POPULATION AND EMPLOYMENT PROJECTIONS – METHODOLOGY AND SUMMARY RESULTS

PHASE I TECHNICAL REPORT

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Prepared for:

Maine Department of Transportation

Maine Turnpike Authority

Prepared by:

PARSONS BRINCKERHOFF

In association with:

Morris Communications • Kevin Hooper Associates
T.Y. Lin • Planning Decisions • Facet Decision Systems
Dr. Charles Colgan, University of Southern Maine • Evan Richert
Normandeau Associates • Preservation Company

OVERVIEW

This memo outlines the procedures being used to develop population and employment projections to support transportation and economic development analysis for the Central York County Connections Study (CYCCS). These projections will be used to describe the baseline conditions (i.e. – conditions without any major transportation improvements or changes in regulatory policies) in year 2035 in terms of population, employment, and transportation network performance, as well as in comparison with alternative transportation scenarios to be examined in the study process.

Projections for the CYCCS were prepared by Dr. Charles Colgan of the Maine Center of Business & Economic Research, University of Southern Maine. They reflect 2010 population estimates recently released by the United States Census Bureau.

POPULATION FORECASTS

For communities in York County, the population projection process consists of the following steps:

1. Develop preliminary projections

    a. Develop a countywide population forecast for 2035 based on economic and demographic factors.

    b. Disaggregate (divide) the county populations to the town level (see page 5 for details on how this is done).

    c. Disaggregate (divide) town level populations to the Transportation Analysis Zones (TAZs), which are smaller geographic areas used in the transportation model. The transportation model estimates trips between TAZs based on the population, jobs and other socio-economic factors for each TAZ.

2. Review preliminary projections with the project team and the project steering and advisory committees.

3. Convert population projections to occupied dwelling unit projections; occupied dwelling units are the basic unit of population used in the transportation model to generate estimates of trips.

4. Review final projections of population, households, and dwelling units with the project team and steering and advisory committees.

PRELIMINARY PROJECTIONS

COUNTYWIDE POPULATION FORECASTS

The county population forecasts were prepared by the University of Southern Maine's (USM's) Center for Business and Economic Research (CBER) using econometric models developed by Regional Economic Models Inc. (REMI) of Amherst, MA and maintained by CBER. These models combine economic and demographic factors to project population, employment, and other measures of the economy. CBER prepares forecasts for the Maine Department of Transportation and for use by transportation planning and other agencies for seven county and multi-county regions, including York County. The York County forecasts used here are part of the statewide forecasts prepared for the seven regions.

Figure 1 illustrates the population of York County since 1970 and forecast population for years 2010 – 2035. Growth trends since 1990 were considered in developing the 2010 – 2035 forecasts, whereas the historic population for 1970 – 1990 is shown for context only. Note that U.S. Census estimates for 2000 – 2010 have been adjusted to reflect the recent 2010 U.S. Census count for York County.
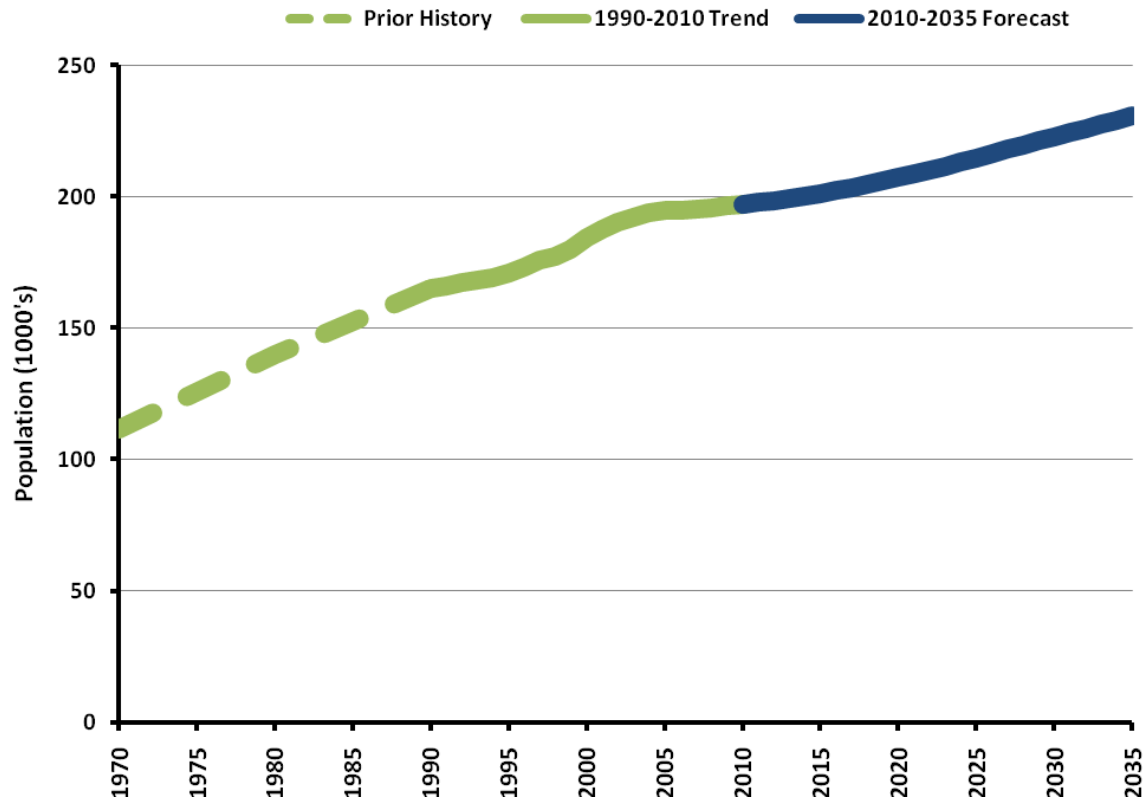
Note: 1990 – 2010 Trend Data adjusted to reflect recent 2010 U.S. Census Estimate of York County Population
Source: University of Southern Maine Center for Business and Economic Research, 2011 and U.S. Census Bureau, 2011.

Figure 1: York County Population Estimates (Historical and Forecast), 1970 - 2035

Population changes may be categorized by four components:

- Natural change – the change in population resulting from births and deaths only.

- Economic migrants – the net migration into the county from all other domestic regions for jobs.

- Retirees – the net migration into the county of retired persons.

- International – the net migration of foreign or immigrant persons into the county.

A fifth component, *Special populations* (such as military and prison populations), does not apply in York County and is therefore not accounted for in the forecasts.

Figure 2 shows the annual level of change associated with each of these components since 1990 and forecast through 2035. York County experienced a spike in economic migrants in 2000, which was associated with the end of the "tech boom" in the late 1990s. Other components have exhibited steadier trends; declining growth in natural population and consistent but small annual increases in retirees and international populations.
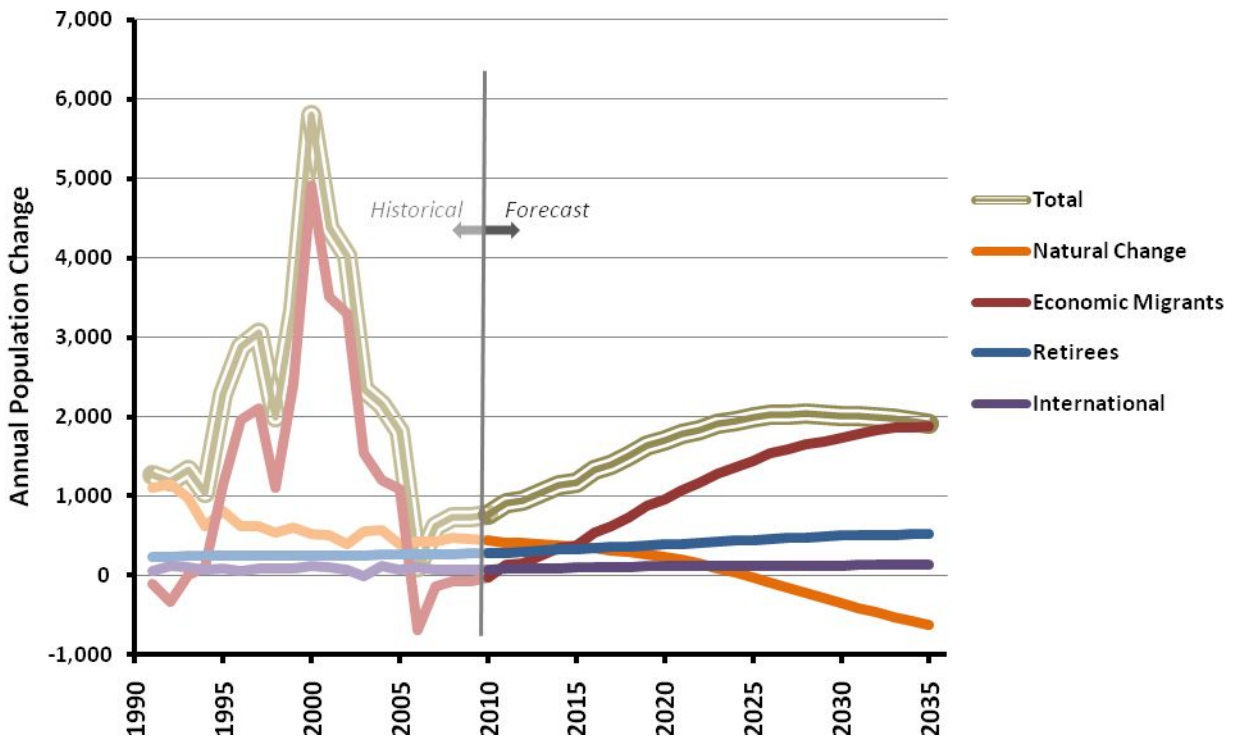
Source: University of Southern Maine Center for Business and Economic Research, 2011.

Figure 2: Historic and Projected Annual Population Change by Component

The rate of natural population growth is forecast to continue its decline, resulting in net decreases by 2024 as deaths exceed births in the county. This trend reflects the aging population in York County and the rest of Maine. From 2025 on, population growth in the county will be due entirely to net in-migration (economic, retiree and international). Net economic migration is expected to be negative in 2009 and 2010 and grow slowly through the next decade as the economy recovers from the recession. The national housing crisis is further restricting migration through this decade, though a recovery in the housing market is expected by the end of the decade. Net economic migration to York County is forecast to accelerate to between 1,000 and 2,000 per year in 2020-2030 and level out just under 2,000 per year from 2030 onward.

Over the entire 2010-2035 period, net economic migration to York County is forecast to average about 1,000 persons per year. This compares with an estimated average economic migration of about 1,200 persons per year over the 1990-2010 period. The lower forecast rate reflects the effects of the recession and housing market slump. The historical data also covers a period in 1998-2002 when economic migration to York County averaged a very high 3,500 per year.

Retiree migration is forecast to grow steadily, increasing from an average rate of about 250 per year (1990-2008) to 400-500 persons per year after 2020. International migration is expected to slowly increase from 100 to about 150 persons per year based on long term population trends.

The net result of these changes is an estimated increase in the York County population of 33,572, a total increase over the estimated 2010 population of 17 percent. This corresponds to an annual average growth rate of 0.6 percent, which is lower than the 1990-2010 average of 0.9 percent per year.

POPULATION PROJECTIONS AT THE TOWN LEVEL

The population projections at the county level must be distributed to the town level such that the sum of all population changes in the towns equals the projected county population totals. There are a number of different approaches that can be used to disaggregate the county totals to the towns, and no particular approach is inherently superior to any other in a region as diverse as York County, which has no single dominant urban area and contains a wide diversity of communities. The approach used to develop projections for the CYCCS applies the same methods at both the zone and town level.

The baseline projections should reflect expected rates of population growth but must also be constrained so that the total projected growth across all towns matches the county projection total discussed above. To do this in a large region like York County, a two-step process is used:

1. The county is divided into 5 zones (Figure 3), grouping towns into geographically compact areas with somewhat similar influences on their patterns of growth. County population growth is first distributed to these zones and balanced so that the zone totals equal the overall.

2. Next, each zone's population growth is distributed to the towns within that zone using the same process as is used to estimate the zone population.

Zones are defined as follows:

- The *Border* zone includes those communities that lie along the New Hampshire border that are part of the Portsmouth-Dover-Rochester metropolitan area. None of these communities are within the study area.

- The *Central* zone comprises the towns of North Berwick, Sanford, Alfred, and Lyman in the study area, as well as Shapleigh and Acton.

- The *Coastal* zone includes the communities along the shore that lie between the Border and Portland communities. The communities consist of Arundel, Kennebunk, Kennebunkport, Wells and Ogunquit within the study area, and York, located beyond the study area.

- The *Lakes* zone includes the communities in the northwest corner of York County. None of these communities are within the study area.

- The *Portland Area* zone comprises those communities in York County that are adjacent to the Portland metropolitan area. Only portions of Waterboro and Biddeford are located within the study area.
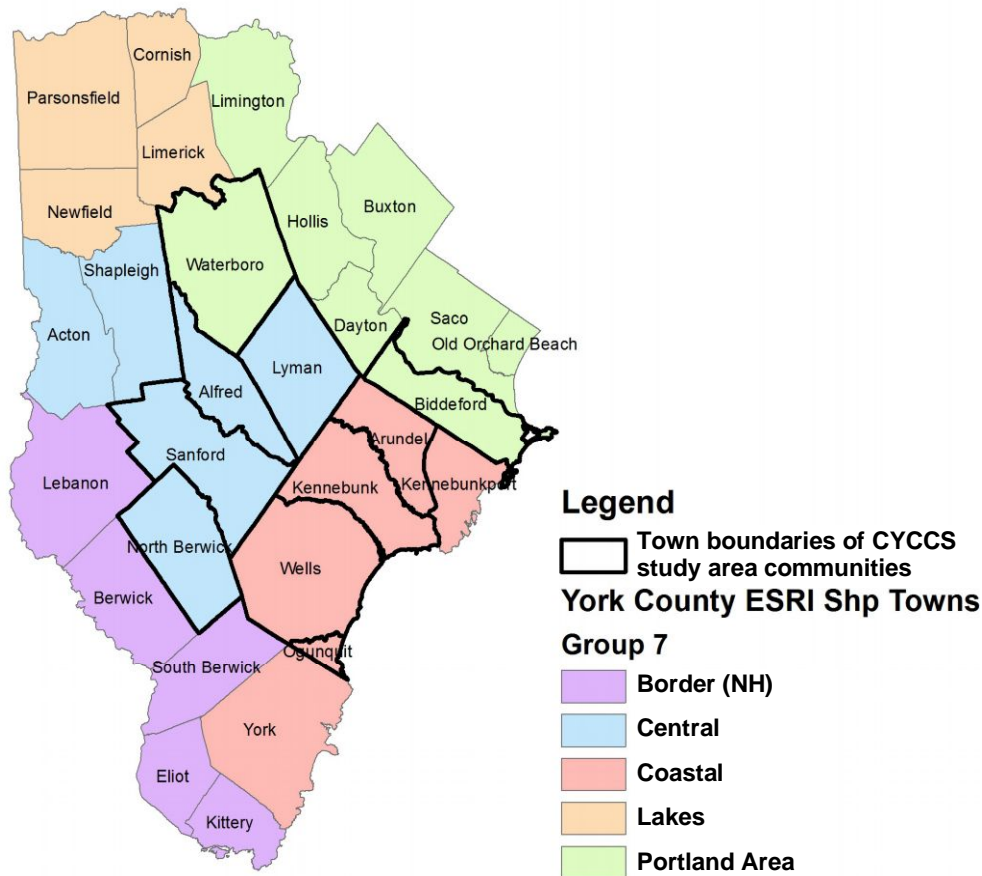

Figure 3: Population Estimate Zones

The calculation process uses equations that are listed in this memorandum's Appendix. Briefly, the first step is to calculate the average annual growth rate for each zone and town over 1990-2010 (Equation 1, Appendix). These average growth rates were then applied to 2010 zone and town populations to generate a "raw" estimate of zone and town populations in 2035 (Equation 2, Appendix). Because these "raw" estimates produce a total growth in York County well in excess of the countywide control forecast discussed above, it is necessary to adjust them so that the sum of the sub-county forecasts equals the county total. This is done by using a two-step process to calculate the share of growth for each town using the "raw" projections to proportionally split the projected overall increase in county population (+33,572); this is done first among the zones and then among the towns.

The first step in the adjustment process is to use the "raw" projections for each zone within the county to determine each zone's proportional share of growth among all zones (Equation 3, Appendix). The

Population and Employment Projections

projected population growth for each zone is then equal to that zone's share of county growth multiplied by the forecast growth of 33,572. The process is then repeated for each zone, with the "raw" projections for all towns used to calculate each town's share of growth within its respective zone. Each town's projected population growth is then that town's share of the zone growth multiplied by the projected zone population. The final population for the town is the sum of the 2010 population and this projected population change (Equation 4, Appendix).

An example helps illustrate the process:

Zone Population Estimates

Note: Annual growth rates shown in Table 1 and referenced in the example below are rounded to one decimal place, whereas the calculations used to prepare projections use unrounded growth rates. The results shown in the following example will therefore differ slightly from what would be calculated using annual growth rates that are rounded to one decimal place.

1. The Central zone had an estimated annual average population growth rate over 1990-2010 of 0.6%.

2. Applying a 0.6% annual growth rate to the estimated 2010 Central zone population of 37,852 yields a "raw" population estimate of 44,059 in 2035, or an increase of 6,207.

3. The same procedure applied to all five zones yields a total population estimate in 2035 of 247,947 for York County, which correlates to a "raw" estimated growth of 50,816. However, the total projected population growth for York County is 33,572 as discussed above, and the sum of zone growth cannot exceed this total.

4. An adjustment is needed to factor each zone's "raw" projected growth so that the total sum of all five zones equals York County's projected growth of 33,572. In this case, the Central zone's share of "raw" growth is 12.2% (6,207 is 12.2% of 50,816).

5. The Central zone share of "raw" growth (12.2%) multiplied by the York County forecast growth of 33,572 yields a forecast population change of 4,101 (see note on rounding in the introduction to this example).

6. The forecast change (4,101) added to the 2010 zone population (37,852) yields a final estimate of 41,953 in the Central zone in 2035.

Town Population Estimates

1. Sanford had an estimated average annual population growth rate over 1990-2010 of 0.08%.

2. This growth rate applied to the 2010 estimated population of Sanford (20,798) yields an estimated 2035 population of 21,224, or a "raw" estimate of growth of 426.

3. The total "raw" population growth from 2010-2035 for all the towns in the central zone using the same procedure would be 7,301. Sanford's projected share of this growth is 5.8%.

4. Applying Sanford's share of growth (5.8%) to the zone growth total calculated above (4,101) yields a final estimated growth for Sanford of 240 and a 2035 population of 21,038.

The results for all towns and zones are shown in Table 1.

Table 1: Population Forecasts by Zone and Town

Zone	Town	Historical			Projected 2035		
		Population 1990	Population 2010	Annual Growth Rate 1990 – 2010	Projected change 2010-2035	Projected 2035 Population	Projected Annual Growth Rate 2010 – 2035
Border Zone		30,836	36,191	0.8%	5,298	41,489	0.5%
	Berwick	5,995	7,246	1.0%	1,169	8,415	0.6%
	Eliot	5,329	6,204	0.8%	784	6,988	0.5%
	Kittery	9,372	9,490	0.1%	90	9,580	0.0%
	Lebanon	4,263	6,031	1.7%	1,976	8,007	1.1%
	South Berwick	5,877	7,220	1.0%	1,279	8,499	0.7%
Central Zone		33,522	37,852	0.6%	4,101	41,953	0.4%
	Acton	1,727	2,447	1.8%	750	3,197	1.1%
	Alfred	2,238	3,019	1.5%	769	3,788	0.9%
	Lyman	3,390	4,344	1.2%	887	5,231	0.7%
	North Berwick	3,793	4,576	0.9%	679	5,255	0.6%
	Sanford	20,463	20,798	0.1%	240	21,038	0.0%
	Shapleigh	1,911	2,668	1.7%	776	3,444	1.0%
Coastal Zone		32,599	41,304	1.2%	9,394	50,698	0.8%
	Arundel	2,669	4,022	2.1%	1,688	5,710	1.4%
	Kennebunk	8,004	10,798	1.5%	3,072	13,870	1.0%
	Kennebunkport	3,356	3,474	0.2%	96	3,570	0.1%
	Ogunquit	974	892	-0.4%	-58	834	-0.3%
	Wells	7,778	9,589	1.1%	1,798	11,387	0.7%
	York	9,818	12,529	1.2%	2,798	15,327	0.8%
Lakes Zone		5,380	7,715	1.8%	2,901	10,616	1.3%
	Cornish	1,178	1,403	0.9%	209	1,612	0.6%
	Limerick	1,688	2,892	2.7%	1,698	4,590	1.9%
	Newfield	1,050	1,522	1.9%	549	2,071	1.2%
	Parsonsfield	1,464	1,898	1.3%	445	2,343	0.8%
Portland Zone		62,250	74,069	0.9%	11,877	85,946	0.6%
	Biddeford	20,710	21,277	0.1%	410	21,687	0.1%
	Buxton	6,494	8,034	1.1%	1,374	9,408	0.6%
	Dayton	1,197	1,965	2.5%	947	2,912	1.6%
	Hollis	3,573	4,281	0.9%	609	4,890	0.5%
	Limington	2,796	3,713	1.4%	887	4,600	0.9%
	Old Orchard Beach	7,789	8,624	0.5%	657	9,281	0.3%
	Saco	15,181	18,482	1.0%	2,893	21,375	0.6%
	Waterboro	4,510	7,693	2.7%	4,100	11,793	1.7%
York County		164,587	197,131	0.9%	33,572	230,703	0.6%

CYCCS

Table 2: Town Population Summary for CYCCS Communities

Study Area	2010 Population	Projected 2035 Population	Projected change 2010-2035	Projected Annual Growth Rate 2010-2035	Share of Study Area Growth
Alfred	2,238	3,019	781	1.2%	6.3%
Arundel	2,669	4,022	1,353	1.7%	10.8%
Biddeford	20,710	21,277	567	0.1%	4.5%
Kennebunk	8,004	10,798	2,794	1.2%	22.4%
Lyman	3,390	4,344	954	1.0%	7.6%
North Berwick	3,793	4,576	783	0.8%	6.3%
Ogunquit	974	892	-82	-0.4%	-0.7%
Sanford	20,463	20,798	335	0.1%	2.7%
Waterboro	4,510	7,693	3,183	2.2%	25.5%
Wells	7,778	9,589	1,811	0.8%	14.5%
TOTAL	74,529	87,008	12,479	0.6%	

DISTRIBUTION OF POPULATION TO THE TAZ LEVEL

Population was converted to households (also known as "occupied dwelling units") prior to distribution to the TAZ level, as summarized in Table 3. Households were next disaggregated to corresponding TAZs using a process that took into consideration the most recent census allocation of households at the block level and visual assessment of existing development within TAZs (for cases where two or more TAZs comprise a census block). Forecast growth was similarly allocated, also taking into account underlying zoning and developable land.

Figures 4-6 compare the current and projected distribution of households by TAZ.

Table 3: Town Households (Occupied Dwelling Units) Summary

| Zone	Town	2010 (US Census)			Projected 2035		
		2010 Population	Pop. in Households	Occupied Households	2035 Population	Pop. in Households	Occupied Households
Border Zone		36,191	35,977	14,493	41,489	41,272	19,503
	Berwick	7,246	7,204	2,749	8,415	8,369	3,674
	Eliot	6,204	6,204	2,509	6,988	6,988	3,306
	Kittery	9,490	9,357	4,302	9,580	9,449	5,783
	Lebanon	6,031	6,031	2,204	8,007	8,007	3,295
	South Berwick	7,220	7,182	2,729	8,499	8,459	3,445
Central Zone		37,852	37,371	15,194	41,953	41,435	19,704
	Acton	2,447	2,447	1,014	3,197	3,197	1,554
	Alfred	3,019	2,886	1,175	3,788	3,628	1,627
	Lyman	4,344	4,344	1,660	5,231	5,231	2,536
	North Berwick	4,576	4,520	1,773	5,255	5,196	2,510
	Sanford	20,798	20,515	8,500	21,038	20,752	9,909
	Shapleigh	2,668	2,659	1,072	3,444	3,432	1,569
Coastal Zone		41,304	40,973	17,894	50,698	50,293	26,195
	Arundel	4,022	4,009	1,569	5,710	5,693	2,453
	Kennebunk	10,798	10,646	4,689	13,870	13,682	7,269
	Kennebunkport	3,474	3,474	1,578	3,570	3,570	1,766
	Ogunquit	892	892	498	834	834	478
	Wells	9,589	9,588	4,120	11,387	11,386	5,777
	York	12,529	12,363	5,440	15,327	15,128	8,451
Lakes Zone		7,715	7,686	3,098	10,616	10,581	4,919
	Cornish	1,403	1,399	609	1,612	1,607	922
	Limerick	2,892	2,886	1,100	4,590	4,582	1,894
	Newfield	1,522	1,517	625	2,071	2,065	1,010
	Parsonsfield	1,898	1,884	764	2,343	2,326	1,092
Portland Zone		74,069	72,481	30,330	85,946	84,192	40,452
	Biddeford	21,277	20,176	8,598	21,687	20,508	9,806
	Buxton	8,034	8,017	3,108	9,408	9,387	4,364
	Dayton	1,965	1,965	712	2,912	2,912	1,141
	Hollis	4,281	4,275	1,668	4,890	4,883	2,405
	Limington	3,713	3,541	1,392	4,600	4,369	2,515
	Old Orchard Beach	8,624	8,589	4,454	9,281	9,242	6,078
	Saco	18,482	18,232	7,623	21,375	21,108	9,720
	Waterboro	7,693	7,686	2,775	11,793	11,784	4,422
York County		197,131	194,489	81,009	230,703	227,773	110,773

CYCCS
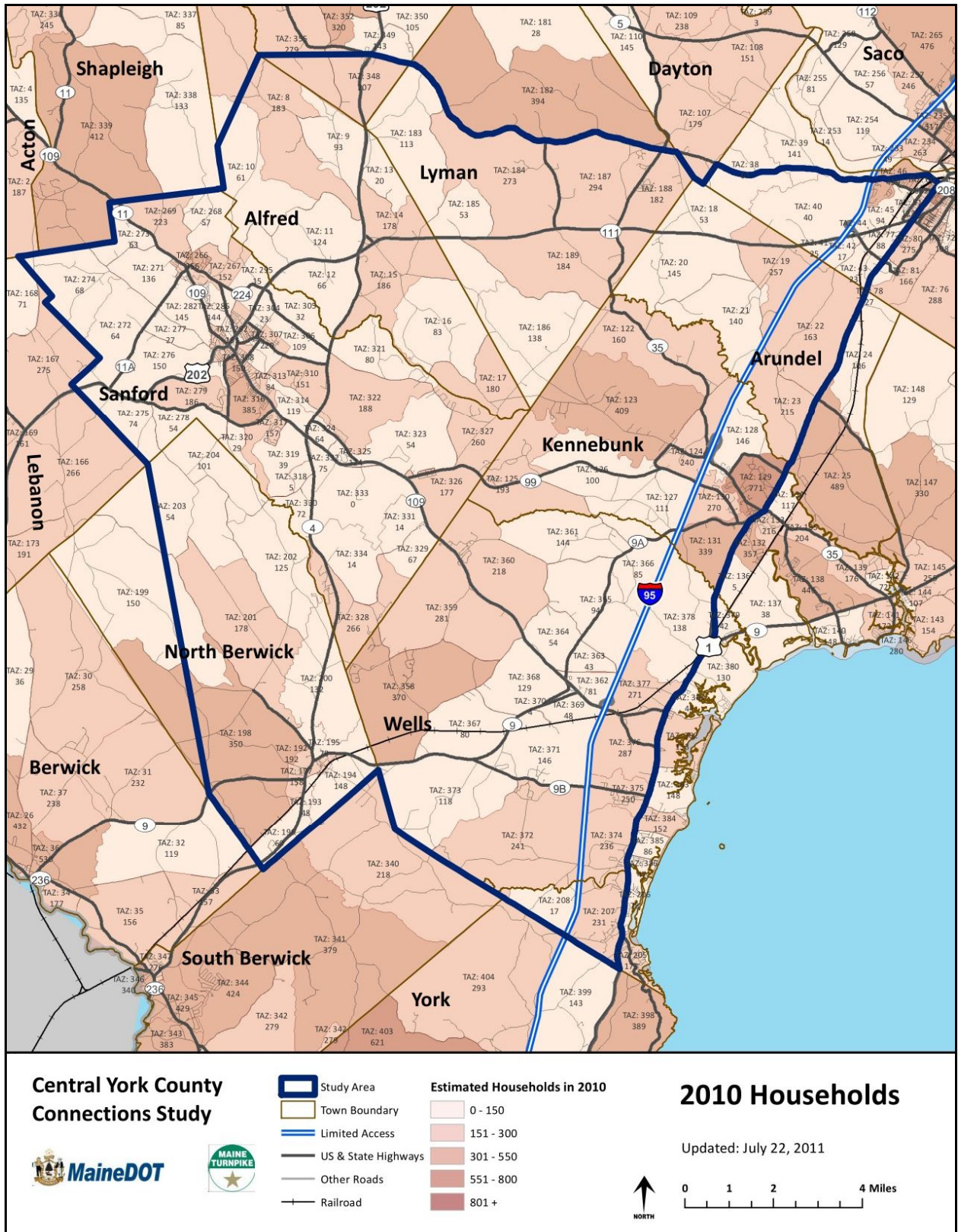
Figure 4: 2010 Households by Traffic Analysis Zone (TAZ)
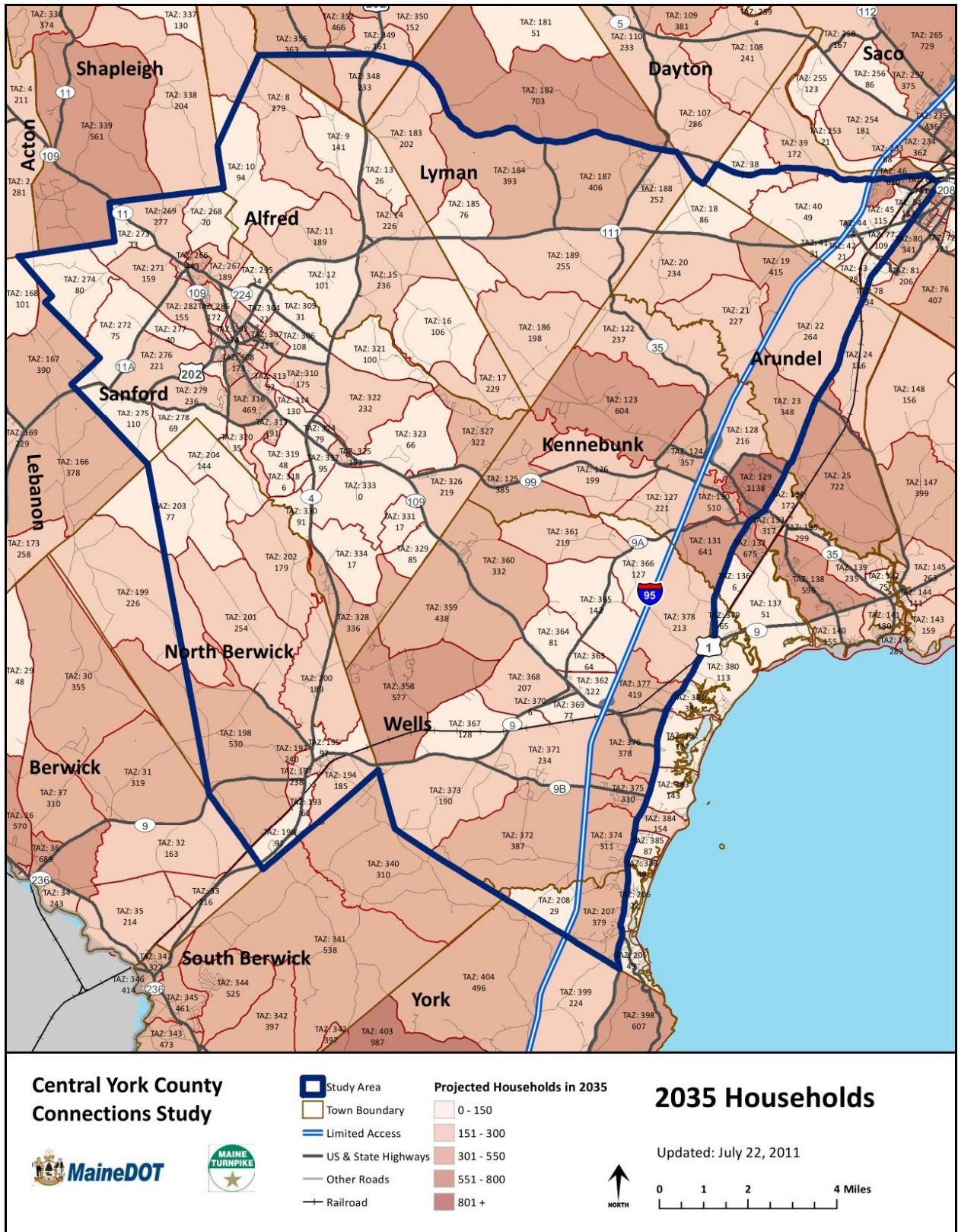
Figure 5: 2035 Households by Traffic Analysis Zone (TAZ)
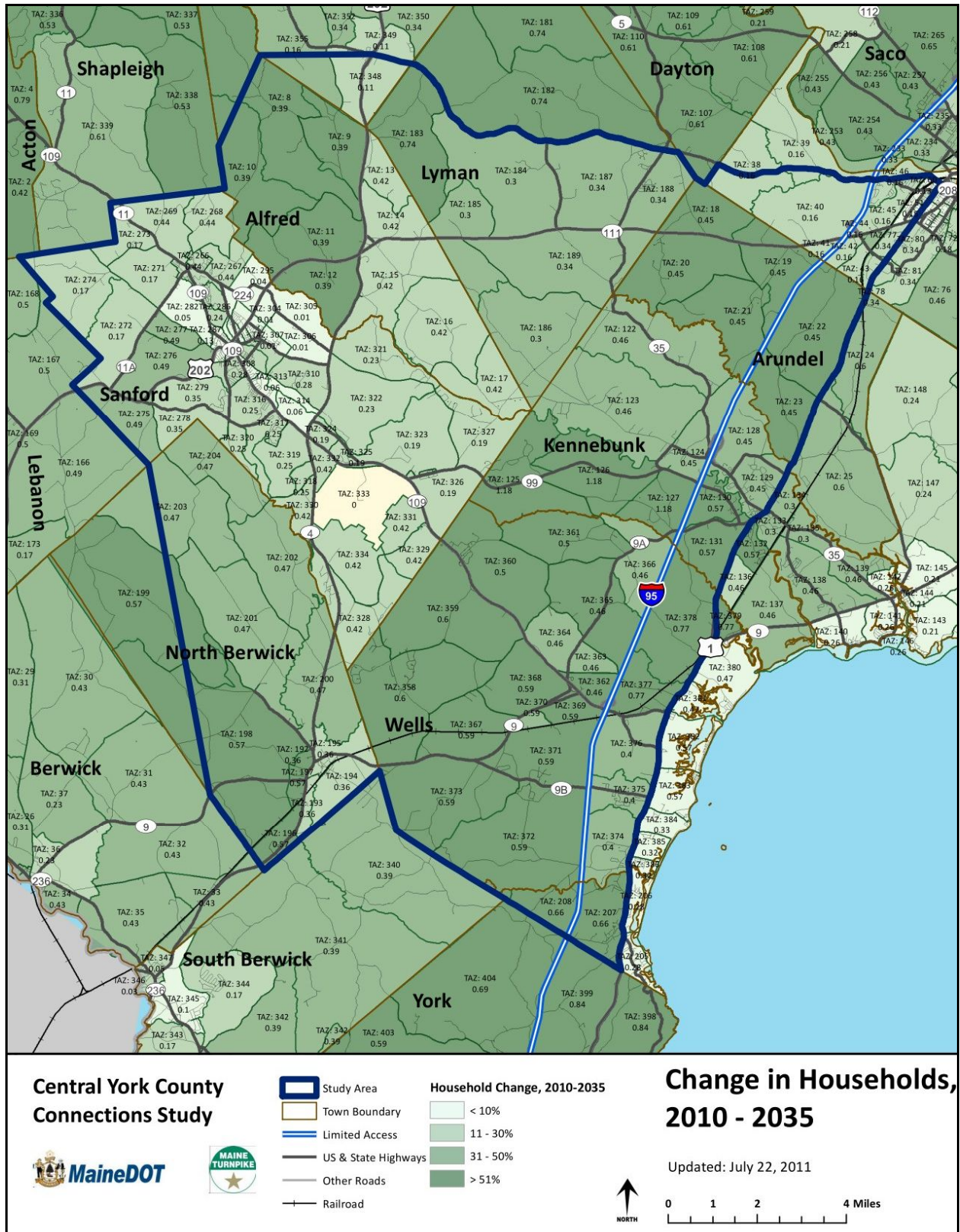
Population and Employment Projections

Figure 6: Change in Households (2010 to 2035) by Traffic Analysis Zone (TAZ)

EMPLOYMENT FORECASTS

The other key demographic projection required by the study's traffic model is an estimate of employment by labor category for each TAZ. Much of the employment data is privileged and cannot be publically distributed. Therefore, only summary data is presented here.

REMI FORECAST

Employment forecasts are also derived by the REMI model described earlier. Table 4 shows the REMI forecast change in employment from 2010-2035 grouped by the five sectors used in the transportation model. Manufacturing employment is forecast to decline by 779 jobs over the time period, while all other sectors are forecast to experience growth. The total net growth is an increase in employment of 20,534 in 2035.

Table 4: Forecast Change in Employment by Sector, 2010-2035

Employment Sector	Projected Growth (2010 -2035)
Manufacturing	-779
Recreation	341
Residual [1]	2,346
Retail	3,253
Services	15,373
TOTAL	20,534

[1] Residual employment refers to all job types not represented by the other sectors shown (for example, agriculture or fishing).

DISAGGREGATION OF EMPLOYMENT CHANGE TO THE TOWN LEVEL

The disaggregation of employment process was similar to that used for the population estimating process, using five zones as an intermediate step followed by distribution from the zone to the town level and ultimately to TAZs. A few differences do, however, apply:

- Historical change was measured from 1997-2010. 1997 is the earliest applicable data set available for Maine to establish employment.

- At the zone level, the absolute change in employment is used rather than the rate of change because of problems with small numbers of base employment producing very large percent changes that could not be used for projections.

- The allocation of projected zone employment from the zone level to the town level was done on the basis of each town's share of 2010 employment in the zone rather than based on prior growth rates. At the town level, growth data was not available for a number of small towns because of a lack of data for 1997. The issues associated with unrealistically high growth rates (over the longer term) as described above are an even larger problem at the town level.

The result is that the dynamics of spatial change are reflected at the zone level, while within zones, employment growth is estimated to occur in proportion to 2010 distributions. Larger towns will get more of the forecast employment growth, smaller towns less.

Existing employment in each sector was allocated to the TAZ level based on data from the 2010 Quarterly Census of Employment. While the projected drop in manufacturing employment will likely occur through the closing or downsizing of specific facilities, which facilities might be affected cannot be accurately predicted. Therefore, the 779 job decrease in employment was distributed proportionally to the twelve TAZs that have the largest employment base.

Summary employment data is shown in Table 5 for York County and in Table 6 for those communities in the CYCCS study area. The employment levels for any given year are for third quarter employment (Jul-Aug-Sep), not annual average.   Only town totals can be shown for confidentiality reasons.
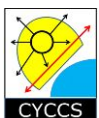
Table 5: Employment Forecasts by Zone and Town

Zone	Town	Historical				Projected 2035			
		1997 Emp.	2010 Emp.	Growth (1997 - 2010)	Share of County Growth Total	2035 Emp.	Growth (2010 – 2035)	Annual Growth Rate	Share of County Growth Total
Border Zone		5,040	7,385	2,345	14.2%	10,220	2,835	1.3%	13.8%
	Berwick		649			958	309	1.6%	
	Eliot		1,225			1,812	587	1.6%	
	Kittery		4,040			5,322	1,282	1.1%	
	Lebanon		461			670	209	1.5%	
	South Berwick		1,010			1,458	448	1.5%	
Central Zone		7,162	8,907	1,745	10.6%	12,306	3,399	1.3%	16.6%
	Acton		150			209	59	1.3%	
	Alfred		649			918	269	1.4%	
	Lyman		326			439	113	1.2%	
	North Berwick		880			1,225	345	1.3%	
	Sanford		6,672			9,217	2,545	1.3%	
	Shapleigh		230			298	68	1.0%	
Coastal Zone		13,679	19,328	5,649	34.1%	25,738	6,410	1.2%	31.2%
	Arundel		967			1,323	356	1.3%	
	Kennebunk		4,324			6,207	1,883	1.5%	
	Kennebunkport		1,916			2,306	390	0.7%	
	Ogunquit		2,358			2,743	385	0.6%	
	Wells		4,210			5,405	1,195	1.0%	
	York		5,553			7,754	2,201	1.3%	
Lakes Zone		542	1,101	559	3.4%	1,491	390	1.2%	1.9%
	Cornish		365			485	120	1.1%	
	Limerick		238			340	102	1.4%	
	Newfield		170			236	66	1.3%	
	Parsonsfield		328			430	102	1.1%	
Portland Zone		16,356	22,604	6,248	37.8%	30,104	7,500	1.2%	36.5%
	Biddeford		8,810			12,075	3,265	1.3%	
	Buxton		1,285			1,721	436	1.2%	
	Dayton		288			359	71	0.9%	
	Hollis		1,063			1,295	232	0.8%	
	Limington		235			330	95	1.4%	
	Old Orchard Beach		2,617			3,204	587	0.8%	
	Saco		6,198			8,414	2,216	1.2%	
	Waterboro		2108			2,706	598	1.0%	
York County		42,779	59,324	16,546		79,859	20,534	1.2%	

Note: 1997 town data not shown due to non-disclosure requirements

Population and Employment Projections

CYCCS

Table 6: Town Employment Summary for CYCCS Communities

Study Area	2010 Employment	Projected 2035 Employment	Projected change 2010-2035	Projected Annual Growth Rate 2010-2035	Share of Study Area Growth
Alfred	649	918	269	1.4%	2.5%
Arundel	967	1,323	356	1.3%	3.2%
Biddeford	8,810	12,075	3,265	1.3%	29.8%
Kennebunk	4,324	6,207	1,883	1.5%	17.2%
Lyman	326	439	113	1.2%	1.0%
North Berwick	880	1,225	345	1.3%	3.1%
Ogunquit	2,358	2,743	385	0.6%	3.5%
Sanford	6,672	9,217	2,545	1.3%	23.2%
Waterboro	2,108	2,706	598	1.0%	5.5%
Wells	4,210	5,405	1,195	1.0%	10.9%
TOTAL	31,304	42,258	10,954	1.2%	

APPENDIX: POPULATION DISAGGREGATION EQUATIONS

In the following equations, the superscript t refers to the town; it also refers to the zone when the zone population estimates are being calculated.

(1) $$r = \frac{\left(P_{10}^t - P_{90}^t\right)/ P_{90}^t}{Y}$$

Where:
> r= average annual growth rate for town t over 1990-2010
> P_{90}^t= Population of town t in 1990 (or in 2010 if denoted by subscript)
> Y=number of years of growth (in this case, 20)

(1) $$r = \left(\frac{P_{10}^t}{P_{90}^t}\right)^{\frac{1}{Y}} - 1$$

Where:
> r= average annual growth rate for town t over 1990-2010
> P_{90}^t= Population of town t in 1990 (or in 2010 if denoted by subscript)
> Y=number of years of growth (in this case, 20)

(2) $$RP_{35}^t = P_{10}^t \times (1 + r)^Y$$

Where:
> RP_{35}^t= Raw population estimate for 2035 for town t
> Y=number of years of growth (in this case, 25)

(3) $$S^t = \frac{RP_{35}^t}{RP_{35}^z}$$

Where:
> S^t=Share of the raw population in town t as a part of zone z (or zone z as a part of county).

(4) $$P_{35}^t = S^t (\Delta P_{35}^z) + P_{10}$$

Where:
> P_{35}^t= Population estimate for 2035 for town t
> Delta P_{35}^z = Estimated change in population in zone z or county