CENTRAL FLORIDA WATER INITIATIVE (CFWI) SMALL AREA ESTIMATES AND PROJECTIONS

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TABLE OF CONTENTS

INTRODUCTION 3

GEOSPATIAL SMALL-AREA POPULATION ESTIMATION AND FORECASTING MODEL OVERVIEW .. 3

COUNTY BUILD-OUT SUBMODELS 4
- Parcels 4
- 2020 US Census Data 4
- Future Land Use 5
- Planned Developments 6
- Wetlands 6
- Administrative Boundaries 6
- BEBR Historical Population Estimates 6
- Build-out Density Calculation 7

GROWTH DRIVERS SUBMODEL 8

GEOSPATIAL SMALL-AREA POPULATION ESTIMATION AND FORECASTING MODEL 9
- Historic Growth Trends 10
- Growth Calculation Methodology 13

PROJECTION DELIVERABLES 14

CONCLUSIONS 16

REFERENCES 17

LIST OF FIGURES

Figure 1. County Build-out Submodels 7

Figure 2. Growth Drivers Submodel 9

Figure 3. CFWI parcels shaded by 2050 projected population density 16

LIST OF TABLES

Table 1. GIS datasets used in the Growth Drivers Submodel 8

Table 2. Population estimate summaries by county and water management district 15

Table 3. Population projection summaries by county and water management district 15

INTRODUCTION

The University of Florida's Bureau of Economic and Business Research (BEBR) produces the official population estimates and projections for the State of Florida through a contract with the Florida Legislature. That contract funds the development of estimates at the state, county and city levels, and projections at the state and county levels. Because finer spatial precision is required for water supply planning, BEBR also develops small-area population estimates and projections for water management and utilities. The purpose of this document is to describe the methods used by BEBR to develop small-area population estimates and projections for the Central Florida Water Initiative (CFWI) Regional Water Supply Planning (RWSP) Area.

GEOSPATIAL SMALL-AREA POPULATION ESTIMATION AND FORECASTING MODEL OVERVIEW

The Geospatial Small-Area Population Estimation and Forecasting Model ("Model") was used to estimate and project permanent residential population at the parcel level, and then normalize those projections to BEBR's latest county level forecasts. First, County Build-out Submodels were developed using property parcel data for each of the six counties that are entirely or partly within the CFWI area. (Note that Brevard County was included because the City of Cocoa's wellfield is in Orange County.) The purpose of the County Build-out Submodel is to develop maximum residential development potential at the parcel level. A detailed description of this model is included in the section titled "County Build-out Submodels". Current permanent population was estimated and then the maximum population to which a county can grow was modeled by the County Build-out Submodels. Areas which cannot physically or lawfully sustain residential development (built-out areas, water bodies, public lands, commercial areas, etc.) were excluded from the County Build-out Submodel. Conversely, the model identified areas where growth is more likely to occur based on proximity to spatial features (e.g., roads) that tend to drive growth to certain areas. This is explained in detail in the section titled "Growth Drivers Submodel".

Historical population was estimated for each year from 2015-2021. A combination of parcel-based unit estimates, average occupancy and household size from the U.S. Census Bureau, surveys of large group quarters, and BEBR's own official population estimates for cities and counties were used to create the 2015-2021 historical estimates.

Next, population growth was modeled between the launch year population (2021) and the build-out population. Projections are based on a combination of historic growth trends (using an approach similar to what we use for our county level forecasts), and spatial constraints and influences, which both restrict and direct growth. This process is described in detail in the section titled "Geospatial Small-Area Population Estimation and Forecasting Model". Population growth calculations were controlled to BEBR's 2022 medium projections (BEBR's latest population forecasts for the years 2025 through 2050), which were available in five-year increments. The source of this data is the BEBR publication *Projections of Florida Population by County, 2025-2050, with Estimates for 2021.* (Florida Population Studies, Bulletin 192, February 2022).

Finally, the parcel-level estimates and projections were summarized by water utility service area boundaries that the three water management districts (SFWMD, SJRWMD, and SWFWMD) maintain in a Geographic Information System (GIS) format. These summaries were exported to a Microsoft Excel spreadsheet with separate tabs for each county to facilitate the review and distribution of the results.

COUNTY BUILD-OUT SUBMODELS

The County Build-out Submodels are composed of multiple GIS data elements. Each model is based on each county property appraiser's GIS parcel database, including the associated tax roll information. Other elements incorporated into each build-out model include the 2020 Decennial Census data, local government future land use data, planned developments, wetland data, and BEBR's official population estimates.

Parcels

GIS parcel layers and county tax roll databases were obtained from each county property appraiser's office. Parcel geometry was checked for irregular topology, particularly overlaps and fragments. Parcel tables were checked for errors, particularly non-unique parcel identifiers and missing values. Required tax roll table fields include actual year built, Florida Department of Revenue (DOR) land use code, and the total number of existing residential units for each parcel. In cases where values or fields were missing, other relevant information was extrapolated and used as a surrogate. For example, data reported by the State of Florida was used to identify the number of residential units (and population) in large group quarters facilities.

2020 US Census Data

Some of the essential attribute information to translate parcels to population in the County Build-out Submodels were derived from data from the 2020 Decennial Census. Average housing unit occupancy and population per household by census tract were calculated and then transferred to each county's parcel data. When combined with parcel-level housing units from property appraiser data, these were used to estimate 2021 population in households at the parcel level. When added to our estimates of population in group quarters (estimated using property appraiser bed counts, 2021 BEBR surveys of large group quarters, and 2020 Census counts), the resulting estimates were then controlled at county and place levels to the 2021 BEBR population estimates.

In cases where property appraiser data were missing or incomplete, other data were used. For example, because mobile home parks without individually platted parcels may not contain the number of units within the property appraiser data, the number of residential units for some of the parks had to be estimated using information on their websites or hand counts from recent imagery.

Future Land Use

Future land use maps were essential elements of the County Build-out Submodel. These maps helped guide where and at what density residential development could occur. Future land use maps are a part of the local government comprehensive plans required for all local governments by Chapter 163, Part II, Florida Statutes. They are typically developed by the local government's planning department, or, in some cases, a regional planning council on behalf of the local government. The planning horizons are a minimum of 10 years, and they often extend for 15 to 20 years into the future. Although these future land use maps may be revised over time, they reflect the most up-to-date plan for future growth areas and densities. The latest available future land use maps were obtained, and land uses and associated densities were assigned to the underlying parcels in the County Build-out Submodels.

Each land parcel in the County Build-out Submodel received a future land use designation. In places where parcels overlapped multiple future land use areas, the parcel was assigned the future land use class within which its centroid fell. Build-out population was modeled only for future land use classes that allow residential development (which include agriculture and mixed use and can sometimes include commercial and other uses not typically associated with residential development).

Development typically does not occur at the maximum densities allowed for each future land use category, so recent development densities were considered a better proxy for future densities than the maximum allowable density. For this reason, the County Build-out Submodel reflected the <u>median</u> density of recent development for each future land use category in the specific incorporated place. For example, if a city's medium density residential future land use designation allows up to 8 housing units per acre, but the median density of units built over the last 20 years is 5.7 housing units per acre, the submodel assumed future densities at 5.7 housing units per acre for that future land use designation in that city. Typically, the median density calculation was limited to the last 20 years of development within each unique combination of land use and jurisdiction, as more recent development was deemed a better proxy for future densities than older development.

In some cases, limiting the historical data to the last 20 years resulted in too small a sample, so either county average values were used (extended beyond the jurisdiction) or a longer base period was used (not limited to the last 20 years). In those cases, the determination of which sample to use depended upon the heterogeneity of the category across county jurisdictions, the heterogeneity of historical densities prior to the last 20 years, and our professional judgement. In some cases, where very few or no historical examples of residential parcels fell within a future land use category, a density from a similar future land use within the county (with sufficient historical samples) was used as a surrogate. Also, vacant or open parcels less than one acre in size were typically considered single family residential, with one housing unit as the maximum allowable density.

Planned Developments

After the future land use densities were calculated, any parcels within planned developments were adjusted to correspond with approved development plans. Although planned developments often do not develop as originally planned by the developer, the total number of units planned (regardless of timing) is likely to be a better forecast of the units at build-out than one based on the median historic densities. Therefore, in each of the County Build-out Submodels, parcels with centroids within a large planned development were attributed with the name of the development. The build-out densities for those parcels were adjusted so that the total build-out for the development was consistent with the development plan, and the build-out population for that area was recalculated.

Wetlands

Wetlands (including surface water) are an important consideration when modeling a county's build-out. Wetland GIS data were overlaid with a county's land parcels. The area of wetlands within parcels were calculated and subtracted from the total area of the parcel feature to determine the developable area in that parcel. There were exceptions to this. In some cases, parcels with little or no developable area after wetlands were removed were already developed, thus the estimated unit total was not reduced by the wetland acreage. In other cases, inaccurate wetland delineations were overridden, such as when platted residential parcels were shown to be covered by the edge of a wetland. In such a case, the parcel was considered developable by the submodel.

Administrative Boundaries

Each parcel in the County Build-out Submodels was also attributed with several administrative boundaries, including:

1. County and city name (or unincorporated area) from the 2020 Census,
2. Water management district boundaries,
3. CFWI utility service area id, and
4. Central Florida Coordination Area (CFCA) boundaries.

These attributes enable queries and summaries of the county submodels by any combination of these boundaries.

BEBR Historical Population Estimates

Historical population was estimated using the parcel and census data for each year from 2015-2021. Starting with the 2021 estimate, we estimated population annually from 2015 to 2020 by removing population from parcels developed on or after each of those years from that year's estimate. For example, if the year the parcel was developed in 2017, the 2015-2017 estimates would be 0 and the 2018-2020 would equal the 2021 estimate. Once this was done, the totals for each year were calibrated to the official BEBR estimates by subcounty area (city, town, village, or unincorporated county).

Build-out Density Calculation

Using GIS overlay techniques, attributes of the census, future land use, wetlands, and administrative boundaries were attributed to each county's parcel data to develop the County Build-out Submodels. These submodels estimate the current population and forecast the maximum population by parcel at build-out. Figure 1 shows the six counties shaded by the projected population per acre at build-out. Lower unit densities are depicted in yellow and higher ones in brown.

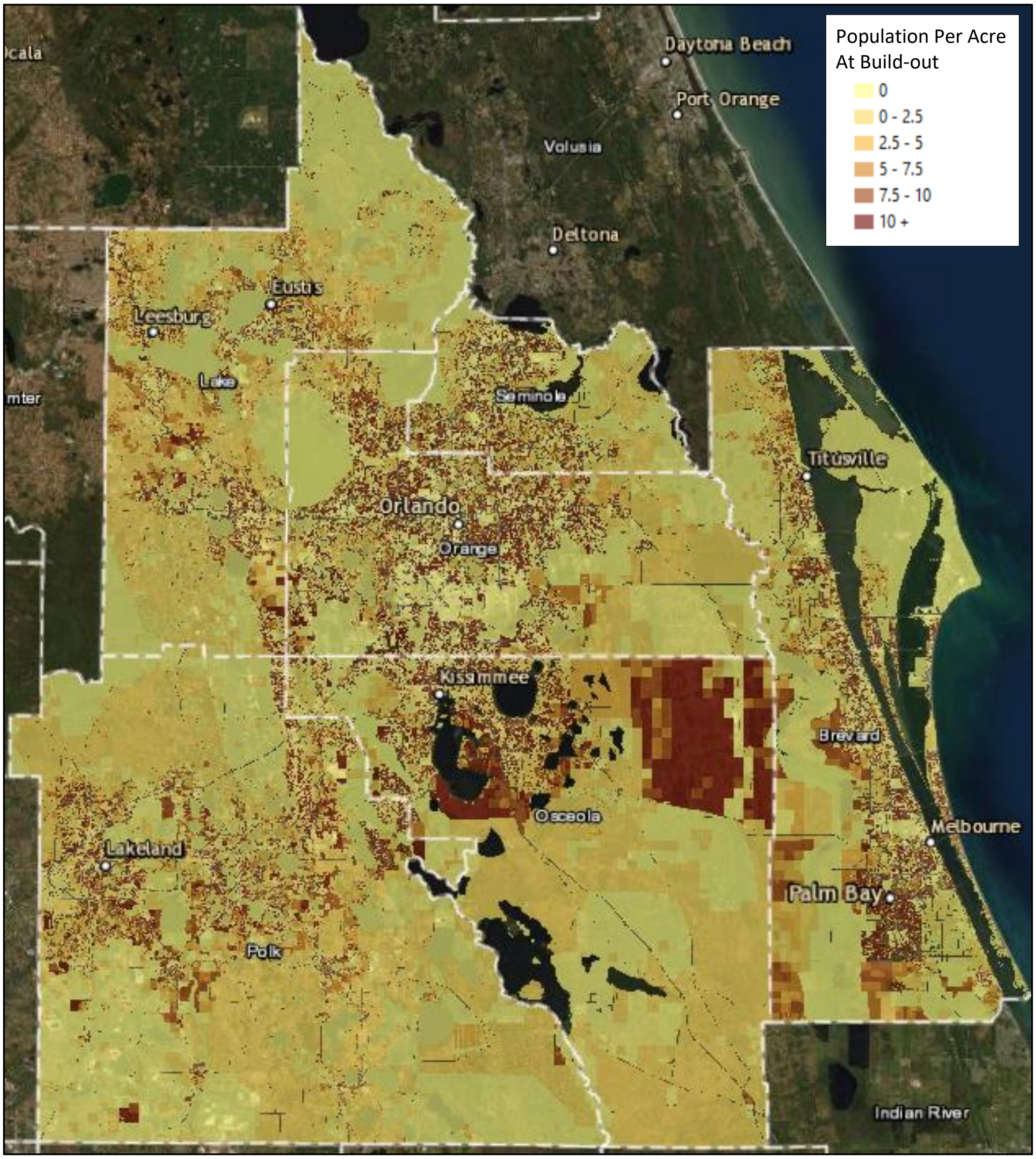

Figure 1. County Build-out Submodels

GROWTH DRIVERS SUBMODEL

The Growth Drivers Submodel is a regional, raster (cell-based) GIS model representing development potential. The submodel is a continuous surface of 10-meter cells containing values of 0-100, with '100' having the highest development potential and '0' having the lowest development potential. It influences the population projection model by factoring in the attraction of certain spatial features, or growth drivers on development. These drivers were identified from transportation and land use/land cover data. They included the following:

1. Proximity to roads and interchanges prioritized by level of use (with each road type modeled separately)
2. Proximity to planned developments
3. Proximity to existing commercial development (based on parcels with commercial land use codes deemed attractors to residential growth)
4. Proximity to existing residential development
5. Proximity to coastal and inland waters

Data used for generating the Growth Drivers Submodel and their sources are listed in Table 1 below.

Table 1. GIS datasets used in the Growth Drivers Submodel

Growth Driver	Data Source
Roads and Limited Access Road Interchanges	Florida Department of Transportation (FDOT) Major Roads: Functional Classification (FUNCLASS), and FDOT Limited Access Road Interchanges
Existing Residential Land Uses	County Property Appraiser Parcel Data
Selected Existing Commercial Land Uses	County Property Appraiser Parcel Data
Coastal and Inland Waters	Land Cover Data, and Florida Geographic Data Library (FGDL) Coastline Data
Planned Developments	Multiple sources, including Regional Planning Councils, local governments, GIS Associates and BEBR

Each of the drivers listed in Table 1 were used as independent variables in a logistic regression equation. Dependent variables included existing residential units as the measure of "presence", and large undeveloped vacant parcels outside of large planned developments were used to measure "absence". The resulting equation could then be applied back to each of the regional grids resulting in a single regional grid with values 0 through 100, for which a value of 0 represented the lowest relative likelihood of development, and a value of 100 represented the highest relative likelihood of development.

This seamless, "regional" submodel encompasses all the counties all or partially within CFWI Regional Water Supply Planning (RWSP) Area, plus a one-county buffer to eliminate "edge effects". In this case, the edge effects refer to the presence or absence of growth drivers outside the CFWI area that could influence growth within it. This submodel was used by the Model to rank undeveloped parcels based on their development potential, which is explained in the Growth Calculation Methodology section.

Figure 2 below depicts the Growth Drivers Submodel for the CFCA region, with higher development probability in red, moderate probability in yellow, and lower probability in blue.

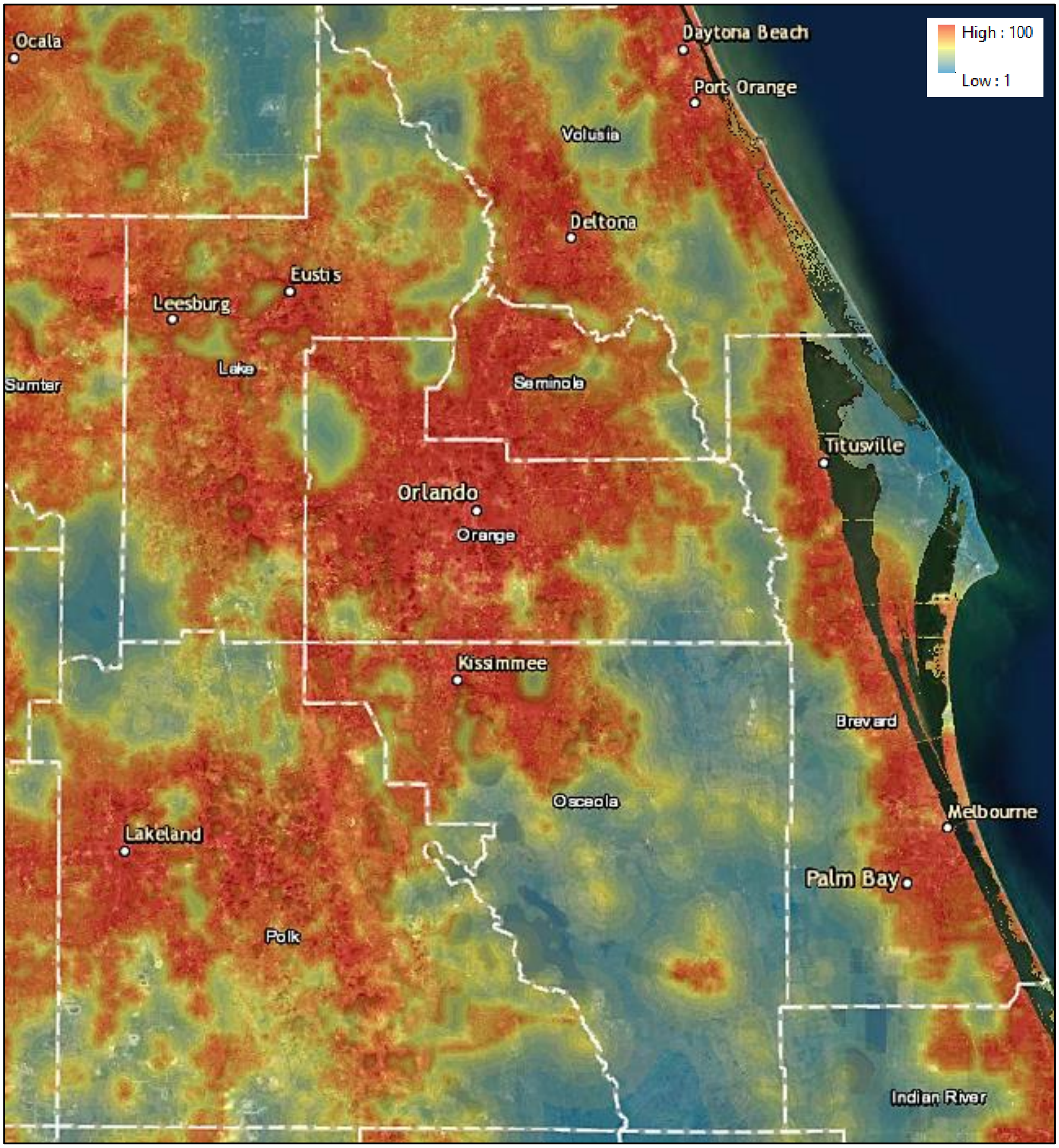

Figure 2. Growth Drivers Submodel

GEOSPATIAL SMALL-AREA POPULATION ESTIMATION AND FORECASTING MODEL

The Small-Area Population Forecasting Model integrates the County Build-out Submodel and the Growth Drivers Submodel, which makes the projection calculations using a combination of those submodels, historic growth trends, and growth controls from BEBR's county-level forecasts.

Historic Growth Trends

The historic growth trends were based on historic population counts from the 1990, 2000, 2010, and 2020 censuses. For 1990, 2000, and 2010, census block population counts were summarized at the 2020 tract level and combined with the 2020 tract population counts. These counts were used to produce eleven tract level projections using five different demographic extrapolation methods using multiple base periods. The length of the base was adjusted to roughly match the length of the projection horizon, so for a 20-year horizon, 20 years of historical data were used to establish the growth trends. The number of trend calculations varied based on the length of the base period used, and the highest and lowest calculations were discarded to moderate the effects of extreme projections. The remaining projections were then averaged.

The five demographic extrapolation methods for projecting population utilized by the model were Linear, Exponential, Constant Share, Share-of-Growth and Shift-Share. The Linear and Exponential techniques employ a bottom-up approach, extrapolating the historic growth trends of each census tract with no consideration for the county's overall growth. The Constant Share, Share-of-Growth and Shift-Share techniques employ a ratio allocation, or top-down approach, allocating a portion of the total projected county population or growth to each census tract based on that census tract's percentage of county population or growth over the historical period. Each of the five methods is a good predictor of growth in different situations and growth patterns, so using a combination of all five and discarding the highest and lowest results was the best way to avoid the largest possible errors resulting from the least appropriate techniques for each census tract within the six counties. This approach is similar to BEBR's county population forecast methods, but the base periods and the number of projections are somewhat different because annual estimates are not available at the tract level.

The calculations associated with the five statistical methods are described on the following pages. The launch year was 2020, and the projections were made for 2025, 2030, 2035, 2040, 2045, and 2050.

1. **Linear Projection Method:** The Linear Projection Method assumes that the change in the number of persons for each census tract will be the same as during the base period (Rayer and Wang, 2022). Three linear growth rate calculations were made, 1990 to 2000, 2000 through 2020, and 2010 through 2020. In the three Linear methods (LIN), population growth was calculated using the following formulas:

$$LIN1 = \frac{(TractPop2020 - TractPop1990)}{30} * 5$$

$$LIN2 = \frac{(TractPop2020 - TractPop2000)}{20} * 5$$

$$LIN3 = \frac{(TractPop2020 - TractPop2010)}{10} * 5$$

2. **Exponential Projection Method:** The Exponential Projection Method assumes that population will continue to change at the same percentage rate as during the base period (Rayer and Wang, 2022). One calculation was made from 2010 through 2020. In the Exponential method (EXP), population growth was calculated using the following formula:

$$EXP = (TractPop2020 * e^{5r}) - TractPop2020$$

$$Where, r = \frac{ln\frac{TractPop2020}{TractPop2010}}{10}$$

3. **Constant Share Projection Method:** The Constant Share Projection Method assumes that each census tract's percentage of the county's total population (CntyPop) will be the same as over the base year (Rayer and Wang, 2022). One calculation was made using the 2020 share of county population. In the Constant Share method (CS), population growth was calculated using the following formula (using 2020–2025 as an example):

$$CS = \frac{TractPop2020}{CntyPop2020} * (CntyPop2025 - CntyPop2020)$$

4. **Share-of-Growth Projection Method**: The Share-of-Growth Projection Method assumes that each census tract's percentage of the county's total growth will be the same as over the base period (Rayer and Wang, 2022). However, if population change is negative at the tract level and positive at the county level (or vice versa), higher county-level projections would result in larger declines in tract projections. This is counterintuitive, so the "Plus-minus" variant of the Share-of-Growth Method was used (Rayer, 2015). Three Share-of-Growth (SOG) calculations were made, 1990 through 2020, 2000 through 2020, and 2010 through 2020. Population growth was calculated using the following formulas <u>if</u> the changes in growth over the base period for the tract and county were both positive or both negative (using 2020–2025 as an example):

$$SOG = \left[\frac{SOG}{CntyPop2025 - CntyPop2020}\right] * \left[\begin{array}{l}\left[CntySum\left[\frac{ABS(SOG)}{CntyPop2025 - CntyPop2020}\right]\right] \\ + \left[1 - CntySum\left[\frac{SOG}{CntyPop2025 - CntyPop2020}\right]\right]\end{array}\right]$$
$$\div \left[CntySum\left[\frac{ABS(SOG)}{CntyPop2025 - CntyPop2020}\right]\right] * (CntyPop2025 - CntyPop2020)$$

$$\begin{array}{l} Where, \\ SOG1 = \frac{(TractPop2020 - TractPop1990)}{(CntyPop2020 - CntyPop1990)} * (CntyPop2025 - CntyPop2020) \\ and\ ABS = Absolute\ Value \end{array}$$

$$\begin{array}{l} Where, \\ SOG2 = \frac{(TractPop2020 - TractPop2000)}{(CntyPop2020 - CntyPop2000)} * (CntyPop2025 - CntyPop2020) \\ and\ ABS = Absolute\ Value \end{array}$$

$$\begin{aligned}&Where,\\&SOG3=\frac{(TractPop2020-TractPop2010)}{(CntyPop2020-CntyPop2010)}*(CntyPop2025-CntyPop2020)\\&and\ ABS=Absolute\ Value\end{aligned}$$

If the changes in growth over the base period were negative at the tract level and positive at the county level or vice versa, the population growth was calculated using the following formulas (using 2020–2025 as an example):

$$SOG=\left[\frac{SOG}{CntyPop2025-CntyPop2020}/5\right]*\left[\begin{array}{l}\left[CntySum\left[\frac{ABS(SOG)}{CntyPop2025-CntyPop2020}\right]\right]\\+\left[1-CntySum\left[\frac{SOG}{CntyPop2025-CntyPop2020}\right]\right]\end{array}\right]$$
$$\div\left[CntySum\left[\frac{ABS(SOG)}{CntyPop2025-CntyPop2020}\right]\right]*(CntyPop2025-CntyPop2020)$$

$$\begin{aligned}&Where,\\&SOG1=\frac{(TractPop2020-TractPop1990)}{(CntyPop2020-CntyPop1990)}*(CntyPop2025-CntyPop2020)\\&and\ ABS=Absolute\ Value\end{aligned}$$

$$\begin{aligned}&Where,\\&SOG2=\frac{(TractPop2020-TractPop2000)}{(CntyPop2020-CntyPop2000)}*(CntyPop2025-CntyPop2020)\\&and\ ABS=Absolute\ Value\end{aligned}$$

$$\begin{aligned}&Where,\\&SOG3=\frac{(TractPop2020-TractPop2010)}{(CntyPop2020-CntyPop2010)}*(CntyPop2025-CntyPop2020)\\&and\ ABS=Absolute\ Value\end{aligned}$$

6. **Shift-Share Projection Method:** The Shift-Share Projection Method assumes that each census tract's percentage of the county's total annual growth will change by the same annual amount as over the base period (Rayer and Wang, 2022). Three Shift-Share calculations were made, 1990 through 2020, 2000 through 2020, and 2010 through 2020. In the three Shift-Share Projection Method (SSH) calculations, population growth was calculated using the following formulas (using the five years from 2020–2025 as an example):

$$SSH_1=\left[\frac{TractPop2020}{CntyPop2020}+\left[\frac{\left(\frac{TractPop2020}{CntyPop2020}-\frac{TractPop1990}{CntyPop1990}\right)}{30}*5\right]\right]*\left(\begin{array}{r}CntyPop2025\\-CntyPop2020\end{array}\right)$$

$$SSH_1=\left[\frac{TractPop2020}{CntyPop2020}+\left[\frac{\left(\frac{TractPop2020}{CntyPop2020}-\frac{TractPop2000}{CntyPop2000}\right)}{20}*5\right]\right]*\left(\begin{array}{r}CntyPop2025\\-CntyPop2020\end{array}\right)$$

$$SSH_2 = \left[\frac{TractPop2020}{CntyPop2020} + \left[\frac{\left(\frac{TractPop2020}{CntyPop2020} - \frac{TractPop2010}{CntyPop2010}\right)}{10} * 5\right]\right] * \left(\begin{matrix} CntyPop2025 \\ -CntyPop2020 \end{matrix}\right)$$

7. **Average of the Projection Extrapolations:** Because the number of trend calculations varied based on the length of the base period used, different combinations of projections were averaged for different forecast years.
    a. For 2025 and 2030 projections, five calculations with base periods up to 10 years were used. The lowest and highest of the five were excluded to moderate the most extreme results of the census tracts within the six-county area, and the remaining three were averaged.
    b. For 2035 and 2040, eight calculations with base periods up to 20 years were used. The two lowest and two highest of the eight were excluded, and the remaining four were averaged.
    c. For 2045 and 2050, eleven calculations with base periods up to 30 years were used. The three lowest and three highest of the eleven were excluded, and the remaining five were averaged.

    The 2045 and 2050 projections, which included all calculations and base periods, were calculated using the following formula:

$$AVG = \frac{\begin{matrix}(LIN1 + LIN2 + LIN3 + EXP + CS + SOG1 + SOG2 + SOG3 + SSH1 + SSH2 + SSH3) \\ -(MIN1 + MIN2 + MIN3 + MAX1 + MAX2 + MAX3)\end{matrix}}{5}$$

$Where,$
$MIN1 - MIN3 \text{ are the three lowest growth calculations for each tract, and}$
$MAX1 - MAX3 \text{ are the three highest growth calculations for each tract.}$

Growth Calculation Methodology

The Population Projection Model then automated growth calculations using the historic growth trends and queries of the County Build-out Submodels and the Growth Drivers Submodel. The methodology for calculating growth for each projection increment included the following steps:

1. Apply the tract-level projected growth to parcels within each tract, distributing growth to parcels with the highest driver values first.
2. Check growth projections against build-out population, and reduce any projections exceeding build-out to equal the build-out numbers.
3. After projecting growth for all census tracts within a particular county, summarize the resulting growth and compare it against countywide BEBR target growth. For each model iteration, this step led to one of two scenarios:
    a. If the Small-Area Population Forecasting Model's projections exceeded the BEBR target growth, reduce the projected growth for all tracts by the percentage that the projections exceeded the BEBR target.

b. If the Small-Area Population projection model's projections were less than the BEBR target, develop parcels with the highest growth driver values and available capacity until the BEBR target growth is reached.

Counties were processed in their entirety and controlled to the BEBR-based target growth.

PROJECTION DELIVERABLES

The final population projections were delivered in multiple formats, including:

1. GIS – Esri file geodatabase containing:
   a. A county-wide parcel polygon feature class for each of the six counties
   b. A county-wide parcel centroid (center point) feature class for each of the six counties
   c. A single parcel polygon feature class with all counties aggregated
   d. A single parcel centroid (center point) feature class with all counties aggregated

2. Tabular – Excel spreadsheet summaries by utility service area, county, and district

To create the tabular deliverables, the parcel-level population estimates and projections feature classes were summarized by water utility service area boundaries. These service areas, maintained by the three water management districts, were overlaid with each county's parcel-level results, and each parcel within a service area was assigned a unique identifier for that service area. The projected population was then summarized by that identifier and exported to a spreadsheet. (Note that these service areas change over time, so for any future use of these deliverables, it is important to match this projection set only with the service areas included in the GIS deliverables for this project.)

The tabular deliverables were provided in an Excel spreadsheet with utility summary tabs for each CFWI county. The population outside of service areas include population with private wells for potable use (considered to be domestic self-supply) or very small utilities without a service area boundary mapped by the water management districts. Note that these service area population summaries may include some self-supplied populations (or populations with private wells) that reside within the service areas.

Tables 2 and 3 below show the population estimate and projection summaries by county and water management district.

Table 2. Population estimate summaries by county and water management district

POPULATION ESTIMATES BY COUNTY AND WATER MANAGEMENT DISTRICT								
COUNTY	**DISTRICT**	**POP15**	**POP16**	**POP17**	**POP18**	**POP19**	**POP20**	**POP21**
BREVARD	SJRWMD	561,714	568,919	575,211	583,563	594,469	606,612	616,742
LAKE	SJRWMD	315,554	322,985	330,734	341,922	356,210	382,815	398,960
LAKE	SWFWMD	1,015	1,000	990	995	1,037	1,141	1,182
ORANGE	SFWMD	363,731	379,072	396,762	414,922	433,893	455,526	473,106
ORANGE	SJRWMD	888,665	901,315	917,118	934,675	952,187	974,382	984,834
OSCEOLA	SFWMD	307,167	321,669	336,393	351,242	369,267	387,395	405,172
OSCEOLA	SJRWMD	1,160	1,193	1,221	1,254	1,284	1,261	1,288
POLK	SFWMD	37,534	38,738	39,890	40,665	42,016	45,383	47,722
POLK	SWFWMD	595,518	608,251	621,755	632,363	648,590	679,663	700,643
SEMINOLE	SJRWMD	442,903	449,124	454,757	463,560	471,735	470,856	477,455
DISTRICT SUM -	SFWMD	708,433	739,478	773,045	806,830	845,177	888,304	926,000
DISTRICT SUM -	SJRWMD	2,209,996	2,243,536	2,279,041	2,324,973	2,375,885	2,435,926	2,479,279
DISTRICT SUM -	SWFWMD	596,532	609,252	622,745	633,358	649,626	680,804	701,825
ALL DISTRICT TOTALS		3,514,961	3,592,266	3,674,831	3,765,161	3,870,689	4,005,034	4,107,104

Table 3. Population projection summaries by county and water management district

POPULATION PROJECTIONS BY COUNTY AND WATER MANAGEMENT DISTRICT								
COUNTY	**DISTRICT**	**POP25**	**POP30**	**POP35**	**POP40**	**POP45**	**POP50**	**POP_BO**
BREVARD	SJRWMD	648,000	678,300	702,000	722,000	739,100	754,500	1,494,661
LAKE	SJRWMD	440,968	485,249	522,396	555,409	584,087	610,329	978,961
LAKE	SWFWMD	1,732	2,351	2,904	3,391	3,813	4,171	14,016
ORANGE	SFWMD	529,105	578,096	616,527	654,188	689,754	732,260	828,401
ORANGE	SJRWMD	1,048,595	1,126,604	1,190,473	1,239,212	1,279,246	1,305,940	1,345,194
OSCEOLA	SFWMD	460,888	521,642	570,027	612,238	650,277	685,644	1,201,351
OSCEOLA	SJRWMD	2,613	3,857	4,974	5,962	6,824	7,557	1,237,246
POLK	SFWMD	53,334	58,906	63,271	66,575	69,622	72,316	219,708
POLK	SWFWMD	757,566	818,894	869,429	912,625	949,878	983,884	1,765,468
SEMINOLE	SJRWMD	499,100	520,900	539,000	554,400	567,300	578,800	579,999
DISTRICT SUM -	SFWMD	1,043,327	1,158,644	1,249,825	1,333,000	1,409,653	1,490,220	2,249,460
DISTRICT SUM -	SJRWMD	2,639,275	2,814,911	2,958,843	3,076,984	3,176,556	3,257,125	5,636,059
DISTRICT SUM -	SWFWMD	759,298	821,245	872,333	916,016	953,691	988,055	1,779,484
ALL DISTRICT TOTALS		4,441,900	4,794,800	5,081,000	5,326,000	5,539,900	5,735,400	9,665,003

The GIS outputs are useful for quality assuring the results and inputs, for maintaining the projection inputs over time, and for graphically depicting projected patterns of future population growth. Figure 3 on the following page shows the parcel-level data for the six counties shaded by projected population per acre in 2050.

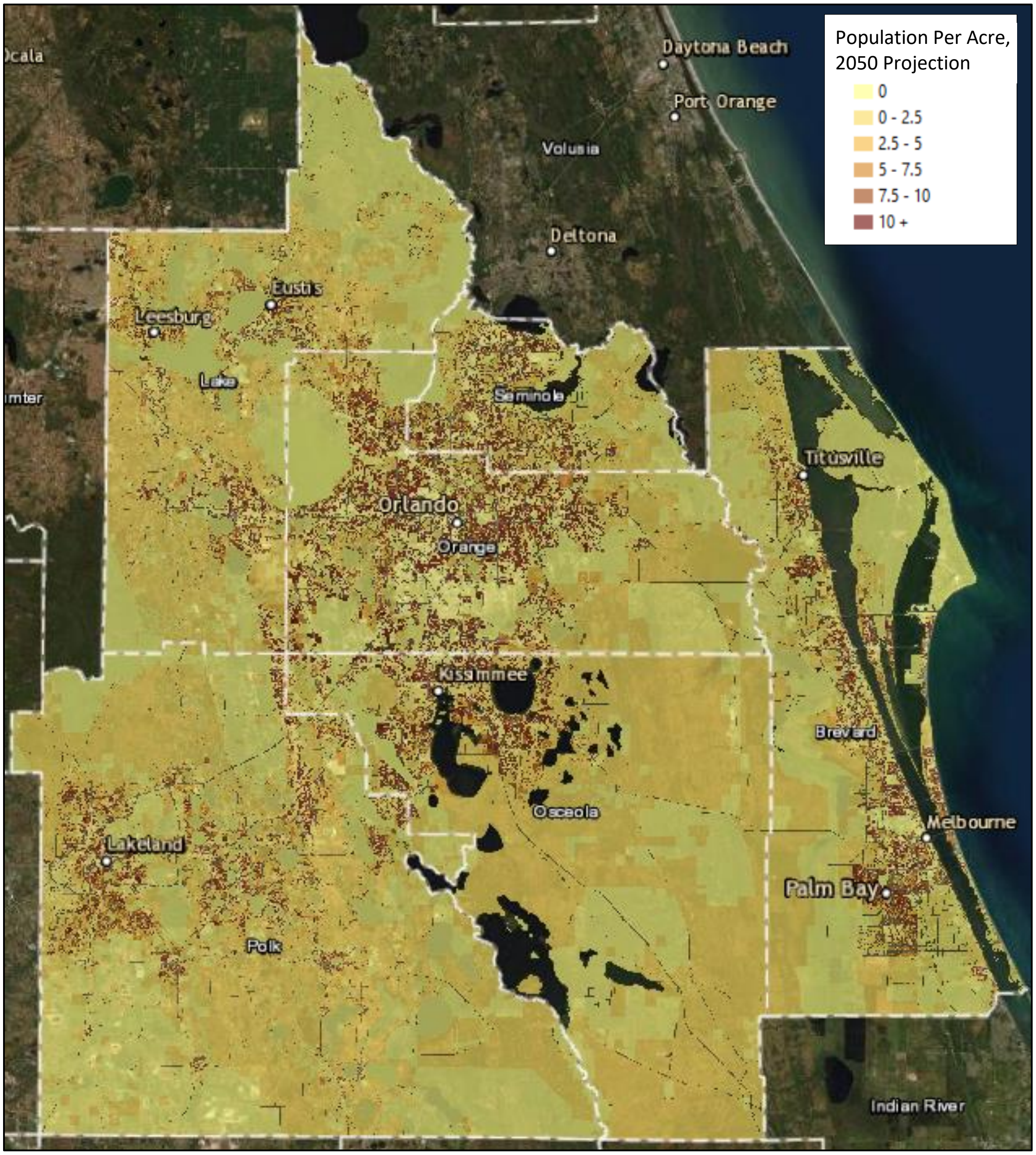

Figure 3. CFWI parcels shaded by 2050 projected population density

CONCLUSIONS

Small area population estimates and projections provide an essential foundation for water supply planning, particularly in areas like Central Florida that are experiencing rapid growth. They are integral to understanding per capita water use and forecasting future demands. BEBR's implementation of this Geospatial Small-Area Population Estimation and Forecasting Model for the CFWI region provided reasonable and consistent estimates and projections for this purpose. Controlling to our own official estimates and projections provided consistency with other projections made by state and local governments, while at the same time providing the spatial precision needed for water supply planning.

REFERENCES

Bureau of Economic and Business Research (2021). "Florida Estimates of Population 2021". Bureau of Economic and Business Research, University of Florida, Gainesville, Florida. URL: https://www.bebr.ufl.edu/wp-content/uploads/2022/02/estimates_2021.pdf.

Bureau of Economic and Business Research (2021). "Florida Population: Census Summary, 2020." December 2021. Bureau of Economic and Business Research, University of Florida. Gainesville, Florida. URL: https://www.bebr.ufl.edu/wp-content/uploads/2022/01/census_summary_2020.pdf.

Rayer, Stefan, and Ying Wang (2022). "Projections of Florida Population by County, 2025-2050, with Estimates for 2021." Florida Population Studies, Volume 55, Bulletin 192, February 2022. Bureau of Economic and Business Research, University of Florida. Gainesville, Florida. URL: https://www.bebr.ufl.edu/wp-content/uploads/2022/02/projections_2022.pdf.

Rayer, Stefan (2015). Personal communication September 9, 2015. Bureau of Economic and Business Research, University of Florida. Gainesville, Florida.

U.S. Census Bureau (2021). 2020 US Census Tracts in Florida with Selected Fields from 2020 Redistricting Summary File. Vector Digital Data. U.S. Census Bureau, Suitland, MD.

U.S. Census Bureau (2011). 2010 US Census Tracts in Florida (with Selected Fields from 2010 Redistricting Summary File and Summary File 1). ETAT.CENTRACT2010_AUG11. Vector Digital Data. U.S. Census Bureau, Suitland, MD.