	1,247,553	-0.03%	1.63%	2.84
2008	437,105	1,253,999	0.52%	-0.59%	2.87
2009	446,136	1,260,211	0.50%	2.07%	2.82
2010	455,269	1,320,741	4.80%	2.05%	2.96
2011	448,536	1,331,912	0.85%	-1.48%	2.97
2012	447,748	1,348,497	1.25%	-0.18%	3.01
2013	450,120	1,404,054	4.12%	0.53%	3.12
			Average Annual Percent Change	Average Annual Percent Change	Average Household Size
			0.93%	0.88%	2.97

#### Table A1: Change in Population and Households in Hawaii, 1993-2013

Source: DBEDT/Census

10-Year Period	Numerical Change in	Period Average Percent
	Households	Change in Households
1980-1990	72,394	1.97%
1981-1991	73,643	2.00%
1982-1992	71,125	2.05%
1983-1993	69,491	1.98%
1984-1994	67,997	1.86%
1985-1995	67,431	1.83%
1986-1996	66,840	1.79%
1987-1997	64,199	1.70%
1988-1998	57,903	1.60%
1989-1999	52,843	1.43%
1990-2000	55,380	1.29%
1991-2001	49,033	1.33%
1992-2002	44,423	1.15%
1993-2003	49,605	1.02%
1994-2004	48,888	1.13%
1995-2005	46,314	1.10%
1996-2006	48,483	1.04%
1997-2007	41,097	1.07%
1998-2008	45,209	0.90%
1999-2009	43,729	0.98%
2000-2010	53,186	0.95%
2001-2011	45,296	0.98%
2002-2012	39,248	0.77%
2003-2013	34,641	0.73%

#### Table A2: Ten Year Changes in Households in Hawaii, 1980 – 2013

Source: US Census Bureau and DBEDT

# Table A3: Alternative Approach to Estimating Future Housing Demand: AnalyzingRatio of Completions to Household Growth

	Ratio of Completions to	o Household Growth	
Year	Completions	Household Growth	Ratio of Completions to Household Growth
1986 - 1996	85,497	67,431	1.27
1987-1997	81,551	66,840	1.22
1988-1998	77,413	64,199	1.21
1989-1999	72,848	57,903	1.26
1990-2000	68,214	52,843	1.29
1991-2001	64,408	55,380	1.16
1992-2002	60,748	49,033	1.24
1993-2003	59,732	44,423	1.34
1994-2004	61,058	49,605	1.23
1995-2005	61,320	48,888	1.25
1996-2006	62,568	46,314	1.35
1997-2007	66,054	48,483	1.36
1998-2008	67,166	41,097	1.63
1999-2009	66,347	45,209	1.47
2000-2010	65,361	43,729	1.49
2001-2011	63,114	45,296	1.39

Source: DBEDT, calculations based on methods used by the Harvard Center for Housing Studies

# Table A4: Expansion of Housing Stock and Change in PopulationAnnual Percent Change

	2006	2007	2008	2009	2010	2011	2012	2013	Period Average Percent Change (2006 - 2013)
Expansion of Housing Stock (annual percent change)	1.82%	1.35%	1.20%	0.55%	0.75%	0.54%	0.40%	0.36%	0.82%
Population Increase (annual percent change)	1.32%	0.45%	1.26%	1.09%	1.26%	0.97%	0.96%	1.00%	0.97%

Source: US Census Bureau (American Community Survey, 1-year estimates), DBEDT

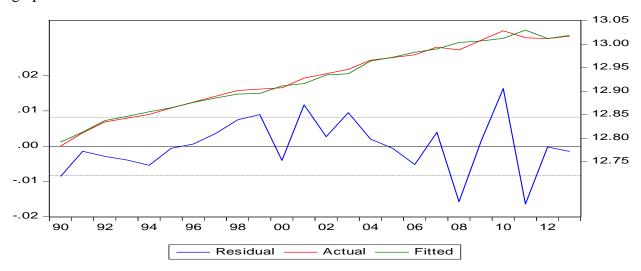
### APPENDIX B:

#### Econometric model – output results and forecast

The model is based on the central assumption that the change in the number of households in the state is a function of the change in the total population and of the average household size:

Dependent Variable: LOG(HOUSEHOLDS) Method: Least Squares Date: 11/21/14 Time: 14:40 Sample (adjusted): 1990 2013 Included observations: 24 after adjustments Convergence achieved after 16 iterations MA Backcast: 1989

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.098890	0.694102	-0.142471	0.8881
LOG(POPULATION_IN_HOUSEHOLDS)	0.957875	0.046621	20.54593	0.0000
LOG(AVERAGE_HOUSEHOLD_SIZE)	-0.387493	0.079790	-4.856405	0.0001
MA(1)	0.667611	0.166825	4.001878	0.0007
R-squared	0.988571	Mean depende	12.92734	
Adjusted R-squared	0.986857	S.D. dependen	0.072024	
S.E. of regression	0.008257	Akaike info crit	-6.604467	
Sum squared resid	0.001364	Schwarz criteri	-6.408125	
Log likelihood	83.25360	Hannan-Quinn criter.		-6.552377
F-statistic	576.6496	Durbin-Watson	stat	2.242559
Prob(F-statistic)	0.000000			
Inverted MA Roots	67			



To look at how effectively the model predicts the future, below is the actual, fitted and residual graph of the model:

In addition, a comparison of the forecasted model with actual high and low predictions are represented below:

