Public Webinar – Overview of CPUC Supplemental Information
February 20, 2020

Presentation will begin at 10:05 a.m.

Energy for What's Ahead℠

SOUTHERN CALIFORNIA EDISON®

Alberhill System Project

Public Webinar – Overview of CPUC Supplemental Information

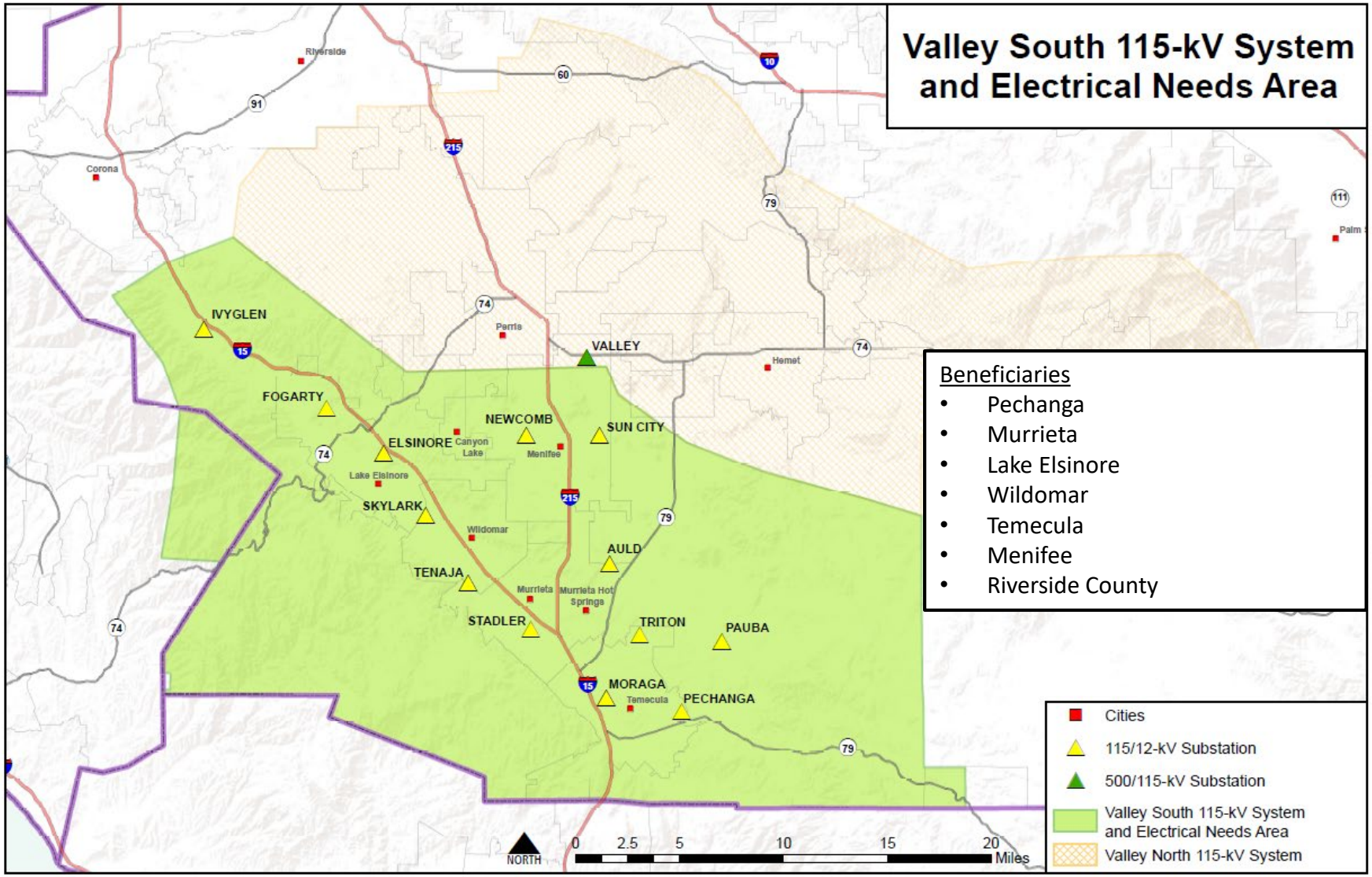
February 20, 2020

www.sce.com/alberhill

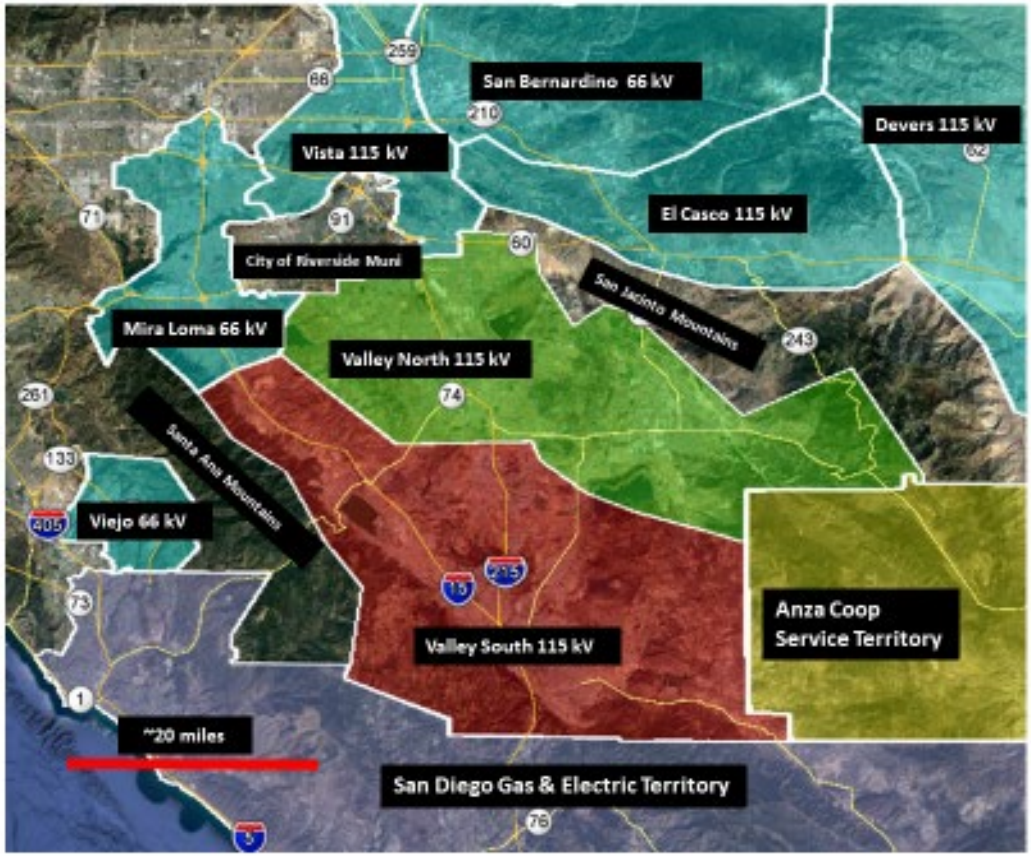
Agenda

- Background
  - Valley South System
  - History of Valley South System
  - Project Need
  - Status of the Proceeding
  - Overview of Supplemental Information Requested by CPUC
- Item A: Load Forecast
- Item F: Reliability Performance
- Item C: Planning Study
  - Item G: Cost-Benefit Analysis
  - Alternatives Assessment and Findings
- Item I: Recommended Solution

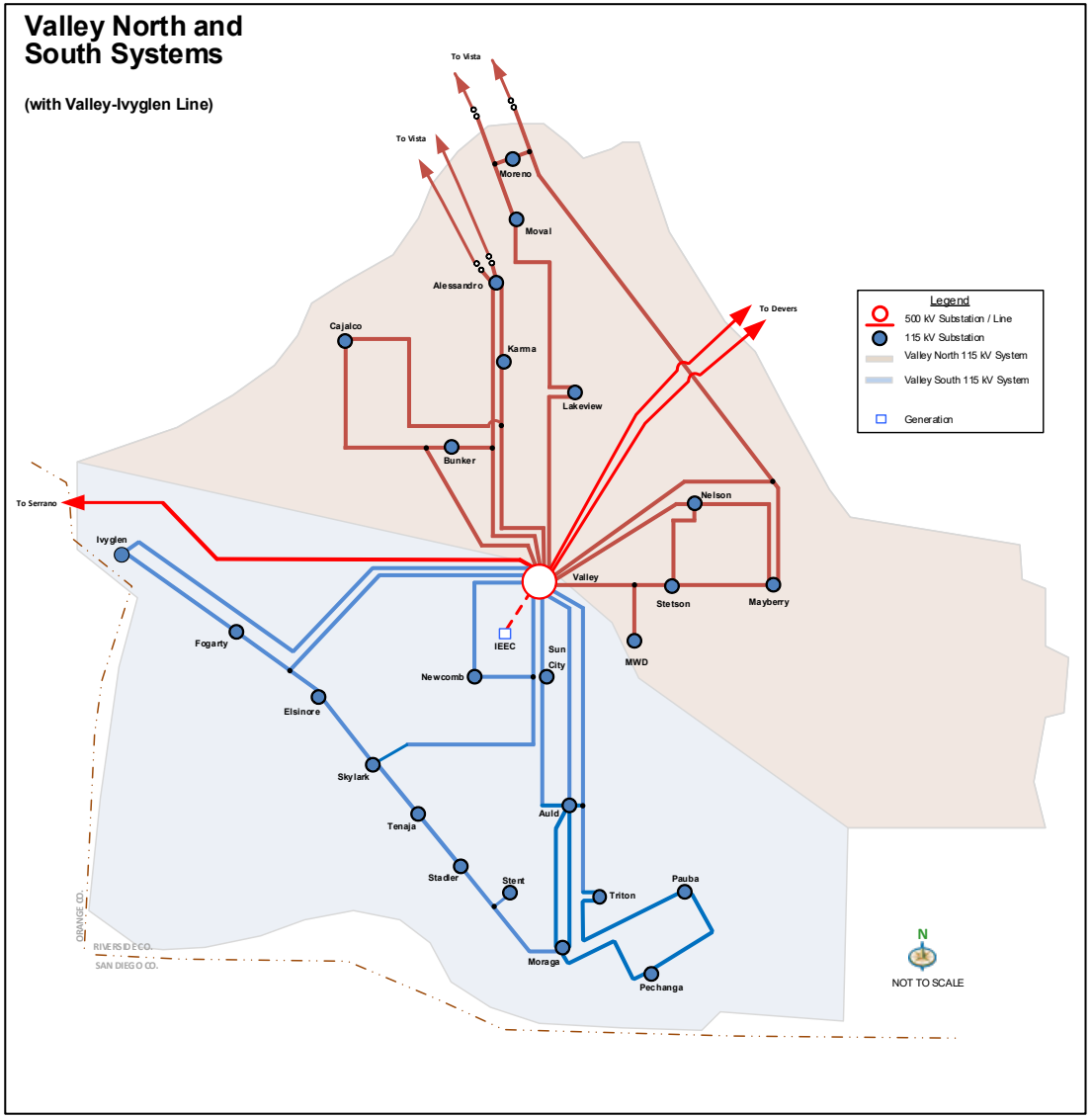
Valley South System - Electrical Needs Area



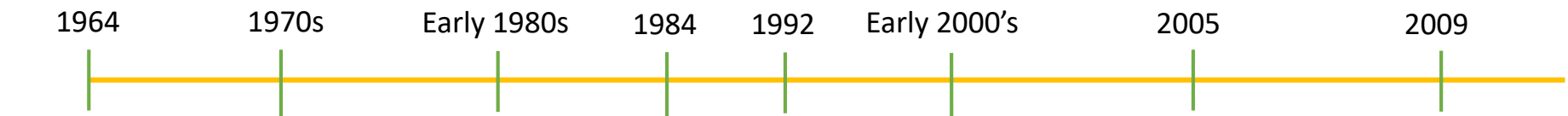
Valley South and Valley North and Surrounding Electrical Systems



Valley South and Valley North – Current Electrical Configuration



History of Valley South System



1964

SCE acquires 115/33 kV, 100 MVA Valley Substation after merging with Calectric.

1970s

SCE anticipates the need to convert Valley Substation to 220/115 kV substation. 220 kV lines would be planned to connect to the transmission grid and the existing 33 kV distribution is planned to be upgraded to 115 kV. The existing 115 kV lines from Vista Substation would function as system-tie lines.

Early 1980s

SCE revises plans for Valley Substation to take advantage of a new 500 kV line from Arizona to Orange County and passing near Valley Substation. The planned expansion of Valley Substation to a 220/115 kV substation is revised to instead convert it to a 500/115 kV substation.

1984

The 500/115 kV conversion of Valley Substation is completed.

1992

Higher than expected growth occurs from among other things, rezoning and development of agricultural land. The single 560 MVA transformer at Valley is not sufficient to serve future load. The spare is in-serviced as a load serving transformer and a new spare is installed.

Early 2000's

Continued growth occurs at unprecedented rates in the region. The spare transformer is again in-serviced as a load serving transformer and a new spare is installed as a near-term solution. Three transformers now act as load serving, with one spare.

SCE recognizes that a long-term solution is needed, but the appropriate environmental studies and regulatory approval will not be obtained before a long-term solution can be constructed.

2005

Valley Substation is split into two separate systems. All existing four transformers are now load serving.

This split resolved the immediate capacity needs and short circuit duty concerns, but created a lack of system tie-lines to Valley South, as the existing tie-lines to Vista are now available only to Valley North.

2009

SCE has completed its proposal for a long-term and comprehensive solutions and then files an application for the Alberhill System Project with the CPUC.

Project Need

- The predominant driver is a need to address ***reliability*** challenges which are expected to occur in the 2022 time frame due to a shortfall in transformation capacity, coupled with the current lack of system tie-lines. The transformation capacity shortfall is expected due to anticipated load growth within the Valley South System.

- Additionally, there has been a long-term need to address ***resiliency*** challenges with the Valley South System due to its lack of system tie-lines, the magnitude of the load served, and the concentration of the supply at a single substation (Valley Substation).

Status of the Proceeding

- SCE's Certificate of Public Convenience and Necessity (CPCN) application for the Alberhill System Project was held open by the CPUC in August 2018 (D.18-08-026).
- The CPUC directed SCE to provide supplemental information on nine specific items, including load forecasting, reliability performance, and project alternatives.
- The Energy Division of the CPUC is currently reviewing the supplemental information in its entirety.

Supplemental Information

Supplemental Information Requested
a) Load forecast including industry accepted methods for estimating load growth and incorporating load reduction programs due to energy efficiency, demand response, and behind-the-meter generation.
b) Identification of all subtransmission planning areas in the SCE system with similar reliability issues.
c) A planning study that supports the project need and includes applicable planning criteria and reliability standards.
d) An analysis of several years of electric reliability performance for the Valley systems to demonstrate existing customer service level.
e) An analysis of outages over the past 5 years by root cause for the Valley South systems in comparison to SCE system average and to other subtransmission radial systems.
f) The forecasted impact of the proposed project on service reliability performance, using electric service reliability metrics where applicable.
g) Cost/benefit analysis of several alternatives for: Enhancing reliability; Providing additional capacity including evaluation of energy storage, distributed energy resources, demand response or smart grid solutions.
h) Identify capital investments or operational changes effectuated to address reliability issues in the absence of construction of Alberhill Substation and associated costs for such actions.
i) Detailed justification of the recommended solution as the best solution, including an explanation of how the proposed project ranks in the SCE capital investment portfolio of infrastructure upgrades.

Package #1 – Data Items & Findings

- Item B - Subtransmission Planning Areas Reliability Issues
  - Valley South System's characteristics make it the most vulnerable SCE systems to future reliability problems which threaten the ability to serve load under expected conditions
- Item D - Past Reliability Performance of Valley South
  - Valley South's reliability performance using SAIDI and SAIFI metrics is not indicative of future reliability performance, nor is the past performance a driver for the Alberhill System Project
- Item E - Outage Root Causes in Valley South
  - Past outages in the Valley South System are driven largely by failures and outages in the distribution system, not the subtransmission system
  - To date, the capacity of the Valley South System has been sufficient to serve customers, but degradation in reliability performance is expected to occur once the transformer capacity margin is eliminated (which is forecasted to occur in 2022)
- Item H - Interim Solutions
  - SCE currently relies on the Valley Substation spare transformer during periods of peak demand (896 MVA)
  - Use of the spare as an interim solution creates Valley North and Valley South system risk as a spare is no longer available for reliability use when it is in-service for capacity
  - Not a viable long-term solution due to electrical system issues that reduce transformers life

Package #2 - Data Items

- Item A - Load forecast including industry accepted methods for estimating load growth and incorporating load reduction programs due to energy efficiency, demand response, and behind-the-meter generation.
- Item C - A planning study that supports the project need and includes applicable planning criteria and reliability standards.
- Item F - The forecasted impact of the proposed project on service reliability performance, using electric service reliability metrics where applicable.
- Item G - Cost/benefit analysis of several alternatives for: Enhancing reliability; Providing additional capacity including evaluation of energy storage, distributed energy resources, demand response or smart grid solutions.
- Item I - Detailed justification of the recommended solution as the best solution, including an explanation of how the proposed project ranks in the SCE capital investment portfolio of infrastructure upgrades.

Item A: Load Forecast

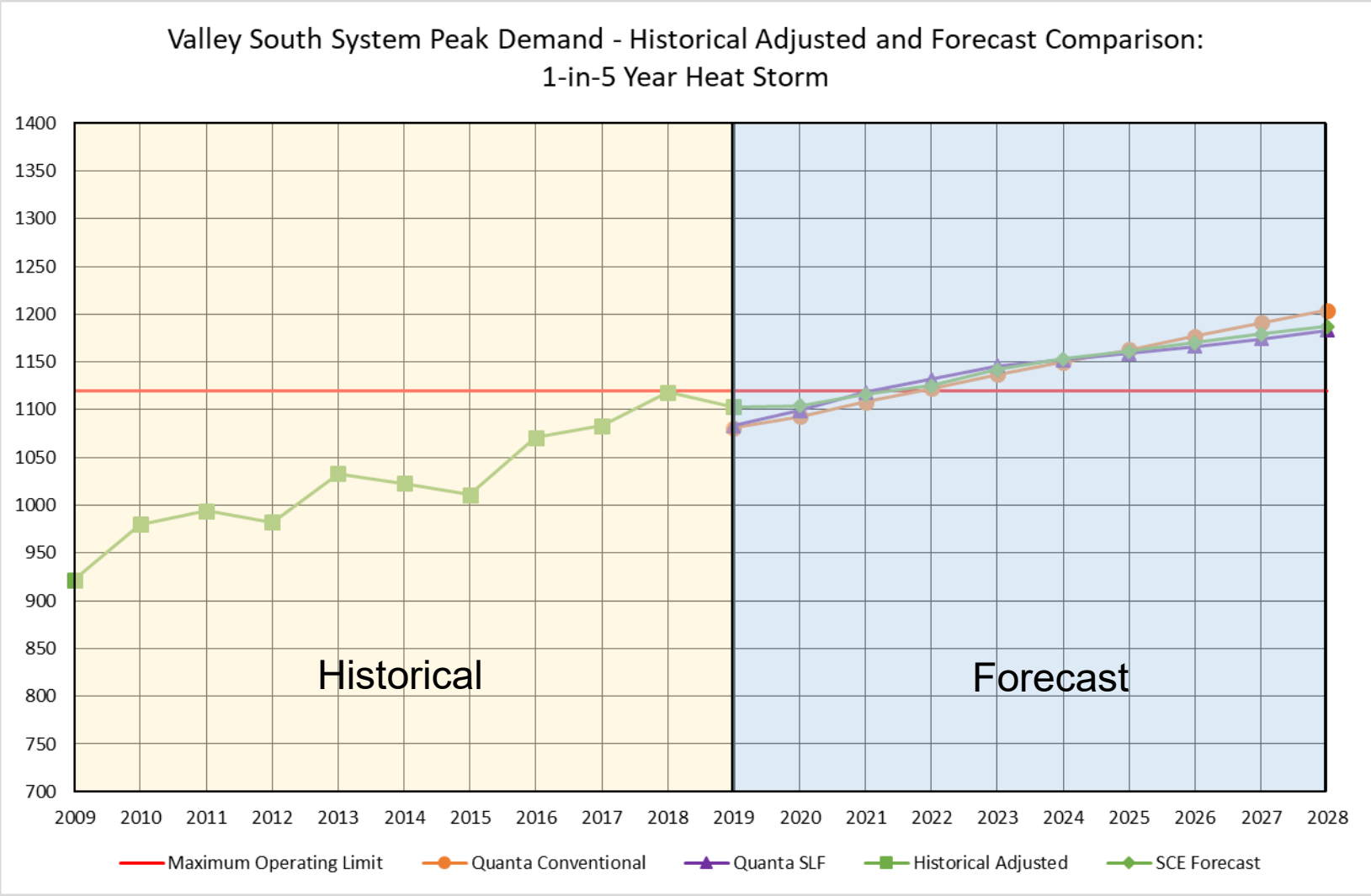
Approach

- SCE provided three forecasts in order to satisfy this data request.
- SCE's forecast for the 10-year period covering 2019-2028 was previously submitted to support the SCE 2021 General Rate Case proceeding.
- Two independent forecasts were performed by Quanta Technology in addition to SCE's 10-year forecast (Conventional Forecast and Spatial Load Forecast).
- DERs incorporated through use of California Energy Commission's (CEC) Integrated Energy Policy Report (IEPR), and industry accepted methodologies for disaggregating DERs into local planning areas

Findings

- The SCE forecast and the Quanta forecasts yield similar results with each showing that the Valley South System peak load, adjusted for a 1-in-5 year heat storm (which is the basis for system planning), will exceed the design capacity in 2022.
- Compound annual growth rates: 0.74% (SCE), 1.09% (Quanta Conventional Forecast), and 0.88% (Quanta Spatial Load Forecast).

Item A: Load Forecast



Item F: Service Reliability Performance

Approach

- Compares the performance of the Valley South System in its current configuration to the performance of the system after implementing the Alberhill System Project using forward-looking, quantitative, and customer-benefit driven metrics.
  - Performance improvements are quantified as reductions in Expected Energy Not Served (EENS), which is the amount of energy that would remain unserved (MW-hrs of customer service interruption) in future planning scenarios due to violations of equipment (e.g., transformer, subtransmission lines) operating ratings.
  - EENS is measured both for normal planning scenarios (i.e., all equipment in service or a single piece of equipment out of service) and beyond-normal planning scenarios (i.e., multiple pieces of equipment out of service).
  - EENS is the primary metric used to derive capacity, reliability and resiliency performance

Findings

- Implementing the Alberhill System Project results in a 97% improvement over the projected Valley South System performance with no project.
  - Through 2028, almost all EENS is addressed by the Alberhill System Project
    - EENS is attributed to beyond-normal planning scenarios, which are not anticipated to be fully addressed by the ASP, or any alternative
  - Through 2048, a significant amount of EENS is addressed
    - None is attributed to transformer capacity overloads; unresolved EENS is mainly due to line overloads, which are straightforwardly addressed by reconductoring
- Improvement driven by meeting capacity need (short term and long term) and effectiveness of system tie-lines in addressing current reliability/resiliency concerns.

Item C: Planning Study

Approach

- Establish the basis for a project in the Valley South System under applicable planning criteria and reliability standards; evaluate a broad range of alternatives to satisfy the electrical need; and recommend the best solution.
- Approach for Item G: Cost Benefit Analysis is embedded into Item C

Key Contents

- Planning Criteria and Process (Section 4.0)
  - Provides context to SCE's planning process, and identifies relevance of guidelines to the Valley South System
  - Alternatives designed to meet planning criteria for at least ten years
- Load Forecast (Section 5.0)
  - Extended 10-year load forecast to 30 years to support a cost-benefit analysis
- Alternatives Development and Screening (Section 6.0)
  - Robust list of twelve alternatives to Alberhill studied in cost-benefit analysis
- Siting and Routing (Section 7.0)
  - Determined preferred substation sites and line routes for cost estimation, risk assessment and environmental impacts
- Cost-Benefit Analysis (Section 8.0)
  - Compared alternative lifecycle costs to monetized system performance benefits based on event probability weighted EENS and SCE GRC value of service study
- Risk Assessment (Section 9.0)
  - Qualitatively compared risks which could impact alternatives' ability to meet project needs or alter their cost-effectiveness

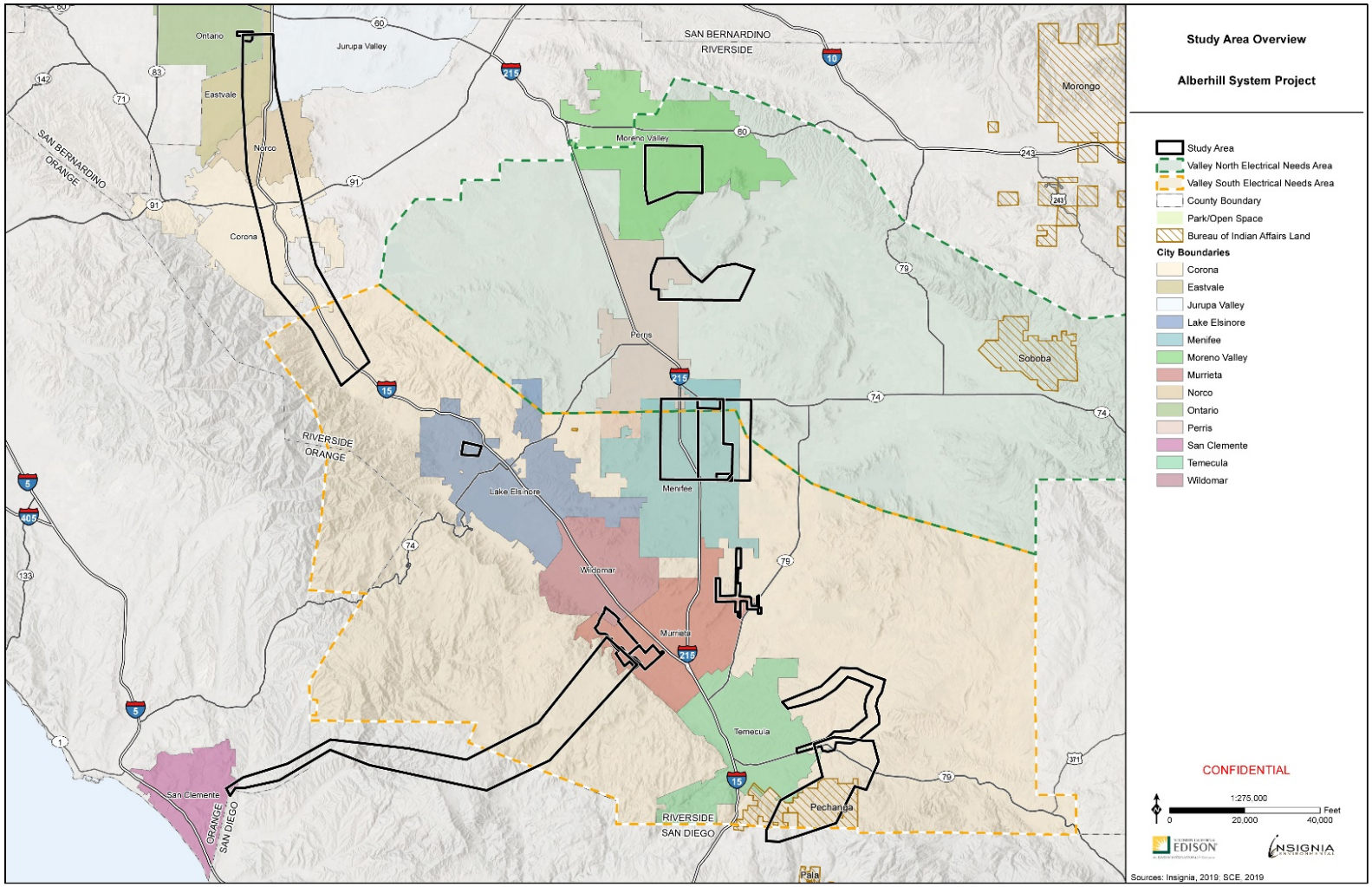
Project Alternatives

- SCE developed a comprehensive list of project alternatives based on a variety of inputs from the CPUC during the Alberhill decision, previous assessment of Alberhill alternatives, public and stakeholder engagement and professional expertise.
- All alternatives were designed to serve load at least through the horizon of the 10-year load forecast in accordance with project objectives.
- Alternatives fall into three categories:
  - Conventional: substation and wires-based solutions with system tie-lines
  - Non-Wires: battery energy storage systems (BESS), as well as the consideration of demand side management (DSM) and other DERs
  - Hybrid: combination of conventional alternatives and non-wires alternatives

Siting and Routing of Alternatives

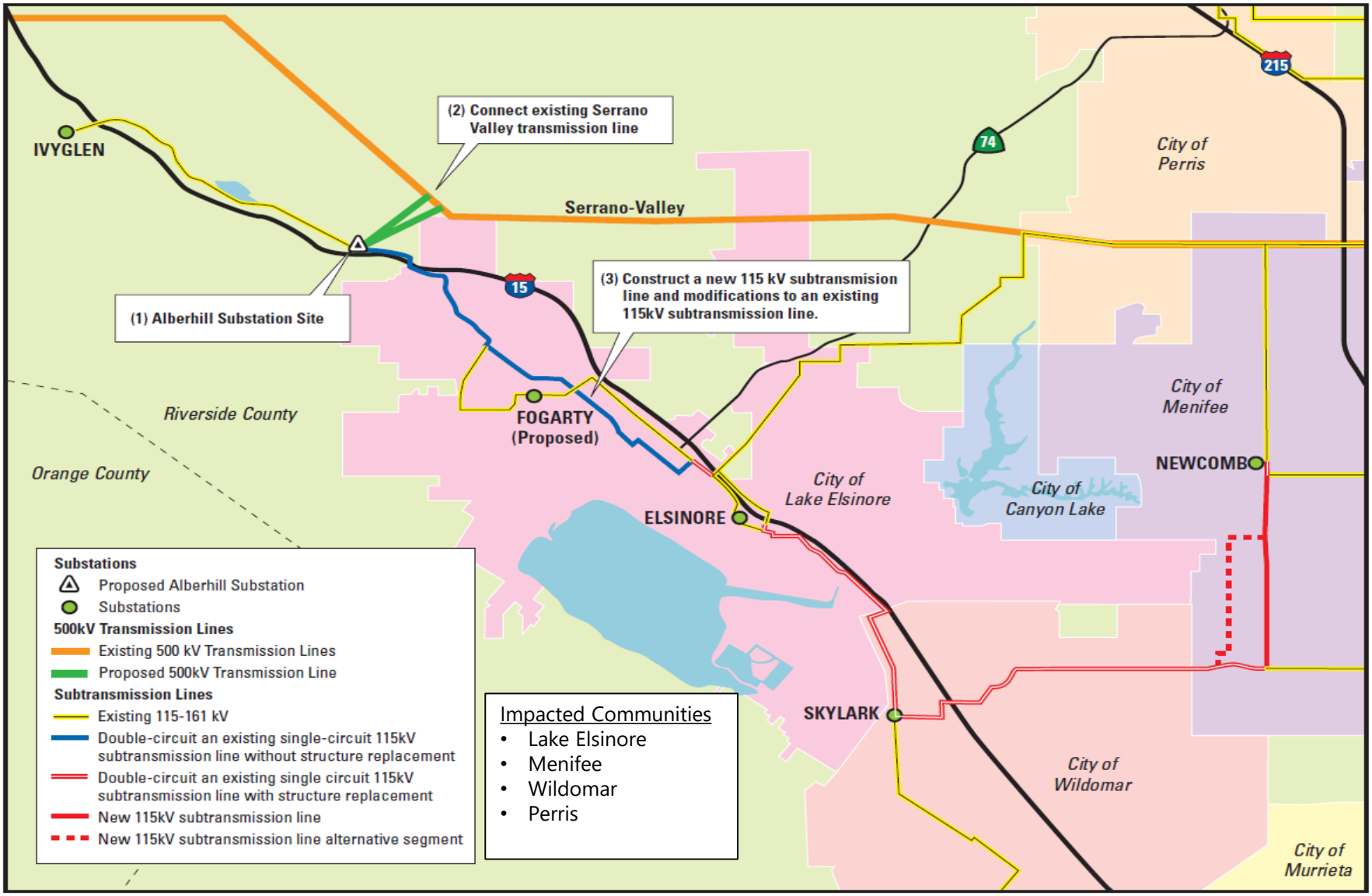
- Siting and routing study was conducted based on SCE's Opportunities, Concerns and Constraints (OCC) methodology.
  - Opportunities - existing SCE right-of-way, SCE-owned property, vacant parcels, industrial land-use designations
  - Concerns – undisturbed land, residential neighborhoods, schools, Tribal land
  - Constraints – Federal property, Habitat Conservation Plan areas, sensitive habitats, airport land-use zones
- A web-based geospatial information system was developed to identify OCCs for each alternative scope element (i.e., substation or BESS site, line route).
- SCE Subject Matter Experts and environmental consultants scored each potential site and route to identify a preferred option.
- The preferred sites and routes were used to assess risk, understand potential environmental impacts and estimate associated costs for each project alternative.

Study Areas for Siting and Routing



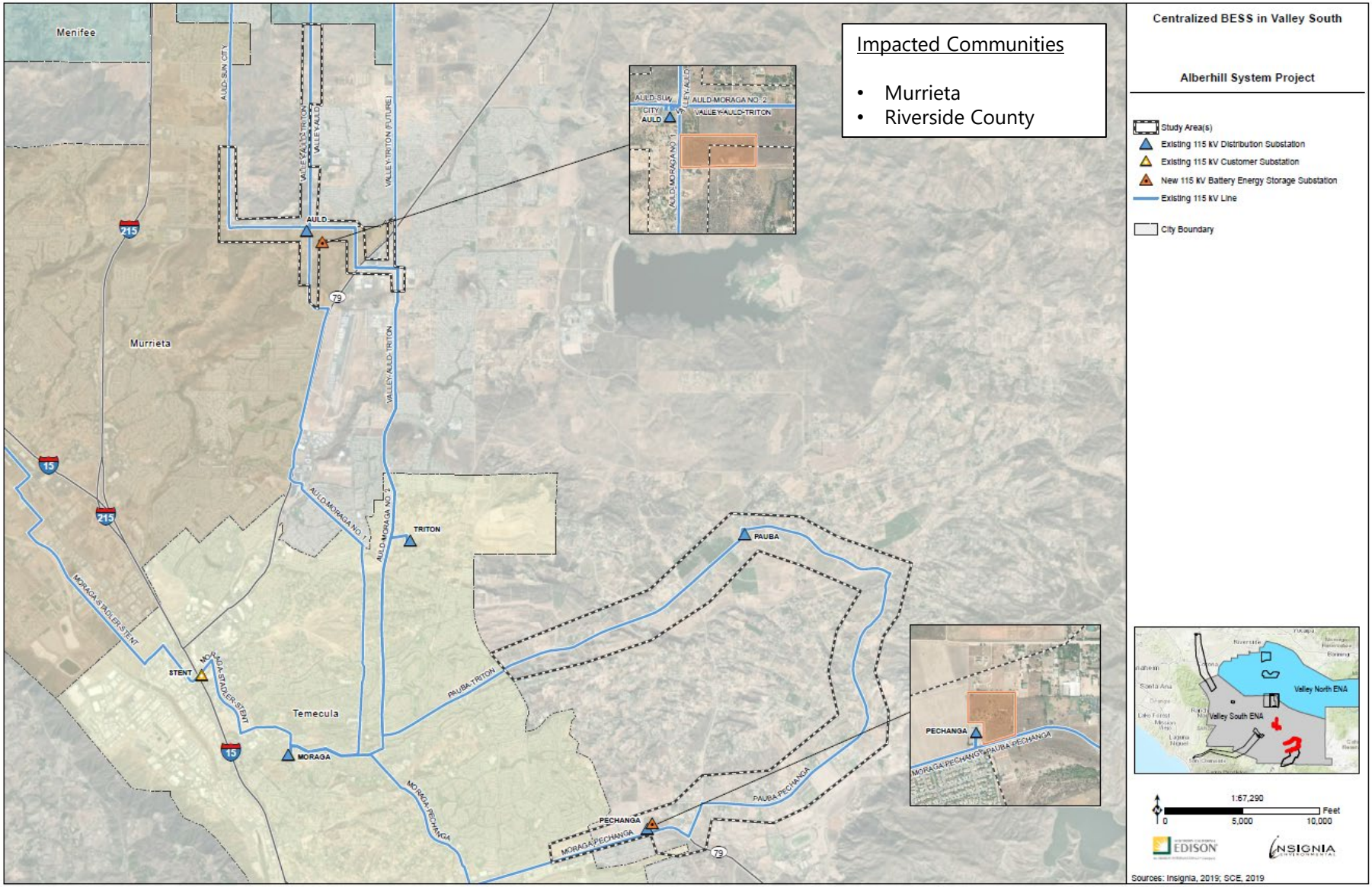
Alberhill System Project

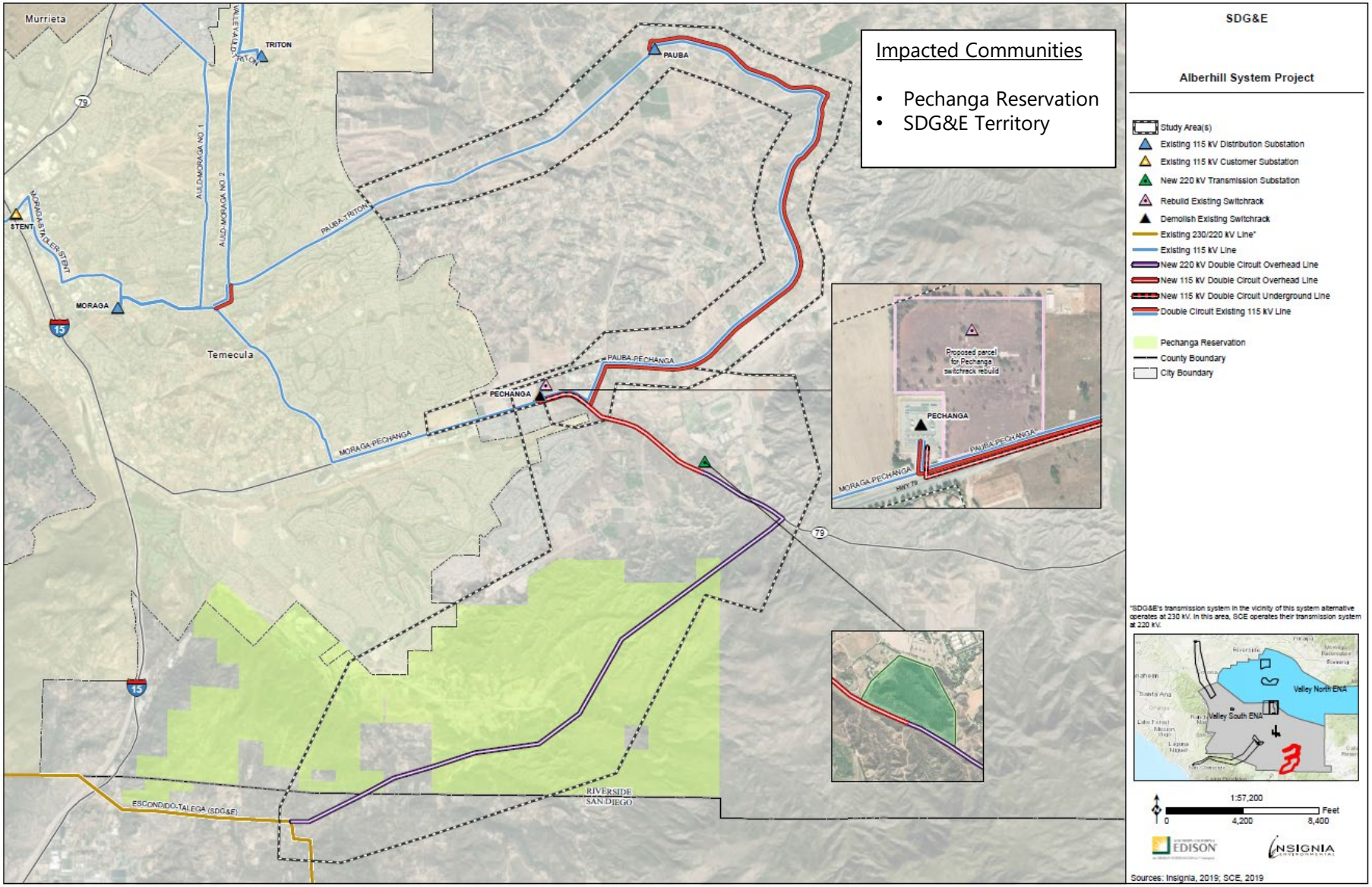
Conventional Solution



Centralized BESS in Valley South

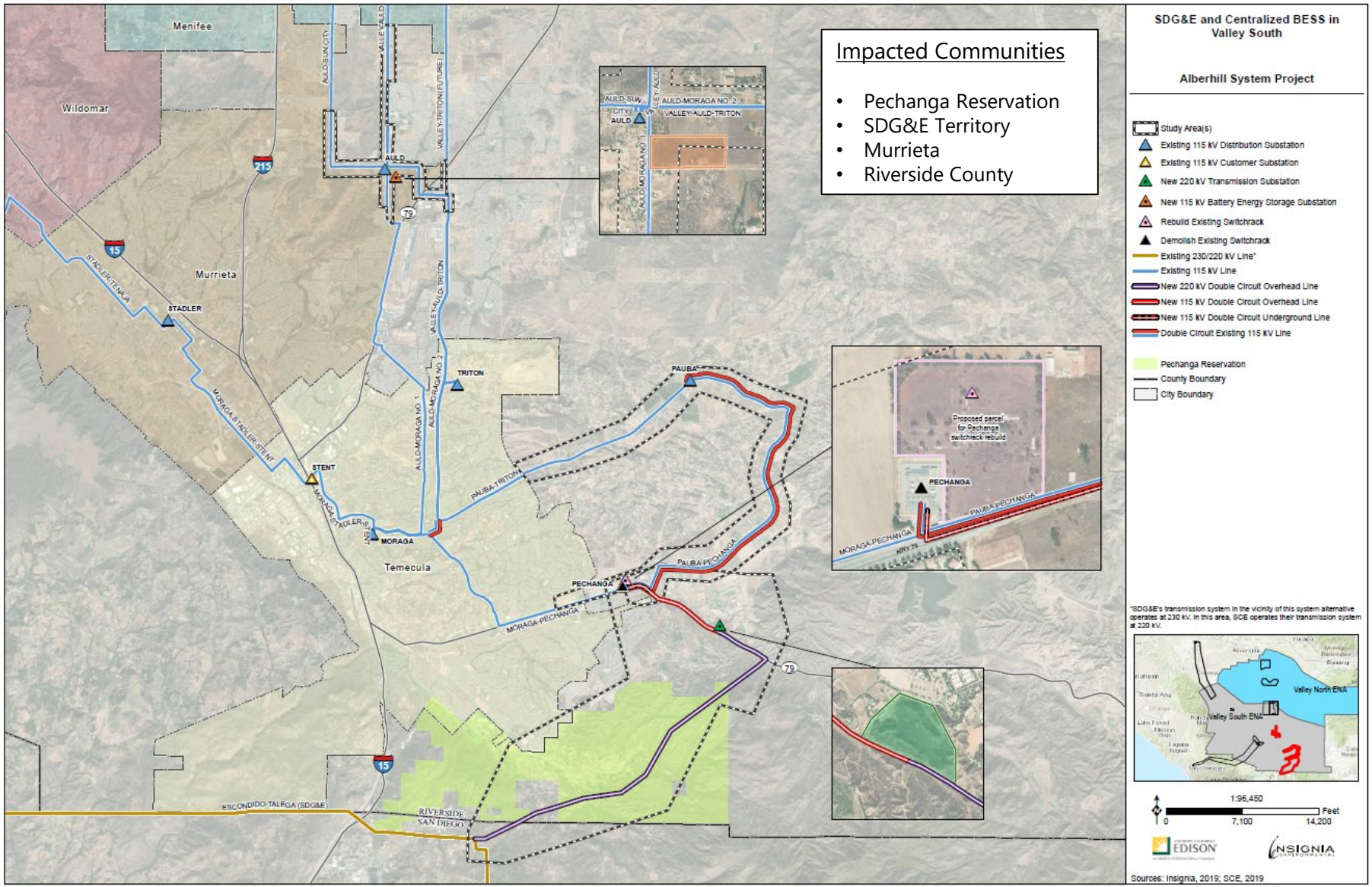
Non-Wires Alternative




Impacted Communities
• Pechanga Reservation
• SDG&E Territory
SDG&E
Alberhill System Project
Study Area(s)
Existing 115 kV Distribution Substation
Existing 115 kV Customer Substation
New 220 kV Transmission Substation
Rebuild Existing Switchrack
Demolish Existing Switchrack
Existing 230/220 kV Line*
Existing 115 kV Line
New 220 kV Double Circuit Overhead Line
New 115 kV Double Circuit Overhead Line
New 115 kV Double Circuit Underground Line
Double Circuit Existing 115 kV Line
Pechanga Reservation
County Boundary
City Boundary
*SDG&E's transmission system in the vicinity of this system alternative operates at 230 kV. In this area, SCE operates their transmission system at 220 kV.
Valley North ENA
Valley South ENA
1:57,200
0
4,200
8,400
Feet
EDISON
INSIGNIA
Sources: Insignia, 2019; SCE, 2019
Murrieta
TRITON
PAUBA
MORAGA
Temecula
PECHANGA
PAUBA-PECHANGA
MORAGA-PECHANGA
PAUBA-TRITON
ESCONDIDO-TALEGA (SDG&E)
RIVERSIDE
SAN DIEGO
Proposed parcel for Pechanga switchrack rebuild
HWY 79

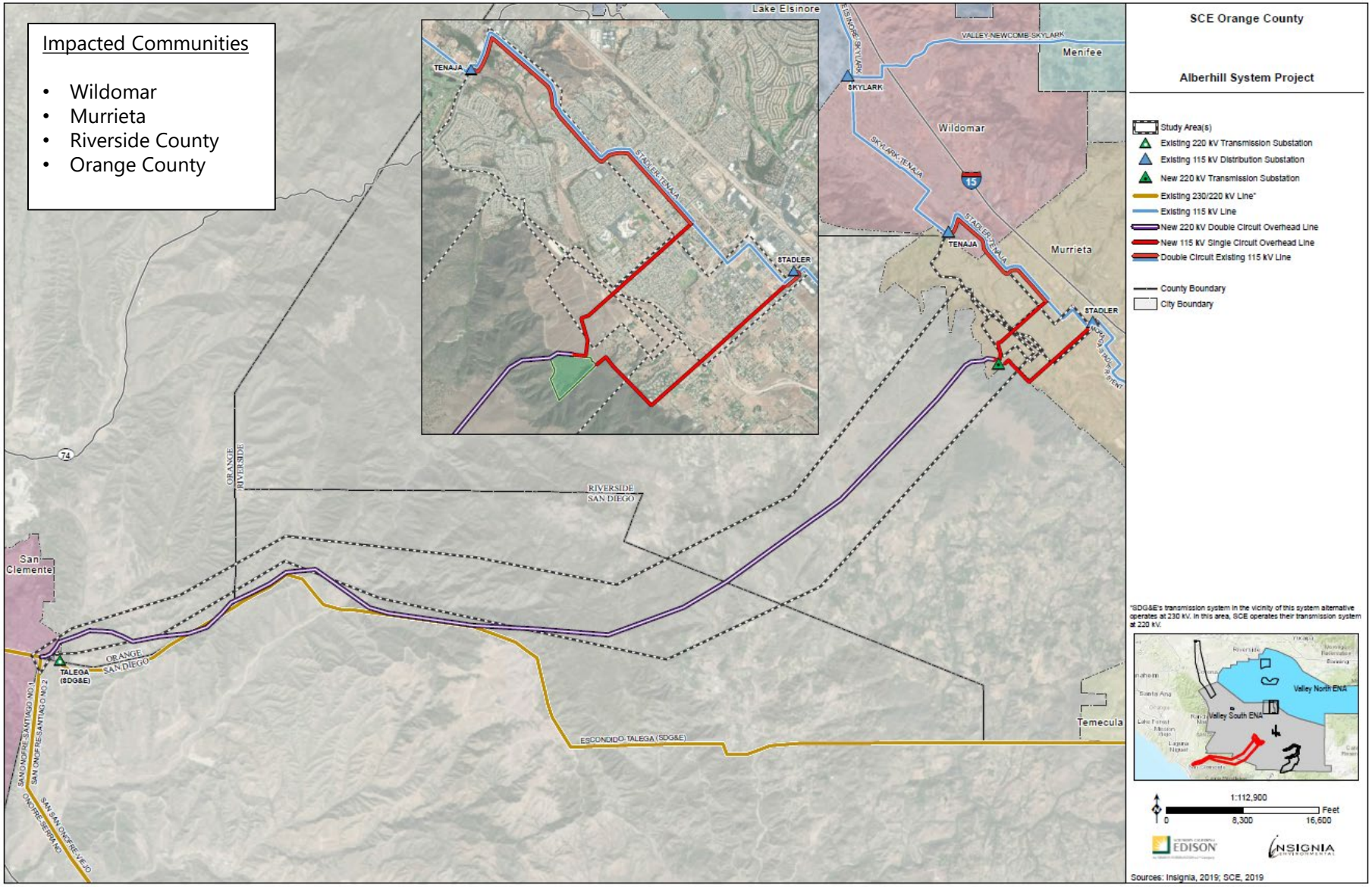
SDG&E and Centralized BESS in Valley South

Hybrid Solution



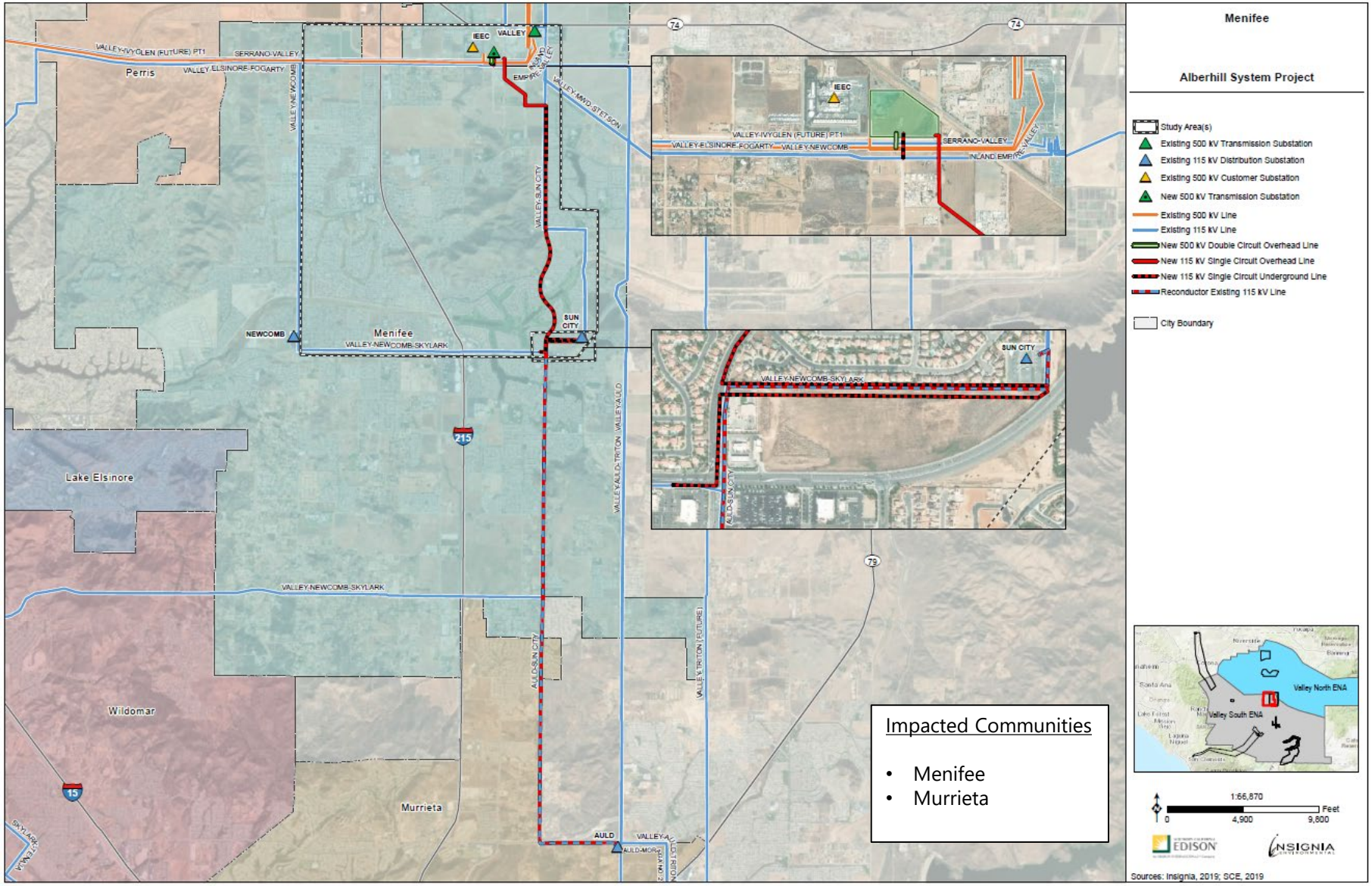
SCE Orange County

Conventional Solution



Menifee

Conventional Solution

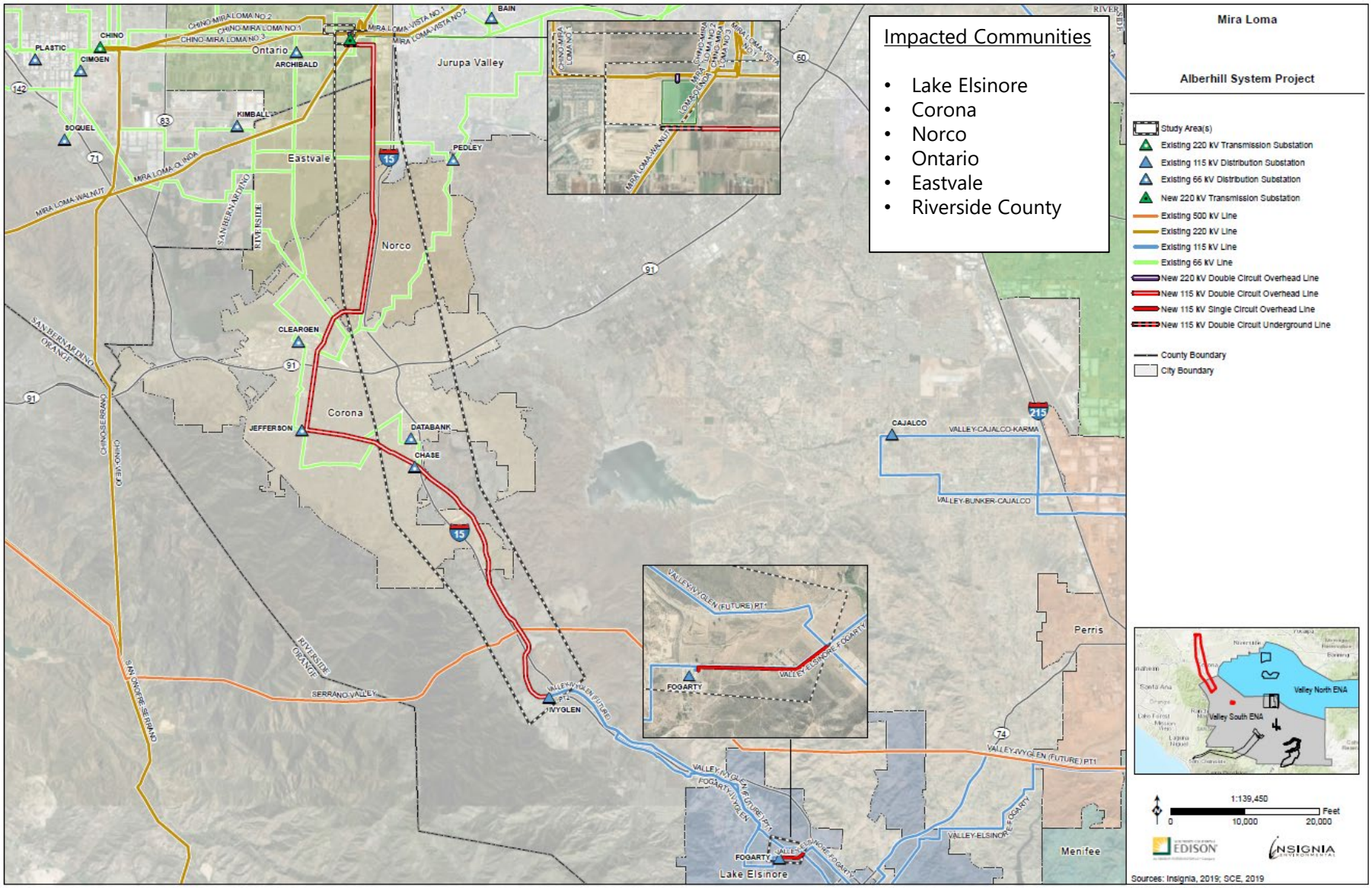


Impacted Communities

- Menifee
- Murrieta

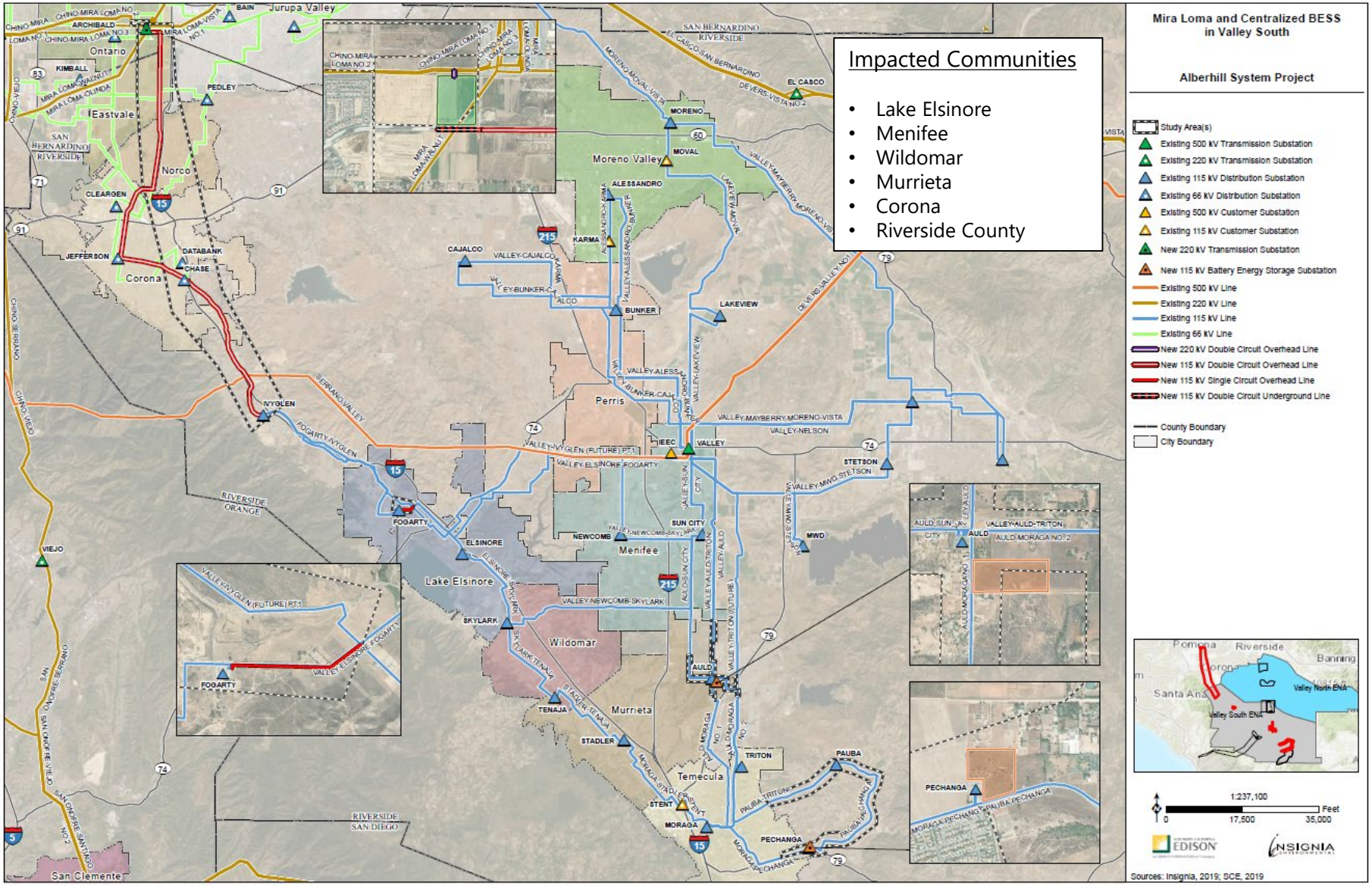
Mira Loma

Conventional Solution



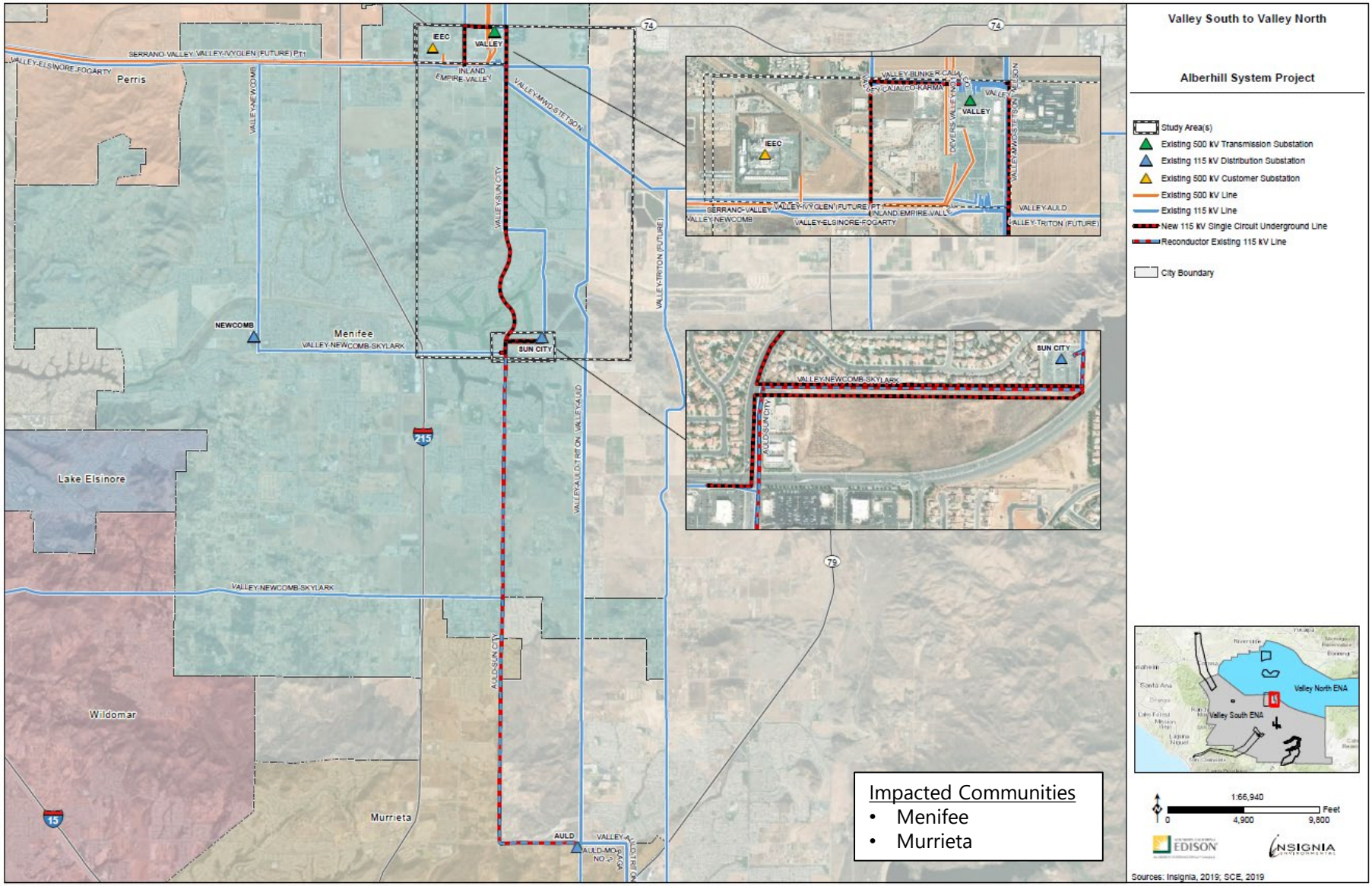
Mira Loma and Centralized BESS in Valley South

Hybrid Solution



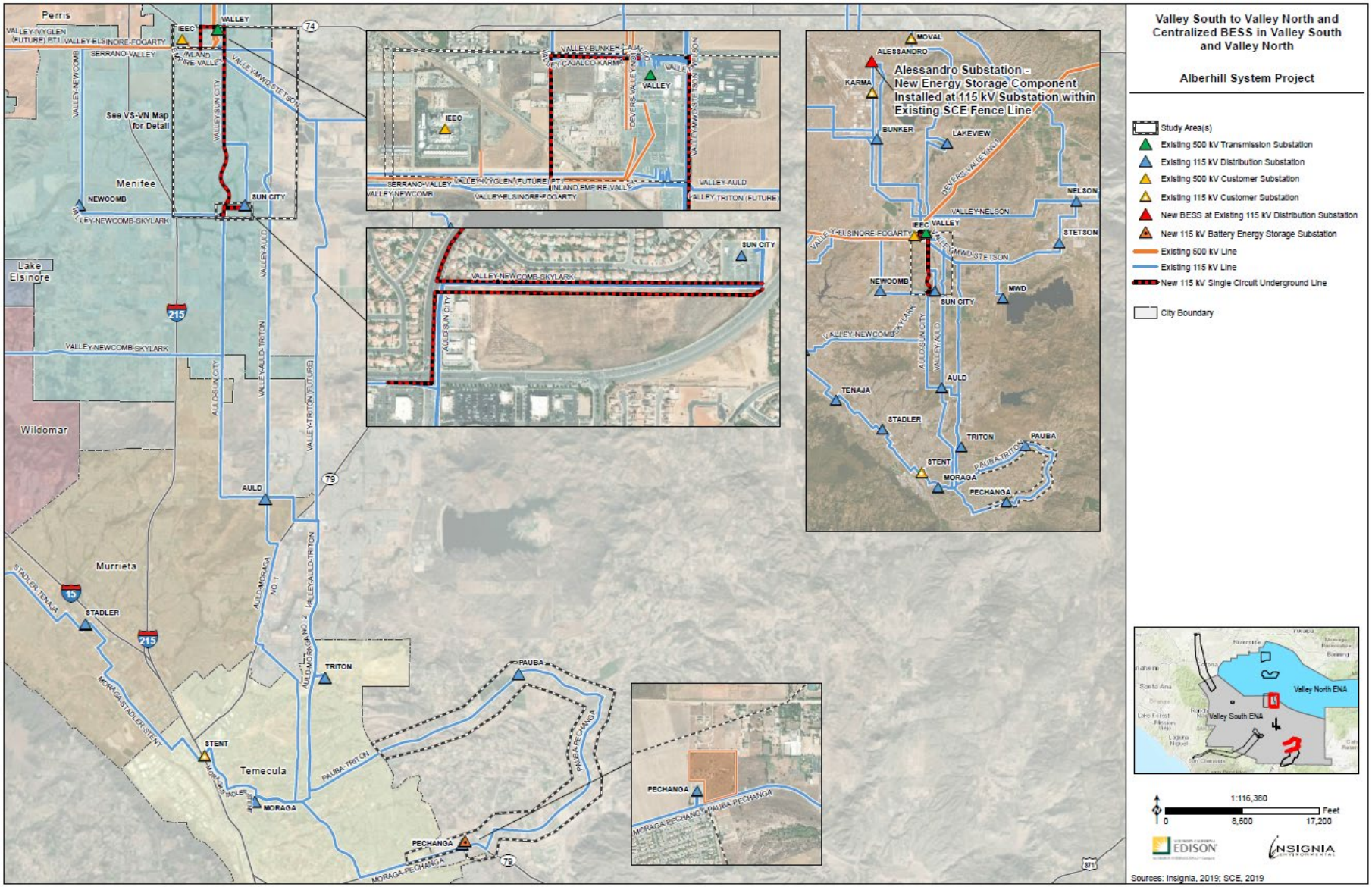
Valley South to Valley North

Conventional Solution



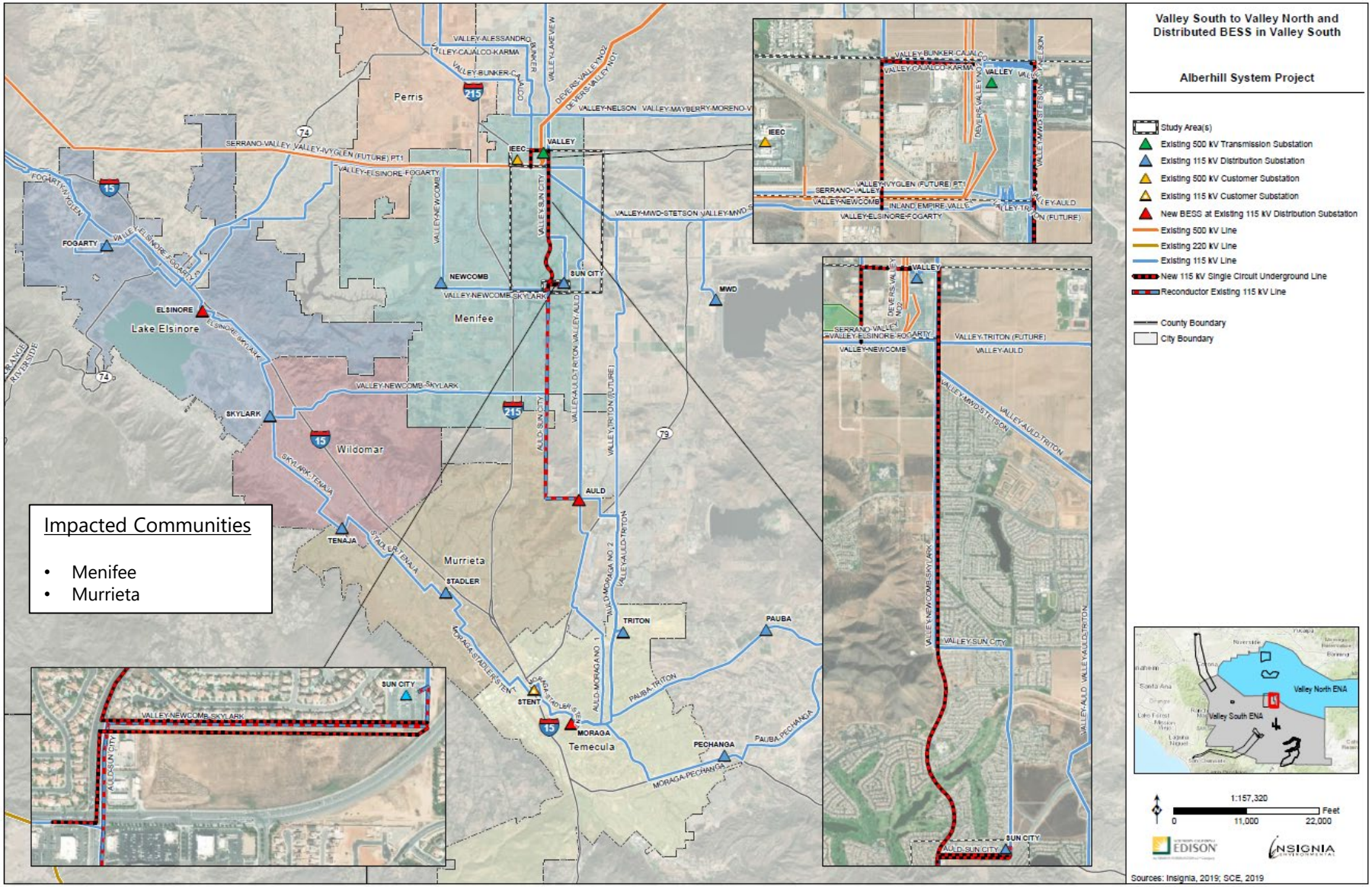
Valley South to Valley North and Centralized BESS in Valley South and Valley North

Hybrid Solution



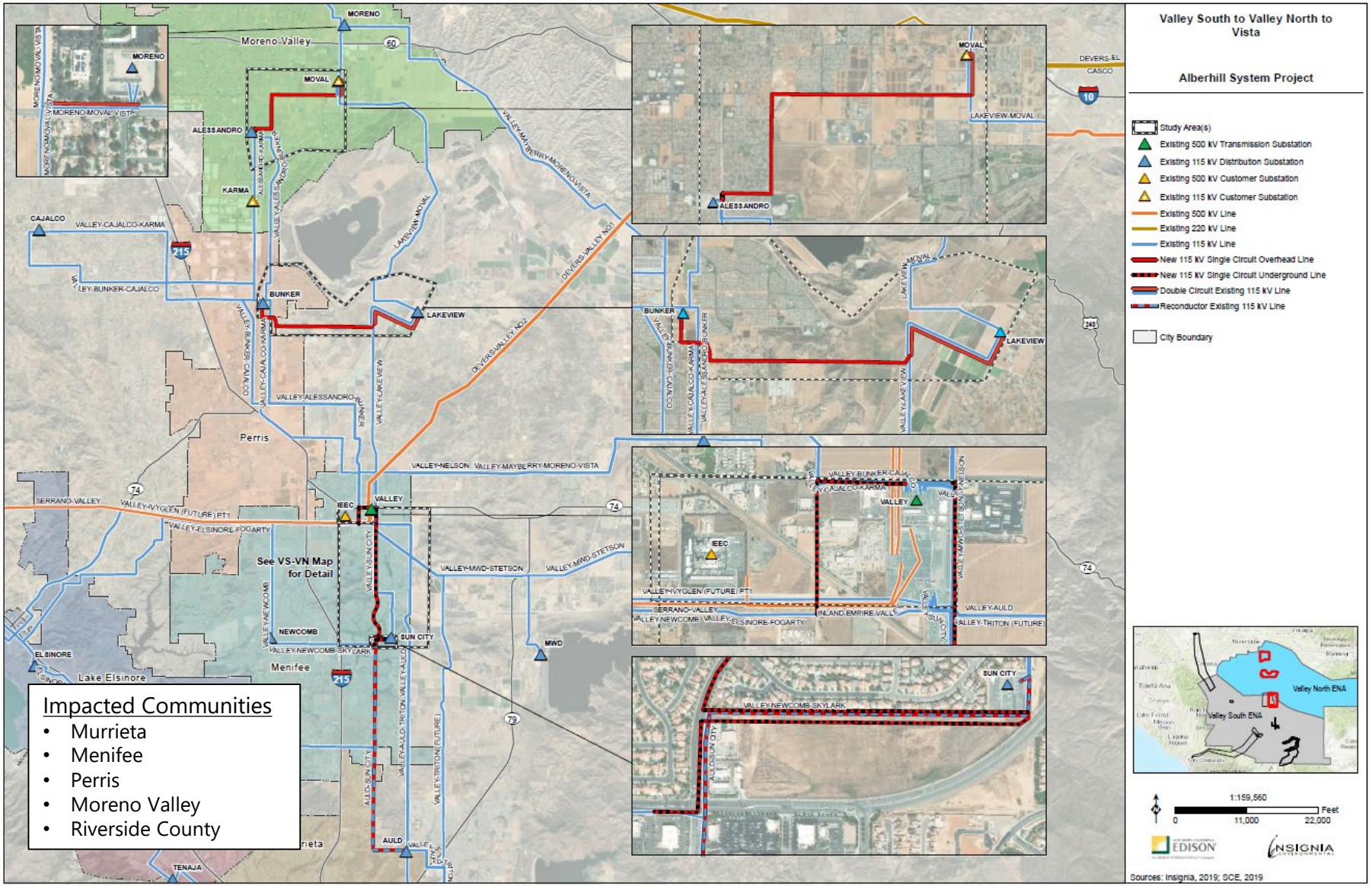
Valley South to Valley North and Distributed BESS in Valley South

Hybrid Solution



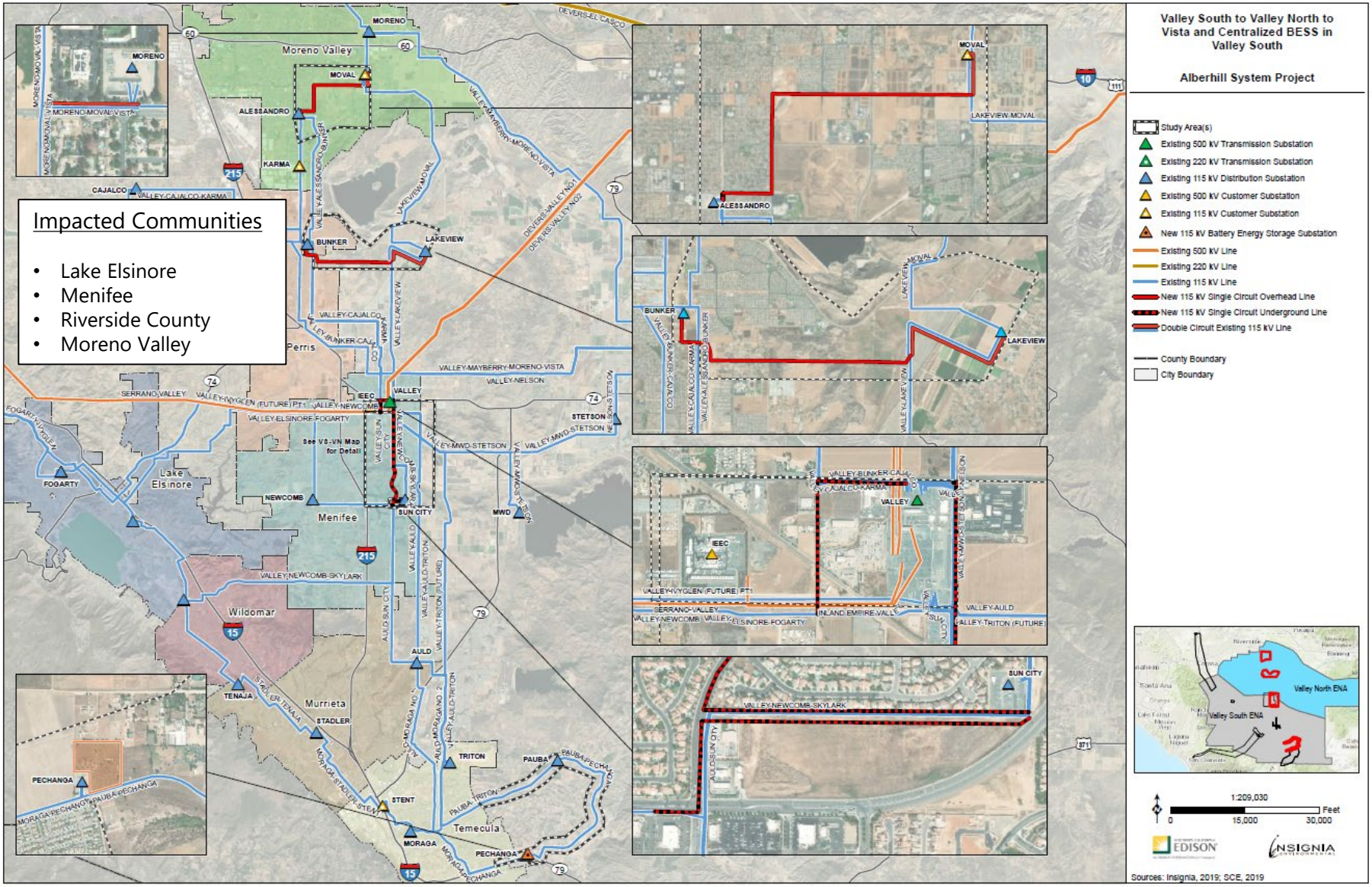
Valley South to Valley North to Vista

Conventional Solution



Valley South to Valley North to Vista and Centralized BESS in Valley South

Hybrid Solution



Costs Estimates and Benefits

- A cost estimate for each alternative was developed, including upfront and future capital costs, as well as recurring operations and maintenance costs
- Cost estimates for each alternative are based on unit cost guides, industry data, and past project cost information for each scope element (e.g., transmission, subtransmission, substation, environmental, real properties, BESS, etc.)
- Benefits of each alternative are a measure of the reduction in outage costs to customers compared to the no project scenario
    - Considers service interruptions that are needed to avoid exceeding capacity limits under normal conditions and probability-weighted equipment failure conditions

Benefit Cost Analysis Results

Alternative	Benefit ($M)	Cost ($M)	Benefit-Cost Ratio
Mira Loma	$3,548	$290	**12.2**
Alberhill System Project	$6,063	$545	**11.1**
Valley South to Valley North	$1,948	$185	**10.5**
Valley South to Valley North and Distributed BESS in Valley South	$2,012	$201	**10.0**
SDG&E and Centralized BESS in Valley South	$4,373	$559	**7.8**
Valley South to Valley North to Vista	$1,988	$270	**7.4**
Valley South to Valley North to Vista and Centralized BESS in Valley South	$2,140	$291	**7.3**
Menifee	$2,262	$315	**7.2**
Mira Loma and Centralized BESS in Valley South	$3,740	$571	**6.6**
SCE Orange County	$5,095	$806	**6.3**
Centralized BESS in Valley South	$3,633	$575	**6.3**
SDG&E	$2,939	$469	**6.3**
Valley South to Valley North and Centralized BESS in Valley South and Valley North	$2,149	$358	**6.0**

Performance Improvements by Alternative

Alternative	Results Through 2028		Results Through 2048	
	Capacity Improvement	Reliability/ Resiliency Improvement	Capacity Improvement	Reliability/ Resiliency Improvement
No Project	0%	0%	0%	0%
Alberhill System Project	100%	97%	98%	96%
SDG&E and Centralized BESS in Valley South	100%	71%	100%	62%
SDG&E	100%	69%	97%	60%
Centralized BESS in Valley South	100%	4%	100%	9%
SCE Orange County	96%	73%	91%	68%
Mira Loma and Centralized BESS in Valley South	92%	39%	97%	41%
Mira Loma	91%	39%	57%	40%
Valley South to Valley North	82%	19%	43%	25%
Valley South to Valley North to Vista	82%	19%	63%	25%
Valley South to Valley North and Distributed BESS in Valley South	82%	19%	49%	26%
Valley South to Valley North and Centralized BESS in Valley South and Valley North	81%	19%	79%	28%
Valley South to Valley North to Vista and Centralized BESS in Valley South	81%	19%	71%	28%
Menifee	80%	61%	72%	54%

Risk Assessment

- A variety of risk factors that could impact the ability of the alternatives to meet project needs or alter their cost effectiveness were studied, including but not limited to:
  - Licensing Delays – project alternatives that have not been through environmental analysis, public engagement, and detailed engineering will experience delays
  - Load Forecast Uncertainty – factors can cause load to deviate from the load forecast, including climate change, cannabis cultivation, enhanced electrification rates, increased DER adoption, etc.
    - Substation-based alternatives and alternatives with system tie-lines performed well under low and high load forecast scenarios
  - Volatility in Peak Load – actual peak load demands vary from year to year; substation-based alternatives with capacity margin best mitigate this risk
  - Impact of Wildfire Mitigation – almost all alternatives include lines in high fire areas; however, the increase in SCE's quantified risk profile for wildfire risk is marginal

Alternatives: Summary of Findings

- Non-Wires Alternatives (NWAs) alone do not meet project objective of creating system tie-lines for reliability/resiliency.
- Alternatives that only transfer load to adjacent systems through system tie-lines are generally lower cost and provide short-term capacity relief (however must be paired with NWAs to address longer term capacity needs and introduce line violations).
    - Effectiveness of system tie-lines for reliability/resiliency varies significantly amongst these alternatives, but is generally less robust than substation-based alternatives, which provide capacity relief through additional transformation capacity and therefore maximize the use of system tie-lines for reliability/resiliency.
- Alternatives that create a new source substation have higher costs but meet long-term capacity needs, have stronger system tie-lines, and are thus more effective in meeting project objectives.
    - Substation based alternatives are also the most effective to address load volatility and load forecast uncertainty, since there is a significant amount of transformation capacity margin
- Implementation risk is higher for new alternatives that have not been subject to extensive design, development, environmental review, and stakeholder engagement.

Item I – Recommended Solution

- The Alberhill System Project is SCE's recommended solution to best address the defined objectives for the project based on a variety of factors:
  - Superior performance in meeting identified capacity, reliability, and resiliency needs of the Valley South System over both near-term and long-term horizons
  - Cost effectiveness in meeting project objectives and improving system performance
  - Mitigation of risks associated with uncertainty and volatility in future load growth
  - Potential for more timely implementation relative to need date
  - Lowest exposure to risk of cost increases through development and design

Question and Answer Session

In addition to responses provided today, written responses will be provided on SCE's Alberhill System Project webpage:

www.sce.com/alberhill

A notification will be sent once responses are available.