City Explained Inc.

— in association with —

Stantec Consulting Services Inc.

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Shaping Our Future
Growth Alternatives Analysis

Upstate South Carolina

Ten-County Cost of Government Services Study

June 2017

The ten-county Upstate Region is growing, and is projected to welcome more than 300,000 new residents by 2040 to reach a total population of nearly 1,750,000 — an increase of 64% since 1990. How and where the region grows will have real impacts on residents' quality-of-life — affecting commute times and transportation choices, economic development opportunities, environmental sustainability, home choices, government finances, and family pocketbooks. The Shaping Our Future initiative is an opportunity to explore and debate alternative patterns for growth in the Upstate keeping in mind their associated trade-offs. Scenario planning — and specifically CommunityViz software — was used to evaluate the impacts of competing growth alternatives to inform future decision-making in the region, especially in regards to land use. A map of the ten-county study area is provided on page 2.

The initiative includes a comprehensive assessment of current policies, market forces and development preferences (the trend development scenario) and illustrates how continued growth under the trend scenario might influence the cost of government, shape infrastructure, support/limit economic development initiatives, or impact the environment. The study also generates information regarding the trade-offs associated with three competing growth scenarios — compact centers, rural villages and major corridors — in terms of land consumption, government revenue generation, and government cost of services. Case studies supplement the region-wide scenario planning analysis and offer insights on a variety of topics important to future growth and development decision-making in the Upstate Region.

The initiative is being advanced by the Shaping Our Future Consortium — a partnership between Upstate Forever, Ten at the Top and the Riley Institute at Furman University — and relies on guidance from a broad spectrum of partners, including: elected officials, the business sector, local governments and utilities, community organizations, schools and universities, and environmental groups. The study's findings and recommendations can serve as a valuable resource for demonstrating the impacts and trade-offs for alternative ways communities might grow in the future, and provide initial guidance for some of the most pressing growth-related issues facing communities in the region. More information about the Shaping Our Future initiative can be found at www.ShapingOurFutureUpstateSC.org.

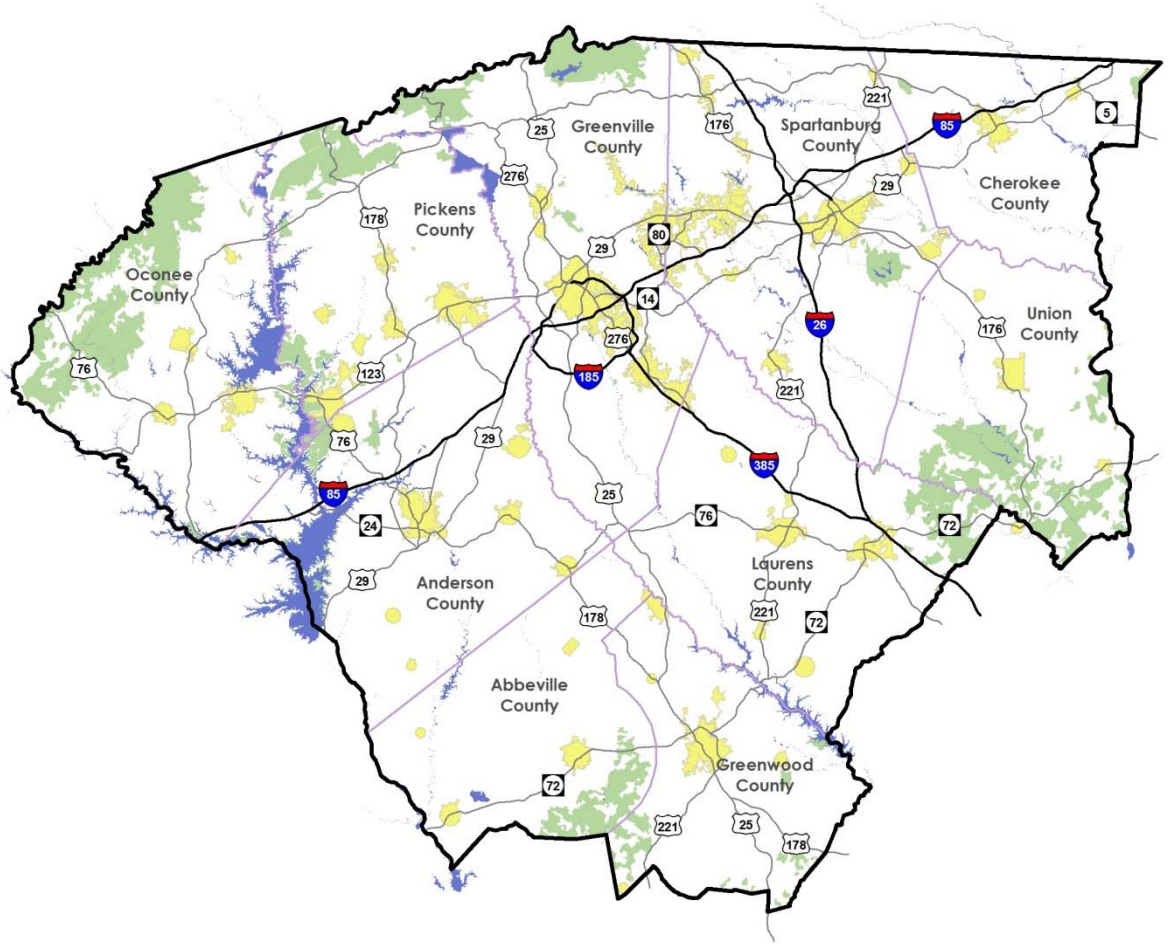
Government Cost of Services

Governments have certain responsibilities to construct, operate, maintain and replace infrastructure to keep pace with existing and future year development patterns and intensities. Some infrastructure categories — roads and transit — rely extensively on state and federal funding, while other categories — water and sewer — operate as enterprise funds, meaning the government-owned utility operates like a business with a separate governing board that sets rates and plans capital improvements based on available funds or bonding capacity.

The size of service areas and the development patterns and intensities within them significantly influences the abilities of government at all levels to provide needed infrastructure and maintain it. The *Shaping Our Future Ten-County Cost of Government Services Study* approximates the average costs — construction, operation, maintenance and replacement — for providing water, sewer, road, transit and public safety (police and fire protection) infrastructure to serve four different growth scenarios. Rates, equations and key assumptions from the Study are used in the Shaping Our Future CommunityViz Models to calculate anticipated costs for providing services for all four growth scenarios.

This work informs the *Shaping Our Future Return-on-Investment Study* in terms of categories studied and time period (2015 to 2040), providing the costs reported in that study for each of the growth scenarios.

Figure 1: Ten-County Study Area for the Shaping Our Future Growth Alternatives Analysis



Community Types

A concise set of land use categories was developed for the Shaping Our Future Growth Alternatives Analysis (referred to as community types) that generalized different terms, phrases and intensities used to describe future development in various local government comprehensive plans. Normalizing terms and concepts in the region helped standardize the process for scenario planning in a ten-county, nearly 6,000-square mile area. General information about the community type categories created for the CommunityViz models is presented in the appendix of this document.

Growth Scenarios

The project team for Shaping Our Future prepared four future year growth scenarios — trend development, compact centers, rural villages and major corridors — to measure the impacts and evaluate the trade-offs related to land consumption, government revenue potential, and the cost of providing government services. General information about each of the growth scenarios is presented in the appendix of this document.

Cost to Serve Methodology

Water & Sewer Infrastructure Cost Estimates

Planning-level cost estimates to extend and/or improve water and sewer infrastructure in the ten-county region were approximated assuming existing system characteristics: pipe size, pipe density, pipe location, and service technology (gravity or pressurized system). Capital improvement plans and annual budgets for

Renewable Water Sources, Easley Combined Utilities, Gaffney Board of Public Works, and Spartanburg Water and Sewer Utility were used to develop average unit costs for water and sewer construction, operation, maintenance and rehabilitation. Data and assumptions for the study were reviewed by staff from the Appalachian Council of Governments (ACOG) with input from their service provider partners, and found to be valid for a ten-county, generalized cost of government services study.

Important steps for estimating water and sewer needs, unit costs, and general costs to serve new development are summarized below.

Step 1: Calculate Infrastructure Needs by Community Type Category

Geographic information system (GIS) data from the ACOG for water and sewer providers in their planning area (line level data) represented a comprehensive data set that was used to develop unit costs for approximating conditions in the larger, ten-county study area. The line level data was compared with grid cell level data for the trend development growth scenario using intersect and overlap equations in CommunityViz. The software automatically calculated the number of pipes, total length of pipes, pipe diameters, and pipe density by grid cell for all developed areas in the ACOG planning area served by water and sewer. Developed grid cells were also identified by community type to approximate the amount of water and sewer infrastructure serving different land uses, development intensities, and development patterns for the ACOG water and sewer service area. This information was summarized in several ArcGIS shapefiles (polygon level data) and made available to the project team.

The study assumed water pipes less than seven inches in diameter and sewer pipes less than eight inches in diameter would be built primarily by the development community, and dedicated to utility companies at a later time for operation, maintenance and rehabilitation responsibilities. This threshold was accepted by staff from the Appalachian Council of Governments (ACOG) with input from their service provider partners and utility experts from outside the region as valid given the scope, scale and schedule for completing the ten-county, generalized cost of government services study. This assumption ensures the statistics reported for operation, maintenance and rehabilitation in the tables that follow are somewhat conservative, but not to a level that would significantly change the order of magnitude results presented herein.

Water and sewer characteristics in GIS for the ACOG planning area were categorized in a database by pipe diameter, community type and grid cell size to approximate general construction, operation, maintenance and rehabilitation unit costs in Step 2 of the process. Information in the database was validated using traditional statistical analysis: mean, median, mode and standard deviation. Average water and sewer system requirements per acre were developed to approximate the needs for future development or redevelopment in the future. Table 1 on page 4 summarizes the average feet of pipe by pipe size category, community type and grid cell size for the ACOG planning area served by water and sewer (the data set used to develop unit costs for approximating conditions in the larger, ten-county study area).

Step 2: Calculate Infrastructure Unit Costs by Community Type Category

Per unit cost estimates for construction, operation, maintenance and rehabilitation by community type and pipe diameter category were developed using information published in the capital improvement plans and annual budgets for Renewable Water Sources, Easley Combined Utilities, Gaffney Board of Public Works, and Spartanburg Water and Sewer Utility. Information from the region's service providers was also validated by utility engineers from outside the region, and found to be valid for a ten-county, generalized cost of government services study.

Table 1: Average Feet of Pipe Identified in the ACOG Planning Area Served by Water & Sewer by Pipe Size Category, Community Type & Grid Cell Size

(Sample Data Set Used to Approximate Needs & Costs to Serve for the Ten-County Study Area)

	RL	SC	IND	SMX	SND	SNA	SO	UC	UR
Water Infrastructure									
7" to 24" Diameter Pipes									
10 Acre Grid Cells	564	713	603	588	572	583	606	829	577
40 Acre Grid Cells	1,207	1,507	1,327	1,481	1,147	1,207	1,357	–	962
160 Acre Grid Cells	2,325	5,704	2,682	1,241	2,544	1,643	2,718	–	–
640 Acre Grid Cells	6,294	–	–	–	–	–	–	–	–
Sample Size (Number of Grid Cells)	2,495	1,677	1,575	60	6,301	304	648	165	105
Greater than 25" Diameter Pipes									
10 Acre Grid Cells	562	585	551	564	553	496	518	612	554
40 Acre Grid Cells	1,158	1,534	1,192	1,420	1,000	1,329	1,399	–	–
160 Acre Grid Cells	2,427	4,953	2,965	–	2,599	–	2,796	–	–
640 Acre Grid Cells	4,350	–	–	–	–	–	–	–	–
Sample Size (Number of Grid Cells)	459	699	566	47	1,533	69	232	77	68
Sewer Infrastructure									
8" Diameter Pipes									
10 Acre Grid Cells	628	780	584	1,109	821	875	644	1,024	841
40 Acre Grid Cells	1,169	1,702	871	1,144	1,448	1,649	1,347	–	–
160 Acre Grid Cells	2,244	–	2,704	–	3,184	1,807	3,036	–	–
640 Acre Grid Cells	–	–	–	–	–	–	–	–	–
Sample Size (Number of Grid Cells)	394	795	476	5	4,442	458	251	166	153
Greater than 8" Diameter Pipes									
10 Acre Grid Cells	547	554	555	518	566	536	624	517	531
40 Acre Grid Cells	966	1,278	1,022	56	1,100	929	1,092	–	–
160 Acre Grid Cells	2,253	3,522	2,123	–	2,355	2,746	3,317	–	–
640 Acre Grid Cells	–	–	–	–	–	–	–	–	–
Sample Size (Number of Grid Cells)	597	338	612	28	2,916	133	152	37	52

Notes:

RL = Rural Living
SC = Suburban Commercial
IND = Industrial
SMX = Suburban Mixed-Use Center
SND = Suburban Neighborhood (Detached Housing)
SNA = Suburban Neighborhood (Attached Housing)
SO = Suburban Office
UC = Urban Center
UR = Urban Residential

Unit cost estimates for all four phases of water and sewer infrastructure (construction, operations, maintenance and rehabilitation) were developed by community type and grid cell size used in CommunityViz — 10 acres, 40 acres, 160 acres and 640 acres — to evaluate the four growth scenarios. Tables 2 and 3 on page 5 summarize the cost per acre assumptions by community type for expanding and/or improving future year water and sewer systems, using pipe size categories as the break point for reporting.

Table 2: Generalized Unit Costs for an Expanded and/or Improved Water System by Community Type & Grid Cell Size

	RL	SC	IND	SMX	SND	SNA	SO	UC	UR
Capital Construction Costs (Pipes 7" or Greater in Diameter)									
10 Acre Grid Cells	$65,222	$127,450	$97,182	$51,913	$180,307	$53,476	$70,663	$74,813	$53,619
40 Acre Grid Cells	$106,336	$125,945	$118,049	$118,805	$106,859	$97,296	$111,400	–	$76,990
160 Acre Grid Cells	$206,349	$457,416	$216,003	$99,252	$222,589	$131,407	$217,842	–	–
640 Acre Grid Cells	$503,732	–	–	–	–	–	–	–	–
Annualized Operation, Maintenance & Rehabilitation Costs (Pipes 7" or Greater in Diameter)									
10 Acre Grid Cells	$2,694	$5,647	$4,247	$2,006	$8,419	$2,089	$2,924	$2,910	$2,103
40 Acre Grid Cells	$4,108	$4,789	$4,573	$4,459	$4,193	$3,658	$4,213	–	$2,887
160 Acre Grid Cells	$7,989	$17,167	$8,118	$3,722	$8,581	$4,928	$8,175	–	–
640 Acre Grid Cells	$18,893	–	–	–	–	–	–	–	–

Notes:

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SC = Suburban Commercial
IND = Industrial
SMX = Suburban Mixed-Use Center
SND = Suburban Neighborhood (Detached Housing)
SNA = Suburban Neighborhood (Attached Housing)
SO = Suburban Office
UC = Urban Center
UR = Urban Residential

Average feet of pipe by community type category and grid cell size are summarized in Table 1.

Capital construction cost statistics are based on an assumption of $80 per lineal foot for pipe between 7" and 24" in diameter and $110 per lineal foot for pipe greater than 25" in diameter.

Annualized operation, maintenance and rehabilitation cost statistics are based on an assumption of $3.00 per lineal foot for pipe between 7" and 24" in diameter and $5.48 per lineal foot for pipe greater than 25" in diameter.

Table 3: Generalized Unit Costs for an Expanded and/or Improved Sewer System by Community Type & Grid Cell Size

	RL	SC	IND	SMX	SND	SNA	SO	UC	UR
Capital Construction Costs (Pipes 8" or Greater in Diameter)									
10 Acre Grid Cells	$110,342	$118,206	$109,587	$127,571	$121,926	$119,778	$122,612	$123,631	$117,530
40 Acre Grid Cells	$197,532	$268,271	$192,475	$59,835	$230,177	$213,490	$224,361	–	–
160 Acre Grid Cells	$438,869	$528,309	$440,151	–	$496,558	$493,152	$634,223	–	–
640 Acre Grid Cells	–	–	–	–	–	–	–	–	–
Annualized Operation, Maintenance & Rehabilitation Costs (Pipes 8" or Greater in Diameter)									
10 Acre Grid Cells	$4,990	$5,570	$4,874	$6,570	$5,781	$5,821	$5,432	$6,261	$5,675
40 Acre Grid Cells	$9,027	$12,500	$8,237	$4,386	$10,700	$10,563	$10,295	–	–
160 Acre Grid Cells	$19,318	$17,610	$20,322	–	$23,207	$20,215	$27,487	–	–
640 Acre Grid Cells	–	–	–	–	–	–	–	–	–

Notes:

RL = Rural Living
SC = Suburban Commercial
IND = Industrial
SMX = Suburban Mixed-Use Center
SND = Suburban Neighborhood (Detached Housing)
SNA = Suburban Neighborhood (Attached Housing)
SO = Suburban Office
UC = Urban Center
UR = Urban Residential

Average feet of pipe by community type category and grid cell size are summarized in Table 1.

Capital construction cost statistics are based on an assumption of $45.00 per lineal foot for pipe 8" in diameter and $150.00 per lineal foot for pipe greater than 9" in diameter.

Annualized operation, maintenance and rehabilitation cost statistics are based on an assumption of $3.59 per lineal foot for pipe 8" in diameter and $5.00 per lineal foot for pipe greater than 8" in diameter.

Step 3: Calculate Infrastructure Costs by Growth Scenario

Grid cells assigned future growth in the CommunityViz model were identified by community type and grid cell size, and multiplied by the unit cost estimates in Tables 2 and 3 to quantify the total costs to expand and/or improve water and sewer infrastructure for each of the growth scenarios. Statistics in the CommunityViz model were divided by 25 years to get an annualized cost for each system at buildout of the scenarios in 2040. Table 4 summarizes anticipated costs to provide water and sewer infrastructure in the future to meet the demands presented by each of the four growth scenarios.

Road Infrastructure Cost Estimates

The road infrastructure assessment for Shaping Our Future assumes an improvements-driven approach, whereby the need and cost for providing new capacity in the system is influenced by traffic volumes from the South Carolina Department of Transportation (SCDOT) statewide travel demand model, generalized road capacity statistics in the travel demand model, and unit cost estimates from the Federal Highway Administration and SCDOT. This approach is consistent with the needs-based portion of the methodology used by metropolitan planning organizations in the Upstate to develop their long-range, metropolitan transportation plans.

Important steps for identifying road improvement needs, unit costs, and general costs to serve new development are summarized below.

Step 1: Develop Socioeconomic Data for the SCDOT Travel Demand Model

One tool available for studying long-term impacts on a road network is the regional travel demand model, which is a computer program that forecasts future year demands on existing and planned roads using anticipated land use, demographic information, and travel patterns unique to the region. Approximating future year conditions on the road network lets transportation officials assess the implications of growth, compare alternative growth scenarios, and provide a framework for measuring the impacts of policy decisions. The foundation for the regional travel demand model is socioeconomic data — including population, housing, and employment estimates — organized into distinct geographic subareas referred to as traffic analysis zones (TAZs). Collectively, this information represents the assumed development potential for the study area. Demand on the road network (i.e., trip generation) is calculated directly from the travel demand model's socioeconomic data.

SCDOT's statewide travel demand model was used for the Shaping Our Future Growth Alternatives Analysis to evaluate the ten-county road network for all four growth scenarios. Grid cells assigned growth in the CommunityViz model

Table 4: Anticipated Costs to Provide New Water & Sewer Infrastructure by Growth Scenario — Annualized & Reported for 2040

	Trend Development	Compact Centers	Rural Villages	Major Corridors
Water Infrastructure				
Capital Construction Costs	$89,198,793	$14,594,528	$21,171,965	$23,381,028
Operation, Maintenance & Rehabilitation Costs	$96,315,657	$15,679,101	$22,786,142	$25,194,539
Total Annualized Cost Assumed in 2040	$185,514,450	$30,273,629	$43,958,107	$48,575,567
Sewer Infrastructure				
Capital Construction Costs	$87,912,356	$15,899,914	$21,482,420	$23,671,963
Operation, Maintenance & Rehabilitation Costs	$98,636,351	$18,817,406	$25,460,460	$27,852,431
Total Annualized Cost Assumed in 2040	$186,548,707	$34,717,320	$46,942,880	$51,524,394

were identified by traffic analysis zone, and data was summarized in a database format for input in the travel demand model. The starting road network for each growth scenario was identical to the existing plus committed network in the adopted SCDOT travel demand model (i.e., only widening of existing roads was considered to provide new vehicle capacity that would serve future development). New roads in new locations throughout the region were not considered as part of the study, which represents a conservative approach for approximating the costs of new road infrastructure to serve an expanding development footprint (primarily applies to the trend development scenario).

Step 2: Calculate Volume-to-Capacity Ratios for Links in the Road Network

Future year deficiencies on the road network were identified for each growth scenario by comparing traffic volumes (demand) to maximum service capacities (supply) for each road segment. Road segments with a volume-to-capacity ratio of 0.90 or higher were identified as congested and in need of improvements to meet future year demands. Existing plus committed collector, arterial, freeway and interstate facilities in the adopted SCDOT travel demand model were included in the road segment analysis. Daily traffic volumes were converted to peak hour volumes using a peak hour factor (K-factor) of ten-percent. This was done to compare peak hour traffic volumes with peak hour road capacities published by the Florida Department of Transportation (commonly used as a reference for transportation agencies throughout the United States, including those in South Carolina). A list of deficient road segments was compiled for each growth scenario in a database.

Step 3: Road Improvement Costs

Road improvement costs were developed to quantify the financial burden of implementing capacity improvements for each of the growth scenarios. In all cases, a "balanced" typical section was assumed for recommending through lane capacity improvements to deficient road segments. For example, a two-lane road was upgraded to a four-lane road when it was determined to be deficient in the future year. This methodology is consistent with professionally-accepted transportation planning principles applied by the South Carolina Department of Transportation (SCDOT) and other local municipalities responsible for improving roads in the State.

Construction costs for the capacity improvements were estimated using information published by the Federal Highway Administration for their Highway Economic Requirements System. Costs from FHWA were calibrated for conditions in the ten-county study area using information presented in the SCDOT Statewide Transportation Improvement Program, 2017-2022. Statistics were divided by 25 years to get an annualized cost for each road system at buildout of the scenarios in 2040.

Table 5 summarizes construction cost estimates by facility type and development context. Operation, maintenance and replacement costs in the SCDOT Statewide Transportation Improvement Program, 2017-2022 were reviewed for the ten-county road network. Ultimately, the consultant team decided to omit all three cost categories from the road analysis because the four growth scenarios assumed the same starting road network. This means the cost to operate, maintain, and replace

Table 5: Generalized Construction Costs for Adding Road Capacity by Facility Type & Development Context

	Rural Interstate	Urban Interstate	Principal Arterial	Minor Arterial	Major Collector
Add New Travel Lane, Cost per Lane Mile					
Rural Areas with Rolling Hills	$2,080,780	–	$1,646,180	$1,601,660	$1,482,940
Small Urban Areas	–	$3,054,920	$2,597,000	$1,917,540	$1,917,540
Large Urban Areas	–	$5,586,200	–	$2,801,580	$2,801,580

existing plus committed lane miles in the road network should be the same for all four growth scenarios. This is a conservative approach for the study in terms of the different operation, maintenance and replacement costs that could be noted to serve the different capacity improvements noted for each of the growth scenarios; however, the amount of new capacity added for each growth scenario is not to a level that would significantly change the order of magnitude results presented herein (evident by the construction cost figures for each scenario).

Table 6 summarizes anticipated construction costs for new road capacity needed to meet the demands presented by each of the four growth scenarios.

longer trips in urbanizing areas of the trend development scenario). Each transit network was conceptual in nature, and not a recommendation for a preferred technology, alignment, etc. between the activity centers. Moving people between activity centers reduced congestion on roads and lowered costs to provide additional road capacity.

The transit networks assumed for each alternative growth scenario are illustrated in Figures 2 through 4 of pages 8 and 9. Orange lines represent bus rapid transit service in a dedicated lane. Green lines represent express bus service operating either on road shoulders where available (allowing buses to use shoulders on freeways and

Table 6: Anticipated Costs to Provide New Road Capacity by Growth Scenario — Annualized & Reported for 2040

	Trend Development	Compact Centers	Rural Villages	Major Corridors
Regional Road Network				
Capital Construction Costs Assumed in 2040	$162,820,600	$130,268,320	$133,802,600	$142,652,120

Transit Infrastructure Cost Estimates

The transit infrastructure assessment assumed theoretical networks for the three alternative growth scenarios and unit costs from studies in Madison, WI (MPO) and Raleigh, NC (CATS). Bus service between local destinations served by single transit agencies (i.e., localized bus or shuttle service) was not included in the infrastructure cost estimates. Important steps for identifying transit improvement needs, unit costs, and general costs to serve new development are summarized below.

Step 1: Rationalize Transit Networks by Growth Scenario

The project team created premium transit networks (i.e., bus rapid transit and regional express routes) for each of the alternative growth scenarios — compact centers, rural villages and major corridors — to move people more efficiently between identified activity centers (as opposed to reliance on automobile travel for

major arterial streets during peak congestion periods to bypass congestion) or mixed in the general purpose traffic lanes.

Figure 2: Transit Network Concept for the Compact Centers Growth Scenario

Figure 3: Transit Network Concept for the Rural Villages Growth Scenario

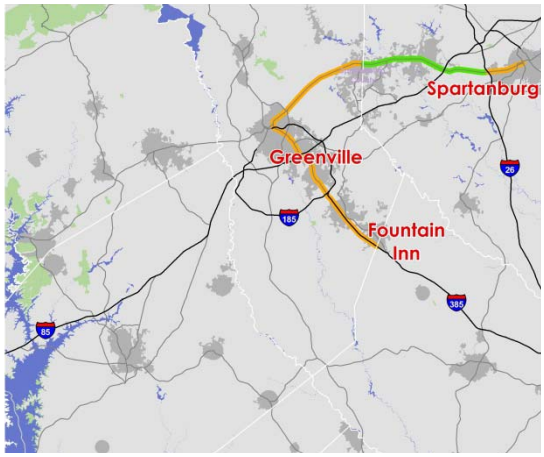
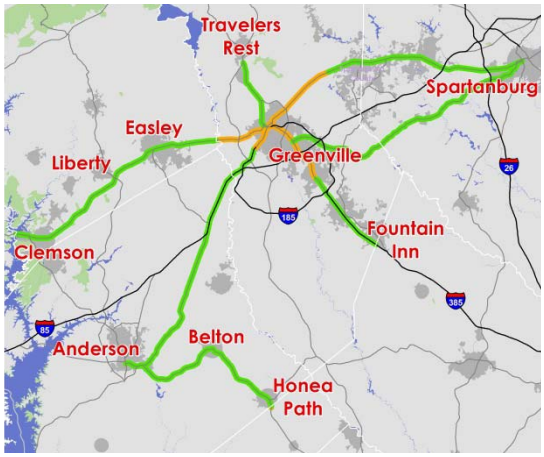


Figure 4: Transit Network Concept for the Major Corridors Growth Scenario



Step 2: Transit Improvement Costs

Transit improvement costs were developed to quantify the financial burden of implementing premium transit corridors for each of the growth scenarios. The centerline mile length and approximated vehicle revenue hours for each technology in the conceptual transit networks was multiplied by a unit cost to determine total system costs: $7.2 million per mile (capital) and $135 per vehicle revenue hour (operations & maintenance) for bus rapid transit service, and $39,000 to $100,000 per mile (capital) and $80 per vehicle revenue hour (operations & maintenance) for express bus service. A detailed breakdown of system characteristics for each growth scenario is provided in the appendix. Transit improvements in certain corridors offset identified road widening needs in urbanized areas, moving people in the corridors via transit vs. automobile. Statistics were divided by 25 years to get an annualized cost for each system at buildout of the scenarios in 2040.

Table 7 summarizes anticipated costs for new transit networks (adding new people-moving capacity to the region) to meet the demands presented by each of the growth scenarios.

Public Safety Infrastructure Cost Estimates

The public safety infrastructure assessment (generally police and fire protection for Shaping Our Future) relied on information published in 2016 Comprehensive Annual Financial Reports (CAFR) for cities and counties in the Upstate, which are self-reporting documents required for annual compliance with Governmental Accounting Standards Board (GASB) rules and requirements. All CAFR documents are audited by an external accounting firm to validate the information presented. Important steps for identifying public safety unit costs and general costs to serve new development are summarized on page 10.

Table 7: Anticipated Costs to Provide New Transit Capacity by Growth Scenario — Annualized & Reported for 2040

	Trend Development	Compact Centers	Rural Villages	Major Corridors
Premium Transit Networks				
Capital, Operation, Maintenance & Replacement Costs Assumed in 2040	–	$5,304,440	$9,447,280	$7,788,760

Notes:

The trend development scenario did not include premium transit corridors (i.e., bus rapid transit or express bus service) to serve anticipated low-density, decentralized growth patterns.

Step 1: Calculate Infrastructure Unit Costs by Community Type Category

Implementation costs for needed public safety capacity improvements were estimated using information published in the 2016 Comprehensive Annual Financial Reports (CAFR) for three cities (Greenville, Spartanburg and Anderson) and for three counties (Abbeville, Greenwood and Oconee) in the Upstate. A statistic for more urban community types — single family detached, single family attached, suburban mixed-use, urban residential and urban center — was calculated using annual expenditures per person information published for the Cities of Greenville, Spartanburg and Anderson. A statistic for the rural living community type was calculated using annual expenditures per person information published for Abbeville, Greenwood and Oconee Counties.

Table 8 summarizes annual expenditure per person estimates by community type and development context for the six locations. The three-county average for rural ($170 per person) and three-city average for urban ($452 per person) conditions were used to approximate the cost of service for providing expanded and/or improved public safety infrastructure to support continued growth in the region.

Step 2: Calculate Infrastructure Costs by Growth Scenario

Grid cells assigned future growth in the CommunityViz model were identified by community type and new residents added, and multiplied by the unit cost estimates in Table 8 (expenditures per person) to quantify the total costs to expand and/or improve public safety infrastructure for each of the growth scenarios.

Table 8: Generalized Unit Costs for Expanded and/or Improved Public Safety Infrastructure by Community Type & Development Context

	RL	SMX	SND	SNA	UC	UR
Expenditure per Person						
City-Level Data						
Greenville	–	$500	$500	$500	$500	$500
Spartanburg	–	$426	$426	$426	$426	$426
Anderson	–	$429	$429	$429	$429	$429
Three-City Average	–	$452	$452	$452	$452	$452
County-Level Data						
Abbeville	$55	–	–	–	–	–
Greenwood	$190	–	–	–	–	–
Oconee	$264	–	–	–	–	–
Three-County Average	$170	–	–	–	–	–

Notes:

RL = Rural Living
SMX = Suburban Mixed-Use Center
UC = Urban Center
UR = Urban Residential
SND = Suburban Neighborhood (Detached Housing)
SNA = Suburban Neighborhood (Attached Housing)

The assumed expenditure per person statistics are based on information published in 2016 Comprehensive Annual Financial Reports (CAFR) for three cities (Greenville, Spartanburg and Anderson) and for three counties (Abbeville, Greenwood and Oconee) in the Upstate. Statistics for individual cities and counties were averaged to report rural and urban condition statistics.

Table 9: Anticipated Costs to Provide New Public Safety Capacity by Growth Scenario — Annualized & Reported for 2040

	Trend Development	Compact Centers	Rural Villages	Major Corridors
Capital, Operation, Maintenance & Replacement Costs Assumed in 2040	$124,877,480	$145,532,881	$143,790,494	$137,677,288

Table 9 summarizes anticipated costs for new public safety capacity needed to meet the demands presented by each of the four growth scenarios. The higher cost to serve for each of the three alternative growth scenarios compared to the trend development scenario in this category (contrary to the observations noted for the three other cost categories included in this study) is a direct result of more urban conditions assumed in the alternative scenarios to accommodate future growth, and the much higher cost per person noted in the CAFR reports for urban areas.

Generally speaking, urban areas provide enhanced fire protection services (station locations, response times, full-time vs. volunteer staffs, etc.) and police protection services (patrol area sizes, response times, number of sworn officers, etc.) to meet demands. These conditions directly impact the costs per person to provide these services at the levels demanded in urban vs. rural conditions — meaning increased development density and proximity in this cost category significantly increases demands for services. This is contrary to the three other cost categories (water and sewer, roads and transit) that benefit from density and close proximity in terms of potential system efficiencies.

Total Cost to Serve Potential for the Four Growth Scenarios

Table 10 on page 12 highlights the combined cost of government services for each of the growth scenarios using the categories identified earlier in this document: water, sewer, roads, transit and public safety. All levels of government responsibility — local, state and federal — are combined in the statistics below. The large service areas for providing infrastructure in the trend development scenario drive much higher costs for the ten-county region, which is not a surprise based on the land consumption statistics reported in the *Shaping Our Future Growth Alternatives Analysis Summary Document* (showing low-density and long-distance service needs for the trend development scenario compared to the alternative growth scenarios).

Return on Investment Potential for the Four Growth Scenarios

Return on investment (ROI) is a statistic used by all levels of government to compare expected revenues and expenditures (i.e., revenues divided by expenditures). See the *Shaping Our Future Return-on-Investment Study* for more information on revenue potential studied for the ten-county region (www.ShapingOurFutureUpstateSC.org).

A ratio of 1.0 or greater represents a condition where revenues equal or exceed expenditures, meaning that revenue generation annualized over 25 years is expected to meet or exceed potential infrastructure costs — construction, operation, maintenance and replacement — annualized over 25 years. Return-on-investment statistics for all four growth scenarios are presented in Figure 5 on page 13.

Annualized ROI statistics reported would actually fluctuate from year-to-year based on the date of construction, the number of years for operation and maintenance that follow, and the scheduled date for replacement. (Note: the ROI study for the Shaping Our Future Growth Alternatives Analysis does not approximate a schedule of

Table 10: Combined Cost of Government Services Anticipated for Each Growth Scenario — Annualized & Reported for 2040

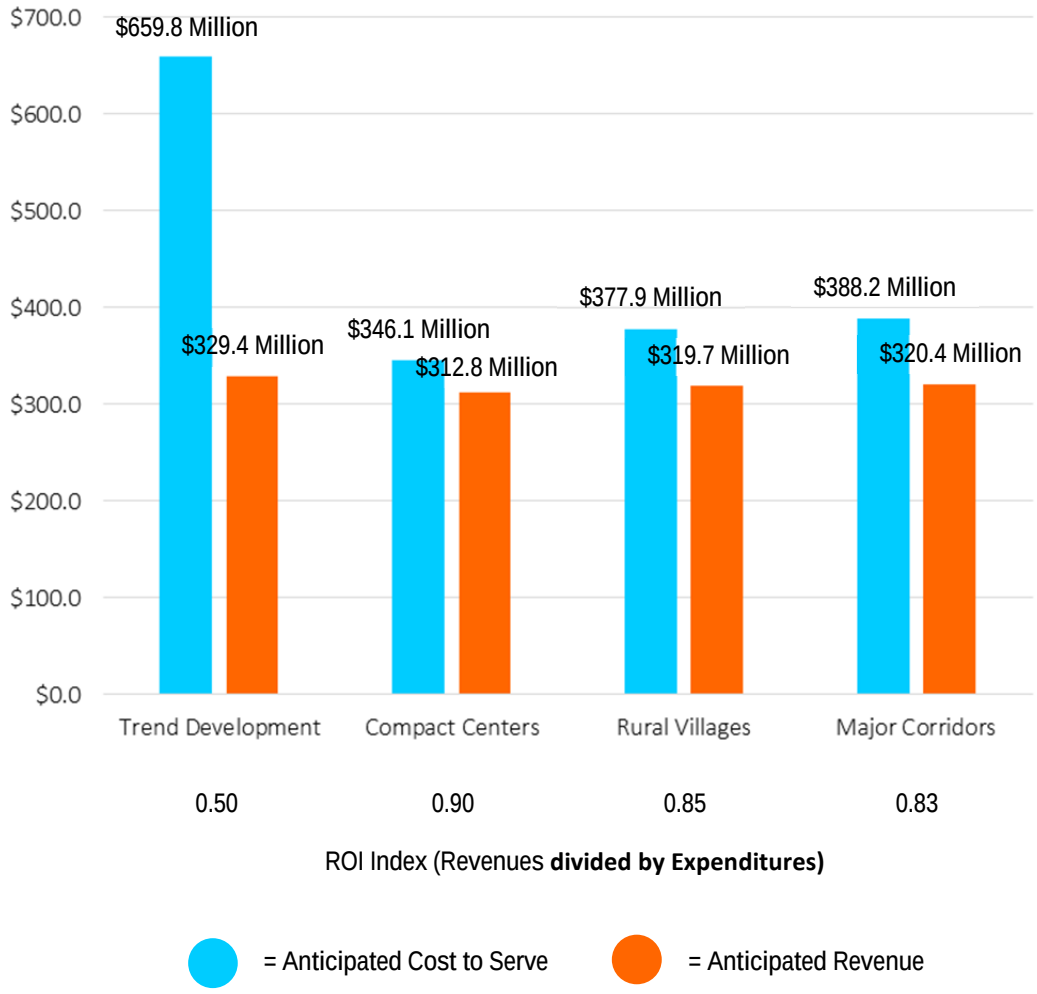
	Trend Development	Compact Centers	Rural Villages	Major Corridors
Local, State & Federal Government Responsibilities Included				
Capital, Operation, Maintenance & Replacement Costs Assumed in 2040	$659,761,237	$346,096,590	$377,941,361	$388,218,129

capital improvements to coincide with the location and timing of development between 2015 and 2040.)

Statistics reported for the four growth scenarios indicate that while none is expected to pay for itself in 2040, the trend development scenario performs substantially worse than the three alternatives. The ROI statistics are assuming the responsibilities of all government levels combined, annualized infrastructure costs over a twenty-five year period, and holding constant current millage rates, utility service rates, federal and state government funding levels, etc. However, the ROI statistics for the three alternative growth scenarios could move above and below the 1.0 threshold over the 25 year planning period based on 1) the timing, location and intensity of new development and 2) the lifecycle of some infrastructure following dedication by private developers.

The low ROI performance for the trend development scenario (0.50) means it is unlikely to ever experience conditions where revenues exceed expenditures in a single year unless services are significantly reduced, delayed or privatized to come in line with available revenues. It is also important to note any deficits realized for water or sewer infrastructure in all of the growth scenarios would likely be addressed using utility rate or revenue bonding tools, meaning both services should not run a deficit in terms of costs vs. revenues in the future (but rates would increase for rate payers). The study also assumed similar or enhanced service levels for roads, transit or public safety would be present in the future; however, it is likely these services would be reduced, delayed or privatized if the annualized cost of providing services regularly exceeds available revenues.

Figure 5: Return-on-Investment Potential for All Levels of Government, Comparing Potential Revenues to Potential Costs to Serve for All Categories — Annualized & Reported for 2040



Appendix A – Place Type Descriptions

Rural Living

Land characterized by large lots, abundant open space and a high degree of separation between buildings. Large acreage, rural family homes and "hobby farms" are scattered throughout the countryside and often integrated into the landscape. The lot size and distance between dwelling units decrease with greater development densities.

Conservation-based subdivisions in rural living areas cluster development and leave large amounts of land for permanent open space and uninterrupted views. Small nodes of commercial activity — gas stations, convenience stores or restaurants — are concentrated at rural crossroads, serving some daily needs of the surrounding rural population.

Land Use Considerations

Primary and secondary land uses listed for the place type represent typical development in the category. They are not meant to be an exhaustive list of all permitted or conditional uses that would be allowed in the place type.

Primary Land Uses

- Single Family Detached Home
- Mobile Home
- Hobby Farm

Secondary Land Uses

- Church
- Gas Station
- Convenience Store
- Restaurant

Form & Pattern

The form and pattern table inventories general development characteristics associated with the place type. Working together, these elements reinforce a sense of place and community brand important to distinguishing development in this category from others in the study area.

Land Use Mix	Separated Uses
Site Efficiency Factor	99%
Residential Density	0.05 – 1.00 DU per AC
Typical Home Size	1,500 – 3,000 SF
Non-Residential Intensity	N/A
Prevailing Building Height	1 – 2 Stories
Typical Block Length	2,500 – 5,000 LF
Street Pattern	Curvilinear
Typical Street Cross Section	Rural, 2L or 4L
Open Space Elements	Buffers / Ponds / Woods
Transportation Choices	Auto
Parking Provision	Private Driveways
Building Orientation	Random
Building Placement	Far From Street

Rural living areas are present throughout the Upstate Region. Many people choose to live in these places to connect with agriculture, natural areas or scenic views. The trade-off is longer commutes (time and distance) for work, school and other daily needs.

Suburban Neighborhood (Detached)

Land generally formed as subdivisions or communities, with a relatively uniform housing type and density throughout. They may support a variety of single-family detached residential types, from mobile homes to large-lot, low-density single-family homes to denser formats of smaller single-family detached homes. Homes are oriented interior to the neighborhood and typically buffered from surrounding development by transitional uses or landscaped areas. Single-family neighborhoods are often found in close proximity to suburban commercial, suburban office and suburban mixed-use centers, which helps provide the consumers and employees needed to support these centers.

Land Use Considerations

Primary and secondary land uses listed for the place type represent typical development in the category. They are not meant to be an exhaustive list of all permitted or conditional uses that would be allowed in the place type.

Primary Land Uses

- Single Family Detached Home
- Mobile Home

Secondary Land Uses

- Church
- School
- Community Center
- Pool and Amenities
- Natural Areas

Form & Pattern

The form and pattern table inventories general development characteristics associated with the place type. Working together, these elements reinforce a sense of place and community brand important to distinguishing development in this category from others in the study area.

Land Use Mix	Separated Uses
Site Efficiency Factor	80 - 90%
Residential Density	1.00 – 5.00 DU per AC
Typical Home Size	1,500 – 4,000 SF
Non-Residential Intensity	N/A
Prevailing Building Height	1 – 3 Stories
Typical Block Length	600 – 1,200 LF
Street Pattern	Curvilinear
Typical Street Cross Section	Suburban, 2L
Open Space Elements	Buffers / Ponds / Woods
Transportation Choices	Auto
Parking Provision	Private Driveway
Building Orientation	Facing Street
Building Placement	Near Street

Suburban neighborhoods with detached housing are typically auto-dependent, with low street connectivity and an abundance of cul-de-sacs. They generally locate near commuting corridors that connect families with work, school and shopping destinations (sometimes several miles away from the neighborhood).

Suburban Neighborhood (Attached)

Land generally formed as complexes or communities, with a relatively uniform housing type and density throughout. They support the highest residential density in the suburban landscape, and may support town homes, condominiums or apartments.

Suburban neighborhoods with attached housing products are found in close proximity to suburban commercial, suburban office and suburban mixed-use centers, which helps provide the consumers and employees needed to support these centers. Buildings are oriented interior to the site and typically buffered from surrounding development by transitional uses or landscaped areas. Large parking lots and low street connectivity are common in suburban multifamily neighborhoods.

Land Use Considerations

Primary and secondary land uses listed for the place type represent typical development in the category. They are not meant to be an exhaustive list of all permitted or conditional uses that would be allowed in the place type.

Primary Land Uses

- Townhome
- Condominium
- Apartment
- Senior Housing

Secondary Land Uses

- Church
- School
- Community Center
- Pool and Amenities
- Natural Areas

Form & Pattern

The form and pattern table inventories general development characteristics associated with the place type. Working together, these elements reinforce a sense of place and community brand important to distinguishing development in this category from others in the study area.

Land Use Mix	Separated Uses
Site Efficiency Factor	90 - 95%
Residential Density	5.00 – 24.00 DU per AC
Typical Home Size	800 – 1,500 SF
Non-Residential Intensity	N/A
Prevailing Building Height	1 – 4 Stories
Typical Block Length	600 – 1,200 LF
Street Pattern	Modified Grid
Typical Street Cross Section	Suburban, 2L or 4L
Open Space Elements	Buffers / Ponds / Woods
Transportation Choices	Auto, Bus
Parking Provision	Surface Lot / On-Street
Building Orientation	Facing Street
Building Placement	Near Street

Suburban neighborhoods with attached housing are typically located near suburban commercial or office development, and used as a transitional land use for neighborhoods with single family, detached housing. Shared amenities on site may include a club house, fitness center, pool or outdoor exercise areas.

Suburban Commercial

Land used to support the daily needs of surrounding suburban residential neighborhoods. They typically locate near high-volume roads and key intersections, and are designed to be accessible primarily by automobile. Buildings are set back from the road behind large surface parking lots with little connectivity between adjacent businesses. Common types of suburban centers in the Upstate Region include: multi-tenant strip centers, big box stores, small outparcels with a drive-through, and large shopping malls.

Land Use Considerations

Primary and secondary land uses listed for the place type represent typical development in the category. They are not meant to be an exhaustive list of all permitted or conditional uses that would be allowed in the place type.

Primary Land Uses

- General Commercial Services
- Multi-Tenant Commercial
- Big Box Commercial
- Restaurant
- Bank
- Hotel
- Professional Office

Secondary Land Uses

- Fire Station
- Police Station

Form & Pattern

The form and pattern table inventories general development characteristics associated with the place type. Working together, these elements reinforce a sense of place and community brand important to distinguishing development in this category from others in the study area.

Land Use Mix	Separated Uses
Site Efficiency Factor	80 - 90%
Residential Density	N/A
Typical Home Size	N/A
Non-Residential Intensity	0.15 – 0.25 FAR
Prevailing Building Height	1 – 2 Stories
Typical Block Length	N/A
Street Pattern	N/A
Typical Street Cross Section	Suburban, 4L or 6L
Open Space Elements	Buffers / Ponds
Transportation Choices	Auto
Parking Provision	Surface Lot
Building Orientation	Facing Street
Building Placement	Behind Surface Lot

Suburban commercial development typically locates near high-volume roads, major intersections or interchanges. Low-profile buildings are separated by large surface parking lots. A lack of safe, convenient pedestrian facilities interior to the site limits opportunities to walk between nearby shops and restaurants.

Suburban Office

Land used to concentrate employment in the Upstate Region on normal work days. They include both large-scale isolated buildings with numerous employees as well as areas containing multiple office uses that support and serve one another. They are typically buffered from surrounding development by transitional uses or landscaped areas and are often located in close proximity to major highways or thoroughfares.

Land Use Considerations

Primary and secondary land uses listed for the place type represent typical development in the category. They are not meant to be an exhaustive list of all permitted or conditional uses that would be allowed in the place type.

Primary Land Uses

- Corporate Office
- Multi-Tenant Professional Office
- Medical Office
- Call Center
- Research & Development Centers

Secondary Land Uses

- Copy Shop
- Restaurant
- Bank
- Government Services
- Flex Space

Form & Pattern

The form and pattern table inventories general development characteristics associated with the place type. Working together, these elements reinforce a sense of place and community brand important to distinguishing development in this category from others in the study area.

Land Use Mix	Separated Uses
Site Efficiency Factor	80 - 90%
Residential Density	N/A
Typical Home Size	N/A
Non-Residential Intensity	0.20 – 0.75 FAR
Prevailing Building Height	1 – 4 Stories
Typical Block Length	800 – 1,500 LF
Street Pattern	Curvilinear
Typical Street Cross Section	Suburban, 4L or 6L
Open Space Elements	Buffers / Ponds
Transportation Choices	Auto
Parking Provision	Surface Lot
Building Orientation	Random
Building Placement	Behind Surface Lot

Suburban office development typically locates near major roads, intersections or interchange (convenient employee access). Large buildings, parking decks or surface parking lots spread development out on the site and leave it generally unconnected. Most trips in these areas are made by automobile.

Suburban Mixed-Use Center

Land formed as a center of walkable, mixed-use development in an otherwise suburban setting (surrounding development characterized by low-density, single-use, unconnected patterns). Uses and buildings in the activity center are located on small blocks with streets designed to encourage pedestrian activities. Buildings in the core of a center may stand three or more stories with residential units or office space above storefronts.

Most visitors arrive to the activity center by automobile, but take advantage of the 'park once' design for the site to walk between complementary land uses. Parking is satisfied with on-street parking, structured parking and shared rear-lot parking strategies. A large-scale walkable activity center may be surrounded by one or more suburban residential neighborhoods that encourage some interaction via an interconnected network of walkable streets.

Land Use Considerations

Primary and secondary land uses listed for the place type represent typical development in the category. They are not meant to be an exhaustive list of all permitted or conditional uses that would be allowed in the place type.

Primary Land Uses

- Restaurant
- Regional-Serving Retail
- Professional Office
- Live/Work/Shop Units
- Townhome
- Condominium
- Apartment
- Park or Plaza
- Movie Theater

Secondary Land Uses

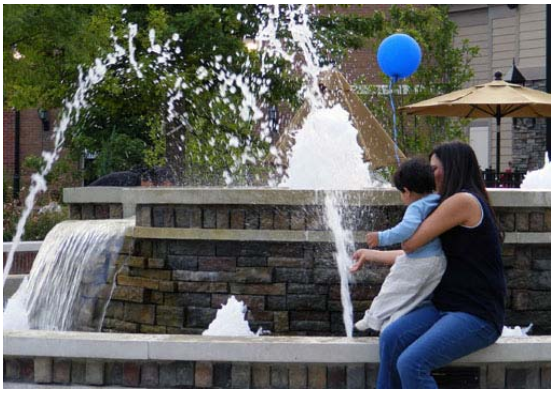
- Day Care
- Dry Cleaners
- Farmers Market

Form & Pattern

The form and pattern table inventories general development characteristics associated with the place type. Working together, these elements reinforce a sense of place and community brand important to distinguishing development in this category from others in the study area.

Land Use Mix	Mix of Uses
Site Efficiency Factor	80 -90%
Residential Density	8.00 – 24.00 DU per AC
Typical Home Size	800 – 2,000 SF
Non-Residential Intensity	0.50 – 1.50 FAR
Prevailing Building Height	1 – 4 Stories
Typical Block Length	400 – 1,200 LF
Street Pattern	Modified Grid
Typical Street Cross Section	Urban, 2L or 4L
Open Space Elements	Parks / Plazas
Transportation Choices	Auto, Bus, Bike, Walk
Parking Provision	Surface Lot / On-Street / Deck
Building Orientation	Facing Street
Building Placement	Behind Sidewalk

Suburban single-family attached neighborhoods provide another housing option in the study area. Townhomes are attached on one or two sides, and units include all floors from ground-level to top story. Units may include direct access to a garage.



Industrial

Land used to concentrate employment in the Upstate Region on normal workdays. Each center generally supports manufacturing and production uses; including warehousing, light manufacturing, medical research and assembly operations. These areas are found in close proximity to major transportation corridors (i.e., highway or rail) and are generally buffered from surrounding development by transitional uses or landscaped areas that shield the view of structures, loading docks or outdoor storage from adjacent properties.

Clusters of uses that support or serve one another are often encouraged to locate in the same light industrial center.

Land Use Considerations

Primary and secondary land uses listed for the place type represent typical development in the category. They are not meant to be an exhaustive list of all permitted or conditional uses that would be allowed in the place type.

Primary Land Uses

- Light Manufacturing & Assembly
- Processing Facility
- Laboratory
- Warehouse
- Distribution

Secondary Land Uses

- Small-Scale Commercial
- Natural Areas

Form & Pattern

The form and pattern table inventories general development characteristics associated with the place type. Working together, these elements reinforce a sense of place and community brand important to distinguishing development in this category from others in the study area.

Land Use Mix	Separated Uses
Site Efficiency Factor	70 - 90%
Residential Density	N/A
Typical Home Size	N/A
Non-Residential Intensity	0.10 -0.20 FAR
Prevailing Building Height	1 – 2 Stories
Typical Block Length	800 – 1,500 LF
Street Pattern	Curvilinear
Typical Street Cross Section	Rural / Suburban, 2L or 4L
Open Space Elements	Buffers / Ponds
Transportation Choices	Auto
Parking Provision	Surface Lot
Building Orientation	Random
Building Placement	Behind Surface Lot

Industrial areas are found near major transportation corridors (highway or rail) and in locations where water and sewer service is readily available (both access and capacity). They tend to locate away from residential neighborhoods, but within reasonable commuting distances for employees.

Some light industrial centers locate near airports or designated truck routes to better serve customers.

Urban Residential

Land used to support a mix of moderate- to high-density housing options. These neighborhoods are relatively compact, and may contain one or more of the following housing types: single family detached (small lots), townhomes, condominiums or apartments.

Buildings are generally oriented toward the street. The design and scale of development in an urban neighborhood encourages active living with a complete and comprehensive network of walkable streets. Cul-de-sacs are restricted to areas where topography, environmental constraints or existing development makes other street connections prohibitive.

Land Use Considerations

Primary and secondary land uses listed for the place type represent typical development in the category. They are not meant to be an exhaustive list of all permitted or conditional uses that would be allowed in the place type.

Primary Land Uses

- Single Family Detached Home
- Townhome
- Condominium
- Apartment

Secondary Land Uses

- Small-Scale Commercial
- Church
- School
- Park

Form & Pattern

The form and pattern table inventories general development characteristics associated with the place type. Working together, these elements reinforce a sense of place and community brand important to distinguishing development in this category from others in the study area.

Land Use Mix	Mix of Uses
Site Efficiency Factor	80 -90%
Residential Density	6.00 – 30.00 DU per Acre
Typical Home Size	800 – 2,500 SF
Non-Residential Intensity	0.25 – 0.75 FAR
Prevailing Building Height	1 – 4 Stories
Typical Block Length	300 – 1,000 LF
Street Pattern	Grid
Typical Street Cross Section	Urban, 2L or 4L
Open Space Elements	Buffers / Parks
Transportation Choices	Auto, Bus, Bike, Walk
Parking Provision	Surface Lot / On-Street / Deck
Building Orientation	Facing Street
Building Placement	Near Street

Urban residential areas are traditionally located near the edges of urban centers. They often represent the first tier of residential development around a downtown or courthouse area, and are well-serve by a series of walkable streets that connect residents with nearby amenities.

Urban Center

Land that satisfies daily economic, entertainment and community needs for surrounding neighborhoods. Uses and buildings are located on small blocks with streets designed to encourage pedestrian activity. Buildings in an urban center typically stand two or more stories in height with non-residential uses on the ground floor and residential units above storefronts.

Neighborhoods surrounding the commercial core are relatively compact and support moderate- to high-density housing options, including: single-family homes (small lots), townhomes, condominiums and apartments.

Land Use Considerations

Primary and secondary land uses listed for the place type represent typical development in the category. They are not meant to be an exhaustive list of all permitted or conditional uses that would be allowed in the place type.

Primary Land Uses

- Townhome
- Condominium
- Apartment
- Restaurant
- Community-Servicing Commercial
- Professional Office
- Live/Work/Shop Units
- Post Office
- Community Facilities

Secondary Land Uses

- Day Care
- Farmers Market
- Neighborhood Park

Form & Pattern

The form and pattern table inventories general development characteristics associated with the place type. Working together, these elements reinforce a sense of place and community brand important to distinguishing development in this category from others in the study area.

Land Use Mix	Mix of Uses
Site Efficiency Factor	90 - 95%
Residential Density	8.00 – 50.00 DU per AC
Typical Home Size	800 – 2,000 SF
Non-Residential Intensity	0.50 – 2.00 FAR
Prevailing Building Height	1 – 8 Stories
Typical Block Length	300 – 1,200 LF
Street Pattern	Grid
Typical Street Cross Section	Urban, 2L or 4L
Open Space Elements	Parks / Plazas
Transportation Choices	Auto, Bus, Bike, Walk
Parking Provision	Surface Lot / On-Street / Deck
Building Orientation	Facing Street
Building Placement	Behind Sidewalk

Urban centers support a variety of land uses and development intensities. Buildings are located close together and oriented toward a network of walkable streets. Residential units are found above storefronts. Nearby amenities (within walking distance) and public gathering areas provide opportunities to enjoy urban living.

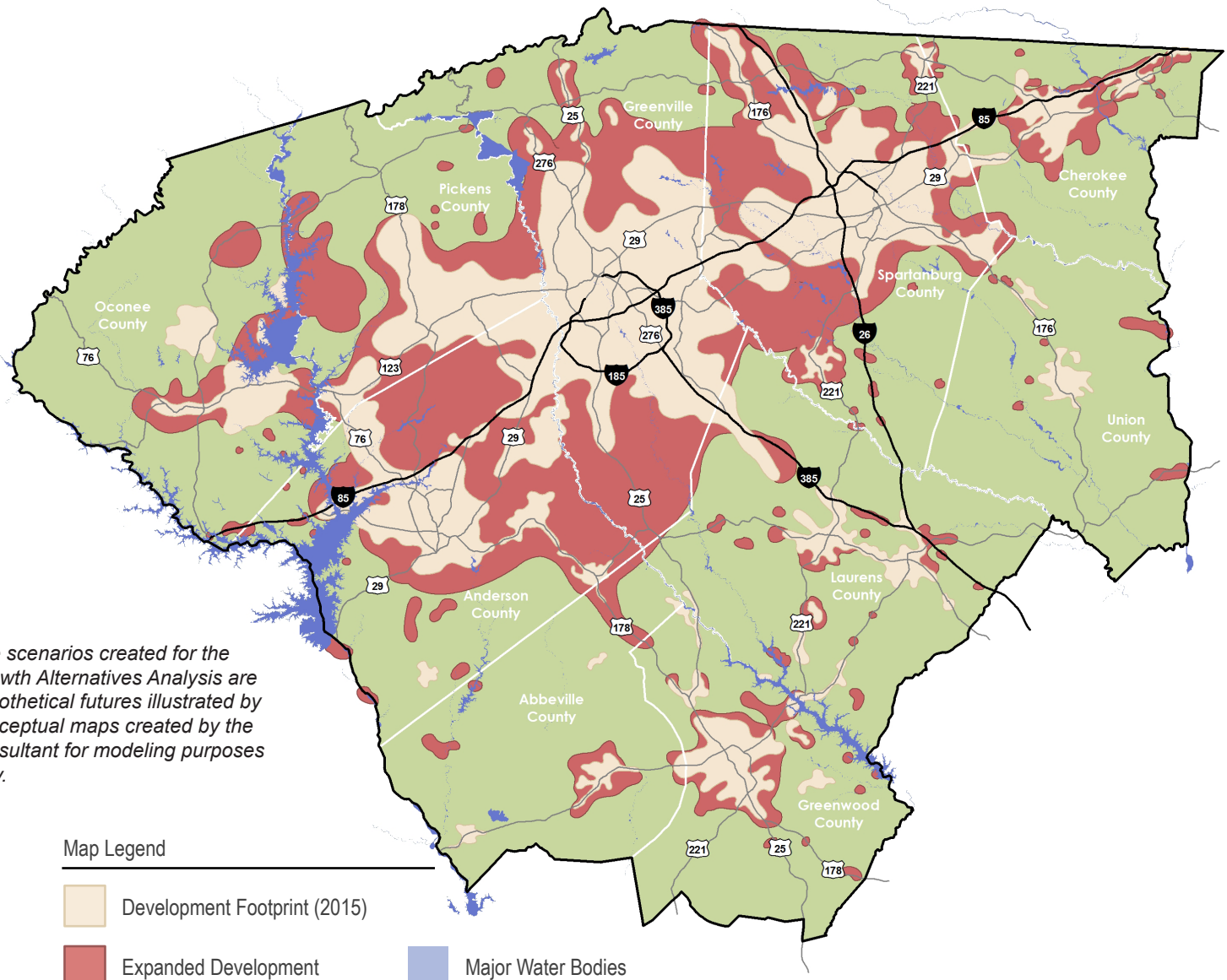
Appendix B – Growth Scenario Descriptions

Pages excerpted from the Shaping Our Future Growth Alternatives Summary Document
(see www.ShapingOurFutureUpstateSC.org for the entire document)

Trend Development Growth Scenario

The Trend Development Scenario shows how the region might develop if adopted community plans were followed for the next 25 years. Future growth would continue to favor low-density, single-use development patterns and intensities moving away from existing city centers, which requires outward expansion of roads, water and sewer lines, fire and police protection, etc., to serve the newly developed areas. This pattern of development consumes a tremendous amount of land — especially rural, farm and forested areas — to accommodate new growth and increases the distance and time spent commuting between home, work and shopping destinations primarily by automobile.

If the Upstate continues following the land use and transportation plans and policies it has for the last 25 years, what will it likely look like by 2040?



The scenarios created for the Growth Alternatives Analysis are hypothetical futures illustrated by conceptual maps created by the consultant for modeling purposes only.

Key Themes for the Scenario

Housing Mix

The region would build primarily large-lot, single-family detached homes to meet future demand. New housing supply would be approximately 90% single family and 10% multifamily. New residential neighborhoods would average fewer than three homes per acre.

Public Facilities & Services

Local governments would continue to expand their water, sewer and transportation systems to keep up with expanding suburban growth. Growth would not be constrained by existing service, and infrastructure investments would focus on new or expanding service areas throughout the region.

Viable Travel Options

Cars would be the primary mode of transportation for residents in the region. Investments in interstates and highways would try to keep up with growth. Only the most urban areas of the region would have transit service, which would primarily operate as a closed system of local bus routes not connected to other cities and towns.

Environmental Stewardship

The amount of new land held as protected open space (parks, greenways, natural areas, etc.) would follow past trends in the region — approximately 62.5 square miles have been protected by local and regional land trusts over the last twenty years — and we would assume a similar rate for land conservation would continue in the future.

Jobs-Housing Proximity

Most employees would still drive long distances for work, especially to destinations in Greenville or along the I-85/I-385 corridors. Only a few communities in the region would have jobs and housing located close enough together to realize expected benefits (e.g., shorter commute distance or lower commute times).

Farmland Preservation

Farmland preservation would not be a priority in the region. Working farms would become new residential neighborhoods, commercial shopping centers, and office complexes.

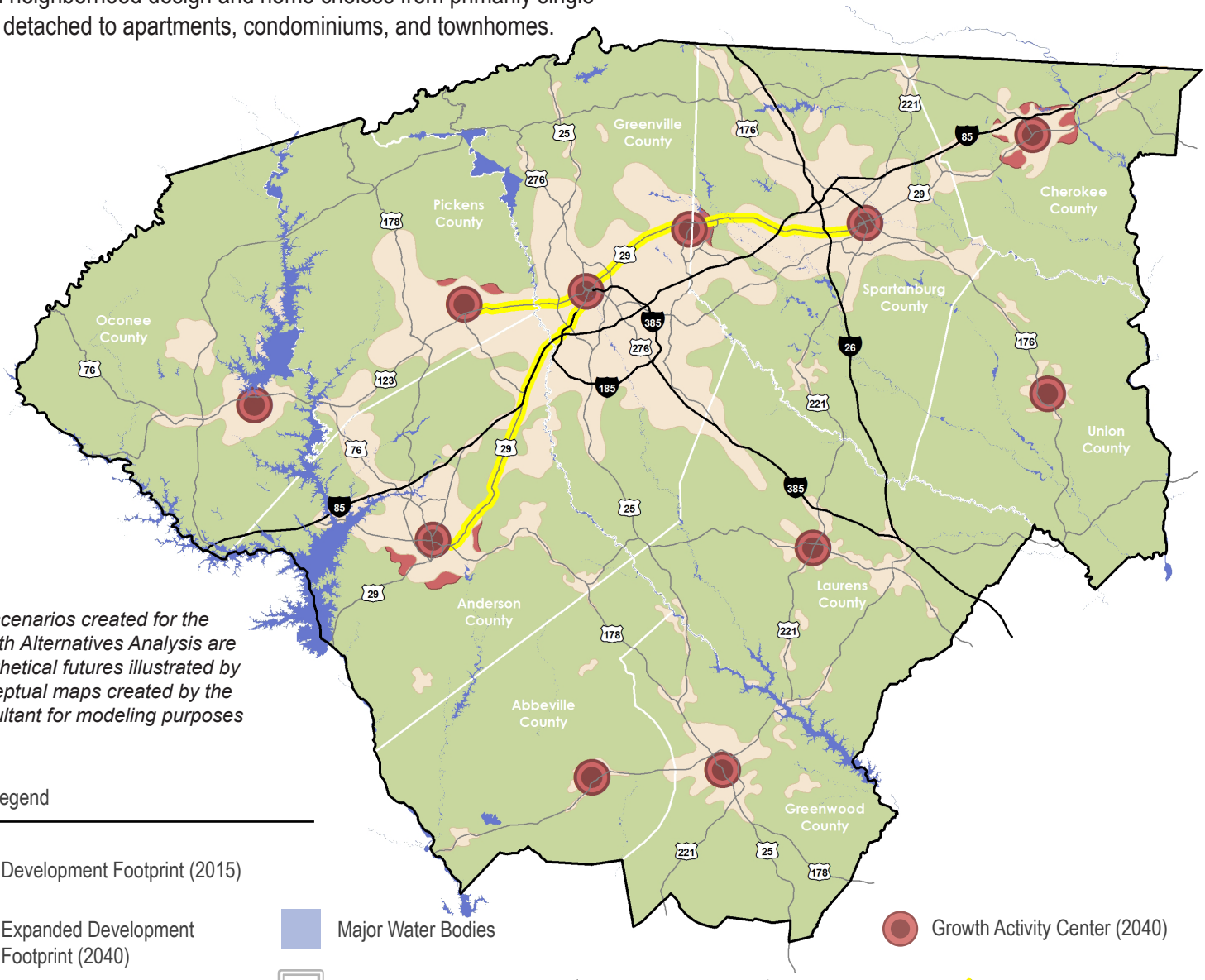
Development Footprint

Single-use, low-density development patterns would be spread throughout the region; exemplified by suburban neighborhoods, highway strip-commercial, and standalone office or industrial development. Mixed-use, walkable development patterns (residential, retail, and office combined) would be focused in only a few urbanizing communities (e.g., Downtown Greenville).

Compact Centers Growth Scenario

The Compact Centers Growth Scenario considers how the region might develop if growth were concentrated in regional growth centers identified on the scenario map. The design, scale and intensity of the centers would create unique places in the region, and encourage active living with opportunities to live, work, shop and play in the same community. Land surrounding future development would remain open space, farmland, forested areas or rural living areas. This is an extreme scenario for the Upstate, but provides a dramatic illustration of the merits of extremely compact growth. This scenario would focus all new development for the region in an area roughly the size of the City of Greenville – less than 30 square miles. It would rely heavily on infill development, repurposed buildings, and redevelopment of underutilized parcels. Also, it would require a major shift in neighborhood design and home choices from primarily single family detached to apartments, condominiums, and townhomes.

What does the region look like if we focus nearly all growth into dense, mixed-use & urban activity centers?



The scenarios created for the Growth Alternatives Analysis are hypothetical futures illustrated by conceptual maps created by the consultant for modeling purposes only.

Map Legend

- Development Footprint (2015)
- Expanded Development Footprint (2040)
- Undeveloped Areas (2040)
- Major Water Bodies
- County Boundaries
- Growth Activity Center (2040)
- Interstates
- Major Roads
- Major Transit Corridors (2040)

Key Themes for the Scenario

Housing Mix

A major shift in neighborhood design and housing choices would favor multifamily housing to meet future demand (62% multifamily vs. 38% single-family). Average residential densities would range from six units/acre for single-family detached homes, to 20 units/acre for townhomes, to 50 units/acre for condominium and apartment homes per acre.

Public Facilities & Services

Infrastructure investments (water, sewer, roads, etc.) would be lower (but not eliminated) by concentrating new growth and development in existing service areas.

Viable Travel Options

The emphasis would be switched from car to transit for trips within the urban centers. Local bus service would connect riders with premium regional transit corridors (bus rapid transit). Widespread use of mixed-use, walkable development principles in the growth centers would help shorten trip length and increase the number of viable travel mode options. Daily travel needs would be served by walking, biking, or transit within, and between, nearby growth centers.

Environmental Stewardship

An abundance of open space, farmland, forested areas and rural living surrounding the identified centers would offset higher densities and less private open space in the urban environments. Low impact development principles would also contribute to a greener landscape in more rural areas.

Jobs-Housing Proximity

Mixed-use, walkable growth centers would significantly increase opportunities to link jobs and housing in close proximity.

Farmland Preservation

Farmland preservation would be a high priority. Working farms would be protected using policies, rules or incentives that promote farming as critical for future economic development. Nearly all farmland identified in the region would be maintained under this scenario.

Development Footprint

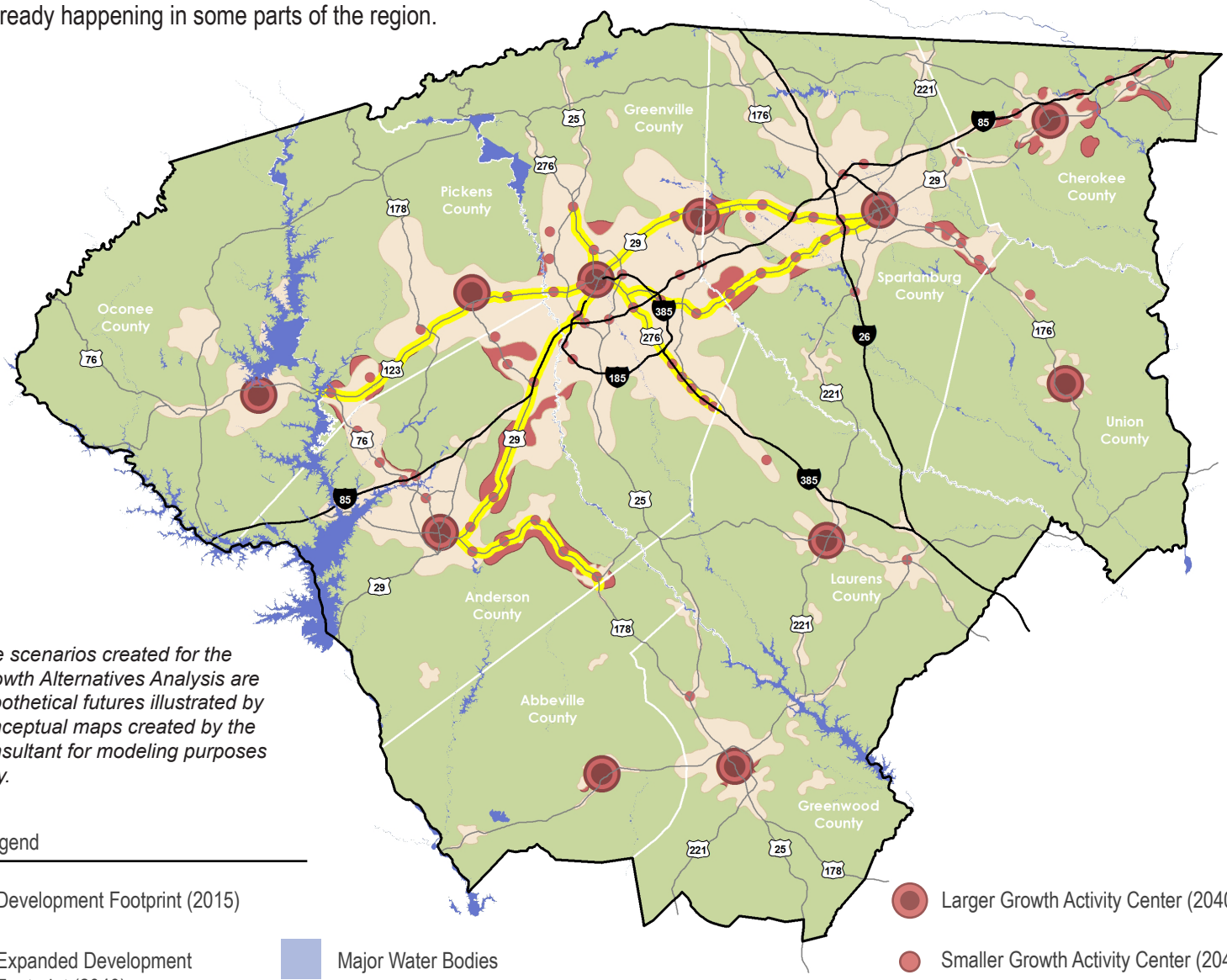
Future growth would be focused in compact, walkable centers. Nearby opportunities to live, work, shop and play would draw people to urban or urbanizing areas. Land outside identified growth centers would be protected for open space, farmland, forested areas and rural living.

Major Corridors Growth Scenario

The Major Corridors Growth Scenario considers how the region might develop if growth is concentrated along transportation corridors. The design, scale and intensity of development in the corridors would create unique places, and encourage active living in a series of centers identified for opportunities to live, work, shop and play in the same community (or at least in close proximity between two or more nearby centers). Targeted investments in premium transit (bus rapid transit) and highway improvements (interstates or limited access highways) would move people efficiently along the corridors and between the identified centers.

This is a moderate scenario for the Upstate that is already happening in some parts of the region.

What does the region look like if we focus growth into strategic transportation corridors that connect many mixed-use, walkable activity centers together?



The scenarios created for the Growth Alternatives Analysis are hypothetical futures illustrated by conceptual maps created by the consultant for modeling purposes only.

Map Legend

- Development Footprint (2015)
- Expanded Development Footprint (2040)
- Undeveloped Areas (2040)
- Major Water Bodies
- County Boundaries
- Interstates
- Major Roads
- Major Transit Corridors (2040)
- Larger Growth Activity Center (2040)
- Smaller Growth Activity Center (2040)

Key Themes for the Scenario

Housing Mix

A shift in neighborhood design and housing choices would better balance the distribution between single-family (54%) and multifamily (46%) housing compared to the Trend Development Growth Scenario. Average residential densities would range from four units/acre for single-family detached homes, to 16 units/acre for townhomes, to 30 units/acre for condominium and apartment homes.

Public Facilities & Services

Infrastructure investments (water, sewer, roads, etc.) would be managed by limiting expansion to new or emerging strategic growth corridors.

Viable Travel Options

Targeted investment in premium transit (bus rapid transit) and highways (interstates or limited access freeways) would efficiently move people between growth centers and development nodes. Local bus service would connect riders with premium regional transit corridors (bus rapid transit). Widespread use of mixed-use, walkable development principles in the growth centers and development nodes would help shorten trip lengths and increase the number of viable travel mode options. Daily travel needs would be served by walking, biking, transit and car within the corridors, centers and nodes.

Environmental Stewardship

Protecting land outside the growth centers or development nodes for open space, farmland, forested areas, or rural living would increase a green print for the region. Low impact development principles would also contribute to a greener landscape in more rural areas.

Jobs-Housing Proximity

Mixed-use, walkable growth centers or development nodes would significantly increase opportunities to link jobs and housing in close proximity along corridors.

Farmland Preservation

Farmland preservation would be a high priority. Working farms would be protected using policies, rules or incentives that promote farming as critical for future economic development, though some farms near the strategic growth corridors may be lost to new development.

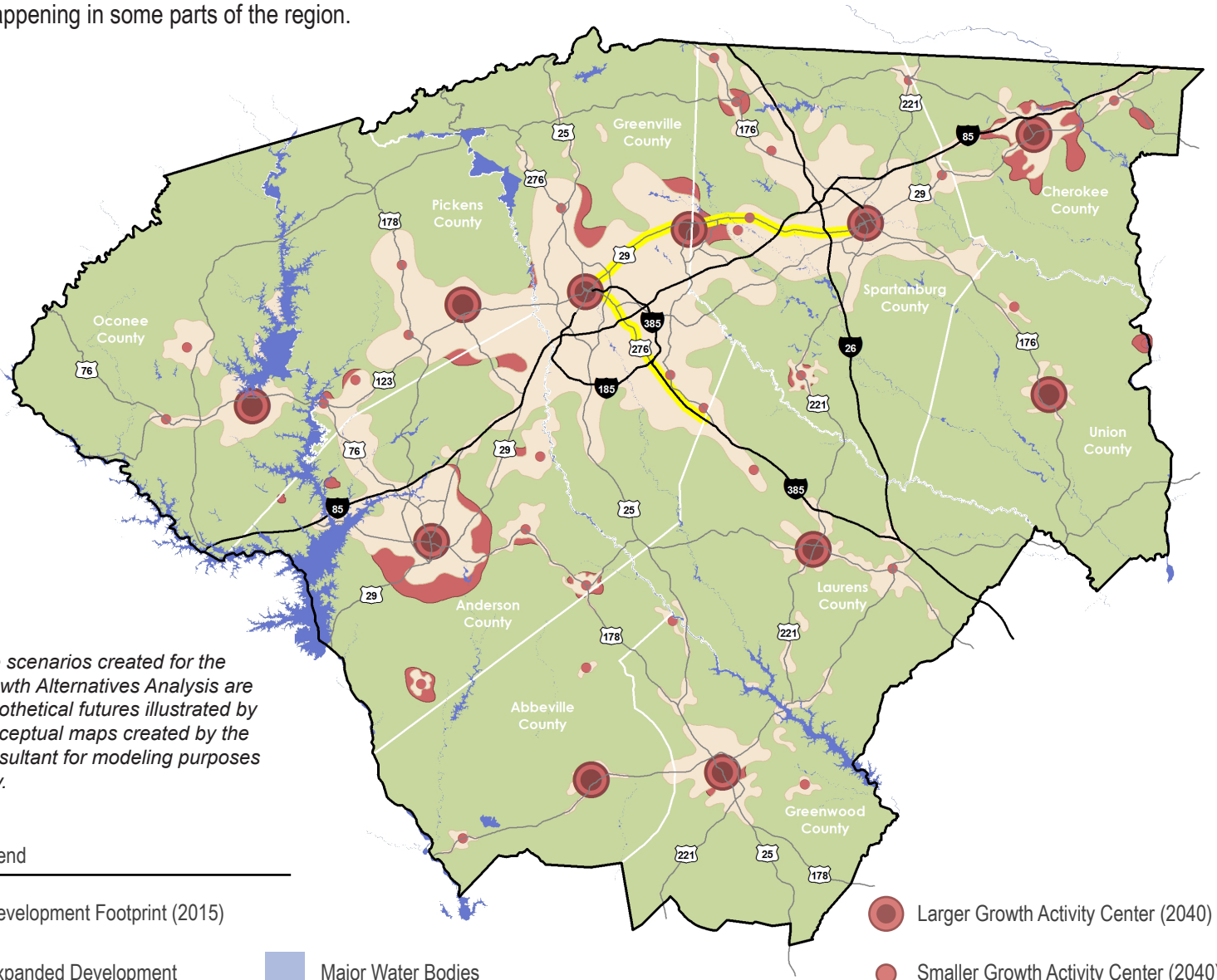
Development Footprint

Future growth would be focused in corridors and compact, walkable centers identified along them. Nearby opportunities to live, work, shop and play would draw people to urban or urbanizing areas. Land outside identified growth centers would be protected for open space, farmland, forested areas, and rural living.

Rural Villages Growth Scenario

The Rural Villages Growth Scenario considers how the region might develop if growth were concentrated into several activity centers identified throughout the region (a more dispersed, less intense group of centers compared to the Compact Centers Growth Scenario). The design, scale and intensity of the centers would create unique places in the region, and encourage active living with opportunities to live, work, shop and play in the same community. However, residents living in some activity centers may need to visit larger activity centers in the region to meet some of their daily needs (especially employment opportunities). Land surrounding the future development footprint would remain as open space, farmland, forested areas or rural living areas. This is a moderate scenario for the Upstate that is already happening in some parts of the region.

What does the region look like if we focus growth into a hierarchy of mixed-use, walkable activity centers located throughout the region?



The scenarios created for the Growth Alternatives Analysis are hypothetical futures illustrated by conceptual maps created by the consultant for modeling purposes only.

Key Themes for the Scenario

Housing Mix

A shift in neighborhood design and housing choices would better balance the distribution between single-family (52%) and multifamily (48%) housing compared to the Trend Development Growth Scenario. Average residential densities would range from four units/acre for single-family detached homes, to 16 units/acre for townhomes, to 30 units/acre for condominium and apartment homes.

Public Facilities & Services

Infrastructure investments (water, sewer, roads, etc.) would be limited by concentrating new growth in existing service areas. This would help reduce government investments to support future development.

Viable Travel Options

The emphasis would be switched from car to transit for trips within the region. Local bus service would connect riders with premium regional transit corridors (bus rapid transit). Widespread use of mixed-use, walkable development principles in the growth centers would help shorten trip length and increase the number of viable travel mode options. Daily travel needs would be primarily served by walking, biking, or transit within, and between, nearby growth centers.

Environmental Stewardship

Protecting land outside the growth centers for open space, farmland, forested areas, or rural living would increase a green print for the region. Low impact development principles also would contribute to a greener landscape in more rural areas.

Jobs-Housing Proximity

Mixed-use, walkable growth centers would significantly increase opportunities to link jobs and housing in close proximity.

Farmland Preservation

Farmland preservation would be a high priority. Working farms would be protected using policies, rules or incentives that promote farming as critical for future economic development. Nearly all farmland identified in the region would be maintained under this scenario.

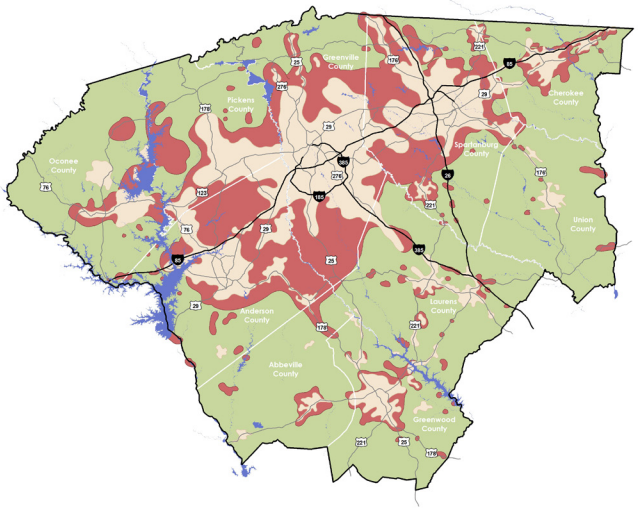
Development Footprint

Future growth would be focused in compact, walkable centers identified throughout the region. Nearby opportunities to live, work, shop and play draw people to urban or urbanizing areas. Land outside the growth centers would be protected for open space, farmland, forested areas, and rural living.

Side-by-Side Comparison of Growth Scenarios

Trend Development Scenario

The Trend Development Scenario shows how the region might develop if adopted community plans are followed for the next 25 years. Future growth would continue to favor low-density, single-use development patterns and intensities moving away from existing city centers, which requires outward expansion of roads, water and sewer lines, fire and police protection, etc. to serve the newly developed areas. This pattern of development consumes a tremendous amount of land — especially rural, farm and forested areas — to accommodate new growth and increases the distance and time spent commuting between home, work and shopping destinations primarily by automobile.

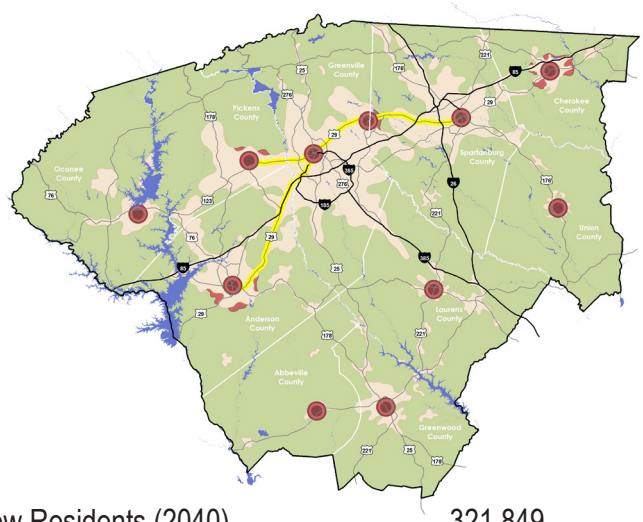


New Residents (2040)	321,849
New Employees (2040)	255,669
Protected Open Space	770 sq. mi.
Total Land Area Developed (square miles)	1,644.5
Housing Mix	90% SF / 10% MF
Jobs-Housing Proximity	Limited Potential
Viable Travel Options	Car
Infrastructure Emphasis	Invest in Expanding Service Areas
Farmland Preservation	Low Priority

Compact Centers Scenario

The Compact Growth Scenario considers how the region might develop if growth were concentrated in regional growth centers identified on the scenario map. The design, scale and intensity of the centers would create unique places in the region, and encourage active living with opportunities to live, work, shop and play in the same community. Land surrounding the future development footprint would remain open space, farmland, forested areas or rural living areas.

This is an extreme scenario for the Upstate, but it provides a dramatic illustration of the merits of extremely compact growth. This scenario would focus all new development for the region in an area roughly the size of the City of Greenville – less than 30 square miles.

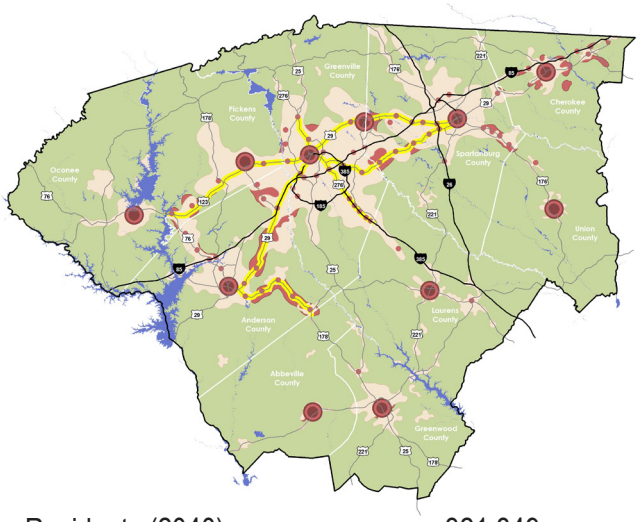


New Residents (2040)	321,849
New Employees (2040)	255,669
Protected Open Space	770 sq. mi.
Total Land Area Developed (square miles)	747.4
Housing Mix	38% SF / 62% MF
Jobs-Housing Proximity	Great Potential
Viable Travel Options	Car, Bus, BRT, Bike & Walk
Infrastructure Emphasis	Invest in Existing Service Areas
Farmland Preservation	High Priority

Major Corridors Scenario

The Major Corridors Growth Scenario considers how the region might develop if growth were concentrated along major transportation corridors. The design, scale and intensity of development in the corridors would create unique places, and encourage active living in a series of centers identified for opportunities to live, work, shop and play in the same community (or at least in close proximity between two or more nearby centers). Targeted investments in premium transit (bus rapid transit) and highway improvements (interstates or limited access highways) would move people efficiently along the corridors and between the identified centers.

This is a moderate scenario for the Upstate that is already happening in some parts of the region.

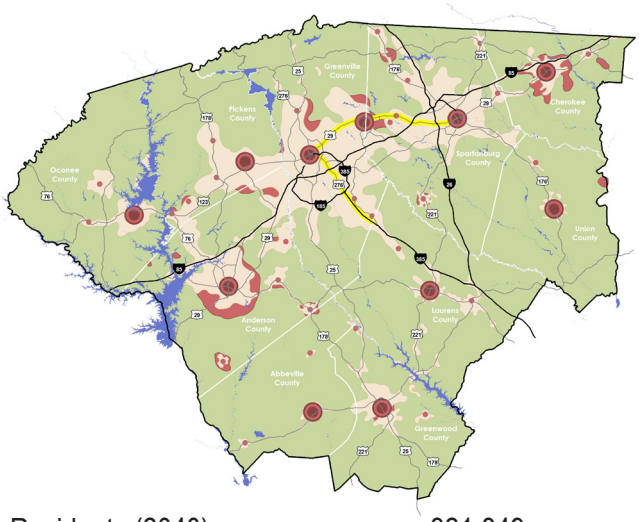


New Residents (2040)	321,849
New Employees (2040)	255,669
Protected Open Space	770 sq. mi.
Total Land Area Developed (square miles)	814.1
Housing Mix	54% SF / 46% MF
Jobs-Housing Proximity	Some Potential
Viable Travel Options	Car, Bus, BRT, Bike & Walk
Infrastructure Emphasis	Invest in Existing & Expand Some Service Areas
Farmland Preservation	High Priority

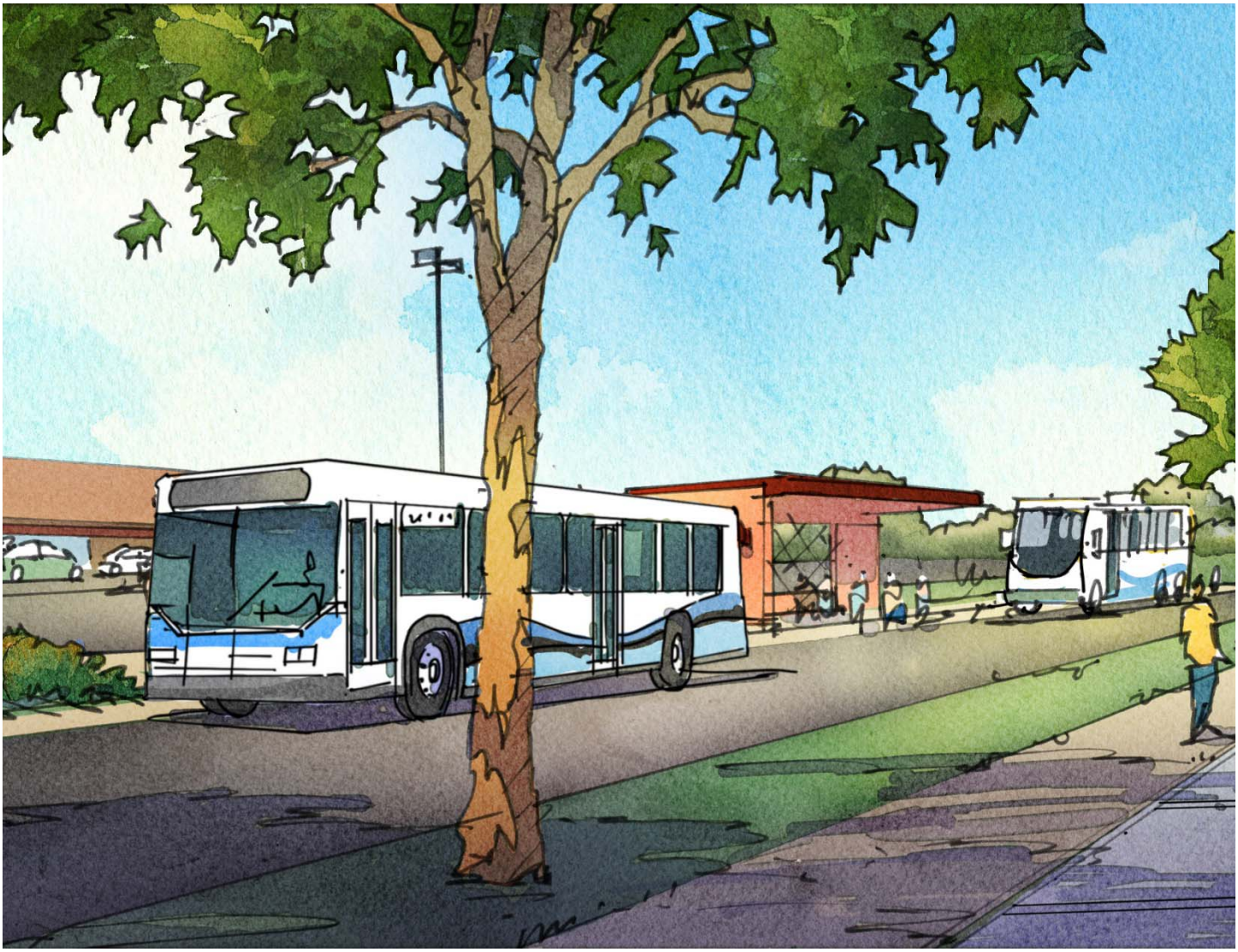
Rural Villages Scenario

The Rural Villages Growth Scenario considers how the region might develop if growth were concentrated into several activity centers identified throughout the region (a more dispersed, less intense group of centers compared to the Compact Centers Growth Scenario). The design, scale and intensity of the centers would create unique places in the region, and encourage active living with opportunities to live, work, shop and play in the same community, however, residents living in some activity centers may need to visit larger activity centers in the region to meet some of their daily needs (especially employment opportunities). Land surrounding the future development footprint would remain as open space, farmland, forested areas or rural living areas.

This is a moderate scenario for the Upstate that is already happening in some parts of the region.



New Residents (2040)	321,849
New Employees (2040)	255,669
Protected Open Space	770 sq. mi.
Total Land Area Developed (square miles)	860.4
Housing Mix	52% SF / 48% MF
Jobs-Housing Proximity	Great Potential
Viable Travel Options	Car, Bus, BRT, Bike & Walk
Infrastructure Emphasis	Invest in Existing & Expand Some Service Areas
Farmland Preservation	High Priority



Appendix C – Transit Network Characteristics

Table A1: General Characteristics for the Transit Network Concepts Developed for the Alternative Growth Scenarios

		Compact Centers		Rural Villages		Major Corridors	
	Units	BRT	Express Bus	BRT	Express Bus	BRT	Express Bus
Transit Network Concept Characteristics							
Route Length	Miles	18	55	32	13	26	136
Service Area Type	Setting	Urban	Suburban	Urban	Suburban	Urban	Suburban
Average Bus Travel Speed	MPH	40	35	45	35	45	35
Total Roud Trip Time	Minutes	27	94	43	23	35	233
Bus Headway in Peak Periods	Minutes	15	30	15	30	15	30
Bus Headway in Non-Peak Periods	Minutes	30	45	30	45	30	45
Number of Buses in Peak Periods	Buses	2	3	3	1	2	8
Number of Buses in Non-Peak Periods	Buses	1	2	1	1	1	5
Weakday Peak Service Duration	Hours	6	6	6	6	6	6
Weakday Non-Peak Service Duration	Hours	6	6	6	6	6	6
Cost per Vehicle Hour	Dollars	$135	$80	$135	$80	$135	$80
Contingency on Capital Items	Percentage	15%	15%	15%	15%	15%	15%