APPENDIX

SCENARIO DEVELOPMENT
Page intentionally left blank
Scenario Development

While SB 375 (2008) mandated the inclusion of a Sustainable Communities Strategy (SCS) within the Regional Transportation Plan (RTP), this type of planning work was not new to SJCOG or the San Joaquin County region. SJCOG had engaged in a number of efforts over the years to plan for more sustainable communities. This legacy continues with the 2018 update to the aspirational (and first) 2014 SCS that is again firmly rooted in, and supported by, timely and credible household and job growth forecasts, early engagement and input from local agency planning and public works professionals, robust market demand and economic studies, and innovative planning studies. Most importantly, this rigorous attention to existing studies and on-going programs produces an SCS with implementation mechanisms, either already in place, or currently under development. The paragraphs below discuss previous planning efforts, studies, and the technical work that informed the development of the 2018 SCS in San Joaquin County.

Beginning with 2014 Plan land-use distribution, SJCOG met with planning staff at San Joaquin County and each of the cities in mid-2017 to gain an understanding of where growth had occurred since the 2014 Plan was prepared and to adjust the future growth distribution to reflect new development projects, projects no longer active, or any changed assumptions for on-going projects. After careful review of staff comments, local agency General Plans and other available planning documents, the four 2014 land-use scenarios were adjusted to reflect these new planning assumptions. The result was three land-use scenarios for technical analysis and public outreach, numbered 1, 2 & 3. Scenario two’s land-use was the 2014 Plan’s final land-use distribution, adjusted for any new planning assumptions. That land-use distribution was used to produce two 2018 outreach scenarios, 2A and 2B, which differed only in their financial assumptions. The final outreach scenario assumptions are detailed later in this report.
**Growth Forecasts**

During development of the 2011 RTP, it became apparent that available forecasts from the California Department of Finance (DOF) were too aggressive in their population projections, due primarily to changed foundational demographic trends and vastly different economic conditions then when the projections had last been updated. SJCOG commissioned new forecasts in 2009 that painted substantially lower population growth and began to reflect a deepening recession whose ultimate effect on job growth was still not clear. SJCOG now partners with the University of the Pacific Center for Business and Policy Research (CBPR) for its population, household and jobs forecasting. The most recent forecasts include total population, total households, total housing units, and total employment by industry sector by Census Designated Place (CDP). These forecasts were vetted with each jurisdiction in San Joaquin County and adjusted by CBPR to reflect local knowledge. The forecast report and methodology are included in Appendix R. The more current forecasts are much closer to updated forecasts from the California Department of Finance – this comparison is also detailed in the CBPR report.

**Previous Studies and Planning Efforts**

**San Joaquin County Regional Blueprint**

In many respect SB375’s Sustainable Communities Strategy was a direct outgrowth of state funded Blueprint Planning efforts – the highly successful effort undertaken by the Sacramento Area Council of Governments (SACOG) was largely complete by the time SB375 was being drafted. The legislation passed in 2008 during the development of the San Joaquin Valley Regional Blueprint (2009). SJCOG also adopted a local Regional Blueprint in early 2010. The San Joaquin County Regional Blueprint was a first of its kind planning document for the region whose principles, goals, and objectives aligned with the integrated transportation and land-use planning set forth in SB375. This study laid the groundwork with its technical analysis and public outreach efforts for the planning framework for the 2014 RTP’s SCS. Many of the technical aspects of the scenario planning exercises were directly incorporated into the SCS scenarios, including attached/detached housing splits, and density estimates. These foundational efforts are still evident in the 2018 Plan.

**Higher Density Housing Study**

This was also a product of the Valleywide Blueprint Planning effort. The study, completed by The Concord Group in June 2012, looked at a variety of economic and demographic data, including PRIZM lifestage cohorts, to produce a snapshot of both consumer-driven and viability-driven estimates of demand for various housing product types. The conclusions and results of this study were directly incorporated into the scenario planning exercises. The housing split goals of Scenarios 2a and 2b were directly informed by this study.

**Local Agency Climate Action Plans**

Several local agency climate action plans were in the process of implementation during the 2018 scenario development process. These plans were considered with respect to any land-use or transportation initiatives.

**SJCOG Regional Smart-Growth Transit Oriented Development Plan**

Adopted in 2012, this thoroughly vetted plan produced a variety of outcomes instrumental in the development of the SCS. The most important among them was the infill sites inventory that was used to direct infill and refill growth as part the alternative scenario development process.
SJCOG Regional Bicycle, Pedestrian and Safe Routes to School Master Plan

This document was consulted in developing the future bicycle infrastructure network and informed potential need for the allocation of plan revenues to the Active Transportation element of the plan investments.

Creation of Land Use Scenarios

Once all relevant studies and technical data had been assembled, SJCOG technical staff and its consultant team at Fregonese Associates set about the technical work to refine and update the land-use scenarios. Fregonese Associates is the developer Envision Tomorrow, the technical tool utilized to create the scenario land-use patterns for both the 2014 and 2018 Plans. Fregonese updated the modeling platform to the most current version, updated the underlying building and development type assumptions, and developed a 2015 “current conditions” scenario. Performance indicators for comparison of the scenarios were either derived directly from the Envision Tomorrow model platform or SJCOG’s travel demand model. Information on the Envision Tomorrow software platform and its indicators is included as Figure M.1.

The SJCOG and Fregonese project team created four alternative scenarios (1, 2A, 2B, & 3), which varied across four key elements: overall development pattern, housing options, growth location/intensity, and transportation investments. The scenarios were designed to be presented to the public to offer a clear explanation of the policy choices inherent in each scenario and how those choices tied directly to future transportation investments in the county. The conceptual foundation for each public outreach scenario is included on the graphic on the next page. These scenarios were presented at public workshops, on-line, and at informational meetings in mid- to late- 2017. The scenarios were compared one against another across several performance metrics, which are further outlined in Appendix M and Chapter 5. The full public outreach process is detailed in Appendix N.
What are the Scenarios?

1. **Scenario 1**
   - Invests in congestion relief through significant expansion and improvements to state highways and regional roadways.
   - Focus of flexible funding is roadway expansion and maintaining roads and streets.
   - Investments in public transit are modest with an emphasis on maintaining existing service over service expansion.
   - ACE expansion only assumed for Modesto/Merced and no expansion of ACE service on existing routes.
   - Least bicycle/pedestrian and smart growth investments.
   - Investments support land use patterns along highway corridors with less development in urban core areas.

2A. **Scenario 2A**
   - Invests in transportation systems that complement compact growth and minimize impacts on agricultural land.
   - Flexible funding flows to all modes of transportation.
   - ACE expansion assumed for Modesto/Merced, San Jose, and "planning level only" work for Sacramento service; includes related minimal improvements needed to support the service expansions.
   - Bus transit service includes expanded Bus Rapid Transit and more connectivity within communities and between communities.
   - More investment in bicycle and pedestrian investments, complementing public transit and increasing alternatives to driving a car.

2B. **Scenario 2B**
   - Transportation investment strategies and land use assumptions mirror Scenario 2A.
   - Assumes a quarter-cent sales tax starting in 2020 - creating over $1 billion of additional revenue in Measure K, resulting in more investments in all transportation modes, in accordance with the existing Measure K investment strategy.
   - Makes possible ACE expansion to both Modesto/Merced and to Sacramento.
   - Highest infusion of investment dollars to transit, bicycle and pedestrian improvements.

3. **Scenario 3**
   - Invests in transportation systems that support the highest level of compact growth and infill, resulting in the least impact on agricultural land.
   - Focus of flexible funds on bicycle/ pedestrian facilities and public transit.
   - Highest level of Bus Rapid Transit Corridors in urbanized areas and more bus transit amenities or stations.
   - Highest level of ACE expansion including service to Modesto/Merced; ACE planning & development to expand to Sacramento; and implementation of additional train capacity to San Jose.
   - Least investment in maintenance of roadway system and expansion of state highways and local roads and streets.

What are the assumptions about the future?

New housing units

<table>
<thead>
<tr>
<th>Scenario 1</th>
<th>Scenario 2A</th>
<th>Scenario 2B</th>
<th>Scenario 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Units (Units/ jobs per acre)</td>
<td>4 / 16.9</td>
<td>8.4 / 18.4</td>
<td>8.4 / 18.4</td>
</tr>
<tr>
<td>Housing Mix by Type (Multi-Family / Single Family)</td>
<td>20% / 80%</td>
<td>39% / 61%</td>
<td>39% / 61%</td>
</tr>
</tbody>
</table>

- Small Lot Single Family
- Conventional Lot Single Family
- Large Lot Single Family
**Final Scenario Selection**

While there was some public support for all four scenario alternatives, public support was most notable for Scenario 2A. In November 2017, SJCOG staff presented a recommendation to its RTP / SCS Working Group to forward Scenario 2A as the basis of the land-use element and investment strategy for the 2018 RTP.

SJCOG staff emphasized that the recommendation:

- Best Achieved the intent of SB375 within the boundaries of local agency General Plans
- Was ambitious and achievable, aligning with ARB direction on GHG targets
- Expanded on a longstanding multi-modal transportation vision
- Provided for greater opportunities for transit use
- Supported additional active transportation investment
- Aligned with current market and economic studies
- Had ambitious conservation goals

The working group was mixed in its support of the SJCOG staff recommendation. Of the nine group members providing input, five supported Scenario 3, three supported Scenario 2a, and one supported 2a with additional bike/pedestrian and transit elements. Two of those supporting Scenario 3, secondarily supported 2a, and one supporting 2a secondarily supported 2a with enhanced transit and bike/ped options. The group did not each a consensus. The recommendation was supported by the SJCOG standing committees and was ultimately adopted by the SJCOG policy board.

After the required adjustments and recommendations were implemented by SJCOG technical staff, the scenario formed the basis of 2018 RTP. The scenario represents a region-specific, balanced multi-modal plan that not only achieves the intent and promise of SB 375, but one that can be implemented through existing and planned programs and policies.
Scenario Planning with Envision Tomorrow

Why Use Scenario Planning?

- Weigh choices against consequences
- Test policy options quickly
- Prepare for uncertainty
- Develop strategies to optimize outcomes
What is Envision Tomorrow?

- Suite of planning tools:
  - Prototype Builder
    - Return on Investment (ROI) model
  - Scenario Builder
    - Extension for ArcGIS

Prototype Builder (ROI Model):
*Quick Building Modeler: Physical & Financial*

- Powerful as standalone tool or integrated with Scenario Builder
- Test existing regulations for financial feasibility
  - Identify regulatory roadblocks
- Test impact of new development regulations on:
  - Financial feasibility
  - Fiscal impact
  - Housing affordability, etc.
- Experiment with sensitivity of key variables:
  - Height / FAR
  - Parking / Landscaping
  - Land Costs / Rents / Subsidies
Model Prototypes Using Real Market Research: Allows for “Reality-based Visualizations”

Use Prototypes for Reality-based Visualizations and 3D Modeling

Reality-based Visualizations:
Exposition and Vermont Blvd, Los Angeles CA
Scenario Builder: *Scenario Painter for ArcGIS*

- Quickly paint scenarios using financially feasible building blocks
- Compare multiple scenarios across a variety of indicators
- Track progress in real-time

Scenario Indicators:

- Anything we can know about a building, we can know about a scenario…
  - Housing and Jobs: mix and density
  - Jobs-Housing Balance
  - Land Consumption: vacant, agricultural, infill
  - Impervious Surface
  - Open Space
  - Housing Affordability
  - Resource Usage: energy and water
  - Waste Production: water, solid, carbon
  - Transportation: travel mode choice, vehicle miles traveled
  - Fiscal Impact: local revenue and infrastructure costs
  - Balanced Housing Index: how scenario housing mix matches expected future demographic profile
Who is Using Envision Tomorrow?

- Sonoran/Lincoln Joint Venture
- Southern California (SCAG)
- Envision Utah
- Chicago (CMAP)
- City of Portland
- Portland Metro
- City of Tulsa

Lincoln Institute of Land Policy

# How is Envision Tomorrow unique?

- **Transparent and accessible tool**
  - simple Arc-Excel link
  - most calculations performed in Excel
- **Start at Building level**
  - financially feasible scenarios
  - wealth of available data on buildings
  - easily modeled indicators (land use, energy, financial)
- **Open Source platform**
  - University and institutional partners keep cutting edge

## Scenario Building Process

1. **Building Types**
2. **Development Types**
3. **Scenario Development**
4. **Evaluation**

Step 1: Model a library of building types that are financially feasible at the local level.
Create Prototype Buildings

Why start with buildings?
- Easily modeled & lots of existing data
  - Density and Design
  - Rents and Sales Prices
  - Costs and Affordability
  - Energy and Water Use
  - Fiscal Impacts

Use ROI Model...

...to Create a Range of Buildings

Scenario Building Process

Step 2: Define the buildings, streets and amenities that make up all the “places” in which we live, work and play.
Development Type Mix
A Variety of Buildings, Streets and Amenities Create a “Place”

Town Center
Medium-Density Residential
Single-Family Residential

Scenario Building Process

Building Types
Development Types
Scenario Development
Evaluation

Step 3: Paint future land use scenarios to test the implications of different decisions or policies.
Real-time Scenario Building and Evaluation

- Test land use policies
- Experiment with new development patterns

Compare Multiple Scenarios
Scenario Building Process

Step 4: Compare the scenarios and monitor the impact of land use decisions in real-time.

Monitor Indicators in Real-time

Detailed Tables

Quick Reference Graphs
Scenario Evaluation

- Evaluation Indicators:
  - **Tier 1: minimal inputs required**
    - Housing and Jobs: mix and density
    - Jobs-Housing Balance
    - Land Consumption: vacant, agricultural, infill
    - Impervious Surface
    - Open Space
  - **Tier 2: moderate inputs required**
    - Housing Affordability
    - Resource Usage: energy and water
    - Waste Production: water, solid, carbon
  - **Tier 3: detailed inputs required**
    - Transportation: travel mode choice, vehicle miles traveled
    - Fiscal Impact: local revenue and infrastructure costs
    - Balanced Housing Index: how scenario housing mix matches expected future demographic profile
Urbanized Acres

What does it mean?
“Urbanized acres” is an indicator of the amount of developed land in each scenario. It may include total urbanized acres in the scenario, or incremental new urbanized acres. It can be further divided into new incremental urbanized acres on vacant land, or urbanization through redevelopment. The number of urbanized acres gives a sense of how much land would be developed under each scenario.

How is it measured?
Each scenario includes a map showing the location of new development. The scenario layer is coded with the existing supply (acreage) of buildable land – both vacant and currently developed. Envision Tomorrow automatically tracks the amount of vacant and developed land that is developed in any given scenario. To get total urbanized acres for a scenario, the acres of new development are added to the number of urbanized acres for the base year. It can be reported as either total urbanized acres or incremental urbanized acres.

Equation:

\[
\text{Sum of acres developed acres (DEVD_ACRE)} \\
\text{where there is existing development (EX_LU not = AG & VAC)} \\
\text{and sum of vacant acres (VAC_ACRE)} \\
\text{where new development has been painted in a scenario (DEV_TYPE > "")}
\]

Example:
Newly Urbanized Acres
San Diego Vision

![Urbanized Acres Chart]

- Current
- Scenario A
- Scenario B
- Scenario C
- Scenario D

- Developed
- Redeveloped
- Vacant Acres
Infill Development or Redevelopment

What does it mean?
Infill development or redevelopment indicates the extent to which new housing and buildings are developed by recycling land that already had some development on it. It indicates that older parts of the area are attracting new housing and investment. High percentages of infill development indicate that a larger proportion of growth is occurring where development has already occurred before.

How is it measured?
Envision Tomorrow automatically tracks the acreage of both vacant and (re)developed lands that are “painted” by the user. This depends on accurate existing land use coverage. The program tracks the amount of development on land that is classified as “developed” currently, as opposed to vacant. The number of redeveloped acres of each development type is multiplied by the number of households and employees per redeveloped acre to get new households and employees on developed land.

Equation:
Percent of New Housing from Infill Development:
\[
\frac{\text{Net Housing Density} \times \text{Developed Acres}}{\left(\text{Net Housing Density} \times \text{Developed Acres}\right) + \left(\text{Gross Housing Density} \times \text{Vacant Acres}\right)}
\]

Example:

Percent of new Growth accommodated through Redevelopment

![Graph showing percent of new growth accommodated through redevelopment]
Housing Mix

What does it mean?
Housing mix indicates whether the housing in an area is single-family, townhouse, or multi-family. This measures the variety of housing types provided, as well as the density typical of new housing types. This is a commonly used subset of the housing data, often a quick snapshot when the more complete Housing Match Indicator is not needed.

How is it measured?
Each scenario contains a different mix of development types. Each development type is defined as a certain mix of building types. Therefore, each development type contains a certain mix of single-family homes, townhomes, and multi-family homes. The number of acres of each development type in each scenario were multiplied by the single-family, townhome, and multi-family percentages in each development type to come up with the number of new single-family, townhome, and multi-family households in each scenario.

Equation:

Example:
Single Family Housing Percentage = Single Family Units / Total Housing Units

Example:
Regional Density

What does it mean?
Regional density is a measure of the number of people, housing units or jobs per urbanized acre or square mile in each scenario. Similar to the measurement of “urbanized acres,” regional density provides a general indicator of density. This is sometimes compared with existing cities, to offer a comparison. The density can either be total, or incremental.

How is it measured?
Regional density is measured by dividing the number of people/units/jobs by the number of urbanized acres in each scenario. Both the urbanized acreage and population count are automatically tracked and updated by Envision Tomorrow. In addition, average FAR is automatically tracked within Envision.

Equation:

- People per Net Residential Acre: Population / Sum of Developed Acres where Population > 0
- Housing Units per Net Residential Acre: Housing Units / Sum of Developed Acres where Housing Units > 0
- Employment per Net Residential Acre: Employees / Sum of Developed Acres where Employees > 0

Population Density
Loss of Agricultural Land and Rangeland

What does it mean?
These two indicators measure the loss of agricultural and rangeland to development. Some people say that maintaining these land uses nearby is important for several reasons. Others say that there is plenty of agricultural and range land, and we shouldn't be concerned with its loss. Regardless, once it is subdivided and developed, it is lost as a crop producing resource. These lands also perform some functions of open space, providing habitat for certain species and relief from the sense of enclosure found in urban areas.

How is it measured?
The loss of agricultural land and rangeland is calculated by summarizing the acres of new development on vacant lands that fall within the agricultural and rangeland classifications of the land cover layer. This same methodology can be applied to a range of important lands, such as environmentally sensitive lands.

Equation:
There is no equation for this indicator since the types of lands users may want to assess impact to is so large. However, the scenario results are spatially distributed in the scenario layer, a quick summary of how new growth impacts a variety of sensitive areas can be calculated using common ArcGIS tools such as select by location or spatial joins. Alternatively, the user can actually pre-populate the scenario layer with a variety of fields that contain the amount of each sensitive lands in each planning geography. For example, a scenario layer based on parcels can include an attribute field that includes the numbe of acres of wetlands in each parcel. The user then can quickly summarize how many acres of wetlands have been “painted,” or had a value assigned in the “dev_type” field.

Percent Loss of Agricultural and Rangeland from 2000

![Chart showing percent loss of agricultural and rangeland from 2000]
Building Energy Use

What does it mean?
Building energy use measures the energy used for heating and cooling, hot water, and lighting, as well as general electricity use (computers, appliances, etc.). Building energy use can be costly in terms of both household budgets and environmental impact, so it is useful to compare the energy efficiency of buildings in each scenario. This is measured in terms of the amount of energy consumed per household or employee per year.

How is it measured?
The Residential Energy Consumption Survey from the US Energy Information Administration provides regional averages for residential energy use per household. The regional average is weighted for each development type based on household square footage. The Commercial Buildings Energy Consumption Survey provides regional averages for commercial energy use per employee, broken down by employment type. A weighted average is calculated for retail, office, and industrial. These assumptions for both housing and employment are applied at the building level and automatically aggregated to the scenario level for evaluation. The user is able to easily change assumptions to better calibrate results for their locality.

Equation:
Building energy use is calculated based on several models developed by the University of Utah using the RECS data described above. The models include both heating and cooling models for single family detached, single family attached, other residential, commercial, office and public buildings. Each model includes specific coefficient values for a range of input variables by building type which are included in tables within the scenario spreadsheet for easy future updates.
Internal Water Consumption

What does it mean?
Water consumption has a major impact both financially and environmentally. Water bills can make up a large proportion of household utility costs, and excessive water consumption can put a strain on water supplies and infrastructure, especially in regions with water scarcity. Internal water consumption by households and employees is therefore a key measure of sustainability.

How is it measured?
National averages for water consumption per household by housing type and per employee by employment type are used to calculate an overall average for each scenario. The existing Envision Tomorrow model is being updated as part of the collaboration with both University of Utah and UT Austin. The user is able to easily change assumptions to better calibrate results for their locality.

Equation:

Internal Water Consumption =
(Housing Unit Count by Type * Gallons of Internal Water Use by Housing Type per Day) + (Employee Count by Type * Gallons of Internal Water Use by Employee Type per Day)

Note: a lookup table containing multipliers is included in the Scenario Spreadsheet and can be changed by users.

Total Water Demand per Capita (gal/day/capita)

Source: EDAW, Fregonese Associates

Total Water Demand Cost per Capita ($/year/capita)

Source: EDAW, Fregonese Associates
Landscaping Water Consumption

What does it mean?  
Water consumption has a major impact both financially and environmentally. Water bills can make up a large proportion of household utility costs, and excessive water consumption can put a strain on water supplies and infrastructure, especially in regions with water scarcity. A major driver of water use by households is the need to water yards and other landscaped areas.

How is it measured?  
A standard measure for the amount of water required per square foot of landscaped area is applied to the calculated amount of landscaping in each scenario to determine the total landscaping water consumption. The user can set maximum watered area assumptions and adjust the assumed amount of water used. The resulting landscaping water consumption is automatically calculated for each scenario.

Equation:

Landscaping Water Use = Building Landscaped Area (Limited in Size by Maximum Lawn Area)  
* Gallons of Water Use per Square Foot of Landscaped Area per Day

Note: there is a user-defined input for “maximum lawn area” that can be included which restricts the lawn or landscape area assumed to be watered. For instance, a rural single family home may have a 5 acre lot size, but not all of it may be irrigated lawn or garden.

Note 2: a lookup table containing multipliers is included in the Scenario Spreadsheet and can be changed by users.