# I. Introduction

This report includes population projections out to the year 2040 for the all counties, cities, towns, and villages in the Genesee/Finger Lakes Region. A top down approach was used, where the region was capped within New York State, and then each county within the region, and finally all the municipalities within the counties were finalized.

# II. Methodology

The methodology was developed primarily by the Capital District Regional Planning Commission, and has been reviewed and agreed upon by the other Regional Planning Organizations within New York State.

The Population Projection Model involves two distinct stages: a quantitative first stage using a log-linear projection model set up in a MS Excel Workbook, and a qualitative second stage using non-quantitative judgments of the likelihood and extent of future population change within particular jurisdictions. The result is a final population projection for each county, and the towns and villages within it.

## A. Quantitative Stage

The Log-Linear model — so-called because of its straight-line form when plotted and a logarithmic scale for X-axis measurements — uses historic population to forecast or project future population based on a logarithmic curve, which is the best general model for natural populations.

The mathematical form of the model is:

$$Y = b0 + b1 \times \ln(X)$$

Where Y = the Dependent Variable population and X = the Independent Variable for the time period (years or index years). The Y-Intercept (point at which ln(X) = 0) is represented by b0, while b1 represents the Coefficient or slope of the natural logarithm (base e = 2.71828183) of X [ln(X)]. After converting the Independent Variable X into logs (log transformation), the Model is "fitted" by the standard (least squares) method of minimizing the sum of the squares of the deviations between the Model values and the actual values as in a Simple Regression Model.

Log-Linear models when used for forecasts project the historic rate of change of the actual data into the future at a steadily declining rate (i.e., historic growth or decline will continue, but at a lesser rate). Log-linear models are an excellent basis for population forecasts because they project average historic rates of change into the future in a manner consistent with the average changes in natural populations. While short-term population data will typically exhibit some variety of saw tooth pattern when charted, long-term population data usually follow a log-linear trend.

The MS Excel Workbook requires input of historic (and optionally, Census-estimated) population data for the region's nine counties and its towns and villages. The sum of the historic populations of the sub-divisions (counties) should equal the region total, as should each county's town and village total equal the county population. Thus, in the case of a county and its Minor Civil Divisions (MCDs), a town may be divided into its constituent villages together with the town population outside of the villages. A MCD may also be divided into the population in group quarters (e.g., for prisons and dormitories) and the population in households to better reflect the diverse population trends of the defined sub-divisions.

The Workbook model uses "Index Years" in place of actual years for computing the natural logs of the *Independent Variables*, with the first year, 1960, set equal to one (1960 = 1). The default "Log Index Factor" for each area and sub-division has been set to one, so that 1961 = 2, 1962 = 3, 1990 = 31, etc. Varying the Log Index Factor will change the slopes of the Population Trend, Initial Projections, and Final Projections for the area or sub-division selected because the absolute value of the slope of a log-linear model declines as the model's X-values increase. Thus, entering a number greater than one (e.g., 2, so that 1961 = 3, 1962 = 5, etc.) as a *Log Index Factor* will result in smaller slopes (absolute value) for the *Population Trend, Initial Projections*, and *Final Projections*. Whereas entering a number less than one but greater than zero (e.g., 0.5, so that 1961 = 1.5, 1962 = 2, etc.) will result in larger slopes (absolute value).

Once the historic (and estimated) data was entered and the Log Index Factor set, the Workbook Model computed the *Log-Linear Population Trends* of the data using simple regressions on the population data and the natural log of the Index Years. It next computed *Initial Projections* based on the *Population Trends* and the historic (and estimated) data. The Initial Projections are derived by computing the difference between the actual data and the Population Trend data for the last year of the actual data (either historic or estimated), and adding that difference to the coefficients of the Population Trends. This creates new trend lines that extend directly from the last year of the actual data and have the same shape (slopes) as the Population Trend lines.

The final procedure in the Quantitative Stage is to force the sum of the sub-divisions to equal the area total for each projection year. Given the independently derived nature of the area and sub-division projections, the sum of the sub-division projections for any particular projection year will virtually never equal the area total. The Workbook Model computes for each projection year the value (factor) which, when applied to all sub-division projections, will yield a sub-division sum equal to the area total. The use of a constant factor (0% < Factor £ 300%) applied to all of the sub-divisions within a projection year results in distributing the required gain or loss of population in proportion to each sub-division's population size.

The extent to which sub-divisions must be adjusted to equal the area total checks the reasonableness of the log-linear trend used in the quantitative model. Adjustment factors for one or more projection years that are much less than 90% or much greater than 110% may indicate a discrepancy between the trends fitted to the area total and the trends fitted to the sub-divisions. This may be reduced by changing the *Log Index Factor* or *making Flat Revisions* to area or sub-division values.

## B. Qualitative Stage Methodology

The projections derived from the Log-Linear Model provide a basis from which to further analyze the forces that affect population change in each area and sub-division, and are not necessarily intended to represent final population projections. There are many historic trends other than simple population which may give an indication of the direction and extent of future population change, including but not limited to: average persons per household, persons in group quarters, building permit issuances, new home construction, immigration and emigration patterns, and labor force data. In addition, there may be new development opportunities or constraints for particular jurisdictions embodied in zoning and sub-division regulations, economic development programs, and capital budgets for transportation facilities. Infrastructure is also looked at as an asset or liability to growth and development in the municipalities. As much of this information as possible has been considered in reviewing the projections derived from the Log-Linear Model for each jurisdiction, and changes made as appropriate.

The forecasts first take into consideration the population occupying group quarters. The number of people occupying group quarters were removed from the total population for each county, town, and village before being run through the Model and were then added in as a flat revision after the projections have been made. This ensures that the group quarter numbers, which are typically static, are not factored in as a population that will have a natural increase over time. New or expanded group quarters and the elimination or downsizing of group quarters are additionally taken into account as flat revisions.

*Additional considerations used to modify forecast numbers after being run through the model are as follows:*

**Input/Output**

This includes looking at the total number of births and deaths for each town and village. In addition, the number of people migrating into and out of the area was taken into consideration. The total number of people coming into the area, through new births and in-migration, minus the number of people who have died or left the area yields a new population through 2000. The trend birth and death rates are following, in addition to in and out-migration trends can therefore be used for evaluating and modifying the initial population projections through 2040.

**Housing and Occupancy Data**

Following the trends in new housing construction in the towns and villages gives another check to the projections obtained through the model. By utilizing data such as the: 1) number of new major subdivisions, which is classified by producing at least four lots, 2) total number of lots resulting from new major subdivisions, 3) persons per household, 4) vacancy rate, and 5) building permit activity, new population entering the municipality can be estimated. The number of new housing lots, minus the number of vacant housing units, is multiplied by the average persons per household for that municipality resulting in the number of new residents in the municipality. This trend can then be projected through 2040 and used to modify initial forecast numbers.

**Land Use and Regulatory Considerations**

Each municipality has unique circumstances that require special consideration. Since quantitative data alone cannot accurately portray the possibilities for future growth or development, additional information was acquired from town and village officials. This includes the acreage available for residential development, the existence and condition of infrastructure, municipal growth management policies and the land use and zoning of available land. A contact at each county was actively involved in providing this information and supplying additional comments that may assist in modifying the initial population projections.

This information provides an overview of the growth potential for each municipality and is an indicator of the type of future development that is likely to occur.  Therefore, the quantitative data was complemented by qualitative information resulting in the best forecast possible.

## III. Review Process

Each county planning department has had the opportunity to review and comment on the methodology, initial projections, and final projections.  Once the initial projections were completed, G/FLRPC staff went to each county with supporting data and discussed modifications that needed to be made that the quantitative portion of the model would not take into consideration.  All modifications that were made to the initial figures were recorded and a justification was given to the county planners for review.  At every stage, the county planners have been involved in the process and have given G/FLRPC staff the critical support and information to make the best possible forecasts.

The model is heavily dependent on historical data.  Rural towns and villages can increase their population by a significant percentage as a result of a new mobile home park or new subdivision.  Since many of the towns and villages have a very small base population, this type of new development would greatly impact the growth rate.  However, this type of development is not as predictable in rural areas as it may be in more urbanized areas.  Furthermore, much of the data collected for the qualitative portion of the methodology is not as significant in rural counties.  For example, looking at the amount of land available for residential development in a rural town is not indicative of the potential for growth.  Although some urban towns are inhibited by the amount of land available for