Special Publication SJ2004-SP19

Population and Water Usage Projection

Technical Memorandum

Burton&Associates

November 3, 2003

Mr. Al Canepa
Project Manager
St. Johns River Water Management District
4049 Reid St.
Palatka, Florida 32177

Re: SE407AA - Population and Water Usage Projection
Technical Memorandum

Dear Mr. Canepa:

Burton & Associates, Inc. and our sub-consultants Strategic Planning Group, Inc. (SPG) and GIS Associates, Inc. are pleased to present this Population and Water Usage Projection Technical Memorandum (TM).

This document has undergone peer review and all peer review comments have been addressed to the satisfaction on the peer reviewers. Letters from the peer reviewers indicating their acceptance are presented in Appendix C.

We appreciate the assistance and cooperation of District staff in the provision of data required for the underlying population and water usage projection analyses. If you have any questions about this Technical Memorandum, or require any additional information, please do not hesitate to call me at (904) 247-0787.

Very truly yours,

Michael E. Burton

Michael E. Burton
President

MEB/cs
Enclosures

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St. Johns River Water Management District
St. Johns River Water Supply Project
Service Area Demand and Affordability Study Element
Population and Water Demand Projection Technical Memorandum

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I. INTRODUCTION

A. BACKGROUND

Burton & Associates is one of three consultants evaluating the overall feasibility of the use of surface water from the St. Johns River as an alternative source for potable water to serve the needs of growth in Volusia and Seminole Counties in east/central Florida. Ch2MHill is conducting a treatability study, which includes operation of a pilot plant to evaluate the effectiveness of various treatment processes and equipment. HDR is conducting a siting study to identify and evaluate feasible sites for a surface water plan in a corridor along the St. Johns River from DeLand in the north to Lake Monroe in the South. Burton & Associates is conducting a service area demand and affordability study to determine the projected water demands for surface water in Volusia and Seminole Counties through 2025 and to assess the affordability of surface water relative to the increased cost of water to end users in the utility service areas in those counties. This Technical Memorandum (TM) is the first deliverable document of the Service Area Demand component of Burton & Associates' responsibilities.

Although each consultant has distinct project responsibilities, significant coordination and data exchange is required among the consultants. This TM will provide important demand center information for HDR to consider before finalizing its siting analysis. HDR's siting analysis will affect the ultimate cost, in terms of transmission requirements, that will be used by Burton & Associates in our affordability analysis. The water usage demand analysis in this TM identifies the projected timing and magnitude of the water demands in Volusia and Seminole Counties which will be used by CH2MHill to determine the optimum sizing and phasing of the surface water plant. The sizing and phasing of the plant will affect the projected plant costs to be provided to us by CH2MHill as inputs to our affordability analysis.

This TM presents the results of the service area demand component of our responsibilities under this contract. For this portion of our contract, Burton & Associates and its subconsultants, Strategic Planning Group, Inc., and GIS Associates, Inc., were charged with forecasting the future population and water usage for Seminole and Volusia Counties by individual water utility service area.

B. GENERAL DESCRIPTION OF THE STUDY PROCESS

1. POPULATION PROJECTIONS

It is important to note that, except as noted below, no standardized methodology is available for forecasting population at the sub-county or intra-county level, much less at utility sub areas. The United States Department of Commerce's Census Bureau projects population at the state level and, in Florida, the University of Florida's Bureau of Business Research (BEBR) issues county level forecasts annually. The University of Florida's Shimberg Institute, using BEBR's methodologies, provides City level population forecasts in Florida[1]. Population forecasting at the intra-county level (even for cities) is very difficult, because, unlike statewide projections at the County level, which do not take into account a County's Comprehensive Plan, developable land or possible population build outs, intra-county level projections are subject to numerous geographic constraints including comprehensive plans, zoning, developable land, infrastructure etc.

Every ten years, the U.S. Census Bureau collects data that are tabulated down to the block level. While these data are excellent for analyzing historic trends, unfortunately, for the reasons given above, the Census Bureau does not attempt to forecast population at any geographic level smaller than a state. Nonetheless, population forecasts are needed at county and sub county levels for a host of planning reasons including planning for the infrastructure needs of future populations.

Transportation planning is one area where small area forecasts are extremely important. Transportation planners have attempted to forecast populations at intra county levels defined as Traffic Analysis Zones (TAZs); unfortunately there are no uniform definitions of TAZ delineations or consistent methodologies for forecasting population at this level of analysis[2]. Nonetheless, TAZs are the only intra county geographic level where forecasts are available for most of Florida's urbanized areas[3]. Because TAZ data are used to forecast traffic loadings and justify improvements to area transportation systems, most planning organizations are at least familiar with their own TAZ projections[4]. Increasingly, Geographic Information Systems (GIS) have begun to be used to assist in population forecasts. Unfortunately, most GIS models have

[1] BEBR utilizes several approaches to forecasting population. One technique is to analyze past trends and project population using 4 statistical techniques and averaging the results into a single estimate/forecast.
[2] In many areas, TAZs do not even conform to Census Tract boundaries which makes historic comparisons all but impossible
[3] Usually provided by local Metropolitan Planning Organizations (MPO)
[4] And whether the TAZ forecasts are consistent with the area's Comprehensive Plan

been constructed for only smaller areas like cities, and no state currently has a complete statewide GIS model available for forecasting populations at the census tract or smaller level.

The St. Johns River Water Management District (the District) has contracted with our subconsultant GIS Associates in another project, to develop a District-wide GIS model that will forecast population and water usage for each of the District's counties.[5] Because of this District-wide effort, the District requested that Burton and Associates, Inc. include GIS Associates as a subconsultant on this project to work with our other subconsultant, Strategic Planning Group, Inc. (SPG) in the development of population and water usage projections for Volusia and Seminole Counties. Additionally, the District requested the use of a GIS methodology to project sub-county population and water usage through 2025 in order to ensure consistency with the District's population and water usage projection methodology for all counties in the District.

The model produced for the District by GIS Associates (referred to hereafter as the model) uses data from the 1980, 1990 and 2000 Censuses as inputs. The model then projects future population using historic trends[6] controlled at County median population estimates for the target year. The projections are controlled by existing and future land use, water bodies, amounts of developable land, major developments, planned infrastructure improvements, etc. to ensure that a geographic area will not receive more population than it could reasonably support. Population that has been "over projected" is then spread to surrounding areas. For the purposes of model development, the model output[7] was first aggregated to Census Tracts and TAZs. By providing output at the TAZ level the model made it possible for our consultants to work with local planning staff by comparing the model output to their respective population forecasts and to arrive at a consensus as to future population projections. Once a general consensus was achieved, the District model could then aggregate TAZ population forecasts to utility boundaries and forecast water usage at the individual utility service area level.

2. WATER USAGE PROJECTIONS

Water usage projections were developed based upon projected population for the Study area using the same methodology used by the District for its 2003 District Water Supply Assessment. In general, projected water usage follows projected population at the same per capita usage level evidenced historically by utility service area. In areas where future water usage is expected to vary significantly from historic per capita patterns due to the nature of projected development,

[5] A description of the methodology can be found in Special Publication SJ99-SP3 Final Report Development of a Population-Based Water Use Model-contract 3 96H200, June 16, 1998.
[6] Based on BEBR's historic trend calculation methodology
[7] From census block level data

implementation of reclaimed water or other factors, adjustments were made to the projected per capita water usage assumptions for future water usage projections.

A summary description of this process is included in Section IV of this report and a detailed description of the District's water usage projection methodology is included in a document entitled "Water Use Projection Methodologies for the 2003 District Water Supply Assessment", which is provided in its entirety in Appendix B.

C. DESCRIPTION OF STUDY ACTIVITIES

One of the major objectives of the study effort was to include the effects of activities at the local level upon population and water usage projections that might not be considered in an analysis at the County level. It was felt that inclusion of these local considerations would provide more accurate projections for the purposes of this study and would help ensure consensus among all stakeholders as to future population forecasts and water usage projections. Therefore, the study design called for meetings to learn of such local factors that might influence population projections with the major planning stakeholders including the East Central Regional Planning Council, the Florida Department of Transportation (FDOT) and each County's Metropolitan Planning Organization (MPO), and County Planning Department. The following table presents the initial stakeholder meetings that were held.

Initial Stakeholder Meetings

ORGANIZATION	CONTACT	DATE
East Central Florida Regional Planning Council	Greg Golgowski	September 10, 2001
FDOT District 5	Jim Martin	September 5, 2001
Metroplan Orlando (MPO)	Dennis Hooker	September 10, 2001
Seminole County	Dick Boyer	September 5, 2001
Volusia County MPO	Mike Neidhart	September 6, 2001
Volusia County Planning Department	Jamie Seaman	September 6, 2001

A number of meetings were conducted with each of the above referenced groups. In the first meetings with these groups, we provided each group with our initial model run that included recently published 2000 Census population figures at the TAZ level. This was the first time the groups had seen current population estimates at the TAZ level, thereby providing an initial check of their own population forecasts. The Regional Planning Council provided information

concerning recent Developments of Regional Impacts (DRIs) but generally felt that County Planning staff would have more accurate data and population forecasts. Little information was gained from the Regional FDOT office, as they do not provide independent forecasts.

Data availability and input differed significant by county. Seminole County and the Orlando MPO have spent considerable time and money forecasting population within their jurisdictions at the TAZ level. The overall aim of this study was to utilize the existing county level TAZ population projection models as a check against the initial District model runs. However, as mentioned, neither the Orlando MPO nor Seminole County had had the opportunity to check their TAZ level population projections (212 individual TAZs) against the 2000 Census. Despite this limitation, the Seminole County projections were more recent and more reliable than those of Volusia County. While the Volusia MPO had a TAZ level population projection model (760 individual TAZs), it was recognized that the model needed to be updated and its future projections could not be used as a quality control check for the District model's Volusia County runs.

Our consultant team met with both the Volusia County MPO and County Planning Staff individually. During those meetings, the District model 2000 Census data, dis-aggregated to TAZ level, were presented and the Volusia MPO model and its deficiencies were discussed. Our consultants presented the general approach of "field testing" the District model against Seminole County TAZ projections before running the full model on Volusia County. The approach decided upon was that once the model was calibrated against Seminole County data and run for Volusia County, the Volusia County population projections at the TAZ level would be reviewed in detail by the County's planning staff and modifications to individual TAZ projections would be suggested.

As mentioned above, the study team was able to obtain two population projection data sets for Seminole County. First, the local multi county MPO had just released its population forecast for Seminole County and there had been some discussion between the County's Planning Department and the MPO concerning the MPO projections, which tended to be slightly lower than the County's projections. However, the County and the MPO reached general consensus on the "macro" results. In meeting with County planning staff, our consultants were able to present the initial District model run and compare with current County population projections. After several iterations, consensus was reached regarding the District model's outputs, which completed the "field test" verification of the District model.

As stated earlier, once agreement had been reached on the TAZ level model runs, the model was re-aggregated at the utility service level. Seminole County has 11 water providers. For purposes of this analysis some providers had separate identifiable sub areas: Florida Water Services was subdivided into four sub areas; Seminole County Environmental Services was divided into six sub areas and Utilities Inc. of Florida was divided into five sub areas. Several problems with boundaries had to be overcome before agreement was reached between the stakeholders and the District. Once boundaries had been agreed upon, population estimates (1990 and 2000) from the Census and population projections for future years (through 2025 in five year increments) were calculated. Some disagreements with projections were voiced by Seminole County, and some adjustments to model results were made based on input from County staff.

It should be noted that the Seminole County population projections for 2020 and 2025 were significantly lower than BEBR's medium projection for each of those periods, as both the County and MPO have projected that Seminole County will reach "build-out" before 2020 while BEBR medium population projections for 2020 and 2025 assume continued growth. Although current zoning and land-use regulations could change over the next 20 years, allowing for more growth in Seminole County than projected, it was decided that the projections of this study should be based upon same zoning and land-use assumptions as the Seminole County population projections.

As discussed above, once the District population model was field-tested and adjusted for Seminole County, the model was run for Volusia County. When general agreement was reached with Volusia County at the TAZ level (760 TAZs), the model results were re-aggregated to fit the local Volusia County water utility boundaries. Volusia County has 13 utility providers, which are primarily municipal providers. As with Seminole County, utility boundaries had to be reconciled in several areas and once agreement was reached, the model was run and its output was reviewed by local utilities. Again, model output adjustments were made at the request of several utilities. Once final agreement was reached, the model results were provided to the MPO and Volusia Planning staff to use the model outputs for their respective planning efforts.[8]

[8] Each MPO and County Planning Department were given a CD with model results

II. DETAILED POPULATION PROJECTION METHODOLOGY AND RESULTS

The purpose of this section is to describe the detailed methodology used and results derived in this Study regarding the projection of population and future water use in the Study Area (Volusia and Seminole Counties) and to demonstrate consistency with the methodology used by the St. Johns River Water Management District (SJRWMD or the District), Division of Water Supply Management (Division) in its projection of future water use demand for the District's 2003 Water Supply Assessment (2003 WSA). In the District's methodology, water usage projections are derived from population projections. Therefore, for the District's 2003 WSA, a model was developed to provide small-area population projections for the 19 counties within the District, upon which the future water demand projections are based.

In this Study, special attention is being paid to Volusia and Seminole Counties, as they constitute the study area for the Service Area Demand and Affordability Study for a surface water treatment plant on the St. Johns River. The same methodology was used to project population in the Study Area as was used by the District for its 2003 WSA, with the exception that adjustments were made based upon local factors in Volusia and Seminole Counties that were determined during the course of the Study. These adjustments allowed a more precise identification of current and projected water demand centers within the Study Area and such detail is not required for the purposes of the District's 2003 WSA. Precise identification of water demand centers within the Study Area is necessary in order to properly evaluate potential sites for the surface water plant and to estimate costs of transmission lines from potential treatment plant sites to the water demand centers.

A. THE NEED FOR A SMALL-AREA POPULATION PROJECTION MODEL

The St. Johns River Water Management District covers a 19 county area, yet the population model must estimate future population for units small enough to accurately aggregate the results to water utility service area boundaries. For example, the 27 different potable water utilities in Orange County have a median service area of 153 acres. This need for small area projections requires small modeling units (the minimum units of measure for which the projections are made).

The population projections made by the University of Florida's Bureau of Economic and Business Research (BEBR) are generally accepted as the standard throughout the State of Florida. The lowest level for which these projections are made is at the county level. However, to project future water demand, the District required a much smaller resolution than was available from the BEBR projections. Therefore, to facilitate the aggregation of model projections to water utility service area boundaries and Traffic Analysis Zones (TAZs), the census block level of census geography was selected as the logical modeling unit choice.

B. MODEL OVERVIEW

The District's GIS-based population model (the model) projects future residential population at the census block level, and normalizes those projections at the county level to the county population projections of the University of Florida's Bureau of Economic and Business Research (BEBR). It does this by calculating a weighted average of the historical growth rate of each block, and factoring in the positive influence of spatial features such as roads, water bodies, and existing residential and commercial areas. It then excludes non-developable lands, including wetlands, conservation areas, inappropriate land uses, road rights-of-way, and areas that are "built out" based on future land use. The remaining areas are then allocated population growth by census block according to the block's growth rate and spatial influences. These projections are made in five-year increments out to 2025, and are re-aggregated by Utility Service Area boundaries, Traffic Analysis Zone (TAZ) boundaries, and other boundaries for comparison with government and utility projections.

The model is a raster-based model, which uses map features that have been converted to a uniform grid (not unlike the pixels on a television or computer screen). This enables the use of modeling methods that are either impossible or impractical using vector data (where map features are represented by points, lines, and polygons). The grid cell size chosen for this model is 30 x 30 meters. Based on past raster modeling experience, and taking into account data scale and accuracy, this represented a good compromise between precision and processing speed.

The model consists of two primary elements: one based on historical growth trends and one based on spatial features that influence growth. (See Figure 1 on the following page for a flowchart outlining the model's methodology.) The Historical Element projects growth based upon past growth trends, and the Spatial Element guides where the growth will be distributed within a given area. The combination of the two elements is essential to accurately distribute population into small areas.

1. MODELING PERIODS

The base year for the model is 2000. Projections were made through the year 2025 in the following five-year increments:

- 2001 through 2005
- 2006 through 2010
- 2011 through 2015
- 2016 through 2020
- 2021 through 2025

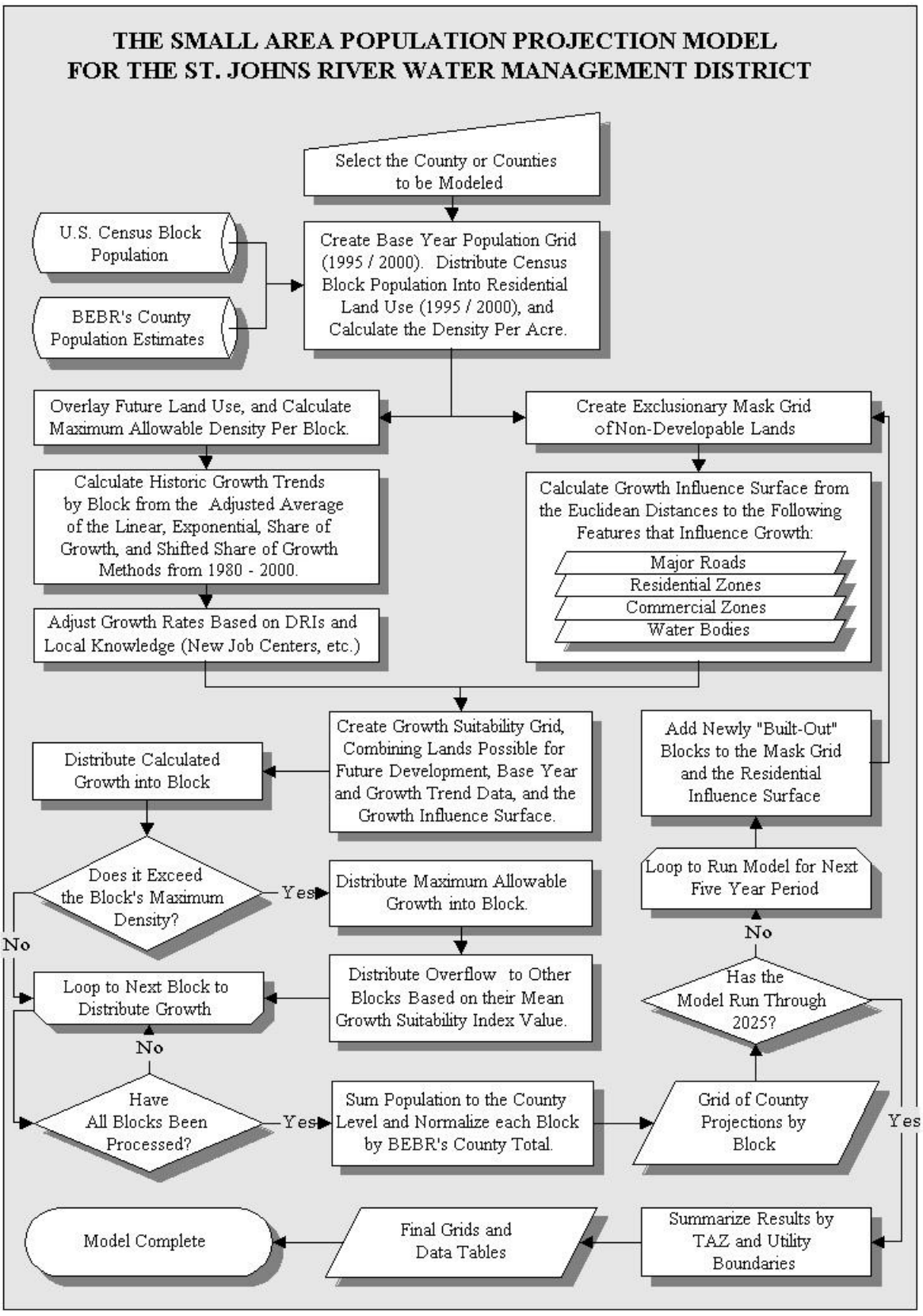


Figure 1. The Modeling Process for Predicting the Spatial Distribution of Future Population Growth for the St. Johns River Water Management District

2. HISTORICAL ELEMENT

The model calculates historic population growth trends based upon census data, along with land use constraints and other local factors as described further herein, to make projections of future population growth. Block-level population data from the 1990 and 2000 censuses were attached to the 2000 block boundaries based upon work performed by the State of Florida as part of its Senate Redistricting effort, where the State calibrated 1990 population data to 2000 block boundaries. Population data from the 1980 Census were utilized at the tract level (as block-level data for 1980 is not available). To use this 1980 data for trend calculation, the 2000 data were summed to the tract level, the growth rate calculations were made, and the growth rates were applied to all 2000 blocks within each tract.

These projections are normalized with county level projections made by BEBR[9]. BEBR's projections are highly regarded throughout Florida, but county level projections are not spatially precise enough for the needs of the District. Because the District model's projections are normalized to BEBR's projections for each modeling period, the model is more a distribution model than a projection model. Although the model projects population growth, it provides the added benefit of accurately projecting the distribution of that growth within a given county.

a. Base Year Residential Population Grid

The Base Year Population Grid is created by overlaying 2000 census block boundaries (including attached population data) with a combined grid of the District's 1995 residential land use and 2000 residential property parcels (for those counties with digital parcel maps). This parcel data augmented the out-of-date land use data, identifying residential areas developed after 1995. Only census blocks with residential areas are allocated population. In the few instances where people live in census blocks with no residential areas (according to land use and parcel data), the population totals for census blocks with residential areas are increased to include the population in census blocks with no residential areas. This occurs when population resides within agricultural, military, conservation, and other areas in a census block that has no residential land use. For example, if 2% of a county's population lives outside of identified residential land use, the populated census blocks will be divided by 0.98 (1 - 0.02) to account for the difference[10].

[9] This was done for Volusia County, but based upon our conversations with Seminole County planners, the decision was made to reduce the BEBR medium projections for Seminole County for 2020 and 2025 due to the lack of available, developable land.

[10] The population in the few blocks with no residential land use and/or residential parcels, was not left in those blocks but rather was added to blocks with residential areas. This is an artifact of the original model which was not based on census data but parcel data aggregated to Township, Range, and Section. It was assumed that was

b. *Historic Growth Trends Grid*

The Historic Growth Trends Grid distributes future growth based upon the extrapolation of past growth trends. These trends are based upon growth rates over the following historical periods (with the latter period receiving additional weight):

- 1980 through 1990
- 1990 through 2000

The historic population growth trends are derived from an average of four methods: Linear, Growth Rate, Share of Growth, and Shifted Share of Growth. The Linear and Growth Rate techniques employ a bottom-up approach, extrapolating the historic growth trends of each census block with no consideration for the county's overall growth. The Share of Growth and Shifted Share of Growth techniques employ a top-down approach, allocating a portion of the total projected county growth to each census block based upon that census block's percentage of county growth over the historical period. Each of the four methods is a good predictor of growth in different situations and growth patterns, so an average of the four was determined to be the best way to avoid the largest possible errors resulting from the "worst" techniques for each census block within the 19 county area (Sipe and Hopkins, 1984: p. 23). This methodology is patterned after that used by BEBR, and is well suited for small area population projections. The results of each of the four projection methods varied from census block to census block, but there were some general trends that can be identified.

Linear Projection Method. The Linear Projection Method assumes that future population change for each census block will be the same as over the historic period (Sipe and Hopkins, 1984: p. 25). Two linear growth rate calculations were made, one from 1980 through 2000, and one from 1990 through 2000. The Linear method (LIN) calculates five-year population changes with the following formulas (using the 2000–2005 growth projections as an example):

$$LIN_1 = [\ 5 \times (\ (\ Pop2000 - Pop1980\ ) / 20\ )\ ]$$

$$LIN_2 = [\ 5 \times (\ (\ Pop2000 - Pop1990\ ) / 10\ )\ ]$$

necessary due to the data used in that model. The focus of that model was growth "hot spots", and this was not considered a weakness in that methodology. This method can result in a slight overestimation of population in census blocks with residential areas. However, this effect is not material to the final water demand projections in this study due to the re-aggregation of population that occurs at the utility service area level prior to projecting water demand. As part of this re-aggregation process, a visual inspection was made using a combination of 2000 aerials and parcels (when available) to distribute population to the utility boundaries. In future modeling efforts this could be changed so that non-residential population is retained in blocks without residential areas where it occurs, and growth is allocated in those areas based on the rates and future land use maximum density, just as for residential areas.

Growth Rate Projection Method. The Growth Rate Projection Method assumes that population will continue to change at the same five-year growth rate as over the historic period. The Growth Rate method (GRO) calculates five-year population changes with the formula (using the 2000–2005 growth projection as an example)[11]:

$$GRO = [\ Pop2000 \times (\ 5 \times (\ (\ (\ Pop2000 - Pop1990\ )\ /\ Pop1990\ )\ /\ 10\ )\ )\ ]$$

Share of Growth Projection Method. The Share of Growth Projection Method assumes that each census block's percentage of the county's total growth will be the same as over the historic period (Sipe and Hopkins, 1984: p. 23). Two share of growth rate calculations were made, one from 1980 through 2000, and one from 1990 through 2000. The Share of Growth method (SOG) calculates five-year population changes with the following formulas (using the 2000–2005 growth projections as an example)[12]:

$$SOG_1 = [\ (\ Pop2000 - Pop1980\ )\ /\ (\ Co.Pop2000 - Co.Pop1980\ ) \times (\ Projected\ Co.Pop2005 - Co.Pop2000\ )\ ]$$

$$SOG_2 = [\ (\ Pop2000 - Pop1990\ )\ /\ (\ Co.Pop2000 - Co.Pop1990\ ) \times (\ Projected\ Co.Pop2005 - Co.Pop2000\ )\ ]$$

Shifted Share of Growth Projection Method. The Shifted Share of Growth Projection Method assumes that each census block's percentage of the county's total population will change at the same rate as over the historic period. It makes a linear extrapolation of the change in each census block's share of the county population over the historic period (Sipe and Hopkins, 1984: p. 25).

The Shifted Share of Growth method (SSH) calculates five-year population changes with the following formula (using the 2000–2005 growth projection as an example):

$$SSH = [\ (\ (\ 5 \times (\ (\ Pop2000\ /\ Co.Pop2000\ ) - (\ Pop1990\ /\ Co.Pop1990\ )\ )\ /\ 10\ ) + (\ Pop2000\ /\ Co.Pop2000\ )\ )\ \times (\ Projected\ Co.Pop2005 - Co.Pop2000\ )\ ]$$

[11] The Growth Rate Method is very similar to BEBR's Exponential Growth Method, but it does not account for compounding. Therefore, it will be slightly higher than a true Exponential rate calculation. In an analysis comparing the two methods, it was determined that the slight differences were not significant to the projections.

[12] The Share of Growth Method has a problem when the block has negative growth while the county has positive growth. When this occurs, greater projected county growth leads to greater declines for the block. This is mitigated by the averaging of the methods as described in the following sub-section.

Average of the Projection Methods. Projections were made using these six methods (Linear – two calculation methods; Growth Rate – one calculation method; Share of Growth – two calculation methods and Shifted Share of Growth – one calculation method). The highest and lowest projections were dropped to reduce errors resulting from the "worst" techniques for each census block. The four remaining projections were then averaged together to account for the considerable variation in growth rates and patterns over all of the census blocks within Seminole and Volusia Counties. All four remaining projections were weighted equally, so the average is calculated with the basic formula:

AVG = [(Sum of four remaining projections) / 4]

The averaging of the four remaining projections reduces the possible errors resulting from the variable results of each individual technique for each census block. Although it has been suggested that some of the methods may not be appropriate for certain areas, this averaging reduces the error associated with not using location-specific modeling methods.

c. Maximum Density Determination

The method for determining when a census block reaches maximum density, or becomes "built-out", is based upon future land use maps developed as part of the comprehensive planning process. The maximum population was calculated for each census block by multiplying the future acreage of residential land uses times the dwelling units (or households) per acre times the county average persons per household. For each period over which the model is run, it tests each census block's calculated growth for that period against this number. If the growth exceeds the available capacity, the growth is calculated to be the capacity less the current population. The additional "lost" growth is stored and later distributed to census blocks with available capacity and high Growth Influence Surface values. This Growth Influence Surface will be described in detail in the discussion on the Spatial Element in the next section.

3. SPATIAL ELEMENT

The Spatial Element of the model helps to guide where growth is distributed within a given county using the relationship of spatial features to future population growth. This Element consists of two primary components: "the Non-Developable Lands Exclusionary Mask Grid" and the "Growth Influence Surface". The Non-Developable Lands Exclusionary Mask Grid identifies areas where future growth is very unlikely to occur based upon physical features (such as water bodies) and land uses/restrictions (such as conservation lands). The Growth Influence Surface is a composite of four other grids identifying areas where future growth is likely to occur

also based on proximity to physical features (such as along major roads) and land use types (such as near commercial zones).

a. *Non-Developable Lands Exclusionary Mask Grid*

The Non-Developable Lands Exclusionary Mask Grid excludes future growth from physical features and land uses/restricted lands that are unlikely to be developed for residential use. The data layers included in the Mask are listed in Table 1.

Table 1. Data Layers in Exclusionary Mask Grid

Data Layer	Data Source, Date Developed
Water Bodies	SJRWMD Level 2 Land Use, 1995
Wetlands	SJRWMD Level 2 Land Use, 1995
Conservation and Other Public Lands	Conservation and Other Public Lands from the University of Florida's GeoPlan Center and SJRWMD, 1999, updated with Florida Natural Areas Inventory (FNAI) Managed Areas, Feb 2001
Major Road Rights-of-Way	Florida Department of Transportation (FDOT) Primary and Secondary Roads, 1996, with 1999 spatial and tabular updates from SJRWMD
Built-Out Residential Areas	SJRWMD Level 2 Land Use, 1995, and Future Land Use, SJRWMD

b. *Growth Influence Surface*

The Growth Influence Surface is developed from physical features and land uses that significantly attract future population growth. Data layers in the Growth Influence Surface are listed in Table 2.

Table 2. Data Layers in Growth Influence Surface

Data Layer	Data Source
Major Roads	Florida Department of Transportation (FDOT) Primary and Secondary Roads, 1996, with 1999 spatial and tabular updates from SJRWMD
Residential Areas	SJRWMD Level 2 Land Use, 1995
Commercial Areas	SJRWMD Level 2 Land Use, 1995
Water Bodies	SJRWMD Level 2 Land Use, 1995

The Growth Influence Surface is created based upon the proximity to the above listed features. The Euclidean distance is calculated from the center of the source cell to the center of each of the surrounding cells by measuring the hypotenuse of a triangle with the X and Y distances as the other two legs (ESRI, 1995). This true Euclidean, rather than cell distance, is calculated outward from each feature independently, normalized as a percent of total (creating values of 0 to 100), and then the four surfaces are combined into a single one. The mean influence value per census block is then calculated based upon the sum of the normalized Euclidean distance values. This value is then used to determine which census blocks receive the overflow growth of built-out census blocks.

The positive influences in this layer have a significant larger area influence in population growth. Disincentives to growth (landfills, sewage treatment plants, prisons, etc.) were initially considered, but because they are more site-specific and would have a more limited influence in deterring population growth, they were not incorporated into this layer.

4. GROWTH CALCULATIONS

a. Growth Suitability Grid

The Growth Influence Surface is then combined with the Historical Growth Trends Grid to create the Growth Suitability Grid. Existing residential land uses and anticipated future residential land uses are used to create the new grid in which future growth can be distributed. The per census block Historical Growth Trends and the mean values from the Growth Suitability Surface are then attached to the new Grid.

b. *Calculation of Growth by Census Block*

The growth is calculated for each census block over the specified period using the per census block growth rates from the Historic Growth Trends Grid. This adjusted average growth is added to the base year population for each census block to derive the future distribution of that growth within the county.

As was anticipated, the majority of the projected growth moved further away from the current urban areas with each succeeding period. Over the earlier periods (2001 through 2005, 2006 through 2010, and 2011 through 2015), most of the projected growth was still clustered around current urban areas. However, over the later periods (2016 through 2020 and 2021 through 2025), much of the growth was projected to occur outside the current urban areas.

These estimates are based upon current densities and development patterns, but at this time there is little indication that these are likely to change in the near future. Consumer preferences and developer costs drive these development patterns and densities. Until the supply of land becomes scarce enough (thus increasing the cost of land), or governmental regulations encourage denser development, we must assume that there will be no fundamental change in current development patterns and densities at least for the near future.

Normalize Growth with BEBR's County Total. Now that the relative distribution of the growth has been determined, the model normalizes this projected growth using BEBR's medium projection county population total. To normalize to BEBR's medium county population totals, the model proportionately adjusts the projected population growth by census block so that the model's projected county total population is equal to BEBR's medium county total population. This results in a population projection for each census block that is normalized to BEBR's medium county population projection.

This was done for Volusia County, but based upon our conversations with Seminole County planners, the decision was made to reduce the BEBR medium projections for Seminole County for 2020 and 2025 due to the lack of available, developable land. Seminole County projects build-out due to land use regulations in approximately 2015. However, this study's 2020 and 2025 projections show growth beyond 2015 based upon the assumption that there will be some conversion of other land uses to residential, and that redevelopment that will increase population density will occur. Therefore, the projections in this study exceed those of Seminole County for 2020 and 2025, but do not reach the BEBR medium projections for those periods. If land use restrictions are relaxed to allow more residential development or development at higher densities

in the future than we have projected, the 2020 and 2025 population projections for Seminole County could be higher.

Test for Build-Out. Each census block is then tested to determine if it has exceeded its maximum capacity, or is built-out. If the base year population plus the projected growth exceeds the census block's growth capacity, the growth will be calculated to equal the capacity minus the base year population. A field in the table is then calculated equal to the excess projected growth. This field containing the excess projected growth is summed for all the census blocks in the county.

Redistribute Any Growth Exceeding Capacity. Census blocks that have not exceeded their capacity for growth are then selected one at a time in the order of their mean growth influence value. Each is again normalized to absorb any excess projected growth. If a census block becomes built-out at this stage, the additional projected growth is distributed to the census block with the highest suitability value that can absorb that growth[13].

5. AGGREGATION TO TAZ AND UTILITY SERVICE AREAS

The final grids containing the distribution of population growth by census block are then summarized by Traffic Analysis Zones (TAZs). For each period, the population totals by census block are divided by the number of residential (both current and future) 30-meter grid cells within the census block to derive per-cell population totals. The TAZ boundaries are then overlaid, and the per-cell values are re-aggregated to these boundaries. Separate population grids are created for each projection period, which are then joined together with the TAZ grid. The new joined grid's Value Attribute Table is then summarized by TAZ, resulting in a table with a record for each unique TAZ within each county. This table is then exported to a dBASE file, imported into Microsoft Excel, reformatted, and "plugged in" to the District's Future Water Demand Model. The data are then aggregated to utility Service Area Boundaries (SABs). This allowed validation of results by county planners at the TAZ level and by utility planners at the utility service area level.

6. QUALITY ASSURANCE REVIEW OF THE RE-AGGREGATION PROCESS

The automated portion of this methodology assumes a homogeneous distribution and density within an individual census block. Although population distribution and density within a given

[13] Consideration was given to distributing the population to the nearest census block with the highest growth potential. However, it was determined that the cost in processing time (it could lengthen a 1 hour run-time per county to a week or two because several new raster layers would have to be created for each built-out block in each five-year model run) would not be worth the marginal increase in accuracy, particularly given the objectives of this project relative to identification of projected water demands at the utility service area/demand center level.

census block could vary a great deal, it is not possible with the available data to automatically account for varied densities within a given census block. Therefore a manual, visual review of the results of the re-aggregation was performed.

This visual Quality Assurance (QA) review was accomplished by visually examining census blocks atop DOQs (Digital Orthophoto Quads, which are 40,000-scale color infrared digital aerial photographs). These aerials were taken between late 1998 through 2000 with the bulk done in 1999, so they roughly correspond with the 2000 Census data. They were scanned with a one-meter resolution; so individual homes are easily distinguishable (and countable, if necessary). Although occupancy status cannot be determined from aerials, they were invaluable in evaluating the accuracy of the automated re-aggregation and making any necessary adjustments.

Digital parcel maps were also used in conjunction with the DOQs to augment the QA effort in some counties. Parcels with a residential land use classification (according to the Florida Department of Revenue's classification system) within a split block could be selected, and the portion of those occupying one SAB (or TAZ) could then be selected to determine proportionality. Any differences in the density within the split block (in terms of both households per parcel and persons per household) were taken into account using the parcel land use codes (single family, multi-family, mobile home, vacant residential, etc.).

7. PROJECTION ADJUSTMENTS TO BASELINE MODEL RESULTS

The automated model produced a "baseline" set of projections for Seminole and Volusia Counties as the Study Area for this Study. These baseline projections were then compared with other projections made by utilities and local planning agencies. These other projections were primarily in the form of TAZ-based models employed by some of the utilities and many of the local planning agencies. To facilitate the comparison, the District model's utility service area-level population projections were also dis-aggregated to the TAZ level to allow comparison with the TAZ level population projection models of Volusia County, Seminole County, and Metroplan Orlando.

To fully understand the differences between projections, a dialogue was opened with utilities and local and regional planners in Seminole and Volusia Counties via meetings and conference calls. An important part of this effort was to solicit information from these "local" stakeholders to leverage their knowledge of what is occurring at the local level that would influence future growth. We collected available information about anything that could cause future projections to deviate significantly from historic trends. Examples of information collected include:

- Developments of Regional Impact (DRIs) and Planned Unit Developments (PUDs)
- New or lost industries/major job centers
- Major road or bridge construction/widening projects
- Potential changes to local land use regulations that will either relax or tighten restrictions on uses or densities
- Estimates of population within a specific utility service area not served by the utility

In Volusia and Seminole Counties, the major planning stakeholders with whom we met included:

- Volusia County Planning Department
- Volusia County Metropolitan Planning Organization
- Seminole County Planning Department
- METROPLAN Orlando
- The East Central Florida Regional Planning Council
- The Florida Department of Transportation

We also discussed the projections via phone and email with the following utilities and/or their consultants:

- City of DeLand (Volusia)
- City of Edgewater (Volusia)
- City of Lake Helen (Volusia)
- City of New Smyrna Beach (Volusia)
- Orange City (Volusia)
- City of Ormond Beach (Volusia)
- Town of Pierson (Volusia)
- City of Port Orange (Volusia)
- Volusia County Utilities (Volusia)
- Florida Water Services Corp (Volusia and Seminole)
- City of Altamonte Springs (Seminole)
- City of Sanford (Seminole)
- Seminole County Environmental Services (Seminole)
- Utilities Inc. of Florida (Seminole)

Furthermore, we submitted the projections for review to <u>all</u> utilities in Volusia and Seminole Counties that pump more than 0.1 million gallons per day (MGD). The utilities were asked to

provide comments, if they did not agree with the projections. The utilities that did not comment include:

- City of Daytona Beach (Volusia)
- City of Holly Hill (Volusia)
- Lake Beresford Water Association (Volusia)
- City of Casselberry (Seminole)
- City of Lake Mary (Seminole)
- City of Longwood (Seminole)
- City of Oviedo (Seminole)
- Palm Valley MHP (Seminole)
- City of Winter Springs (Seminole)

We used the information we received from these local stakeholders to make adjustments to model results. These adjustments included augmenting or reducing growth rates from the baseline projections (exemplified by the increased projected growth rates in western Volusia County due to the widening of I-4), or overriding the rates in favor of using other data (exemplified by replacing baseline model projections with DRI or PUD projections of local planners). In the case of both Volusia and Seminole Counties, the local planners seemed to have a good, realistic understanding of how their counties were growing. Their input was invaluable for adjusting the sometimes aggressive projections of developers (in the case of new developments) and utilities (who tend to be conservative in their planning, leading to projections on the high end). The adjustments were made at the TAZ level if possible, or if the new information was not site-specific, at the utility level. After the adjustments were made for Volusia County, they were again normalized to BEBR's medium population projection totals. In the case of Seminole County, only the 2005, 2010, and 2015 projections were normalized to BEBR's medium population projections, as the scarcity of available residential land use (according to the current comprehensive plan) made BEBR's medium projection for 2020 and 2025 appear too high.

C. POPULATION PROJECTION RESULTS

1. POPULATION PROJECTIONS BY TAZ

The first level of aggregation of population projections was from census blocks to traffic analysis zones (TAZs). Because local planners in Seminole and Volusia Counties use TAZs for their own forecasting, this aggregation to TAZs facilitated comparison of model results with other

projections. Tables A1 and A2, in Appendix A, contain the total county population projections by TAZ for Volusia and Seminole Counties respectively.

Aggregation to the TAZ level also provided a basis for spatially depicting which areas of each county are projected to have particularly high and/or low growth relative to the region as a whole. The population density maps in Figures 2 and 3 on the following page represent this spatial allocation of growth. These figures depict the population density in Volusia and Seminole Counties by TAZ in 2000 and projected for 2025 respectively. This TAZ population is expressed as population per acre, which is more meaningful than total TAZ population, as TAZs can vary widely in size.

Figures 4-9 following Figures 2 and 3 show the growth by TAZ for each of the five-year periods in a dot density format. The growth dots (in red) show areas of new growth atop the 2000 base year population (in olive green).

Figure 2: Year 2000 Population Density by TAZ

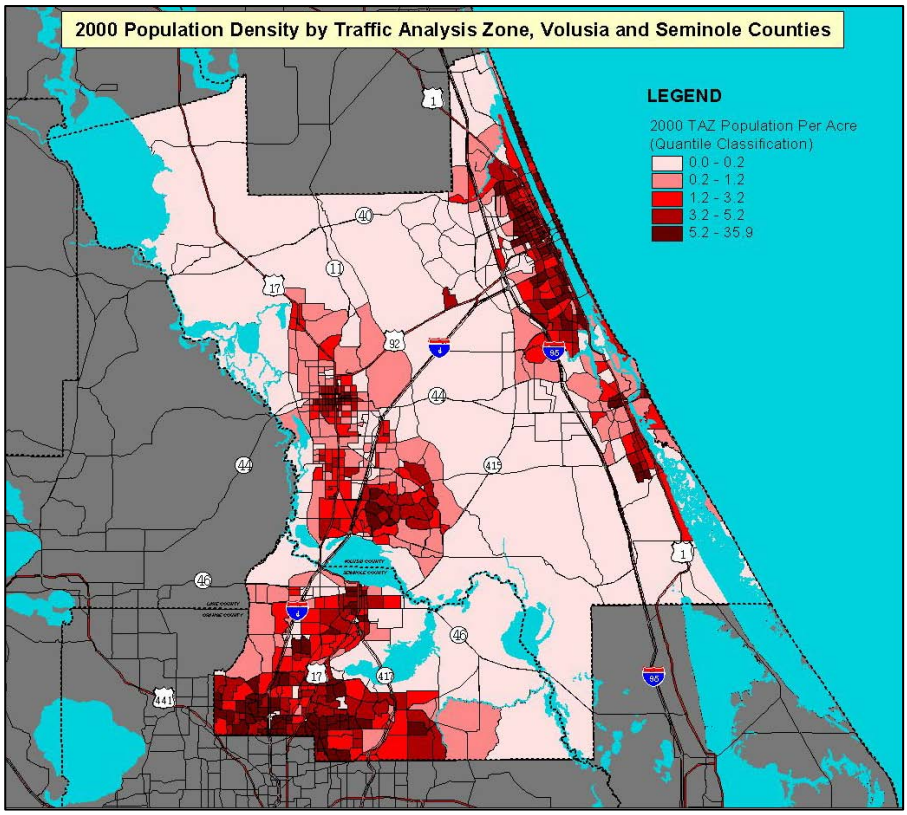


Figure 3: Year 2025 Population Density by TAZ

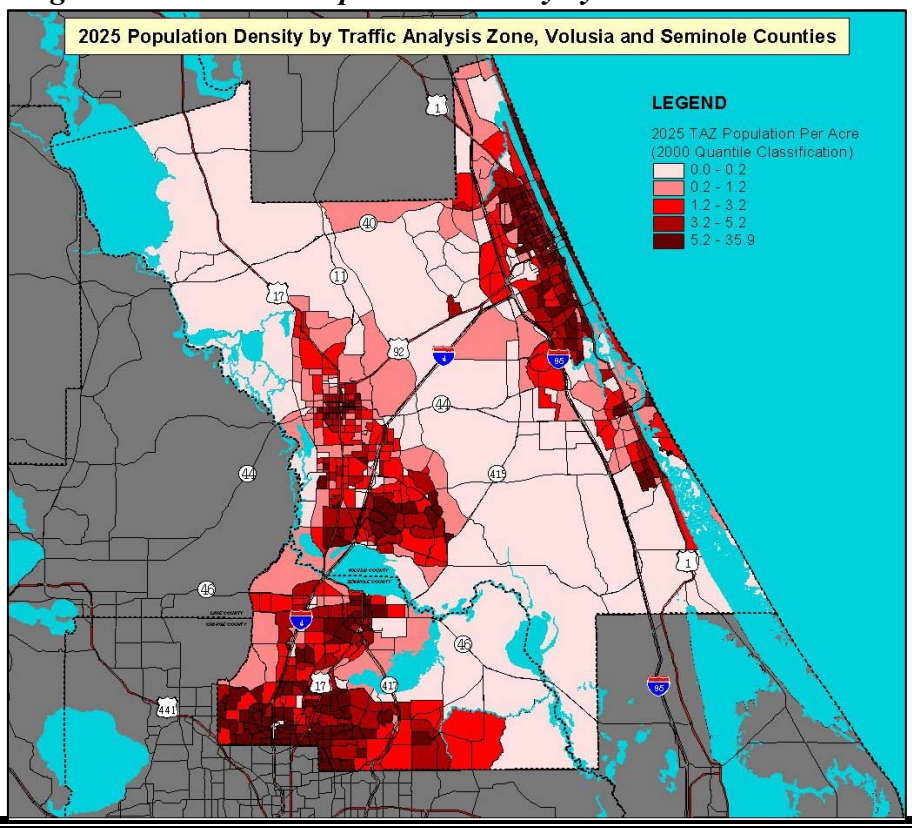


Figure 4: Year 2000 Population Dot Density

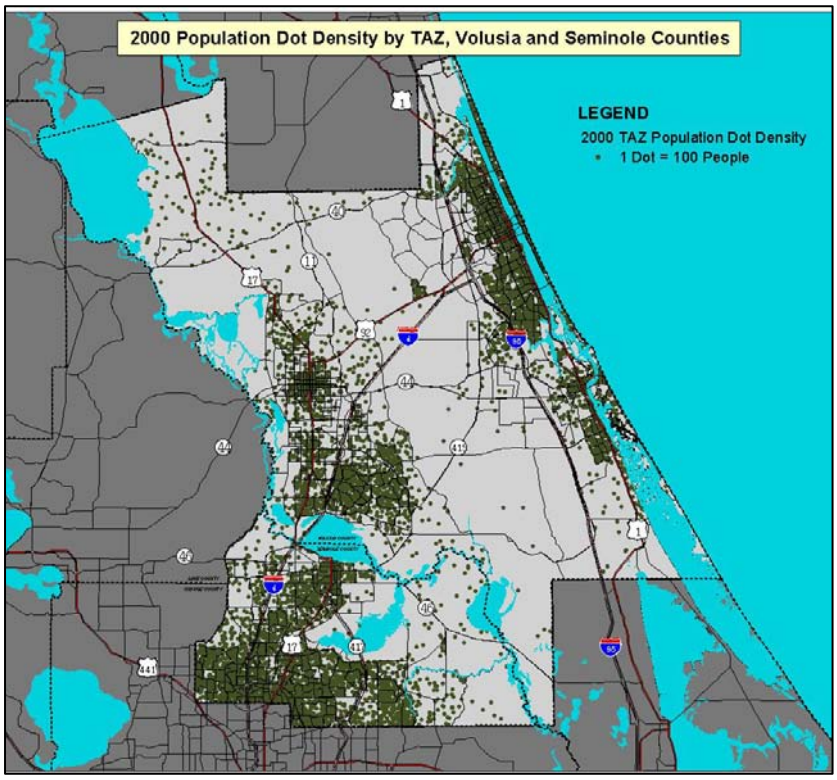


Figure 5: 2000 – 2005 Growth Dot Density

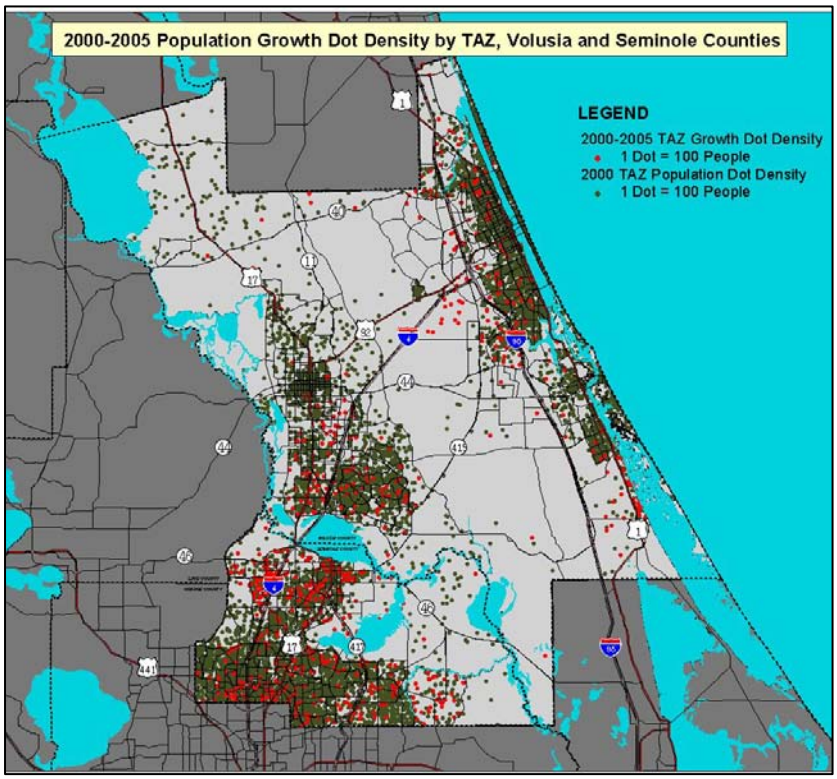


Figure 6: 2000 – 2010 Growth Dot Density

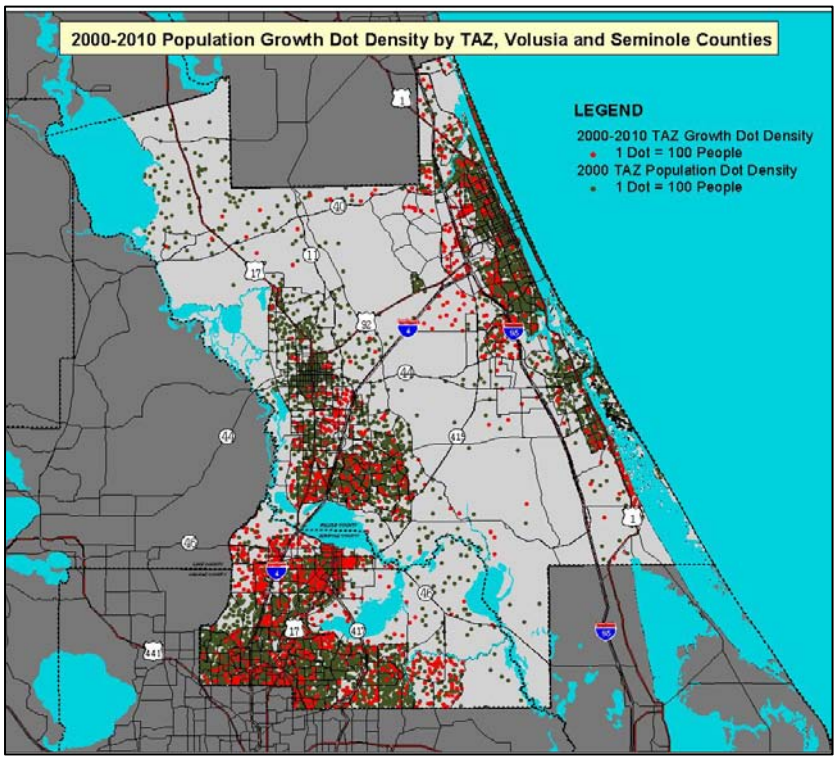


Figure 7: 2000 – 2015 Growth Dot Density

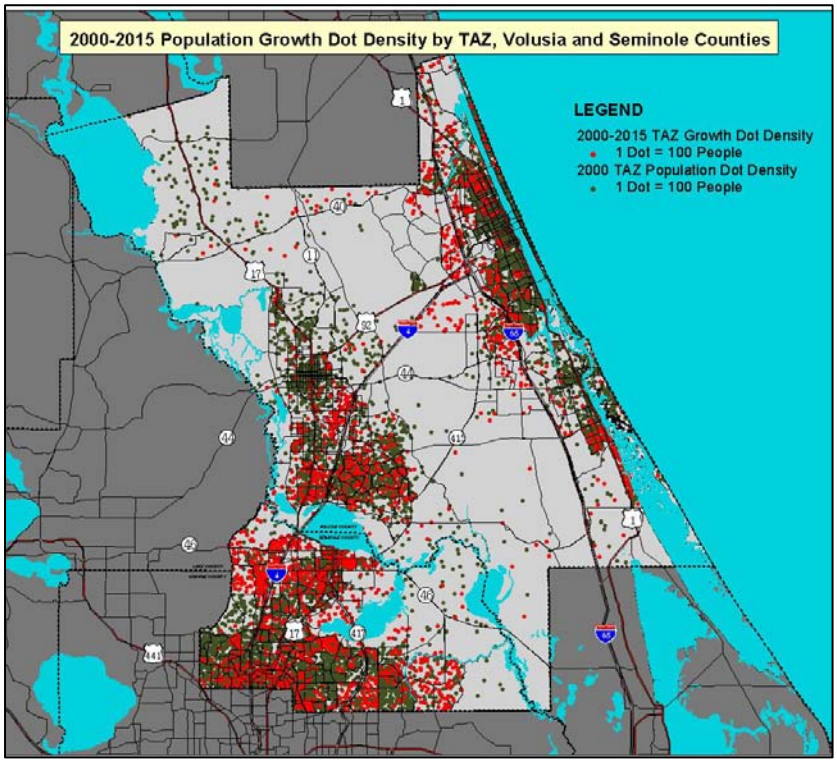


Figure 8: 2000 – 2020 Growth Dot Density

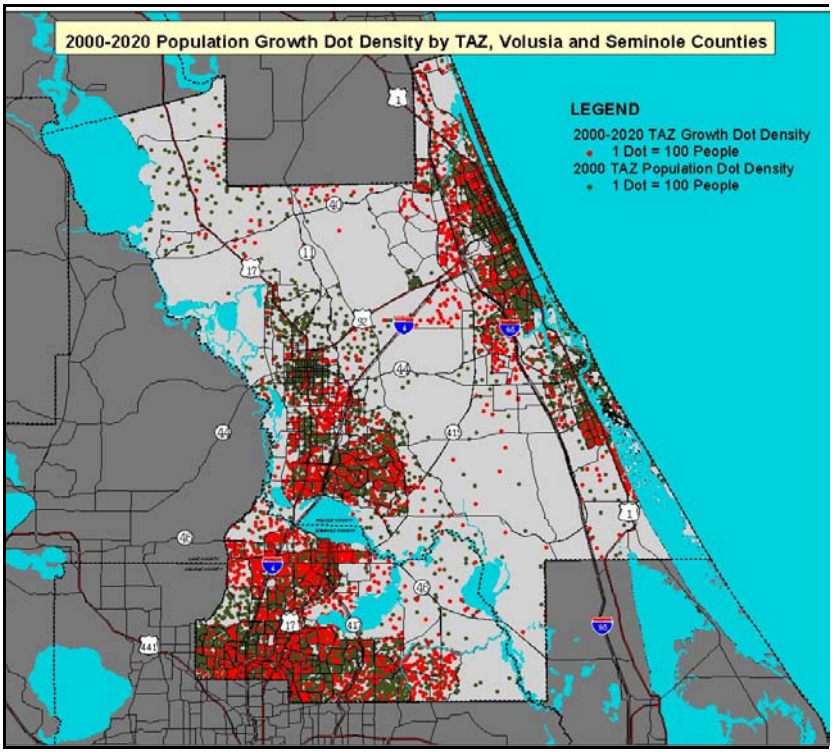
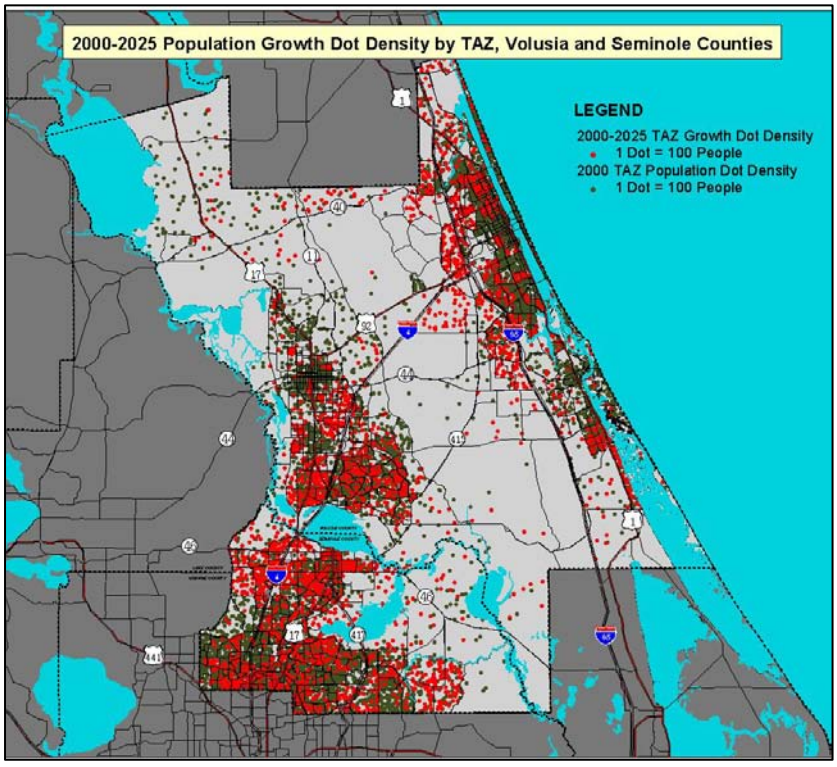


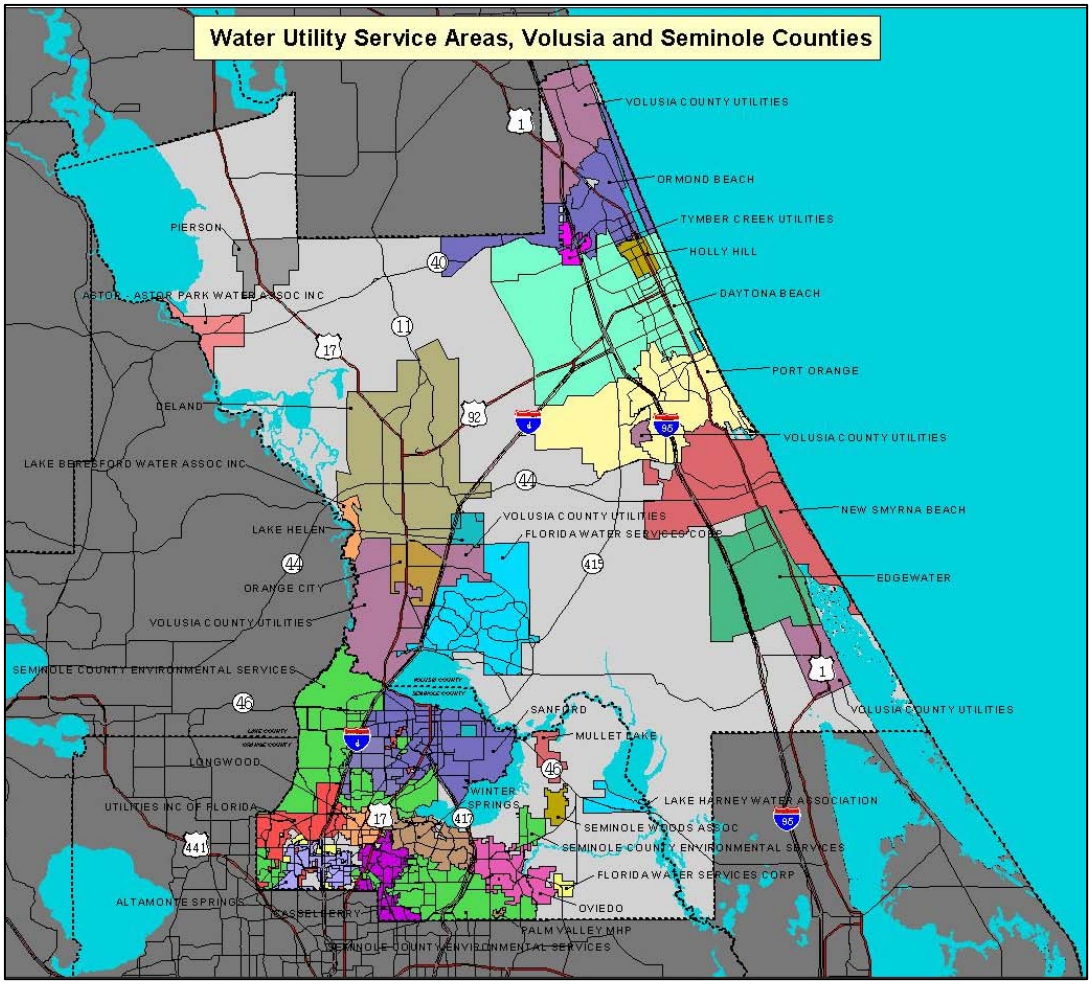
Figure 9: 2000 – 2025 Growth Dot Density



1. POPULATION PROJECTIONS BY UTILITY SERVICE AREA

The projection of water usage is compiled at the utility service area level (see Section III for water usage projections). Therefore, it was necessary to aggregate population projections to utility service areas. Figure 10 illustrates the water utility service areas in Volusia and Seminole Counties. There are some small public supply utilities not shown here, but only the utilities shown in the figure [which pumped more than 0.1 MGD (million gallons per day) in the year 2000] were included in the re-aggregation process.

Figure 10: Potable Water Utility Service Areas in Volusia and Seminole Counties



The final results of the population and water usage projections are provided in tabular (spreadsheet) and GIS formats and, as shown in the previous sub-section, the spatial results (the final population grids) are useful in that they graphically depict projected patterns of future growth. However, the primary end products are the utility output tables (derived from the service area grids' Value Attribute Tables), which are used to "plug in" to the District's

spreadsheet-based Future Water Demand Model. Tables 3 and 4 below contain the population projections by utility service area for Volusia and Seminole Counties respectively.

Table 3: Projections of Population Served by Public Supply Utilities > 0.1 AMGD for Volusia County by Utility Service Area

VOLUSIA COUNTY PUBLIC SUPPLY UTILITIES PUMPING MORE THAN 0.1 AMGD	POPULATION ESTIMATES AND PROJECTIONS							
	1990 Census Data	1995	2000 Census Data	2005	2010	2015	2020	2025
DAYTONA BEACH CITY OF	85,121	86,146	88,751	91,966	96,460	102,470	116,373	125,767
DELAND CITY OF	42,188	45,687	49,938	53,078	55,775	59,220	62,313	66,037
EDGEWATER CITY OF	15,030	16,335	18,462	20,634	23,659	26,908	29,214	31,254
FLORIDA WATER SERVICES CORP	45,451	55,166	65,169	74,209	84,708	93,278	97,686	101,343
HOLLY HILL CITY OF	11,796	12,132	12,568	13,261	13,982	14,966	16,144	17,091
LAKE BERESFORD WATER ASSOC INC	1,070	1,161	1,228	1,334	1,481	1,684	1,705	1,741
LAKE HELEN CITY OF	2,314	2,529	2,743	3,088	3,515	4,033	4,621	5,233
NEW SMYRNA BEACH CITY OF	24,584	26,101	27,753	29,497	31,355	33,828	36,667	38,431
ORANGE CITY	9,355	10,203	11,051	11,916	12,771	13,603	14,087	14,452
ORMOND BEACH CITY OF	39,448	41,893	46,961	51,769	56,853	61,188	65,275	68,899
PIERSON TOWN OF	2,039	2,212	2,400	2,630	2,729	2,855	2,935	2,994
PORT ORANGE CITY OF	43,537	49,706	55,874	61,892	67,015	71,408	75,031	78,148
PONCE INLET TOWN OF	1,744	2,150	2,500	2,895	3,148	3,434	3,509	3,575
VOLUSIA COUNTY UTILITIES	10,171	15,656	22,282	32,427	39,895	46,844	53,302	59,326
COUNTY TOTALS	333,847	367,076	407,679	450,596	493,346	535,719	578,860	614,291

Table 4: Projections of Population Served by Public Supply Utilities > 0.1 AMGD for Seminole County by Utility Service Area

SEMINOLE COUNTY PUBLIC SUPPLY UTILITIES PUMPING MORE THAN 0.1 AMGD	POPULATION ESTIMATES AND PROJECTIONS							
	1990 Census Data	1995	2000 Census Data	2005	2010	2015	2020	2025
ALTAMONTE SPRINGS CITY OF	43,387	46,226	49,064	55,576	60,620	64,625	67,540	68,701
CASSELBERRY CITY OF	44,240	45,257	46,274	49,727	53,732	61,159	63,467	64,778
FLORIDA WATER SERVICES CORP - APPLE VALLEY	2,622	2,643	2,660	2,966	3,344	3,774	4,101	4,380
FLORIDA WATER SERVICES CORP - CHULUOTA	1,623	1,879	2,134	3,937	4,921	5,781	6,643	7,382
FLORIDA WATER SERVICES CORP - DRUID HILLS / BRETTON WOODS	855	717	579	579	579	579	579	579
FLORIDA WATER SERVICES CORP - MEREDITH MANOR	1,218	1,258	1,297	1,349	1,401	1,436	1,451	1,467
LAKE MARY CITY OF	5,955	8,707	11,458	13,411	14,815	16,797	17,012	17,187
LONGWOOD CITY OF	12,905	13,038	13,171	14,265	15,608	17,542	17,961	19,332
OVIEDO CITY OF	11,471	18,516	25,561	28,478	31,094	34,393	34,847	35,861
PALM VALLEY MHP	658	1,060	1,462	1,812	1,949	2,254	2,221	2,275
SANFORD CITY OF	34,760	36,604	38,447	47,982	57,022	64,423	68,180	70,333
SEMINOLE COUNTY - INDIAN HILLS / CONSUMER / HAYS	25,257	31,987	39,149	41,663	43,853	45,719	47,007	47,934
SEMINOLE COUNTY - LYNWOOD / BELAIRE	6,060	7,042	8,079	8,995	9,824	10,582	10,970	11,289
SEMINOLE COUNTY - COUNTRY CLUB / GREENWOOD	9,209	12,089	15,158	17,400	19,839	22,708	23,336	23,792
SEMINOLE COUNTY - HANOVER / HEATHROW / MONROE	4,890	7,832	10,979	17,143	23,485	30,005	30,437	30,870
SEMINOLE COUNTY - CHASE GROVE / PLANT 42	247	1,139	2,031	2,449	2,728	2,471	3,011	3,088
UTILITIES INC OF FLORIDA - SANLANDO UTILITIES CORP	33,430	33,509	33,587	35,174	36,629	37,529	37,830	38,071
UTILITIES INC OF FLORIDA - JANSEN	598	637	675	713	749	749	749	749
UTILITIES INC OF FLORIDA - OAKLAND SHORES	355	341	326	326	326	326	326	326
UTILITIES INC OF FLORIDA - RAVENNA PARK	951	925	898	925	951	976	976	976
UTILITIES INC OF FLORIDA - WEATHERSFIELD	3,208	3,230	3,252	3,278	3,307	3,319	3,319	3,319
WINTER SPRINGS CITY OF	22,448	26,765	31,083	36,944	37,641	39,694	42,093	43,595
COUNTY TOTALS	266,348	301,397	337,324	385,091	424,417	466,842	484,057	496,283

III. DETAILED WATER USAGE PROJECTION METHODOLOGY AND RESULTS

This section describes the water use projection methodology employed by the District for the 2003 Water Supply Assessment (WSA). It is summarized from the District's document entitled "Water Use Projection Methodologies for the 2003 District Water Supply Assessment" (Moore, Fitzgerald, and Wilder, 2002), which is provided in its entirety in Appendix B. This methodology was also employed in developing the water usage projections, which are presented in this report for Seminole and Volusia Counties.

The 2003 WSA defines public supply water use as water use/demand from utilities with an annual average daily flow (AADF) of at least 0.1 million gallons per day (MGD). Utilities with a lesser flow are included in the "Domestic self-supply and small public supply" category.

Utility water use data was obtained from Monthly Operating Reports (MOR) submitted by the utilities to the Florida Department of Environmental Protection (DEP). This data was provided to the larger public supply utilities for verification along with projected water use and population.

A. ESTIMATE SELF-SUPPLIED POPULATION WITHIN UTILITY SERVICE AREAS

The first step in translating the population growth projections into water use projections was to adjust for population within utility service areas that are on private wells (not served by a utility). This was done for utilities that had information indicating that a significant number of people within their service area met this criterion. This information was provided to us either as residential meters (which we then multiplied times a persons-per-household estimate that was reasonable for that area), or as a percentage of served to unserved population that the utility had already calculated. The portion of those utilities' population estimates and projections determined to receive water through self-supply was moved from the utility into the Domestic Self-Supply category totals.

B. CALCULATE GROSS PER CAPITA WATER USE

The gross per capita water use for each utility was calculated and multiplied by the population projections to forecast future water use. This was done using the following steps:

- For 1995 through 1999, divide each utility's total annual pumpage in million gallons per year or MGY [from the utility Monthly Operating Reports (MORs) submitted to the Florida Department of Environmental Protection (DEP)] by its served population estimate for that year (which was an interpolation of the 1990 and 2000 censuses). This resulted in an annual per capita use estimate for each of the five years.

- Average the per capita use estimates for the five years from 1995 through 1999.

- Multiply by 1,000,000 (to convert from MGY to gallons per year) and divide by 365 (to convert from gallons per year to average gallons per day). This was done to facilitate the communication of this process to utilities, which tend to think of water usage in terms of average daily per capita usage.

For some utilities, slight adjustments were made to per capita calculations. This was due to utility service areas experiencing development of a significantly different character from its historic customer base. Consider this example: ABC Utility has an existing customer base of 10,000 that has an average daily per capita water usage of 80 gallons per day. ABC's current customers generally live in more modest homes with no in-ground irrigation systems. Much of the new growth that ABC is experiencing is very high-end development which has lush landscapes and in-ground irrigation systems. The large lots and St. Augustine grass characteristic of the projected new development will require much more outdoor water demand than ABC experienced historically. Therefore the per capita multiplier for new growth would be inflated by a percentage (say 10%) or replaced by a reasonable per capita water use estimate provided by the utility. Note that in this example, the old per capita of 80 gallons per day would still be used for current customers. These types of adjustments, where made, were mutually agreed upon by the utility and the District.

C. CALCULATE WATER USE PROJECTIONS

Water use projections were then calculated by utility service area by multiplying each utility's average daily per capita use times its population projection for each period and dividing by 1,000,000 (to convert to MGD). For example, an average daily per capita use of 87.0 and a 2025

population projection of 107,700 would result in a 2025 water use projection of 9.4 MGD. The equation to calculate this is as follows:

87.0 (avg. gals per capita per day) x 107,700 (2025 population) / 1,000,000 = 9.4 MGD

The final water use projections for Volusia and Seminole County utilities are provided in Tables 5 and 6 on the following page. Water usage projections were not dis-aggregated to the TAZ level.

D. REVIEW WATER USE PROJECTIONS WITH UTILITIES AND MAKE ADJUSTMENTS

Preliminary projections were provided to the utilities with a solicitation for comments. In the cover letter it was stipulated that if a response were not received by the end of the review period the projections would be considered reasonable and finalized. Non-responsive utilities with greater than a 20% difference between the new 2020 water usage projection and the 2020 water usage projection provided by the utility in the 1998 Water Supply Assessment were contacted to ensure that the utility agreed with these latest water usage projections. Adjustments were made to both the water demand and population projections based upon credible data provided by the utilities and/or planners contacted. This information typically involved new developments, but also included current and anticipated land use changes and other projections provided by local planners (in the case of Seminole County Environmental Services). Consensus was eventually reached with each of the utilities in Seminole and Volusia Counties for which projections were made.

Table 5: Water Use Projections for Volusia County by Utility Service Area

VOLUSIA COUNTY PUBLIC SUPPLY UTILITIES PUMPING MORE THAN 0.1 AMGD	WATER DEMAND PROJECTIONS (AMGD)					
	2000	2005	2010	2015	2020	2025
DAYTONA BEACH CITY OF	13.18	13.65	14.32	15.21	17.28	18.67
DELAND CITY OF	5.47	5.82	6.11	6.49	6.83	7.24
EDGEWATER CITY OF	1.77	2.00	2.32	2.66	2.90	3.12
FLORIDA WATER SERVICES CORP	11.01	12.54	14.31	15.76	16.51	17.12
HOLLY HILL CITY OF	1.26	1.33	1.40	1.50	1.62	1.71
LAKE BERESFORD WATER ASSOC INC	0.18	0.19	0.21	0.24	0.24	0.25
LAKE HELEN CITY OF	0.26	0.31	0.36	0.42	0.49	0.56
NEW SMYRNA BEACH CITY OF	4.76	6.36	6.49	6.71	7.00	7.12
ORANGE CITY	1.44	1.81	2.17	2.53	2.84	2.92
ORMOND BEACH CITY OF	6.06	6.93	7.58	8.39	8.92	9.39
PIERSON TOWN OF	0.13	0.14	0.14	0.15	0.15	0.16
PORT ORANGE CITY OF (INCLUDES TOWN OF PONCE INLET)	5.75	6.42	6.99	7.48	7.87	8.20
VOLUSIA COUNTY UTILITIES	3.42	5.23	6.62	7.94	9.18	10.36
UNCLAIMED I-4 / SR 472 ACTIVITY CENTER WATER USE	0.00	0.25	0.50	1.00	1.50	1.72
DOMESTIC SELF-SUPPLY & UTILITIES < 0.1 MGD	4.77	4.89	5.02	5.14	5.26	5.38
COUNTY TOTALS	59.46	67.86	74.55	81.62	88.59	93.92

Table 6: Water Use Projections for Seminole County by Utility Service Area

SEMINOLE COUNTY PUBLIC SUPPLY UTILITIES PUMPING MORE THAN 0.1 AMGD	WATER DEMAND PROJECTIONS (AMGD)					
	2000	2005	2010	2015	2020	2025
ALTAMONTE SPRINGS CITY OF	6.79	7.69	8.39	8.94	9.34	9.50
CASSELBERRY CITY OF	6.12	6.58	7.11	8.09	8.39	8.57
FLORIDA WATER SERVICES CORP - APPLE VALLEY	0.49	0.55	0.62	0.70	0.76	0.81
FLORIDA WATER SERVICES CORP - CHULUOTA	0.21	0.39	0.48	0.57	0.65	0.72
FLORIDA WATER SERVICES CORP - DRUID HILLS / BRETTON WOODS	0.11	0.11	0.11	0.11	0.11	0.11
FLORIDA WATER SERVICES CORP - MEREDITH MANOR	0.30	0.31	0.33	0.33	0.34	0.34
LAKE MARY CITY OF	2.95	3.45	3.82	4.33	4.38	4.43
LONGWOOD CITY OF	1.97	2.13	2.33	2.62	2.68	2.89
OVIEDO CITY OF	4.06	4.52	4.94	5.46	5.53	5.69
PALM VALLEY MHP	0.28	0.35	0.38	0.44	0.43	0.44
SANFORD CITY OF	5.62	7.21	8.72	9.95	10.58	10.94
SEMINOLE COUNTY - INDIAN HILLS / CONSUMER / HAYS	8.26	8.79	9.25	9.64	9.91	10.11
SEMINOLE COUNTY - LYNWOOD / BELAIRE	1.16	1.29	1.41	1.52	1.58	1.62
SEMINOLE COUNTY - COUNTRY CLUB / GREENWOOD	2.30	2.64	3.00	3.44	3.53	3.60
SEMINOLE COUNTY - HANOVER / HEATHROW / MONROE	3.81	6.16	8.58	11.06	11.23	11.39
UTILITIES INC OF FLORIDA - SANLANDO UTILITIES CORP	9.49	9.94	10.35	10.61	10.69	10.76
UTILITIES INC OF FLORIDA - JANSEN	0.08	0.09	0.09	0.09	0.09	0.09
UTILITIES INC OF FLORIDA - OAKLAND SHORES	0.10	0.10	0.10	0.10	0.10	0.10
UTILITIES INC OF FLORIDA - RAVENNA PARK	0.09	0.09	0.10	0.10	0.10	0.10
UTILITIES INC OF FLORIDA - WEATHERSFIELD	0.37	0.37	0.37	0.37	0.37	0.37
WINTER SPRINGS CITY OF	4.30	5.11	5.21	5.49	5.82	6.03
DOMESTIC SELF-SUPPLY & UTILITIES < 0.1 MGD	4.80	5.14	5.31	5.46	5.57	5.65
COUNTY TOTALS	63.65	73.00	80.98	89.43	92.20	94.27

IV. DEMAND CENTER IDENTIFICATION

The scope of this Study included identification of Demand Centers, or clusters of projected growth in water demand over the projection period. Therefore, additional work was performed to group clusters of TAZs with high population projections into Demand Centers. Since water usage projections generally follow population projections (see water usage projection methodology in Section III), the rationale behind this effort was to identify contiguous groupings of water utilities that are projected to have high growth within their service areas, and therefore high impacts upon future water demand relative to the total demand of the two-county region.

To accomplish this, the TAZ-level projections were "smoothed" by averaging the per acre growth and total population projections within a one-mile circular neighborhood (or radius) of each 30-meter grid cell in the Volusia and Seminole County TAZ grid. This resulted in the development of projected per acre growth and total population contours, facilitating the manual selection of groups of utilities representing projected demand clusters. Figure 11 presents the 2000-2025 population growth clusters.

Figure 11: 2000 – 2025 Population Growth Clusters

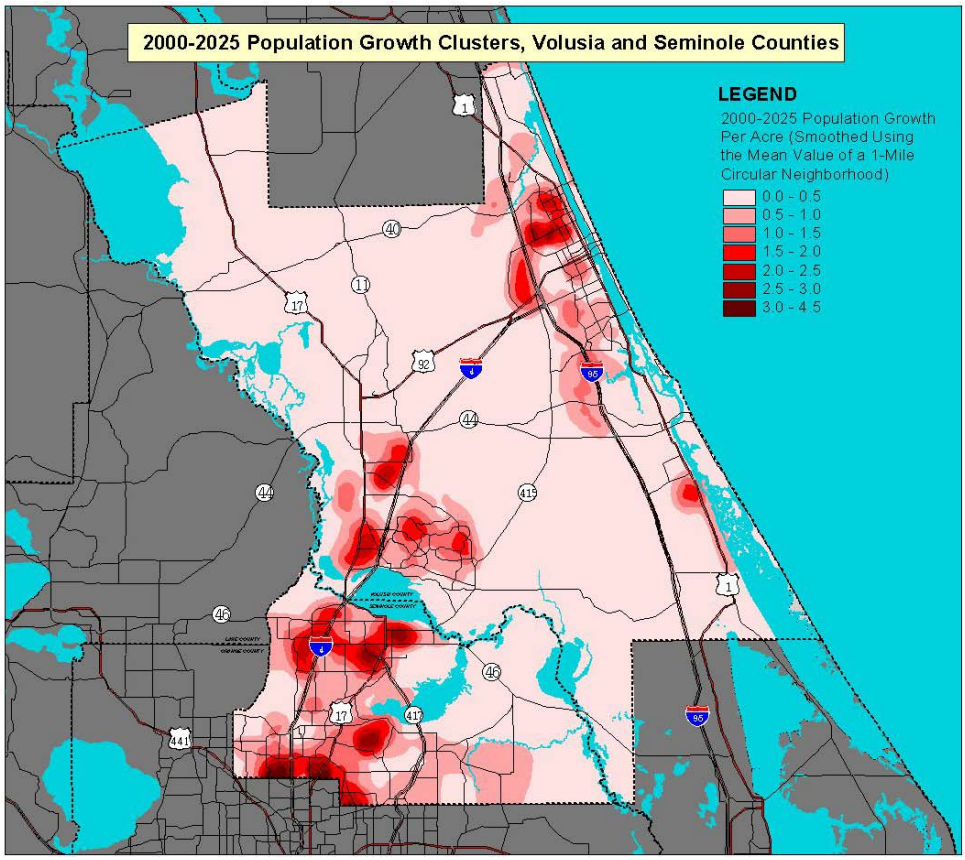


Figure 11 shows that there are three projected population growth clusters in the two county study area, 1) in northeast Volusia County, 2) in southwest Volusia County, and 3) in western Seminole County. Utility service areas were then overlaid on these three primary 2025 projected population clusters. Figures 12-14 below and on the following page represent these three primary 2025 projected population clusters and the utilities that provide service to those areas.

Figure 12: 2025 Northeast Volusia County Population Cluster

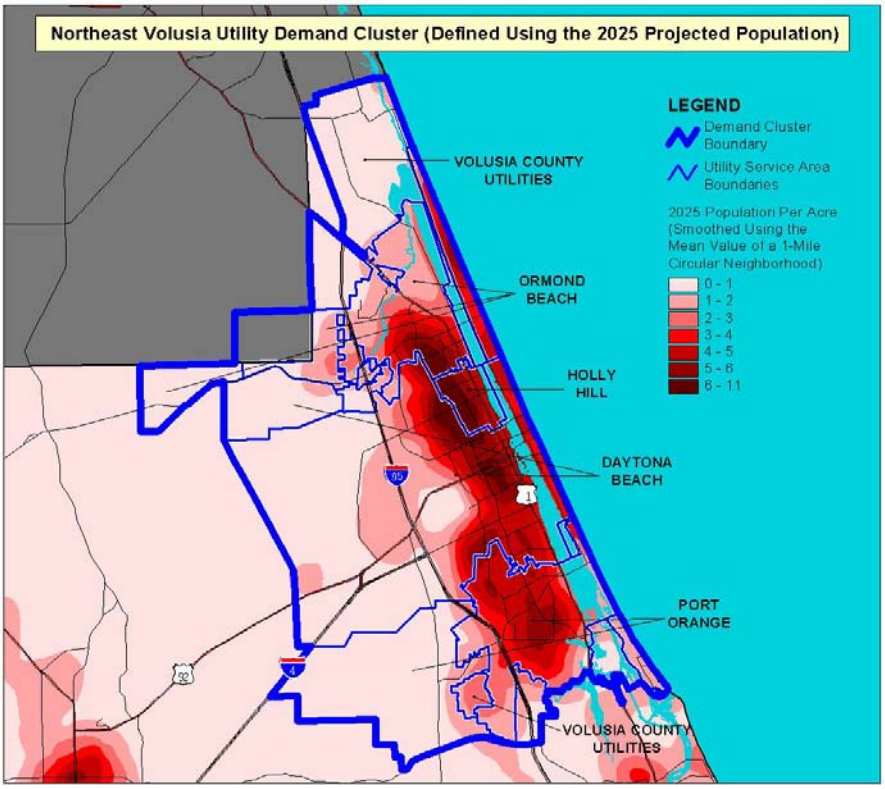


Figure 13: 2025 Southwest Volusia County Population Cluster

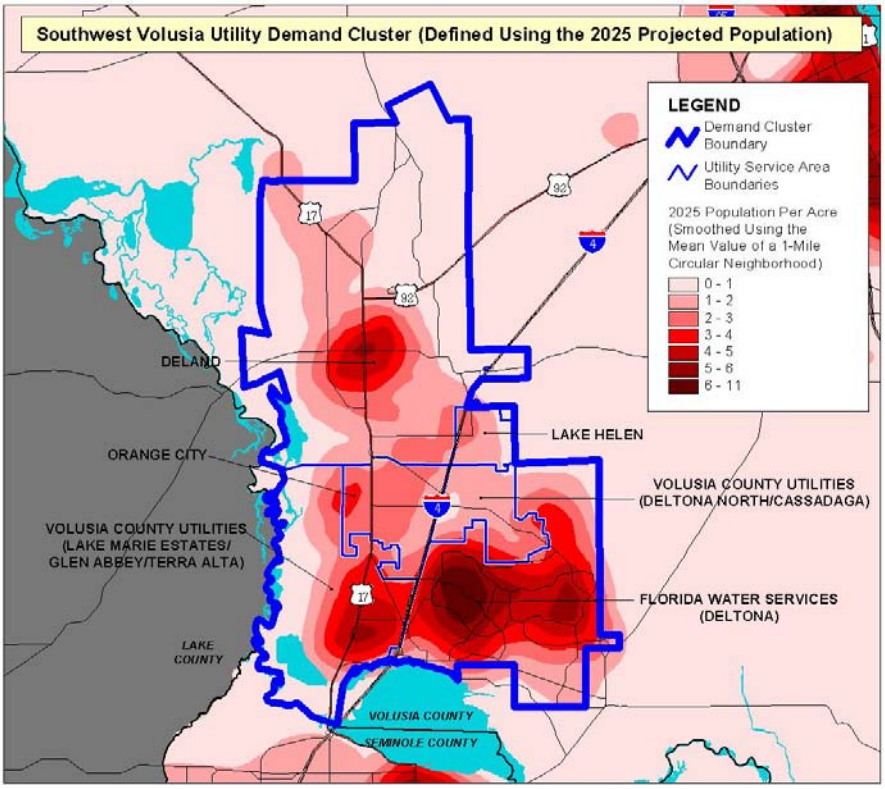
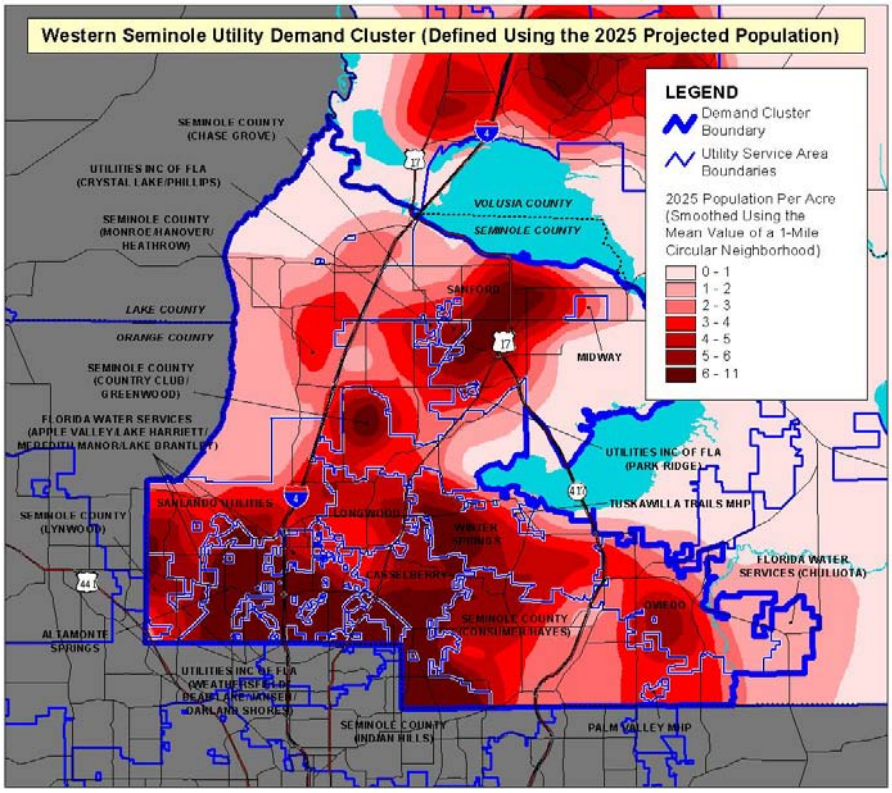


Figure 14: 2025 Western Seminole County Population Cluster



This clustering methodology proved to be a useful tool for defining regions of concentrated projected demand. Although automated methods of selecting the clusters are readily available, a manual approach provided the needed flexibility to select contiguous utilities (in their entirety) that overlapped areas of concentrated demand.

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APPENDIX A

County Population Projections
Dis-Aggregated to the TAZ Level

Table A1: Population Projections for Volusia County by TAZ

TAZ	ACRES	POPULATION PROJECTIONS RE-AGGREGATED TO TAZ					
		2000	2005	2010	2015	2020	2025
1	957	1144	1315	1470	1591	1737	1905
2	290	1516	1591	1678	1798	1919	2068
3	324	1873	1919	1964	1977	1977	1978
4	261	1422	1454	1487	1497	1497	1497
5	12	174	179	184	185	186	186
6	142	1138	1163	1188	1195	1195	1195
7	163	1287	1314	1341	1350	1350	1350
8	23	268	280	293	300	300	300
9	170	1252	1309	1370	1424	1468	1517
10	317	1620	1677	1740	1780	1808	1845
11	27	165	194	224	251	279	308
12	221	724	737	751	754	754	754
13	364	816	909	1009	1075	1075	1075
14	7	25	31	39	47	55	63
15	124	335	339	343	344	344	344
16	157	262	262	262	262	262	262
17	156	981	1015	1052	1069	1075	1081
18	24	260	313	370	428	485	513
19	28	8	8	8	8	8	8
20	418	1683	1710	1737	1740	1740	1740
21	132	336	341	345	347	354	359
22	89	688	694	694	694	694	694
23	45	261	261	261	261	261	261
24	42	336	350	350	350	350	350
25	32	414	414	414	414	414	414
26	10	49	49	49	49	49	49
27	102	830	830	830	830	830	830
28	248	1132	1132	1132	1132	1132	1132
29	40	142	142	142	142	142	142
30	131	416	416	416	416	416	416
31	134	138	138	138	138	138	138
32	105	388	388	388	388	388	388
33	117	923	923	923	923	923	923
34	23	0	0	0	0	0	0
35	38	12	10	0	0	0	0
36	125	802	802	802	802	802	802
37	99	247	247	247	247	247	247
38	62	127	127	127	127	127	127
39	78	958	958	958	958	958	958
40	32	12	15	20	24	31	38
41	17	204	204	204	204	204	204
42	122	291	291	291	291	291	291
43	106	1113	1113	1113	1113	1113	1113
44	26	49	49	49	49	49	49
45	22	29	29	29	29	29	29
46	87	494	494	494	494	494	494
47	102	218	218	218	218	218	218
48	163	144	144	144	144	144	144
49	67	348	348	348	348	348	348
50	15	0	0	0	0	0	0

Table A1: Population Projections for Volusia County by TAZ (Cont'd)

TAZ	ACRES	POPULATION PROJECTIONS RE-AGGREGATED TO TAZ					
		2000	2005	2010	2015	2020	2025
51	39	5	0	0	0	0	0
52	106	483	483	483	483	483	483
53	128	146	152	154	166	190	209
54	2169	330	545	800	1050	1305	1589
55	1787	295	423	566	715	871	1038
56	3957	699	1025	1383	1701	2013	2356
57	5338	6	7	8	8	9	9
58	1907	1512	1822	2165	2533	2901	3245
59	807	0	0	0	0	0	0
60	3402	5503	5736	5948	6002	6057	6087
61	336	1151	1213	1282	1289	1296	1296
62	91	84	87	89	90	90	90
63	681	2242	2374	2512	2587	2606	2626
64	1029	4321	4455	4584	4627	4634	4637
65	1173	590	733	879	990	1086	1183
66	2699	773	1036	1328	1629	1936	2250
67	790	2500	2528	2592	2612	2614	2615
68	453	0	0	175	276	461	589
69	561	267	330	387	446	507	571
70	250	0	0	461	562	708	798
71	352	0	0	1725	2104	2648	3132
72	498	547	547	547	547	547	547
73	436	114	114	114	114	114	114
74	319	1743	1865	1964	2079	2210	2312
75	350	2426	2426	2426	2426	2426	2426
76	213	848	848	848	848	848	848
77	212	1365	1365	1365	1365	1365	1365
78	152	1320	1497	1686	1868	1938	1987
79	109	527	532	540	572	625	669
80	55	168	169	171	176	184	191
81	129	546	546	546	546	546	546
82	459	1833	2148	2515	2925	3404	3945
83	337	1022	1142	1277	1426	1597	1780
84	197	1147	1182	1215	1226	1228	1229
85	545	2078	2371	2693	3003	3303	3607
86	63	221	229	247	266	279	288
87	254	724	733	746	748	748	748
88	236	882	893	906	907	907	907
89	24	29	30	31	31	31	31
90	88	127	141	156	174	193	212
91	219	703	748	795	843	902	967
92	227	693	706	722	739	758	777
93	53	154	157	164	168	168	168
94	252	846	865	902	930	930	930
95	335	749	769	791	834	896	955
96	88	197	201	204	214	229	243
97	70	429	465	502	525	551	576
98	35	0	0	0	0	0	0
99	35	149	149	149	149	149	149
100	54	120	122	127	132	132	132

Table A1: Population Projections for Volusia County by TAZ (Cont'd)

TAZ	ACRES	POPULATION PROJECTIONS RE-AGGREGATED TO TAZ					
		2000	2005	2010	2015	2020	2025
101	26	103	103	103	103	103	103
102	55	130	133	139	143	148	154
103	20	6	6	6	6	6	6
104	127	791	799	812	842	895	945
105	165	1043	1075	1111	1178	1261	1331
106	82	288	294	306	317	317	317
107	64	371	378	389	410	439	469
108	90	535	547	571	588	588	588
109	115	451	472	494	532	584	632
110	58	391	410	449	480	480	480
111	45	390	390	390	390	390	390
112	51	215	215	215	215	215	215
113	65	92	92	92	92	92	92
114	88	188	188	188	188	188	188
115	37	13	13	13	13	13	13
116	98	1035	1035	1035	1035	1035	1035
117	54	293	293	293	293	293	293
118	92	0	0	0	0	0	0
119	16	0	0	0	0	0	0
120	56	54	54	54	54	54	54
121	19	148	148	148	148	148	148
122	23	9	9	9	9	9	9
123	123	0	0	0	0	0	0
124	125	66	66	66	66	66	66
125	11	155	155	155	155	155	155
126	9	16	16	16	16	16	16
127	68	857	857	857	857	857	857
128	173	867	968	985	996	1053	1077
129	76	613	613	613	613	613	613
130	62	394	394	394	394	394	394
131	189	578	578	578	578	578	578
132	37	81	81	81	81	81	81
133	101	536	536	536	536	536	536
134	110	554	554	554	554	554	554
135	111	463	463	463	463	463	463
136	64	385	385	385	385	385	385
137	17	105	105	105	105	105	105
138	33	158	158	158	158	158	158
139	45	399	399	399	399	399	399
140	30	1078	1078	1078	1078	1078	1078
141	113	1109	1109	1109	1109	1109	1109
142	106	863	863	863	863	863	863
143	35	0	0	0	0	0	0
144	48	85	85	85	85	85	85
145	34	0	0	0	0	0	0
146	28	0	0	0	0	0	0
147	40	130	130	130	130	130	130
148	130	592	592	592	592	592	592
149	282	2255	2255	2255	2255	2255	2255
150	99	349	349	349	349	349	349

Table A1: Population Projections for Volusia County by TAZ (Cont'd)

TAZ	ACRES	POPULATION PROJECTIONS RE-AGGREGATED TO TAZ					
		2000	2005	2010	2015	2020	2025
151	103	560	560	560	560	560	560
152	15	149	149	149	149	149	149
153	60	265	265	265	265	265	265
154	114	727	727	727	727	727	727
155	40	192	192	192	192	192	192
156	111	512	512	512	512	512	512
157	509	1549	1604	1621	1722	1959	2142
158	179	1057	1209	1348	1582	1996	2430
159	89	323	637	899	1048	1278	1476
160	188	1022	1022	1022	1022	1022	1022
161	70	332	332	332	332	332	332
162	194	1033	1033	1033	1033	1033	1033
163	61	0	0	0	0	0	0
164	331	2015	2015	2015	2015	2015	2015
165	562	239	304	358	432	543	602
166	463	12	121	224	328	460	584
167	591	9	159	295	434	606	770
168	175	311	311	311	311	311	311
169	305	0	0	0	0	0	0
170	132	1177	1177	1177	1177	1177	1177
171	173	1427	1427	1427	1427	1427	1427
172	199	1338	1338	1338	1338	1338	1338
173	161	861	861	861	861	861	861
174	76	376	376	376	376	376	376
175	66	132	132	132	132	132	132
176	281	1024	1269	1535	1951	2665	3515
177	478	1852	1852	1852	1852	1852	1852
178	289	408	408	408	408	408	408
179	149	24	24	24	24	24	24
180	65	340	340	340	340	340	340
181	339	321	321	321	321	321	321
182	529	0	0	0	0	0	0
183	46	0	0	0	0	0	0
184	94	0	0	0	0	0	0
185	939	639	844	1004	1100	1283	1429
186	277	0	0	0	0	0	0
187	1052	0	0	0	0	0	0
188	71	0	0	0	0	0	0
189	146	0	0	0	0	0	0
190	29	32	32	32	32	32	32
191	21	171	183	185	195	206	207
192	81	0	0	0	0	0	0
193	542	125	201	323	521	839	1347
194	286	1732	1918	2115	2315	2549	2765
195	81	248	248	248	248	248	248
196	151	859	872	897	915	927	935
197	670	1259	1349	1412	1475	1534	1579
198	203	3	3	3	3	3	3
199	297	0	0	0	0	0	0
200	33	209	209	209	209	209	209

Table A1: Population Projections for Volusia County by TAZ (Cont'd)

TAZ	ACRES	POPULATION PROJECTIONS RE-AGGREGATED TO TAZ					
		2000	2005	2010	2015	2020	2025
201	82	476	476	476	476	476	476
202	156	153	164	171	185	215	240
203	340	141	141	141	141	141	141
204	163	1310	1552	1552	1552	1552	1552
205	50	1081	1291	1291	1291	1291	1291
206	25	0	0	0	0	0	0
207	12	104	104	104	104	104	104
208	413	844	844	844	844	844	844
209	182	533	533	533	533	533	533
210	34	140	140	140	140	140	140
211	565	1397	1422	1448	1448	1448	1448
212	1675	3550	3550	3550	3550	3550	3550
213	329	1041	1041	1041	1041	1041	1041
214	94	363	363	363	363	363	363
215	163	1223	1223	1223	1223	1223	1223
216	341	1318	1318	1318	1318	1318	1318
217	485	2341	2341	2341	2341	2341	2341
218	193	1106	1106	1106	1106	1106	1106
219	80	652	652	652	652	652	652
220	435	435	435	435	435	435	435
221	105	608	608	608	608	608	608
222	198	83	83	83	83	83	83
223	203	94	94	94	94	94	94
224	109	125	125	125	125	125	125
225	92	452	462	469	476	486	498
226	17	12	6	0	0	0	0
227	224	1346	1400	1431	1536	1731	1880
228	307	1026	1225	1374	1550	1772	1925
229	371	2009	2009	2009	2009	2009	2009
230	336	1090	1116	1142	1165	1186	1220
231	463	3311	3311	3311	3311	3311	3311
232	420	699	703	705	712	730	752
233	578	3290	3342	3394	3434	3466	3491
234	607	1838	1988	2142	2264	2337	2432
235	298	2784	2849	2957	3046	3119	3147
236	315	1414	1818	2108	2445	2716	2792
237	1083	3100	3342	3517	3682	3850	3973
238	379	2	178	259	364	422	453
239	894	3717	4035	4218	4304	4394	4497
240	702	2538	2680	2831	3032	3245	3410
241	243	271	271	271	271	271	271
242	543	205	206	218	229	238	245
243	713	832	832	832	832	832	832
244	321	0	0	0	0	0	0
245	155	710	710	710	710	710	710
246	146	793	793	793	793	793	793
247	252	208	208	208	208	208	208
248	426	2206	2361	2467	2625	2774	2944
249	139	708	708	708	708	708	708
250	412	2416	2513	2615	2716	2813	2906

Table A1: Population Projections for Volusia County by TAZ (Cont'd)

TAZ	ACRES	POPULATION PROJECTIONS RE-AGGREGATED TO TAZ					
		2000	2005	2010	2015	2020	2025
251	210	612	612	612	612	612	612
252	187	648	648	648	648	648	648
253	573	3855	3855	3855	3855	3855	3855
254	475	2046	2046	2046	2046	2046	2046
255	170	224	246	268	291	311	337
256	670	2093	2311	2531	2758	2988	3239
257	630	3110	3182	3244	3292	3337	3464
258	511	1568	1632	1745	1857	1970	2093
259	311	1262	1267	1270	1270	1270	1270
260	352	1473	1595	1786	1986	2095	2217
261	2001	78	78	78	78	78	78
262	2114	198	216	235	257	280	301
263	1430	128	144	187	243	266	291
264	2891	1521	1680	1755	1792	1825	1825
265	511	287	295	310	321	339	352
266	1007	354	444	545	648	767	869
267	579	208	266	332	394	465	529
268	558	5	7	9	11	13	15
269	535	1695	1743	1828	1898	2003	2068
270	640	16	16	16	16	16	16
271	959	2476	2535	2535	2535	2535	2535
272	315	381	395	419	443	476	503
273	6	0	0	0	0	0	0
274	605	3179	3179	3179	3179	3179	3179
275	61	379	379	379	379	379	379
276	45	26	26	26	26	26	26
277	134	617	617	617	617	617	617
278	243	683	683	683	683	683	683
279	1191	560	559	566	572	589	595
280	1856	919	998	1093	1190	1306	1409
281	1067	1044	1044	1044	1044	1044	1044
282	208	497	497	497	497	497	497
283	175	705	705	705	705	705	705
284	204	740	740	740	740	740	740
285	24	119	119	119	119	119	119
286	39	99	99	99	99	99	99
287	124	667	667	667	667	667	667
288	36	6	6	6	6	6	6
289	551	0	0	0	0	0	0
290	428	680	680	680	680	680	680
291	284	0	0	86	170	265	358
296	82	186	186	186	186	186	186
297	602	16	20	24	29	37	43
298	82	57	59	64	67	68	68
300	1249	521	557	606	652	712	760
301	1759	2982	2982	2982	2982	2982	2982
302	1352	1384	1418	1478	1589	1724	1830
303	2481	28	32	36	41	46	49
304	5365	135	158	180	213	248	285

Table A1: Population Projections for Volusia County by TAZ (Cont'd)

TAZ	ACRES	POPULATION PROJECTIONS RE-AGGREGATED TO TAZ					
		2000	2005	2010	2015	2020	2025
305	991	371	386	410	434	464	491
306	3471	28	35	37	40	40	40
307	18037	0	0	0	0	0	0
308	134	261	261	261	261	261	261
309	334	719	719	719	719	719	719
310	720	593	636	652	665	680	680
311	256	203	203	203	203	203	203
312	539	961	1069	1141	1162	1207	1207
313	1741	353	362	379	406	420	421
314	1167	990	1105	1237	1372	1527	1668
315	648	530	538	549	564	575	594
316	757	268	288	317	345	367	374
317	163	773	773	773	773	773	773
318	213	498	506	510	529	537	552
319	163	502	508	517	531	533	533
320	115	416	416	416	416	416	416
321	58	290	290	290	290	290	290
322	275	897	897	897	897	897	897
323	369	1442	1472	1535	1615	1638	1666
324	753	1631	1631	1631	1631	1631	1631
325	1006	204	213	233	255	267	283
326	893	333	455	554	649	684	714
327	5099	312	315	327	348	356	367
328	453	1764	1832	1976	2151	2255	2367
329	284	1300	1344	1443	1562	1631	1704
330	340	1918	2000	2162	2360	2481	2608
331	328	1953	2043	2224	2443	2582	2728
332	206	1121	1215	1363	1537	1664	1794
333	220	1006	1048	1138	1243	1308	1380
334	574	1691	1782	1960	2175	2320	2469
335	361	1282	1604	1966	2242	2470	2703
336	180	43	53	66	82	96	110
337	99	192	210	235	266	290	315
338	2318	3206	5886	6381	6842	7096	7261
339	10090	1138	1644	1711	1786	1829	1910
340	12789	783	1131	1198	1277	1348	1431
341	33566	404	413	427	440	460	481
342	3620	106	114	121	132	151	168
343	1815	0	256	795	970	1222	1363
344	9750	43	1361	2378	3364	3957	4536
345	3376	0	0	0	0	0	0
346	1672	0	0	0	0	0	0
347	2692	0	0	0	0	0	0
348	3783	0	0	0	0	0	0
349	2772	68	68	68	68	68	68
351	369	0	0	260	552	694	882
352	690	0	0	437	765	1342	1956
353	1106	0	0	300	633	1117	1595
355	6235	0	18	35	45	54	62

Table A1: Population Projections for Volusia County by TAZ (Cont'd)

TAZ	ACRES	POPULATION PROJECTIONS RE-AGGREGATED TO TAZ					
		2000	2005	2010	2015	2020	2025
358	476	131	142	154	167	180	194
359	1340	0	0	0	0	0	0
399	336	0	0	0	0	0	0
400	2564	12	14	18	20	22	23
401	732	1922	1976	2042	2108	2167	2243
402	2051	1276	1581	1938	2316	2715	3123
403	436	1104	1283	1487	1685	1885	2084
404	8849	959	1325	1698	2081	2475	2873
405	2020	0	0	139	273	427	579
406	1977	98	713	1326	1945	2725	3457
407	798	2622	2622	2622	2622	2622	2622
408	962	30	632	1191	1496	1752	1901
409	8995	640	656	671	696	734	772
410	15813	3	3	3	3	3	3
411	1806	137	140	144	153	160	174
412	2981	1213	1574	1818	2080	2353	2625
413	302	0	0	0	0	0	0
414	158	229	309	388	471	552	635
415	821	1322	1519	1745	1887	2047	2175
416	493	352	520	687	861	1035	1213
417	1247	2727	3301	3523	3545	3545	3545
418	1985	1092	1606	2246	2653	2983	3320
419	661	767	900	1081	1255	1420	1593
420	1358	746	824	899	949	998	1055
421	2390	301	301	301	301	301	301
422	1567	229	229	229	229	229	229
423	1644	179	179	179	179	179	179
424	1702	0	0	30	679	1327	1948
425	764	0	0	0	0	0	0
426	1150	86	100	116	133	150	169
427	22343	468	468	468	468	468	468
428	8806	394	479	568	663	764	870
429	17662	0	0	0	0	0	0
430	4319	7	7	7	7	7	7
431	32419	398	563	733	921	1114	1318
432	8477	18	22	27	33	40	47
433	3505	12	15	19	23	27	31
434	39033	386	466	551	644	740	844
435	975	225	225	225	225	225	225
436	1005	7	7	7	7	7	7
437	1264	18	141	218	855	1493	2195
438	464	0	0	0	0	0	0
439	1361	1	150	202	214	226	237
440	4178	0	0	0	0	0	0
441	2930	6	28	94	133	186	205
484	2678	260	289	322	362	404	449
485	17033	902	1029	1161	1312	1469	1645
487	300	266	272	300	330	356	388
488	185	0	0	0	0	0	0

Table A1: Population Projections for Volusia County by TAZ (Cont'd)

TAZ	ACRES	POPULATION PROJECTIONS RE-AGGREGATED TO TAZ					
		2000	2005	2010	2015	2020	2025
489	96	0	0	0	0	0	0
490	162	353	557	756	803	874	875
491	217	18	30	41	50	59	67
492	161	0	0	0	0	0	0
493	81	45	45	45	45	45	45
494	82	217	217	217	217	217	217
495	1023	439	471	490	532	577	630
496	4261	459	519	569	619	670	728
500	85	0	0	0	0	0	0
501	19213	826	846	871	885	898	924
502	23222	3907	3907	3907	3907	3907	3907
503	31978	5092	5237	5407	5843	6257	6702
504	20845	137	137	137	137	137	137
505	4876	93	102	111	121	133	147
506	1281	358	358	358	358	358	358
507	243	452	524	577	629	681	740
508	1555	447	447	447	447	447	447
509	3607	1347	1347	1347	1347	1347	1347
510	228	484	526	533	553	572	600
511	1154	2401	2401	2401	2401	2401	2401
512	2792	1334	1334	1334	1334	1334	1334
513	2175	254	254	254	254	254	254
514	5050	1567	1567	1567	1567	1567	1567
515	20968	66	67	72	81	88	97
516	420	565	597	625	654	678	703
517	182	342	376	376	376	376	376
518	320	511	553	577	613	646	684
519	576	382	423	452	503	554	618
520	895	259	265	271	279	287	294
521	2160	2329	2376	2428	2459	2565	2729
522	427	1338	1338	1338	1338	1338	1338
523	403	327	363	387	430	474	526
524	120	123	123	123	123	123	123
525	209	34	37	39	44	48	52
526	275	220	220	220	220	220	220
527	161	121	121	121	121	121	121
528	263	117	156	187	229	272	319
529	59	1	1	1	1	1	1
530	325	343	343	343	343	343	343
531	731	862	973	1072	1222	1304	1405
532	1392	590	611	614	648	678	707
533	243	217	236	252	271	280	291
534	243	235	235	235	235	235	235
535	212	82	82	82	82	82	82
536	786	17	19	21	24	27	30
537	3152	253	262	271	284	294	308
538	545	104	127	141	155	166	170
539	2329	1748	1821	1908	1976	2057	2089
540	258	52	52	52	52	52	52

Table A1: Population Projections for Volusia County by TAZ (Cont'd)

TAZ	ACRES	POPULATION PROJECTIONS RE-AGGREGATED TO TAZ					
		2000	2005	2010	2015	2020	2025
541	95	49	49	49	49	49	49
542	71	361	361	361	361	361	361
543	89	492	516	535	554	584	611
544	161	514	514	514	514	514	514
545	257	235	235	235	235	235	235
546	101	148	148	148	148	148	148
547	100	428	428	428	428	428	428
548	101	406	406	406	406	406	406
549	104	378	378	378	378	378	378
550	101	490	490	490	490	490	490
551	103	1236	1236	1236	1236	1236	1236
552	102	322	322	322	322	322	322
553	81	326	326	326	326	326	326
554	166	90	129	159	193	227	265
555	81	625	625	625	625	625	625
556	40	167	167	167	167	167	167
557	80	434	434	434	434	434	434
558	40	332	332	332	332	332	332
559	16	7	7	7	7	7	7
560	15	8	8	8	8	8	8
561	15	22	22	22	22	22	22
562	16	7	7	7	7	7	7
563	15	16	16	16	16	16	16
564	14	15	15	15	15	15	15
565	79	266	266	266	266	266	266
566	78	357	357	357	357	357	357
567	80	467	467	467	467	467	467
568	79	485	485	485	485	485	485
569	80	422	436	451	467	489	537
570	80	414	418	423	437	437	437
571	80	402	414	427	449	449	449
572	81	304	304	304	304	304	304
573	81	289	289	289	289	289	289
574	79	625	649	671	694	728	761
575	40	79	79	79	79	79	79
576	41	634	634	634	634	634	634
577	41	137	137	137	137	137	137
578	81	518	518	518	518	518	518
579	79	213	228	240	246	249	256
580	41	129	137	143	149	155	166
581	41	563	563	563	563	563	563
582	41	341	362	371	397	404	406
583	41	139	149	152	163	172	186
584	37	22	24	27	27	27	27
585	76	362	362	362	362	362	362
586	229	141	153	159	171	185	201
587	53	147	147	147	147	147	147
588	81	443	470	482	514	545	588
589	464	1438	1452	1474	1491	1518	1521
590	1135	254	269	274	295	317	349

Table A1: Population Projections for Volusia County by TAZ (Cont'd)

TAZ	ACRES	POPULATION PROJECTIONS RE-AGGREGATED TO TAZ					
		2000	2005	2010	2015	2020	2025
591	8174	3074	3209	3324	3626	3937	4293
592	79	311	311	311	311	311	311
593	53	133	133	133	133	133	133
594	80	414	414	414	414	414	414
595	234	926	926	926	926	926	926
596	437	422	457	482	527	571	626
597	258	138	150	161	178	193	212
598	121	0	0	0	0	0	0
599	336	144	160	184	208	234	260
600	242	0	0	0	0	0	0
601	178	0	2	7	9	11	13
602	335	77	114	197	244	279	319
603	246	519	547	573	597	621	636
604	97	71	71	71	71	71	71
605	269	305	402	501	608	711	821
606	814	1807	1831	1861	1918	1973	2024
607	281	96	226	352	468	575	692
608	148	0	0	0	0	0	0
609	647	211	300	460	570	663	770
610	615	199	199	199	199	199	199
611	304	673	703	703	703	703	703
612	670	503	551	582	641	702	777
613	88	103	103	103	103	103	103
614	184	644	644	644	644	644	644
615	165	364	440	495	567	637	719
616	242	738	761	798	815	815	815
617	995	1101	1137	1143	1208	1277	1373
618	2813	5	5	5	5	5	5
619	289	32	37	43	48	53	59
620	136	127	165	204	250	296	343
621	166	54	62	71	84	93	106
622	85	27	29	31	35	39	42
623	132	243	293	348	407	463	526
624	154	541	711	871	1045	1197	1362
625	80	40	54	69	85	102	119
626	383	887	956	1010	1059	1096	1134
627	227	469	469	469	469	469	469
628	240	798	798	798	798	798	798
629	133	159	179	242	266	277	291
630	229	304	304	304	304	304	304
631	241	718	718	718	718	718	718
632	1084	666	1032	1521	2109	2468	2793
633	176	94	94	94	94	94	94
634	590	652	686	713	735	748	753
635	450	1999	2056	2073	2075	2076	2085
636	206	368	368	368	368	368	368
637	122	322	322	322	322	322	322
638	650	51	73	96	117	136	153
639	26	0	0	0	0	0	0
640	66	116	116	116	116	116	116

Table A1: Population Projections for Volusia County by TAZ (Cont'd)

TAZ	ACRES	POPULATION PROJECTIONS RE-AGGREGATED TO TAZ					
		2000	2005	2010	2015	2020	2025
641	165	59	59	59	59	59	59
642	132	280	280	280	280	280	280
643	162	24	88	250	333	394	462
644	72	67	67	67	67	67	67
645	81	117	117	117	117	117	117
646	366	183	183	183	183	183	183
647	117	10	10	10	10	10	10
648	47	52	52	52	52	52	52
649	912	1717	1966	2213	2457	2645	2846
650	25	0	0	0	0	0	0
651	147	8	10	12	13	13	13
652	199	690	690	690	690	690	690
653	202	111	125	136	145	162	178
654	456	794	946	1109	1260	1392	1524
655	93	164	166	174	188	202	221
656	471	1783	1946	2105	2393	2573	2758
657	302	13	114	397	551	672	807
658	836	0	288	1078	1474	1750	2057
659	345	17	67	197	264	311	362
660	182	0	35	125	178	210	247
661	267	160	176	187	207	226	253
662	204	1	49	175	240	283	344
663	548	0	252	943	1287	1523	1789
664	211	0	361	652	911	1140	1377
665	25	32	32	32	32	32	32
666	14	9	9	9	9	9	9
667	101	9	9	9	9	9	9
668	118	109	109	109	109	109	109
669	34	2	2	2	2	2	2
670	615	932	1144	1376	1620	1858	2119
671	1615	69	84	99	117	133	150
672	444	1064	1243	1453	1793	2139	2516
673	100	117	166	216	272	330	393
674	100	102	137	181	225	269	319
675	324	944	944	944	944	944	944
676	372	779	796	813	823	825	843
677	1829	687	831	988	1161	1338	1542
678	81	346	444	517	556	575	588
679	1130	3312	3492	3602	3870	4092	4538
680	1587	125	162	204	250	295	346
681	3608	762	910	1071	1241	1409	1595
682	1036	775	989	1222	1482	1741	2023
683	770	2816	3042	3251	3646	3972	4299
684	167	94	115	137	155	173	182
685	1068	1632	2156	2730	3360	3994	4681
686	688	2117	2344	2591	2849	3077	3321
687	355	1404	1554	1709	1865	2009	2168
688	594	1665	1974	2324	2593	2819	3149
689	1623	219	261	301	346	390	437
690	46	107	107	107	107	107	107

Table A1: Population Projections for Volusia County by TAZ (Cont'd)

TAZ	ACRES	POPULATION PROJECTIONS RE-AGGREGATED TO TAZ					
		2000	2005	2010	2015	2020	2025
691	46	204	204	204	204	204	204
692	46	154	167	175	186	197	211
693	2669	391	391	391	391	391	391
694	53	67	67	67	67	67	67
695	80	0	0	0	0	0	0
696	45	166	166	166	166	166	166
697	44	14	14	14	14	14	14
698	44	278	278	278	278	278	278
699	79	0	0	0	0	0	0
700	1132	0	0	0	0	0	0
701	1060	175	185	194	208	222	238
702	321	262	283	300	337	383	435
703	333	495	534	562	591	616	640
704	83	302	321	338	342	356	356
705	228	532	591	667	768	884	1012
706	344	524	549	565	615	682	755
707	318	19	19	19	19	19	19
708	407	337	386	438	515	614	727
709	220	703	814	871	899	905	922
710	1408	1113	1253	1400	1548	1681	1821
711	236	150	150	153	163	176	193
712	410	557	622	708	787	830	877
713	2473	1251	1382	1527	1678	1796	1935
714	2166	2387	2387	2387	2387	2387	2387
715	149	177	203	232	261	277	293
716	1391	5683	5813	6121	6308	6442	6581
717	645	952	976	1047	1117	1157	1211
718	39	0	0	0	0	0	0
719	3326	989	1090	1205	1327	1436	1559
720	309	1527	1643	1779	1987	2105	2225
721	252	805	939	1104	1260	1369	1480
722	390	0	0	0	0	0	0
723	592	673	791	981	1175	1330	1568
724	510	576	618	685	746	775	798
725	682	834	882	957	1012	1034	1064
726	633	1881	1921	1921	1921	1921	1921
727	712	2776	2950	3319	3623	3771	3933
728	258	1278	1394	1596	1780	1883	1992
729	453	1293	1451	1659	1838	1936	2037
730	540	2694	2739	2751	2751	2751	2751
731	469	3091	3246	3490	3764	3871	3957
732	753	2731	2805	3278	3698	3958	4493
733	244	1348	1411	1516	1589	1594	1614
734	590	2305	2351	2550	2700	2734	2783
735	846	2643	2733	2995	3184	3234	3302
736	253	1385	1429	1567	1679	1719	1769
737	419	2020	2154	2354	2497	2532	2584
738	722	3867	3972	4127	4178	4274	4381
739	630	3957	4193	4310	4550	4726	5016
740	525	1586	1649	1705	1764	1769	1787

Table A1: Population Projections for Volusia County by TAZ (Cont'd)

TAZ	ACRES	POPULATION PROJECTIONS RE-AGGREGATED TO TAZ					
		2000	2005	2010	2015	2020	2025
741	446	1379	1447	1553	1624	1624	1624
742	289	638	687	780	857	896	924
743	69	73	90	110	129	143	156
744	194	385	391	406	415	415	415
745	271	381	443	522	594	640	686
746	80	437	469	513	546	555	570
747	743	2793	3067	3234	3618	3947	4459
748	660	1877	2166	2526	2849	3047	3394
749	1380	1493	1629	1765	1862	2024	2197
750	1365	4920	5193	5327	5504	5779	6384
751	925	3395	3593	3796	4026	4417	4823
752	2177	2694	2853	3039	3382	3583	3891
753	4725	243	252	264	278	278	278
754	604	1313	1504	1718	1935	2118	2419
755	738	268	327	392	458	517	578
756	549	483	565	662	748	788	821
757	537	529	602	690	774	834	898
758	1207	412	426	441	460	477	504
759	5727	640	700	767	841	915	999
760	19735	2067	2176	2287	2614	2955	3325
	TOTALS	**445329**	**479404**	**516836**	**552663**	**585808**	**620814**
	BEBR	**443343**	**477400**	**512000**	**547700**	**583800**	**618800**
	DIFF	**0%**	**0%**	**1%**	**1%**	**0%**	**0%**
	SJR	**443343**	**486535**	**529608**	**572241**	**615477**	**651001**
	DIFF	**0%**	**-1%**	**-2%**	**-3%**	**-5%**	**-5%**

Table A2: Population Projections for Seminole County by TAZ

TAZ	ACRES	POPULATION PROJECTIONS RE-AGGREGATED TO TAZ					
		2000	2005	2010	2015	2020	2025
1	7559	1345	1797	2715	3632	3632	3632
2	1199	1452	1919	3226	4533	4533	4533
3	2889	2238	3074	4123	5172	5172	5172
4	203	28	33	145	256	256	256
5	1849	3591	5634	7350	9066	9066	9066
6	3143	846	1083	2398	3712	3712	3712
7	2483	2581	2609	2642	2674	2674	2674
8	117	0	111	487	863	863	863
9	265	12	12	13	13	13	13
10	838	2644	3205	3766	4328	4328	4328
11	873	1661	1935	2210	2484	2541	2596
12	257	42	46	51	55	517	557
13	680	992	1044	1096	1148	1148	1174
14	979	3010	3284	3347	3591	3761	3965
15	519	778	849	920	991	991	991
16	558	734	785	835	886	1368	1547
17	931	3167	4049	4930	5811	5811	5811
18	361	2195	2376	2557	2738	2738	2738
19	266	724	803	881	960	960	960
20	985	1923	2143	2363	2583	2583	2583
21	303	0	0	0	0	0	0
22	1043	1928	2376	2823	3271	3805	3805
23	1133	4130	4750	5369	5989	6208	6463
24	323	1151	1839	2527	3215	3215	3215
25	162	1109	1109	1109	1109	1109	1109
26	273	1862	1913	1963	2014	2196	2196
27	456	1675	1746	1816	1887	2037	2089
28	261	928	1026	1125	1224	1224	1224
29	733	2082	2160	2239	2317	2414	2414
30	562	311	476	641	805	1978	1978
31	253	0	0	0	0	0	0
32	898	203	229	255	282	613	691
33	1128	191	893	1596	2299	2299	2299
34	1342	599	631	664	696	725	725
35	1004	879	1100	1322	1543	1543	1543
36	205	1425	1578	1732	1885	1885	1885
37	252	1445	1641	1836	2031	2031	2031
38	85	441	508	575	642	755	842
39	116	792	911	1031	1151	1151	1151
40	112	355	402	449	496	556	580
41	65	258	319	381	442	442	451
42	53	349	385	422	458	458	458
43	763	15	15	15	15	15	15
44	1424	1327	1599	1870	2141	2141	2141
45	1864	129	148	167	186	186	186
46	983	12	267	495	672	927	1162
47	891	1608	1880	2151	2422	2602	2641
48	814	2810	4239	5669	7099	7099	7099
49	282	1288	1516	1744	1973	2030	2030
50	197	719	812	904	997	1075	1075

Table A2: Population Projections for Seminole County by TAZ (Cont'd)

TAZ	ACRES	POPULATION PROJECTIONS RE-AGGREGATED TO TAZ					
		2000	2005	2010	2015	2020	2025
51	276	886	926	967	1007	1018	1050
52	141	17	23	30	36	36	36
53	266	1630	1790	1951	2111	2111	2111
54	281	1021	1127	1234	1341	1341	1341
55	298	872	896	920	944	1018	1042
56	464	812	1053	1294	1536	1827	2063
57	515	1252	1356	1460	1564	1564	1564
58	332	208	216	224	232	262	286
59	546	1156	1247	1337	1428	1428	1428
60	6392	646	1791	2936	4081	4081	4081
61	1333	415	492	568	645	645	645
62	2535	331	357	383	408	408	408
63	6275	224	603	982	1361	1651	1651
64	12484	1502	1690	1879	2067	2229	2229
65	22335	2997	3187	3376	3566	4102	4102
66	9002	416	418	419	421	461	502
67	16543	673	685	697	710	710	710
68	12701	7196	10312	13427	16543	18108	18341
69	1348	1552	1736	1920	2104	2294	2354
70	1545	2024	2230	2436	2643	2643	2643
71	8031	512	873	1235	1596	1717	1717
72	560	2381	2465	2548	2632	2632	2632
73	984	3309	3620	3931	4243	4243	4243
74	369	349	356	363	369	369	369
75	1496	2441	2771	3101	3430	3553	3559
76	1254	4138	4625	5111	5597	5597	5597
77	959	6811	6971	7132	7293	7293	7293
78	4225	14322	14649	14975	15302	15302	15302
79	2744	5143	6042	6942	7842	7842	7842
80	1866	1727	2342	2957	3571	3571	3571
81	1054	1608	1608	1608	1608	1608	1608
82	736	3469	3596	3722	3849	3945	3945
83	1152	4986	5160	5334	5508	5904	5904
84	620	2589	2713	2837	2961	2961	2961
85	407	0	21	42	63	63	63
86	1044	178	202	227	252	1078	1078
87	1369	2965	4035	5106	6176	6176	6176
88	856	3218	3220	3222	3224	4067	4067
89	389	0	0	0	0	0	3367
90	686	3977	4294	4610	4927	4937	4937
91	503	3057	3166	3275	3384	3384	3384
92	287	2910	3168	3426	3683	3683	3683
93	444	23	25	27	29	29	29
94	580	2082	2221	2360	2499	2638	2777
95	560	2446	2460	2473	2486	2831	2831
96	650	2845	3039	3233	3427	3527	3527
97	641	2332	2799	3266	3733	3765	3765
98	362	1203	1294	1385	1477	1510	1510
99	97	682	707	731	756	846	858
100	347	1920	1983	2045	2108	2152	2152

Table A2: Population Projections for Seminole County by TAZ (Cont'd)

TAZ	ACRES	POPULATION PROJECTIONS RE-AGGREGATED TO TAZ					
		2000	2005	2010	2015	2020	2025
101	90	607	640	674	707	714	714
102	424	2800	3039	3278	3517	3697	3697
103	793	3434	3544	3653	3763	3995	3995
104	297	1102	1115	1128	1141	1168	1173
105	415	2334	2407	2480	2553	2561	2561
106	206	1365	1367	1369	1371	1404	1404
107	492	3275	3275	3275	3275	3313	3363
108	361	1885	1885	1885	1885	1885	1945
109	497	1222	1284	1347	1409	1409	1436
110	556	3840	3917	3993	4070	4146	4222
111	1423	4052	4266	4481	4695	4909	5123
112	606	1943	1949	1956	1962	1962	2010
113	263	1667	1847	2027	2207	2226	2226
114	232	1468	1517	1567	1616	1630	1630
115	505	4349	4955	5561	6166	6220	6220
116	506	2348	2473	2599	2725	2749	2749
117	105	2444	2606	2767	2928	3090	3251
118	252	1726	1900	2073	2247	2363	2368
119	278	2396	2448	2501	2554	2583	2588
120	240	2135	2249	2363	2477	2525	2585
121	257	2068	2322	2576	2830	2830	2830
122	394	2509	2759	3008	3257	3285	3285
123	108	1019	1031	1042	1054	1054	1054
124	36	0	0	0	0	0	0
125	357	1026	1104	1182	1261	1302	1302
126	203	968	1530	2093	2655	3217	3780
127	304	1545	1644	1744	1843	1843	1843
128	125	1196	1302	1409	1515	1517	1517
129	68	402	444	487	529	529	529
130	57	412	467	522	576	576	576
131	174	2407	2628	2850	3072	3072	3072
132	414	3001	3087	3173	3259	3259	3259
133	230	1520	1574	1628	1682	1682	1682
134	190	1247	1264	1281	1298	1298	1298
135	105	0	0	0	0	0	0
136	80	0	0	0	0	0	0
137	99	0	0	0	0	0	0
138	207	1660	1783	1906	2029	2029	2029
139	433	2510	2539	2557	2557	2557	2557
140	475	2447	2518	2590	2662	2832	2832
141	162	763	812	862	911	911	911
142	541	939	1097	1256	1414	1466	1517
143	246	297	453	608	764	764	764
144	181	863	891	920	948	948	948
145	403	852	1039	1227	1414	1519	1603
146	415	2011	2164	2318	2471	2471	2471
147	183	487	521	555	589	589	590
148	296	1468	1506	1545	1583	1651	1781
149	476	3022	3058	3093	3129	3252	3253
150	525	288	317	345	374	374	374

Table A2: Population Projections for Seminole County by TAZ (Cont'd)

TAZ	ACRES	POPULATION PROJECTIONS RE-AGGREGATED TO TAZ					
		2000	2005	2010	2015	2020	2025
151	120	267	280	292	305	305	305
152	451	2099	2213	2326	2440	2440	2483
153	320	1134	1184	1233	1283	1309	1388
154	481	2725	2791	2856	2921	2921	2969
155	416	2626	2671	2716	2761	2761	2761
156	335	0	0	0	0	0	0
157	528	1473	1505	1537	1568	1614	1620
158	508	1466	1468	1471	1473	1473	1473
159	1137	3055	3168	3282	3395	3395	3395
160	567	3839	4365	4891	5417	5417	5417
161	3513	3786	3843	3900	3957	3957	3957
162	1013	2756	2817	2877	2938	2945	3027
163	1351	6951	6951	6951	6951	7286	7286
164	577	2531	2535	2539	2543	2543	2543
165	541	807	849	890	932	1567	1680
166	467	3271	3327	3382	3438	3563	3563
167	155	1077	1118	1159	1201	1229	1333
168	458	4131	4334	4537	4740	4740	4740
169	230	1795	1828	1862	1896	1959	1959
170	363	1330	1296	1296	1296	1296	1296
171	410	2497	2663	2829	2996	3308	3308
172	63	435	490	546	601	601	601
173	101	2134	2340	2545	2751	2957	3163
174	232	1231	1337	1443	1549	1549	1549
175	611	2903	3675	4447	5219	5991	6763
176	331	1905	2004	2102	2201	2201	2201
177	163	761	843	925	1007	1007	1007
178	254	1221	1267	1313	1359	1359	1359
179	429	2469	2550	2632	2713	2866	2866
180	526	2955	2965	2974	2984	2984	2984
181	796	1659	1751	1844	1937	1949	1949
182	337	1294	1310	1326	1342	1342	1342
183	239	761	893	1025	1157	1157	1157
184	785	1257	1495	1733	1971	1971	1971
185	569	3179	3179	3179	3179	3179	3179
186	317	1895	2007	2159	2288	2384	2503
187	305	1666	1666	1666	1666	1666	1726
188	348	1443	1443	1443	1443	1443	1443
189	83	680	759	838	917	917	917
190	137	2371	2501	2630	2760	2889	3019
191	154	263	310	358	405	409	409
192	249	61	62	63	64	64	64
193	222	1725	1725	1725	1725	1725	1725
194	245	2185	2265	2345	2424	2424	2424
195	192	1697	1837	1976	2115	2115	2115
196	204	1506	1555	1605	1654	1654	1654
197	789	4298	4550	4803	5056	5248	5561
198	261	1070	1199	1229	1229	1229	1229
199	405	711	1019	1078	1136	1136	1136
200	623	231	2386	2407	2429	2429	2429

Table A2: Population Projections for Seminole County by TAZ (Cont'd)

TAZ	ACRES	POPULATION PROJECTIONS RE-AGGREGATED TO TAZ					
		2000	2005	2010	2015	2020	2025
201	542	287	603	603	603	603	603
202	513	374	495	708	921	921	921
203	772	1448	1467	1486	1486	1486	1486
204	316	363	403	443	483	483	483
205	548	5993	6160	6327	6327	6327	6327
206	597	4754	4860	4967	5073	5073	5073
207	536	102	119	135	152	152	152
208	428	1064	1213	1361	1510	1658	1807
209	138	0	0	0	0	0	0
210	283	69	75	80	86	86	86
211	165	1313	1364	1416	1467	1467	1467
212	230	1096	1192	1289	1385	1385	1385
		365201	**404896**	**444363**	**483699**	**500436**	**509658**
	BEBR	**365196**	**401800**	**438600**	**476200**	**514800**	**552400**
	DIFF	**0%**	**1%**	**1%**	**2%**	**-3%**	**-8%**
	SJR	**365196**	**414212**	**454445**	**497651**	**515475**	**528134**
	DIFF	**0%**	**-2%**	**-2%**	**-3%**	**-3%**	**-3%**

APPENDIX B

WATER USE PROJECTION METHODOLOGIES
FOR THE
2003 SJRWMD WATER SUPPLY ASSESSMENT

Water Use Projection Methodologies for the 2003 District Water Supply Assessment

by

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Introduction and Overview

The purpose of this document is to describe the methodologies used by the St. Johns River Water Management District (SJRWMD), Division of Water Supply Management (Division), to compute water use demand projections for the 2003 Water Supply Assessment (2003 WSA). As background to the proposed 2003 WSA methodologies, SJRWMD has included an overview of the work done for the 1998 Water Supply Assessment (1998 WSA). The data collection procedures initiated during the 1998 WSA effort marked the beginning of an established methodology to obtain water use and water supply system information through an on-going integrated inventory, data collection and mapping project. The objective is to have the data needed to calculate demand projections compiled and verified in advance of the actual demand projection work. Many important lessons were learned in the process and are critical in redesigning the procedures. The modifications on the whole do not represent radical changes but may raise some questions.

The methodologies are divided into sections. The first section is an overview of demand projections: what they are, who uses them and how they are used. This section also clarifies the water use categories that will be detailed in the methodologies. The second section describes the differences between the 1998 WSA and the 2003 WSA methodologies.

Special emphasis will be paid to the public supply and agricultural water use methodologies. These two categories represent approximately 76% of the 1995 water use in SJRWMD. Public supply water use has the single largest projected 2020 increase in water use and future public supply need is central to the regional water supply planning process. In addition, a new section on wastewater and reuse is included because of its importance in groundwater modeling and regional water supply planning.

Categorical methods used in 1998 WSA and proposed changes for 2003 WSA

A. Public Supply Utilities

1. Population Projections

a) Introduction

A very general but widely observed assumption is that the demand for potable water will increase in relative proportion to population growth, at a reasonably similar rate of growth. This general principle has been observed by the United

States Geological Survey - Water Resources Department, based on years of inventory of water use and population growth throughout the United States. The assumption that increases in demand occur at approximately the same rate as population growth comprises the basis for the SJRWMD population projection methodology and demand assessment used in the 1998 WSA. SJRWMD allowed for projected water use to vary by plus or minus 20% from the utility-based projection, but required the utility to demonstrate why this was expected.

In areas that experience high tourist or seasonal population or are experiencing a rapid growth of median to high-income development, the ratio of population growth to demand is likely to be skewed. Seasonal population influxes skew water use assessments (e.g. per capita estimates), because their population may not be considered in the service population estimate. The result is generally an overestimate of per capita water use. SJRWMD can incorporate seasonal use in projections by having the utility determine whether the relative rate of seasonal use is likely to remain constant or change.

New median to high-income residential developments are increasingly being sold with in-ground automatic sprinkler systems that have been shown to be associated with high water use, and therefore, high per capita use rates. Although it is unlikely that much can be done about the right to use automatic sprinklers, their mismanagement could be addressed through increased education, conservation rate structures and management requirements such as the use of rain sensors.

1998 WSA Methodology

In recognition of the pivotal role of population in demand projections, SJRWMD determined that it was essential to develop a consistent methodology to project population growth for the 1998 WSA projections. The need for such a methodology became apparent during the first water supply assessment for the year 2010, when the only public supply projections used were those provided by the utilities. When SJRWMD aggregated these user-based projections by county, they generally exceeded the University of Florida Bureau of Economic and Business Research (BEBR) estimates of county growth by a significant amount. Although SJRWMD knew growth would not necessarily be uniform throughout a county, SJRWMD had no basis to determine whether or not a projection was reasonable.

In 1994, SJRWMD approached the GeoPlan Center at the University of Florida, in the Department of Urban and Regional Planning, to develop a population model that could be used in the demand projection process. The objective was to predict the distribution of BEBR county level population projections throughout the county so that population growth within water supply service area boundaries could be calculated.

At the time GeoPlan began its work, the TAZ models were in their infancy. The methodology was still being refined, and models for many regions were incomplete or not available for use in a GIS. Furthermore, unlike in the South and South West Florida water management districts, TAZ data did not cover large sections of SJRWMD. GeoPlan opted to use the Florida Department of Revenue tax database that included variables for residential occupancy, occupancy type, and year of occupancy and related each residence to a Section/Township/Range address. GeoPlan had created a similar model for an electric utility, and at the time GeoPlan appeared to offer the best plan to meet SJRWMD needs. The project was completed after two extensions. The project work is described in greater detail in Doty, 1997.

SJRWMD's projection procedure using TAZ data (when available) was as follows.

1. Using the TAZ tabular data, develop a county database with population by cell from 1990 – 2020 at five year intervals (interpolated from the beginning and end years) using the information pertaining to single and multiple family residences.
2. Relate this database to the TAZ spatial grid coverage, relating on the cell ID key.
3. Overlay the SAB coverage for a county.
4. Tally population by SAB.
5. Prepare a set of two maps for each utility, showing population in 1995 and 2020 (color-coded in a scheme to visually portray cells where population changed).
6. Send the maps to the utilities. The cell numbers were annotated on the map. A copy of the data was sent along with the map; so the utilities could use the data in their review (i.e. see what the current and projected population was for each cell within their service area boundary).

Estimating county-level population is a relatively simple process for counties falling completely within the SJRWMD boundaries, as estimates of the current and projected population can be taken directly from BEBR publications. BEBR projection updates must be considered, as BEBR released several updates during the 1998 WSA planning process, some of which changed population projections enough to be discernable in demand projections. SJRWMD tried to avoid updating unless there was a significant difference. However, this is a decision that must be made in concert with the other water management districts, in order to assure consistency in any work done on counties split among more than one water management district.

The process for counties falling within more than one water management district is complicated by different versions of the data as well as by differences in methodology in distributing population across the county. TAZ data are commonly used to distribute and count population within polygons. Although TAZ population data were initially based on the 1990 Census blocks, the data files are

manipulated by county and regional planning entities in a series of modifications to better reflect actual conditions at the time of the modeling. Updates or modifications are not always clearly noted on the data file or in its documentation. This confusion leads to inconsistencies among analyses done by the different water management districts, since they are not always using the same versions of the data.

Inconsistencies were also caused by slight differences in methodology. The theory behind the methodology used to distribute TAZ population within polygons representing district or service area boundaries was consistent among the water management districts. The differences lay in how to divide the TAZ cell population when district boundaries bisected cell boundaries. The differences among programming decisions were not great but did produce slightly different results. SJRWMD determined that the differences were relatively insignificant, and agreed to accept the results of analyses conducted by the other water management districts on population splits. However, it was then incumbent on the other districts to inform SJRWMD of any changes made to their projections.

SJRWMD sent the completed maps to the utilities, along with the demand projections, and asked them to comment on the projections. SJRWMD acknowledged that the methodology was simplistic and would not take into account local actions which could affect how and when growth occurred. However, SJRWMD presented this methodology as a reasonable starting point and stated that SJRWMD was ready to consider utility and local government reasons on why the methodology was not appropriate for their area. SJRWMD allowed utilities a margin of plus or minus 20% without explanation as to why their projections differed.

By the time SJRWMD completed the population model in 1997, it was clear that the TAZ model system was integrated into the state and regional planning system. Although still subject to criticism over reliability and accuracy, the TAZ system represents a method and plan adopted by local and regional planning agencies and is used by the local community and governments to guide their long-range growth management decisions.

c) 2003 WSA Methodology

The District has contracted with an outside consultant (GIS Associates, Inc.) to complete the population projections for 2025. The consultant will develop a projection methodology using census block level data (1980, 1990 and 2000) to estimate small area population growth. The consultant is collaborating with public supply utilities, and in many cases with local governments, regional planning councils, metropolitan planning organizations, county and city planners, and other planning organizations to ensure all pertinent information is included in the population model.

SJRWMD assures that the following issues are addressed when estimating population, either by the consultant or by SJRWMD staff.

- ArcInfo Arc Macro Language (AML) program code will be developed to re-aggregate the census block projections to the utility SAB. In cases where the census block is bisected by a service area boundary (i.e., one part of the block lies within the SAB and the other outside), current and future land use will be taken into account to improve accuracy of the re-aggregation. The population of the block will be divided proportionately to the percentage of the current and/or future residential areas falling within each subset. Recent aerial photography, parcel data (where it exists) and other projections will be used to make adjustments to this re-aggregation.
- Some SABs and portions of SABs are not served and are unlikely to be served in the foreseeable future. It is fairly unlikely that many of these areas will be assigned a high population by the model based on current and future land use, census block data or TAZ data. The SAB coverage will be modified to distinguish parts of the served area which: 1) are not currently served and 2) are not likely to be served within the 2025 planning horizon.
- In the past, the SAB coverage contained slivers of served areas in adjacent counties. In most cases this was due to inaccuracies in the digitizing or county boundaries. However, some utilities do in fact cross county boundaries. SJRWMD will check when these occur, and correct them if they are inaccurate. If they are accurate, SJRWMD will total the population from all segments including those from neighboring counties.
- Projections will be made from 2000 to 2025 in five-year increments.
- The population estimates within the SAB comprise the entire population. In some SABs there is a significant portion of unserved residents who obtain their water from private wells. Working with the utility, SJRWMD will obtain estimates of the current percentage of population served (having a connection to the distribution system), and an estimate of the percentage of population served in 2025. It is likely that future developments will be connected to the public supply system and that the percent not served will decrease over time.
- SJRWMD will record the date (month and year) of base data being used to generate the population projections. The data are constantly being updated, and the District will document the data being used in order to verify which data set is being used in the projections. Documenting the date of the source data is very important in understanding why SJRWMD county totals may differ from those reported by another WMD that might be using census, BEBR, or other data released at a different time.

Components of the Final Population Database

The data being developed and compiled by the consultant will be stored in a population database (in GIS and tabular formats) containing at least the first of the two tables and data listed below.

- Population (2000 – 2025) by Utility Service Area Boundary (SAB)
- Population (2000 – 2025) by Traffic Analysis Zone (TAZ), for those counties that have delineated TAZs

1) Public Supply Water Demand Projections

a) Introduction

The 1998 WSA defined public supply water use as "water use/demand from utilities with an annual average daily flow (aadf) of at least 0.25 mgd".

Utilities with a lesser flow were included in the "Domestic and small self-supply" category. Although the number of utilities falling within the public supply category was small compared to the total number of permitted utilities, their combined water use accounted for more than 90% of total public supply use. Not only did these utilities constitute the majority of the total public supply use, but also tended to be concentrated in urban corridors, resulting in a larger potential cumulative impact to water related resources.

Information on all utilities was obtained from SJRWMD's RDBMS. Information on the larger public supply utilities was verified through detailed surveys, field inspections and review of permit information. Information about the smaller utilities was used directly as provided from the RDBMS unless there were notable errors, in which case additional information was requested of the utility.

b) 1998 WSA Methodology

The general methodology for developing public supply water use demand projections is described in the 1998 WSA report. In the 1998 WSA , individual projections were made for each utility falling within the definition of the public supply water use category, i.e., for systems with an aadf of at least 0.25 mgd or reasonably anticipated to use that amount in 2020. Projections were also made for a number of smaller utilities in Lake and Marion counties. The methodology used for the 1998 WSA is outlined below.

For each county and utility:

- Report average annual daily flow (aadf) for 1995, as reported in the AWUS.
- Report service area population (using TAZ data if this was available, else population reported in the AWUS).
- Calculate per capita use in gallons per day of average annual daily use (gpdpc) and multiply the result by the projected service area population.
- Establish a margin of acceptable deviation (plus or minus 20% of the SJRWMD projections).

- Request that the utility review and comment on projections. Continue to work with utilities if there is a substantial difference (greater than 20%).
- In a small number of cases, SJRWMD never reached concurrence with specific utilities. SJRWMD used utility-based demand projections in the hydrogeologic models, in regional work plans and in the inventory of individual demand projections (Table 6). However, in the 1998 WSA county summary tables, SJRWMD used the countywide population projections as the official projections.

This methodology resulted in two sets of projections, referred to as user-based and population-based. User-based projections are those developed through negotiations with the individual utilities. These are listed in Table 6 of the 1998 WSA report, and were used for subsequent work group and individual utility planning and design efforts. The large majority of the user-based projections were within our acceptable 20% margin of the population-based projections. However, because SJRWMD allowed this 20% margin, the total utility user-based projected increase in a county was generally greater than the BEBR and SJRWMD population-based projected increase. Although population-based projections were developed by SJRWMD and were used in the negotiation process with the utilities, SJRWMD did not list population-based projections individually for each utility in the 1998 WSA. SJRWMD's objective was to work with the utilities in developing management strategies and was concerned if the population-based projections were used in lieu of user-based projections, that the users would disassociate themselves from the process.

The county level population-based projections for public supply were included at the request of FDEP. FDEP was concerned that the increase in total demand of the user-based projections exceeded the projected population growth and would be interpreted by the state legislature as an indication of acceptance of increasing per capita use. SJRWMD acknowledged the user-based projection total could be on the high side, but countered it was more an issue of timing: when demand would reach that level, not if demand would reach that level. SJRWMD analyses indicated if the utilities were correct in their projections, lack of adequate groundwater supply would become a serious issue within a matter of years. If the BEBR approved population projections were correct, the critical time is delayed by only a few years. SJRWMD argued that the risk of not beginning to plan for the inevitable shortfall was too great considering the time lag in establishing new supply sources.

SJRWMD calculated countywide public supply projections based on a very simple formula provided below. This projection was used in all the water use projection tables in 1998 WSA , except for Table 6.

- Establish the county wide public supply average per capita use for 1995 (using withdrawal amounts reported in the AWUS).

- Multiply the service area population in 1995 by the population-based projected county growth rate (1995 – 2020).
- Multiply the county average per capita use rate by the population-based projected service area population.

When possible, SJRWMD assigned current and projected use to the water treatment plant level for an individual utility. The sum of the water treatment level totals equaled the utility total. This assignment was possible where actual withdrawals were reported at the plant level and where there was reasonable assurance that the distribution of projected withdrawals would be at roughly the same rates or where population projections were available for the water treatment plant service area.

When detailed information was available, groundwater modelers distributed utility or water treatment plant level demands among individual wells. Water demands were spread evenly among all wells for the other utilities.

Some of the shortcomings of this methodology are listed below.

- Reported water use is equivalent to water withdrawal. The assumption is that the components of projected demand will be the same as the base year and all components will increase at a uniform rate (reuse, purchases or sales, conservation, non-residential uses, etc.).
- Withdrawals from a single year (1995) were used as the basis for projections. Projections are therefore automatically biased to climate conditions of the base year (i.e., drought or exceptionally rainy, unseasonable weather patterns).
- The method does not specifically account for reuse and sales or purchases of potable water.
- SJRWMD was not able to reconcile the discrepancy between some user-based projections and population-based projections.
- Distribution of water withdrawals among the wells was a very tedious task.

In hindsight, SJWRMD overestimated the ability to reach concurrence with all utilities. SJRWMD had counted on interaction from the other utilities to bring down projections made by utilities that appeared to SJRWMD and many of these other utilities, to be unjustifiably high.

c) 2003 WSA Methodology

SJRWMD has identified the following changes to improve the methodology for the 2003 WSA.

1) Redefine public supply to include all utilities with an aadf above 0.1 mgd.
2) Determine projected use.
    a) For public suppliers with an aadf of at least 0.25 mgd:

i) Develop water use demand projections based on total expressed needs if the utility can demonstrate that use is not equal to withdrawals.
ii) Seek input from these utilities to identify total needs.
iii) Identify withdrawal/supply sources and amounts.

b) For public suppliers with an aadf between 0.1 – 0.25 mgd:
SJRWMD will assume use equals withdrawals, unless otherwise informed.

c) Public suppliers with an aadf < 0.1. mgd:
These suppliers are included in the domestic self-supply category; use equals withdrawals.

3) Use the 1995-1999 average use to avoid weather-related biases:
   a) For all public supply utilities, calculate average use and gross per capita for the period 1995 – 1999. Project year 2000 water use demand and compare to DEP MOR actual estimated year 2000 reported use.
   b) For all public supply utilities with an aadf of > 0.25 mgd:
   Adjust average use to account for total use if this information is made available.
4) Determine distribution of withdrawals among wells using EN-50 information from the most current year, proportional distribution for wells associated with plant data, or have larger utilities provide a management scheme.
5) Determine how to resolve differences between SJRWMD and user-based projections.
6) Present alternative scenarios for conservation.

Note: In the discussion below, the term “utility” can be confusing when used in reference to dispersed systems, such as utilities located in multiple counties. SJRWMD considers the utility level for these cases to be the individual subdivision or water treatment plant system, having a distinct customer base.

Procedures for Developing Demand Projections

This procedure develops demand projections for public supply water use from the top level, i.e., at the utility level, working down to the lowest level, the well. Modelers need the data at the well level. The process requires repeated communication with utilities, input from the public supply utility task force, and presentations at public workshops.

SJRWMD will obtain a summary of water use for the period 1995 – 2000 from the FDEP MORs or directly from the utility. These data will be used to establish average annual water use and gross per capita water use for the period (1995 – 1999). In many cases, fluctuations in water use during this period are likely due more to seasonal weather or climate conditions rather than population growth. Using the period’s average water use will avoid the issue of biases due to weather extremes during a base year. Water use data for the year 2000 will serve as a model check through comparisons with water use demand projections for the year 2000.

Step1. Preliminary projection and establishment of well water use distribution

The output of the previous process will be a preliminary water use demand projection at the utility level. SJRWMD will present this information to the utility with requests for additional information that could be used to develop a more precise projection. This information should be required of all utilities with at least 0.25 mgd of current or reasonably anticipated projected 2025 water use, and optional for smaller utilities.

1a. Calculate average annual use and gross per capita use for the period 1995 – 1999

Relate the utility water use database to the population database by utility; calculate for each utility the average annual water use in the period, and the average annual gross per capita. Note: The gross per capita is not strictly a single family residential per capita, but includes water used by other categories (i.e. multi-family residential, commercial, industrial, etc.).

Summary

a. The base year is the period 1995 through 1999.
b. For each utility, list the MOR aadf for each year from 1995 to 1999 at the utility/system level.
c. For each utility, report the population served for each year from 1995 to 1999 using methodology described in Section II.
d. For each utility, calculate and report:
    i. Average annual and monthly use for the period in mgd (MOR or utility reported data)
    ii. Average annual gross per capita use in gallons per day for each year 1995 – 1999 (gpcgpd).
    iii. Average gross per capita use for the period 1995 – 1999 (gpcpd)
    iv. Percent difference between the average annual use for the period 1995-1999 and the 2025 water use projection.

1b. Calculate projected water use demand as a function of reported withdrawals and population growth

SJRWMD will project demand based on information currently available, i.e. current reported withdrawals and population projections developed by the consultant. At this stage, SJRWMD will not specifically account for unreported uses such as purchases, fixed sales, reuse, and changes in amount of unaccounted for uses. SJRWMD is assuming that the population projections are accurate for each utility. The utilities will be asked to comment on these assumptions.

The demand projection calculation is as follows:

Multiply the average gross per capita use for the period 1995 – 1999 by the projected service area population, and then divide by 1,000,000 to get projected demand in mgd.

Example:
(87 gpcgpd * 107,700 people in 2025) / 1,000,000 = 9.4 mgd, projected demand

SJRWMD will present the result to the utility as a preliminary projection that assumes total use is accounted for by the reported withdrawal amount and all uses will increase in direct proportion to projected population growth. This is a starting point from which SJRWMD will need utility cooperation in providing additional information in order to refine the projection to a level of confidence suitable for their use. The extent to which SJRWMD may adjust the projection depends on how much additional information each utility can provide.

1c. Establish method of withdrawal distribution among production wells

This information will guide the distribution of current and projected withdrawals among the existing wells. If not currently available, SJRWMD will ask utilities to provide information on how to distribute monthly withdrawals among the wells. SJRWMD will focus on getting information for utilities with an aadf > 0.25 mgd.

1 Obtain monthly EN-50 water use data for the year 2000 (if available).
2 If EN-50 data is not available request a distribution ratio from the utility.
3 If EN-50 data or a distribution ratio is not provided distribute water use evenly across existing wells.

1d. Verify preliminary projections

SJRWMD will begin the utility verification process work as follows.

Provide to the utility:

- Population projections
- Preliminary projections based on withdrawals
- Methodology document
- A request for information needed to adjust projections (if adjustments are needed) as described below.

SJRWMD will request that each Utility:

1. Verify projections, and send SJRWMD their comments by a specific date.
2. Provide verifiable information so that SJRWMD can adjust current and projected demands to account for total use and varying increases in demand projections.

3. Information pertaining to use. If any of the questions below are pertinent to their situation, the utility will need to provide SJRWMD with a breakdown of use by type.
   a) Should the demand projection be adjusted to account for other uses, sales and supply sources?
   b) What is the current estimated potable demand offset by reuse? Will this rate remain stable or increase/decrease through 2025 and by how much?
   c) What is the average rate for unaccounted for uses? Will this rate remain stable or increase/decrease by 2025 and by how much?
4. Provide information pertaining to supply. If they get supply from alternative sources:
   a) What are the current bulk sales or purchases, and to or from whom? Will this rate remain stable or increase/decrease by 2025 and by how much?
   b) Do they use Aquifer Storage and Recovery (ASR)? If yes, what is the ratio of input/output? What is the source of water stored in the ASR system?
   c) Do they use Reverse Osmosis (RO)? If yes, what is the ratio of input/output? What is the source of water treated in the RO system?
   d) Are there any other alternative sources (other than ground and surface water and those listed above)? If so, how much is used and will be needed in 2025?
5. Provide information for any significant changes to the water supply and distribution system:
   a) New wells or water treatment plants with proposed dates.
   b) Abandoned wells or water treatment plants with proposed dates.
   c) Changes in capacity of wells or water treatment plants with proposed dates.
   d) New well fields or surface water sources with proposed dates

Step 2. Calculate adjusted current water use

This step will be conducted for most of the larger utilities (>0.25 mgd) or others who have requested to go through the process. SJRWMD will need the additional information requested in the preliminary projections correspondence above to calculate adjusted projections.

The first step is to adjust reported current use to reflect all use, not just withdrawals. The adjusted use will serve as the basis for revised projections. The term “adjusted” is used to indicate that the reported use amount has been adjusted for unreported uses and now represents total use. For utilities in the 0.1 – 0.25 mgd range, withdrawals are assumed to be a reasonable reflection of total use, unless SJRWMD is provided with information to the contrary.

<u>Calculate current adjusted use</u>

i. Which years need adjustment(s)?
ii. Amount in purchases

iii. Potable offset from reuse
iv. Other (such as unaccounted for use)
v. Calculate total adjusted use
vi. Calculate the adjusted gross per capita use

Adjust averages for total uses:

i. Calculate the adjusted average annual use for the historic period (1995 – 1999)
ii. Calculate the adjusted average of the gross per capitas for the historic period (1995 – 1999).
    a. Divide the adjusted average annual use by the estimated population for each year in the historic period (1995 – 1999), calculate the average for those five years, divide by 365 and multiply by 1,000,000 (to convert to mgd).
        1) This is the current adjusted average gross per capita. SJRWMD will document any further adjustments to the gross per capita amount as it is used in demand projections. (For example, if there is reason to believe that this gross per capita will be greater/lesser in the future due to conservation efforts, irrigation use increases because of increased use of automatic sprinklers, etc.).

Step 3. Calculate projected adjusted use

Projected adjusted use
Calculation of projected adjusted use has two options, shown as 3a and 3b.

Step 3a is used in situations where the utility expects total use to increase at a rate proportional to population growth. If they have fixed sales, these will increase at the same rate as the population growth. Likewise for the reuse offset amount, unaccounted for uses, etc. This projection calculation is similar to the projections based on withdrawals and population:

Multiply the adjusted average gross per capita by the projected service area population
Example:
(121 gpcgpd * 107,700 people in 2025) / 1,000,000 = 13.06 mgd projected use

Step 3b is used in situations where the utility expects the rate of increase in total use to occur at dissimilar rates among the major use types. SJRWMD will assume that residential use will increase at the population growth rate unless given good reason to believe otherwise.

Calculate projected use at varying rates (Step 3b):

- Disaggregate total use in 2000 by major use types
- Note that water utility use (unaccounted for uses) occurs as a percentage of the subtotal
- Calculate the percentage of total use accounted for by each use type
- Calculate projected use by use type, explaining basis for calculation

Step 4. Conservation scenarios
SJRWMD will now have a complete set of projections – simple projections based on withdrawals and projected population, and for the larger utilities, projections based on total use and a varying increase rate.

SJRWMD can at this point present scenarios showing the impact of increased conservation. Examples include:

- Decrease in gross per capita consumption
- Decrease in the amount of unaccounted for water
- Increase in amount of reuse water for landscape irrigation
- Increase in rate structure for potable water
- Increase in rate structure for reuse

Step 5. Verify estimates of projected total water use

SJRWMD will present demand projections in the following order:

Public supply advisory task force: Before publishing any of the projections, SJRWMD will submit the draft projections to the established group for comment.

Water management district staff: After getting feedback from the task force members, projections and comments will be presented to SJRWMD staff and members of the interdistrict coordination group.

Utilities: SJRWMD will present projections to the utilities. SJRWMD will provide a list of projections (population and demand for the base year and target year) for all the utilities, so each utility can see its projections in reference to the group as a whole. SJRWMD will request they provide comments within two weeks.

Public review: Present projections at public meetings for each of the work group areas after SJRWMD has notified each individual utility of the projections and given them time to respond.

Step 6. Continue negotiation and communication with each utility until concurrence for projected use is reached. If a concurrence cannot be reached, this matter should be discussed with the public supply advisory task force. Care should be taken to document the entire process.

II) Domestic Self-Supply and Small Public Supply Systems

a) Introduction

The Domestic Self-Supply and Small Public Supply Systems water use category is defined in the 1998 WSA to cover demand from:

- Small public supply systems with an average annual daily flow of between 0.01 – 0.25 mgd.
- Individual domestic users not serviced by a public supply system (< 0.01 mgd).
- Estimates of lawn irrigation and other residential uses from small private wells.
- Estimates of demand from planned urban expansion for which the supply source has not yet been identified.

The assessment of demand in this category is closely associated with projections of population growth and estimates of the public supply population; therefore, projections of demand in this category are made after estimates of the public supply population have been verified through the public process. Reliable data sources for this category are scarce.

b) 1998 WSA Methodology

The procedure used in the 1998 WSA assessment can be broken into two steps.

Step 1. Calculate current and future population.
This step required that the total current and projected population among split counties was calculated and agreed upon by the affected water management districts and the public supply service area population was calculated. The procedure for this step was to subtract the public supply population from the county total. The remainder was the population served either by a private system or by a small public supply system.

Step 2. Calculating current and projected water use.
If water use in this category were limited to that used by the defined population, this step would consist simply of multiplying the population by the estimated non-public supply per capita use. In the 1998 WSA , SJRWMD used a demand of 100 gallons per day (gpd) per capita as a reasonable approximation based on an examination of the range of per capita use among the public supply utilities. Special consideration was given to the utilities serving rural populations. This procedure (multiply domestic and small self-supply population by the per capita gpd) was sufficient for the majority of counties.

However, in counties such as Brevard and Duval where there are a large number of private wells used for outdoor irrigation within public supply service area

boundaries, SJRWMD considered whether additional steps would need to be taken to account for this use. This use was not accounted for in the population estimates, since the majority of the owners of private wells located within a public service area boundary are connected to public supply systems and were therefore counted among the served population. Nor was this use included in the public supply demand estimate, since the withdrawals are from a private source.

Determining the amount of water used by private wells located within public supply service areas can be very difficult to estimate, since there are no known reliable databases reporting the number of these wells. County managed well inventories tend to be incomplete if they exist at all. SJRWMD convened a number of meetings with the utilities and the Water Use Subcommittees to discuss how to estimate the amount of current and projected use in this category. The issue was resolved by not directly including an estimate of this use in the analyses. Instead SJRWMD did the following:

2. Acknowledged that the per capita estimate of 100 gpd was observed to be on the high end of the range of reasonable estimates, allowing for a margin that would include unaccounted for uses. However, this would place the use outside of the service area boundary where the domestic and small supply system population was located. This issue was not addressed in the 1998 WSA .
3. Acknowledged that future use from private wells would either remain stable or decrease in urban areas. Since the models assess potential impacts due to changes or flux and the projected flux from this use could be expected to be minimal, the method used would not have a significant impact on the model results.
4. Acknowledged that the models already included an approximation of the impact of private wells since they represent current static conditions, which include withdrawals from private wells.

c) 2003 WSA Methodology

The procedure for the 2003 WSA should follow the steps used for the 1998 WSA:

Step 1. Calculate total county population in the base and target year.
Step 2. Calculate domestic and small self-supply population.
Step 3. Calculate current and projected water use.

Changes will include:

3) Considering redefinition of the public supply water use category (discussed in detail in the section on public supply).
   a) Redefine the lower threshold for public supply annual average daily flow to be 0.1 mgd rather than 0.25 mgd.
   b) Redefine the range for inclusion in the small public supply systems to be 0.01 – 0.1 mgd.
   c) For each county and for each year from 1995-1999 calculate the gross per capita by calculating the total public supply population and public supply

total water use for utilities above the .1 mgd threshold and dividing the public supply water use by the public supply population. Calculate the public supply county average gross per capita water use by averaging the gross per capita values (1995-1999). Use the public supply average gross per capita for projecting water use in the target year. This assumes the rate of domestic self-supply use is consistent with the average rate of public supply use.

4) SJRWMD will improve coordination with the other water management districts by deciding in advance:
   a) Which release of BEBR population estimates to use.
   b) When to use BEBR updates.
   c) How to distribute population among water management districts.
   d) How to communicate changes which may impact other districts.

5) SJRWMD will discuss the issue of withdrawals from private wells early in the process and investigate other data sources by:
   a) Meeting with members of the work groups to determine whether this use will have an impact on the modeling (the process referred to as the "So what?" test).
   b) Reviewing census 2000 data for Florida when it is made available.
   c) Considering the use of census 1990 data if the 2000 data are not available.
   d) Soliciting input from utilities on the extent of private wells in their service area.
6) Use Census/TAZ data to help distribute population in this category (This is being done by the consultant hired to work on population estimates).
7) Provide clear documentation of projected water use for which a supply source has not been identified, i.e., the amount and who has claimed this projected need (name of utility and the contact).

APPENDIX C

ACCEPTANCE LETTERS FROM PEER REVIEWERS

UNIVERSITY OF FLORIDA

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September 29, 2003

Mr. Al Canepa
Assistant Director
Department of Resource Management
ST. JOHNS RIVER WATER MANAGEMENT DISTRICT
Post Office Box 1429
Palatka, Florida 32178-1429

Peer Review of Revised *SE407AA Population and Water Demand Projection Technical Memorandum*

Dear Mr. Canepa:

This letter summarizes my review of the revised *"St. Johns River Water Supply Project, Service Area Demand and Affordability Study Element, Population and Water Demand Projection Technical Memorandum, Final Draft – With Adjustments from Peer Review"* dated September 24, 2003, prepared by Burton & Associates, and submitted to me on September 25, 2003. I have reviewed this report and found one small error in footnote 11. I have discussed this with Rich Doty and he has made the appropriate change. Other than that, this report addressed my previous comments satisfactorily.

My review covered the methodology used to prepare small-area population projections. I found the data sources and projection techniques to be valid, well documented, and widely used in the demographic profession. The attention to details such as growth constraints, proximity to high-growth areas, and spillover from nearby areas was impressive. The projection process also allowed for input from a variety of stakeholders, which is important when projections are used for public policy purposes. My review did not cover the accuracy of the base data, the validity of the geographic boundaries, the use of an alternative county-level projection in Seminole County, or the projected numbers themselves.

Thank you for the opportunity to work with the District on this important project.

Sincerely,

Stanley Smith

cc: Jerry M. Salsano
Taurant Consulting, Inc.

9.27.2003

Mr. Al Canepa
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The revised draft addresses my comments satisfactorily. I appreciate the opportunity to assist the District with this assignment and I commend the study authors for their hard work on this important study.

Very truly yours,

Paul D. Zwick, Ph.D.

cc: Jerry M. Salsano
Taurant Consulting, Inc.

Draft Response Letter 9-27-2003.doc