The Reliability and Markets (R&M) Committee is expected to consider R&M Committee Agenda Item 6.1:

AEPSC Brownsville Area Improvements Transmission Project

at its meeting on December 2, 2024.

The Board of Directors is expected to hear the R&M Committee's recommendation on this matter at the Board meeting on December 3, 2024.

Attached are the Board materials in relation to these agenda items.

Item 6.1: AEPSC Brownsville Area Improvements Transmission Regional Planning Group (RPG) Project

Kristi Hobbs
Vice President, System Planning and Weatherization

Reliability and Markets Committee Meeting

ERCOT Public
December 2, 2024

Reliability and Markets Committee Request

- **Purpose**
  - Provide an overview of the $423.8 million AEPSC Brownsville Area Improvements Transmission Tier 1 Reliability Project.

- **Voting Items / Requests**
  - ERCOT staff requests and recommends that the Reliability and Markets (R&M) Committee recommend that the Board of Directors (Board):
    1. Endorse the AEPSC Brownsville Area Improvements Transmission Regional Planning Group (RPG) Project based on NERC and ERCOT reliability planning criteria.

Key Takeaways:

- The AEPSC Brownsville Area Improvements Transmission Project is a Tier 1 project requiring Board consideration for endorsement, following a recommendation by the R&M Committee.
- The Project has completed RPG review and received an independent assessment from ERCOT staff and unanimous endorsement by the Technical Advisory Committee (TAC).
- ERCOT studied several options and recommends Option 2A as it addressed the reliability violations, is the least cost solution and improves long-term load-serving capability into Brownsville area in Cameron County.

Tier 1 Project Requirement

- ERCOT Protocol Section 3.11.4, Regional Planning Group Project Review Process, defines the level of transmission projects that require Board consideration
  - Projects with an estimated capital cost of $100 Million or greater are Tier 1 projects (3.11.4.3)
  - Tier 1 projects require Board endorsement (3.11.4.7)
  - ERCOT shall present Tier 1 projects to TAC for review and comment; and comments from TAC shall be included in the presentation to the Board (3.11.4.9)
- Pursuant to R&M Committee Charter Section IV(B)(2)(a)
  - R&M Committee's duties include reviewing and making recommendations to the Board regarding any Tier 1 project

Key Takeaway: The AEPSC Brownsville Area Improvements Transmission Project is a Tier 1 project requiring Board consideration for endorsement, with prior review and recommendation by the R&M Committee.

AEPSC Brownsville Area Improvements Transmission Project

- AEPSC submitted AEPSC Brownsville Area Improvements Transmission Project for RPG review in March 2024
- The purpose of the project is to address the reliability needs in the Brownsville area in Cameron County
- ERCOT performed an independent review of the project and identified thermal and voltage violations in the Brownsville area in Cameron County
- ERCOT's endorsement of the project is based on the reliability need to relieve thermal overloads on 105.9 miles of 138-kV transmission lines, one 345/138-kV transformer and 1 voltage violation in the Brownsville area in Cameron County to meet ERCOT reliability planning criteria
- ERCOT presented the project to TAC on October 30, 2024
  - TAC voted unanimously to endorse the project (Option 2A from the ERCOT review)

Key Takeaway: The AEPSC Brownsville Area Improvements Transmission Project has completed RPG review and received unanimous endorsement by TAC.

Basis for ERCOT Board Endorsement

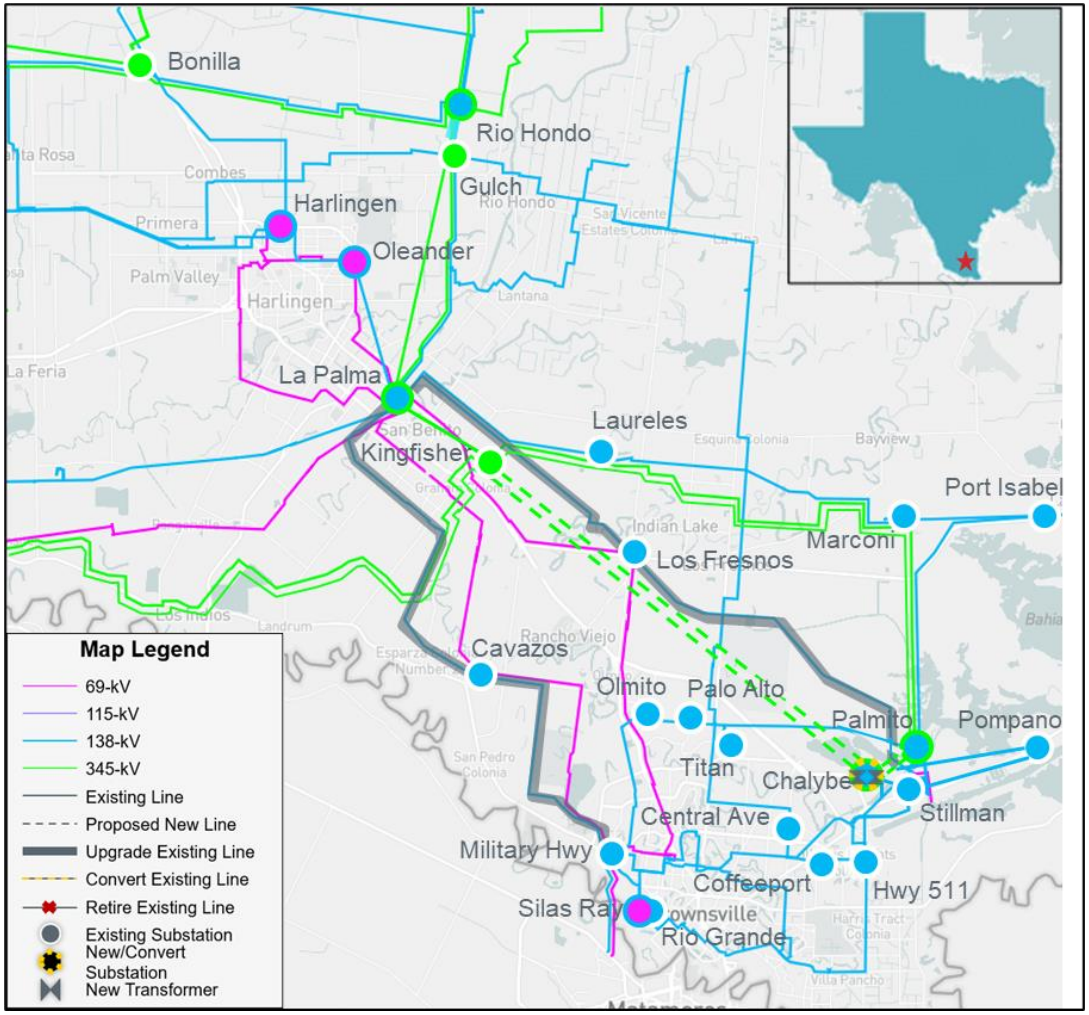
- ERCOT's independent review identified a reliability need for the AEPSC Brownsville Area Improvements Transmission Project to satisfy:
  - NERC TPL-001-5.1 Table 1 Reliability Criteria for category:
    - P1 contingency, loss of a single transmission element
    - P3 contingency, loss of generating unit followed by a single transmission element
    - P6-2 contingency, loss of a transformer followed by a single transmission element
    - P7 contingency, loss of a common tower
  - ERCOT Planning Guide Section Reliability Performance Criteria contingency:
    - 4.1.1.2(1)(a): The contingency is a loss of a common tower
    - 4.1.1.2(1)(c): The contingency is a loss of a single generating unit followed by a single transmission element or common tower outage
    - 4.1.1.2(1)(d): The contingency is a loss of a single 345/138-kV transformer followed by a single transmission element or common tower outage

Key Takeaway: The AEPSC Brownsville Area Improvements Transmission Project is needed to meet reliability under NERC and ERCOT Planning Guide criteria.

Request for Committee Vote

ERCOT staff requests and recommends that the R&M Committee recommend that the Board:

- Endorse the need for the AEPSC Brownsville Area Improvements Transmission Project (Option 2A) based on NERC and ERCOT reliability planning criteria



Appendix

ERCOT Recommendation

ERCOT recommends Option 2A from the ERCOT review of the AEPSC project to:

- Expand the planned Chalybe 138-kV substation to install a new 345-kV ring-bus arrangement, with two 345/138-kV autotransformers with normal and emergency ratings of at least 675 MVA;
- Construct a new Chalybe to Kingfisher 345-kV double-circuit transmission line with normal and emergency ratings of at least 2668 MVA per circuit, on a new ROW, approximately 22.0-mile;
- Construct a new Chalybe to Palmito 345-kV double-circuit transmission line with normal and emergency ratings of at least 2668 MVA per circuit, on a new ROW, approximately 2.0-mile;
- Construct a new Chalybe to Stillman 138-kV single-circuit transmission line with normal and emergency ratings of at least 987 MVA, on a new ROW, approximately 2.0-mile;
- Rebuild the existing La Palma to Fresno 138-kV single-circuit transmission line with normal and emergency ratings of at least 535 MVA, approximately 10.3-mile;
- Rebuild the existing Fresno to Stillman 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 12.0-mile;

ERCOT Recommendation (continued)

ERCOT recommends Option 2A from the ERCOT review of the AEPSC project to:

- Rebuild the existing Military to Villa Cavazos 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 10.0-mile;
- Rebuild the existing La Palma to Villa Cavazos 138-kV single-circuit transmission line with normal and emergency ratings of at least 535 MVA, approximately 12.2-mile; and
- Expand the planned Chalybe 138-kV substation to install two +/-150 MVAr STATCOMs.

Key Takeaway: ERCOT studied several options and recommends Option 2A to address the reliability violations, is the least cost solution and improves long-term load-serving capability into the Brownsville area in Cameron County.

Date: November 21, 2024
To: Board of Directors
From: Julie England, Reliability and Markets (R&M) Committee Chair
Subject: American Electric Power Service Corporation (AEPSC) Brownsville Area Improvements Transmission Regional Planning Group (RPG) Project

Issue for the ERCOT Board of Directors

ERCOT Board of Directors Meeting Date: December 3, 2024
Item No.: 10.3.1

Issue:
Whether the Board of Directors (Board) of Electric Reliability Council of Texas, Inc. (ERCOT) should accept the recommendation of ERCOT staff to: (1) endorse the need for the Tier 1 American Electric Power Service Corporation (AEPSC) Brownsville Area Improvements Transmission Regional Planning Group (RPG) Project in order to meet the reliability requirements for the ERCOT System and address thermal and voltage violations in Brownsville area in Cameron County, which ERCOT staff has independently reviewed and which the Technical Advisory Committee (TAC) has voted unanimously to endorse.

Background/History:
AEPSC proposed the Brownsville Area Improvements Transmission Project in March 2024, a $387.7 million, Tier 1 project with the expected in-service date of May 2027, to meet reliability planning criteria in the Brownsville area in Cameron County. Protocol Section 3.11.4.7, Processing of Tier 1 Projects, requires ERCOT to independently review submitted projects. ERCOT performed an independent review of the AEPSC Brownsville Area Improvements Transmission Project and identified thermal and voltage violations in the Brownsville area in Cameron County. The ERCOT project recommendation (Option 2A), a $423.8 million, Tier 1 project with the expected in-service date of May 2029 addresses the need for a project under NERC and ERCOT Planning Criteria to address thermal overloads on 105.9 miles of 138-kV transmission lines, one 345/138-kV transformer and 1 voltage violation in Cameron County with the following ERCOT System improvements:

- Expand the planned Chalybe 138-kV substation to install a new 345-kV ring-bus arrangement, with two 345/138-kV autotransformers with normal and emergency ratings of at least 675 MVA;
- Construct a new Chalybe to Kingfisher 345-kV double-circuit transmission line with normal and emergency ratings of at least 2668 MVA per circuit, on a new ROW, approximately 22.0-mile;
- Construct a new Chalybe to Palmito 345-kV double-circuit transmission line with normal and emergency ratings of at least 2668 MVA per circuit, on a new ROW, approximately 2.0-mile;

- Construct a new Chalybe to Stillman 138-kV single-circuit transmission line with normal and emergency ratings of at least 987 MVA, on a new ROW, approximately 2.0-mile;
- Rebuild the existing La Palma to Fresno 138-kV single-circuit transmission line with normal and emergency ratings of at least 535 MVA, approximately 10.3-mile;
- Rebuild the existing Fresno to Stillman 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 12.0-mile;
- Rebuild the existing Military to Villa Cavazos 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 10.0-mile;
- Rebuild the existing La Palma to Villa Cavazos 138-kV single-circuit transmission line with normal and emergency ratings of at least 535 MVA, approximately 12.2-mile; and
- Expand the planned Chalybe 138-kV substation to install two +/-150 MVAr STATCOMs.

For construction to meet the May 2029 in-service date, the AEPSC Brownsville Area Improvements Transmission Project (Option 2A) requires Public Utility Commission of Texas (PUCT, Commission) approval of a Certificate of Convenience and Necessity. AEPSC will work with ERCOT as early as practical to develop outage plans needed for construction and implement Constraint Management Plans (CMP) based on expected operational conditions for the time period when construction outages are planned.

ERCOT's independent review verified the reliability need for the AEPSC Brownsville Area Improvements Transmission Project to satisfy ERCOT Planning Guide Section 4.1.1.2(1)(a), 4.1.1.2(1)(c), 4.1.1.2(1)(d), Reliability Performance Criteria, contingencies are the loss of a common tower, the loss of a single generating unit followed by a single transmission element or common tower outage, and the loss of a single 345/138-kV transformer followed by a single transmission element or common tower outage, respectively.

RPG considered project overviews during meetings in June 2024 and September 2024. Between June 2024 and September 2024, ERCOT staff presented scope and status updates at RPG meetings in June, July, August, and September. Pursuant to paragraph (2) of Protocol Section 3.11.4.9, Regional Planning Group Acceptance and ERCOT Endorsement, ERCOT presented the Tier 1 project to the Technical Advisory Committee (TAC) for review and comment, and on October 30, 2024, TAC unanimously endorsed the project as recommended by ERCOT. Pursuant to paragraph (1)(a) of Protocol Section 3.11.4.3, Categorization of Proposed Transmission Projects, projects with an estimated capital cost of $100 million or greater are Tier 1 projects, for which Protocol Section 3.11.4.7(2) requires endorsement by the Board. Pursuant to Section 3.11.4.9, ERCOT's endorsement of a Tier 1 project is obtained upon affirmative vote of

the Board. Section IV(B)(2)(a) of the R&M Committee Charter requires the R&M Committee to review and make a recommendation to the Board regarding any Tier 1 project.

ERCOT's assessment of the Sub-Synchronous Resonance (SSR) of existing facilities in Cameron County in the South Weather Zone, conducted pursuant to Protocol Section 3.22.1.3, Transmission Project Assessment, yielded no adverse SSR impacts to the existing and planned generation resources at the time of the study. Results of the congestion analysis ERCOT conducted pursuant to Planning Guide Section 3.1.3, Project Evaluation, indicate new congestion in the area with the addition of the AEPSC Brownsville Area Improvements Transmission Project (Option 2A). Upgrading the new congested line did not yield sufficient economic benefit and therefore was not recommended for upgrade as part of this project.

The project completion date is subject to change based on customer changes and the CCN process. If any long-term issues are identified regarding the outages necessary to rebuild the 138-kV transmission lines, Constraint Management Plans (CMP) will be developed as needed.

The report describing the ERCOT Independent Review of the AEPSC Brownsville Area Improvements Transmission Project (Option 2A), including ERCOT staff's recommendation, is attached as ***Attachment A***.

Key Factors Influencing Issue:

1. ERCOT System improvements are needed to meet reliability planning criteria for Cameron County in the South Weather Zone.
2. ERCOT staff found the recommended set of improvements to be the most efficient solution for meeting the planning reliability criteria and addressing thermal overloads and voltage violations.
3. Protocol Section 3.11.4.7 requires Board endorsement of a Tier 1 project, which is a project with an estimated capital cost of $100 million or greater pursuant to Protocol Section 3.11.4.3(1)(a).
4. TAC voted unanimously to endorse the Tier 1 AEPSC Brownsville Area Improvements Transmission Regional Planning Group (RPG) Project (Option 2A), as recommended by ERCOT, on October 30, 2024.

Conclusion/Recommendation:

ERCOT staff recommends, and the R&M Committee is expected to recommend, that the Board endorse the need for the Tier 1 AEPSC Brownsville Area Improvements Transmission RPG Project (Option 2A), which ERCOT staff has independently reviewed, and which TAC has voted unanimously to endorse based on ERCOT reliability planning criteria.

ELECTRIC RELIABILITY COUNCIL OF TEXAS, INC.
BOARD OF DIRECTORS RESOLUTION

WHEREAS, pursuant to Section 3.11.4.3(1)(a) of the Electric Reliability Council of Texas, Inc. (ERCOT) Protocols, projects with an estimated capital cost of $100 million or greater are Tier 1 projects, for which Section 3.11.4.7 requires endorsement by the ERCOT Board of Directors (Board); and

WHEREAS, after due consideration of the alternatives, the Board deems it desirable and in the best interest of ERCOT to accept ERCOT staff's and the and Reliability and Markets (R&M) Committee's recommendations to endorse the need for the Tier 1 AEPSC Brownsville Area Improvements Transmission Regional Planning Group Project (Option 2A), which ERCOT staff has independently reviewed and which the Technical Advisory Committee (TAC) has voted to endorse based ERCOT reliability planning criteria;

THEREFORE, BE IT RESOLVED, that the Board hereby endorses the need for the Tier 1 AEPSC Brownsville Area Improvements Transmission Regional Planning Group Project (Option 2A), which ERCOT staff has independently reviewed, and which TAC has voted to endorse based on ERCOT reliability planning criteria.

CORPORATE SECRETARY'S CERTIFICATE

I, Chad V. Seely, Corporate Secretary of ERCOT, do hereby certify that, at its December 3, 2024 meeting, the Board passed a motion approving the above Resolution by _____.

IN WITNESS WHEREOF, I have hereunto set my hand this ___ day of December, 2024.

_____
Chad V. Seely
Corporate Secretary

ERCOT Independent Review of the AEPSC Brownsville Area Improvements Transmission Project

Document Revisions

Date	Version	Description	Author(s)
09/27/2024	1.0	Final Draft	Caleb Holland
		Reviewed by	Robert Golen, Prabhu Gnanam

Executive Summary

American Electric Power Service Corporation (AEPSC) submitted the Brownsville Area Improvements Transmission Project to the Regional Planning Group (RPG) in March 2024. AEPSC proposed this project to address thermal overloads and voltage violations in the Brownsville area upon addition of new large load. The project is located in Cameron County in the South Weather Zone.

The AEPSC proposed project was estimated to cost $387.7 Million and was classified as a Tier 1 project per ERCOT Protocol Section 3.11.4.3. The proposed project will require a Certificate of Convenience and Necessity (CCN) application.

ERCOT performed an Independent Review and confirmed a need for the project under P1 (N-1) conditions.

The ERCOT Independent Review (EIR) evaluated ten different transmission project options. Based on the study results described in the Section 5 and 6 of this report, ERCOT recommends the following option (Option 2A) to address the reliability issues mentioned above. Option 2A consists of the following:

- Expand the existing Chalybe 138-kV substation to install a new 345-kV ring-bus arrangement, with two 345/138-kV autotransformers with normal and emergency ratings of at least 675 MVA;
- Construct a new Chalybe to Kingfisher 345-kV double-circuit transmission line with normal and emergency ratings of at least 2668 MVA per circuit, on a new right of way (ROW), approximately 22.0-mile;
- Construct a new Chalybe to Palmito 345-kV double-circuit transmission line with normal and emergency ratings of at least 2668 MVA per circuit, on a new ROW, approximately 2.0-mile;
- Construct a new Chalybe to Stillman 138-kV single-circuit transmission line with normal and emergency ratings of at least 987 MVA, on a new ROW, approximately 2.0-mile;
- Rebuild the existing La Palma to Fresno 138-kV single-circuit transmission line with normal and emergency ratings of at least 535 MVA, approximately 10.3-mile;
- Rebuild the existing Fresno to Stillman 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 12.0-mile;
- Rebuild the existing Military to Villa Cavazos 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 10.0-mile;
- Rebuild the existing La Palma to Villa Cavazos 138-kV single-circuit transmission line with normal and emergency ratings of at least 535 MVA, approximately 12.2-mile; and
- Expand the existing Chalybe 138-kV substation to install two +/-150 MVAr STATCOMs.

ERCOT recommends that any STATCOM additions have grid-forming-like capabilities to operate reliably at weak grid conditions and support the system strength.

The cost estimate for this Tier 1 project is approximately $423.8 Million. A CCN application will be required for the construction of the new transmission lines due to approximately 26.0 miles of new ROW. The expected In-Service Date (ISD) of this project is May 2029.

AEPSC has advised that this date is subject to change based on customer changes and the CCN process. If any long-term issues are identified regarding the outages necessary to rebuild the 138-kV transmission lines, Constraint Management Plans (CMP) will be developed as needed.

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1 Introduction

In March 2024, American Electric Power Service Corporation (AEPSC) submitted the Brownsville Area Improvements Transmission Project to the Regional Planning Group (RPG) to address NERC TPL-001-5.1 and ERCOT Planning Guide criteria thermal overloads and voltage violations due to 650 MW of new load in the Brownsville area. This project is located in the South Weather Zone in Cameron County.

The AEPSC proposed project is classified as a Tier 1 project pursuant to ERCOT Protocol Section 3.11.4.3, with an estimated cost of $387.7 Million. One or more Certificate of Convenience and Necessity (CCN) applications will be required for the construction of the new 345-kV double-circuit transmission line from Chalybe to Kingfisher, the new 345-kV double-circuit transmission line from Chalybe to Palmito, and the new 138-kV transmission line from Chalybe to Stillman, due to approximately 26.0 miles of new right of way (ROW). The expected In-Service Date (ISD) of the proposed project is May 31, 2027.

ERCOT conducted an Independent Review for this RPG project to identify any reliability needs in the area and evaluate various transmission upgrade options. This report describes the study assumptions, methodology, and the results of the ERCOT Independent Review of the project.

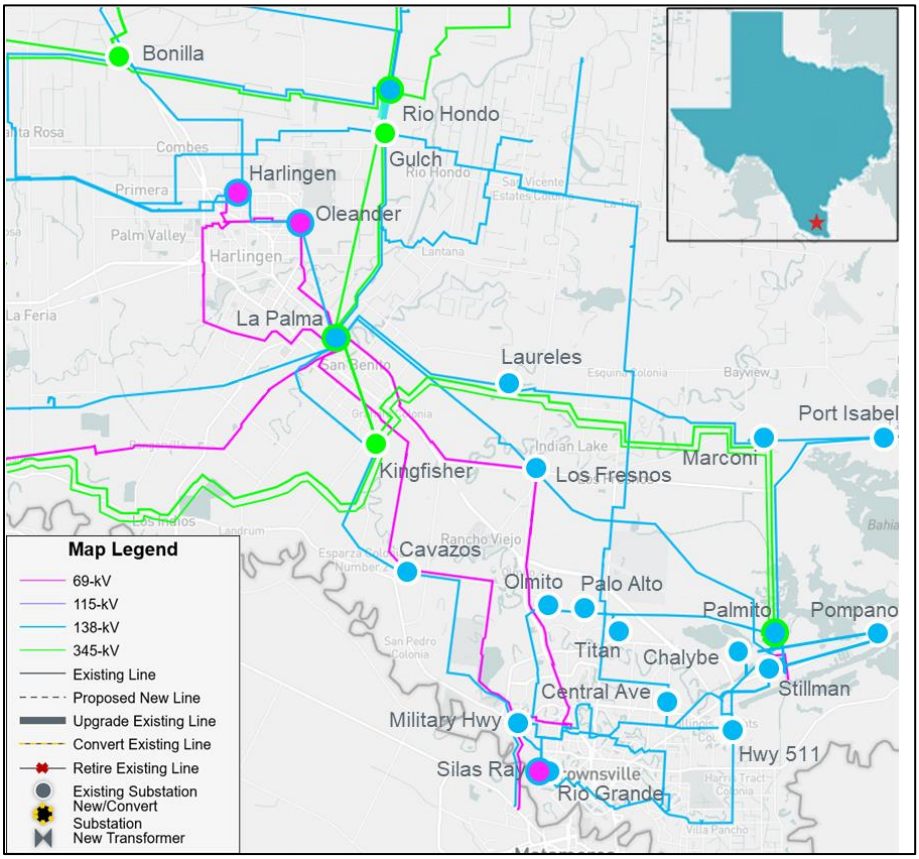


Figure 1.1: Map of Transmission System in The Brownsville Area

2 Study Assumptions and Methodology

ERCOT performed studies under various system conditions to identify any reliability issue and to determine transmission upgrades to support the proposed Brownsville Area Improvements Transmission Project if an upgrade was deemed necessary. This section describes the study assumptions and criteria used to conduct the independent study.

2.1 Study Assumptions for Reliability Analysis

This project is in the South Weather Zone in Cameron County. Willacy and Hidalgo Counties were also included in the study because of their electrical proximity to the proposed project.

2.1.1 Steady-State Study Base Case

The Final 2023 Regional Transmission Plan (RTP) cases, published on the Market Information System (MIS) on December 22, 2023, were used as reference cases in this study. Year 2028 Summer was selected for the long-term outlook. The steady-state study base case was constructed by updating transmission, generation, and loads of the following 2028 Summer Peak Load case for the South and South Central (SSC) Weather Zones:

- Case: 2023RTP_2028_SUM_SSC_12222023[1].

2.1.2 Transmission Topology

Transmission projects within the study area with an In-Service Date (ISD) prior to May 31, 2027, were added to the study base case. The ERCOT Transmission Project Information and Tracking (TPIT)[2] report posted in February 2024 was used as reference. The added TPIT projects are listed in Table 2.1.

Table 2.1: List of Transmission Projects Added to the Study Base Case

TPIT No	Project Name	Tier	Project ISD	County
69463	AEP_TCC_ArroyoInterconnection	Tier 4	Nov-24	Cameron
73061	Falfurrias to King Ranch: 138 kV Line Rebuild	Tier 4	Nov-26	Brooks
73359	Vertrees: Construct New Distribution Station	Tier 4	Feb-25	Hidalgo
73661	New transformer (T2) at BPUB Palo Alto Substation	Tier 4	Mar-24	Cameron
76082	Union Carbide: Rebuild 138 kV Station	Tier 4	Jun-26	Cameron
76214	North Edinburg: 345 kV Reconfigure	Tier 4	Oct-24	Hidalgo
76574	TexasAg Wind Interconnection	Tier 4	May-25	Hidalgo
77144	Pompano: New 138 kV Station	Tier 4	Jul-24	Cameron

[1] 2023 Regional Transmission Plan Postings: https://mis.ercot.com/secure/data-products/grid/regional-planning?id=PG3-3200-M
[2] TPIT Report: https://www.ercot.com/gridinfo/planning

2.1.3 Generation

Based on the February 2024 Generator Interconnection Status (GIS)[3] report posted on the ERCOT website on March 1, 2024, generators in the study area that met Planning Guide Section 6.9(1) conditions with a Commercial Operations Date (COD) prior to May 31, 2027, were added to the study base case. These generation additions are listed in Table 2.2. All new generation dispatches were consistent with the 2024 RTP methodology.

Table 2.2: List of Generation Added to the Study Base Case Based on the February 2024 GIS Report

GINR	Project Name	Fuel	Project COD	Capacity (~MW)	County
19INR0054	Monte Cristo 1 Wind	WIN	08/20/2025	234.5	Hidalgo
24INR0436	Carambola BESS	OTH	05/31/2026	97.4	Hidalgo

The status of each unit that was projected to be either indefinitely mothballed or retired at the time of the study was reviewed. The units listed in Table 2.3 were opened (turned off) in the study base case to reflect their mothballed/retired status.

Table 2.3: List of Generation Opened to Reflect Mothballed/Retired/Forced Outage Status

Bus No	Unit Name	Capacity (~MW)	Weather Zone
110941	SL_SL_G1	65.0	Coast
110942	SL_SL_G2	65.0	Coast
110943	SL_SL_G3	30.0	Coast
110944	SL_SL_G4	30.0	Coast
140042	WFCOGEN_UNIT4	17.0	North
130121	SGMTN_SIGNALM2	6.6	Far West
132931	TOSBATT_UNIT1	2.0	Far West

Generation listed in Table 2.4 were closed (turned on) in the study base case to reflect the change in their Generation Resource as these resources are returning to year-round service.

Table 2.4: List of Generation Closed to Reflect Returning to Service Status

Bus No	Unit Name	Max Capacity (~MW)	Weather Zone
110020	WAP_GT2	71.0	Coast
150023	MCSES_UNIT8	568.0	North-Central
110261	TGF_TGFGT_1	78.0	Coast

2.1.4 Loads

Loads in the South Weather Zone were updated based on the new confirmed loads in the study area. Minimum reserve requirements were maintained consistent with the 2023 RTP.

[3] GIS Report: https://www.ercot.com/misapp/GetReports.do?reportTypeId=15933

2.2 Long-Term Load-Serving Capability Assessment

ERCOT performed a long-term load-serving capability assessment on the options with higher load conditions to compare the performance of the study options.

In the higher load condition evaluation, the conforming loads in the study area were increased (non-scalable loads were not increased), and conforming loads outside the South Weather Zone were decreased to balance power.

2.3 Maintenance Outage Scenario

ERCOT developed an off-peak maintenance season scenario to further evaluate the study options.

The load level in the South Weather Zone was reduced to 90.1% of its summer peak load level in the study base case. This scaling is meant to reflect assumed off-peak season loads based on ERCOT load forecast for future years as well as historical load in the South Weather Zone.

2.4 Study Assumptions for Congestion Analysis

Congestion analysis was conducted to identify any new congestion in the study area with the addition of the preferred transmission upgrade option.

The 2023 RTP 2028 economic case was updated based on the April 2024 GIS[4] report and the February 2024 TPIT[5] for generation and transmission updates to conduct congestion analysis. New confirmed load in Cameron County was also added to the study base case. The 2028 study year was selected based on the proposed ISD of the project.

New transmission projects additions are listed in Table A.1 in Appendix A of this document.

New generation additions listed in Table A.2 in Appendix A of this document were added to the economic base case and all generation listed in Table 2.3 were opened (turned off) in the study base case to reflect their mothballed/retired status. Generation listed in Table 2.4 were removed from seasonal settings in the study base case as these resources are returned to year-round service.

2.5 Methodology

This section lists the Contingencies and Criteria used for project review along with tools used to perform the various analyses.

2.5.1 Contingencies and Criteria

The reliability assessments were performed based on NERC Reliability Standard TPL-001-5.1, ERCOT Protocol, and ERCOT Planning Criteria[6].

[4] GIS Report: https://www.ercot.com/mp/data-products/data-product-details?id=PG7-200-ER
[5] TPIT Report: https://www.ercot.com/gridinfo/planning
[6] ERCOT Planning Criteria: http://www.ercot.com/mktrules/guides/planning/current

Contingencies[7] were updated based on the changes made to the topology as described in Section 2.1 of this document. The following steady-state contingencies were simulated for the study region:

- P0 (System Intact);
- P1, P2-1, P7 (N-1 conditions);
- P2-2, P2-3, P4, and P5 (345-kV only);
- P3: G-1 + N-1 (G-1: generation outages) {Silas Ray Unit C9, Cameron Wind Unit 1, San Roman Wind Unit 1, and North Edinburg Unit 1 – Partial Steam}; and
- P6-2: X-1 + N-1 (X-1: 345/138-kV transformers only) {Palmito – Ckt 1, La Palma – Ckt 1, Rio Hondo – Ckt 1}.

All 69-kV and above buses, transmission lines, and transformers in the study region were monitored (excluding generator step-up transformers) and the following thermal and voltage limits were enforced:

- Thermal
  - Rate A (normal rating) for pre-contingency conditions; and
  - Rate B (emergency rating) for post-contingency conditions.
- Voltages
  - Voltages exceeding pre-contingency and post-contingency limits; and
  - Voltage deviations exceeding 8% on non-radial load buses.

2.5.2 Study Tool

ERCOT utilized the following software tools to perform this independent study:

- PowerWorld Simulator version 23 for Security Constrained Optimal Power Flow (SCOPF) and steady-state contingency analysis; and
- UPLAN version 12.3.0.29978 to perform congestion analysis.

3 Project Need

Steady-state reliability analysis was performed in accordance with NERC TPL-001-5.1 and ERCOT Planning Criteria described in Section 2.5 of this document. This analysis indicated thermal overloads and a voltage violation in the Brownsville area as seen in the AEPSC project submission. These issues are summarized in Table 3.1 and visually illustrated in Figure 3.1. Detailed thermal overloads and voltage violations are listed in Table 3.2 and Table 3.3 respectively. No unsolved power flow was observed.

[7] Details of each event and contingency category is defined in the NERC reliability standard TPL-001-5.1

Table 3.1: Reliability Issues Seen Under NERC TPL-001-5.1 and ERCOT Planning Criteria in the Study Area

NERC Contingency Category	Voltage Violations	Thermal Overloads	Unsolved Power Flow
P0: N-0	None	None	None
P1, P2-1, P7: N-1	1	13	None
P3: G-1+N-1	None	1	None
P6-2: X-1+N-1	None	3	None

Table 3.2: Thermal Overloads Observed in the Brownsville Area

NERC Contingency Category	Overloaded Element	Voltage Level (kV)	Length (~miles)	Loading %
P1: N-1	CNTRLAVESUB8 (5766) -> COFFPORT4A (8914) CKT 1	138	2.4	109.3
P1: N-1	COFFPORT4A (8914) -> HIWAY511SUB8 (5767) CKT 1	138	1.1	105.3
P1: N-1	LA_PALMA4A (8314) -> LAURELESSUB8 (5756) CKT 1	138	9.4	102.9
P1: N-1	MARCONI4A (8266) -> P_ISABEL4A (8338) CKT 1	138	6.2	122.4
P1: N-1	MILITARY4D (8275) -> OLMITO4A (8950) CKT 1	138	5.5	151.3
P1: N-1	OLMITO4A (8950) -> PALOALTO (5965) CKT 1	138	0.4	145.0
P1: N-1	P_ISABEL4A (8338) -> CHALYBE4A (8735) CKT 1	138	12.9	117.7
P1: N-1	PALOALTO (5965) -> TITAN (5963) CKT 1	138	2.5	138.7
P1: N-1	TITAN (5963) -> CHALYBE4A (8735) CKT 1	138	7.3	124.0
P3: G-1+N-1	LAURELESSUB8 (5756) -> MARCONI4A (8266) CKT 1	138	8.4	116.0
P6-2: X-1+N-1	HIWAY511SUB8 (5767) -> CHALYBE4A (8735) CKT 1	138	4.5	101.5
P6-2: X-1+N-1	PALMITO345 (79500) -> PALMITO138 (79600) CKT 1	345/138	-	108.7
P6-2: X-1+N-1	PALMITO138_2 (79606) -> STILLMAN (79601) CKT 2	138	0.4	104.6
P7: N-1	CAVAZOS4A (80229) -> MILITARY4A (8339) CKT 1	138	10.0	121.6
P7: N-1	L_FRESNO4A (8333) -> STILLMAN (79601) CKT 1	138	12.0	146.5
P7: N-1	LA_PALMA4A (8314) -> CAVAZOS4A (80229) CKT 1	138	12.2	129.3
P7: N-1	LA_PALMA4A (8314) -> L_FRESNO4A (8333) CKT 1	138	10.3	149.3

Table 3.3: Voltage Violation Observed in the Brownsville Area

NERC Contingency Category	Violating Bus	Voltage Level (kV)	Base Loading (pu)	Max Loading (pu)
P1: N-1	POMPANO4A (8535)	138	0.89	-

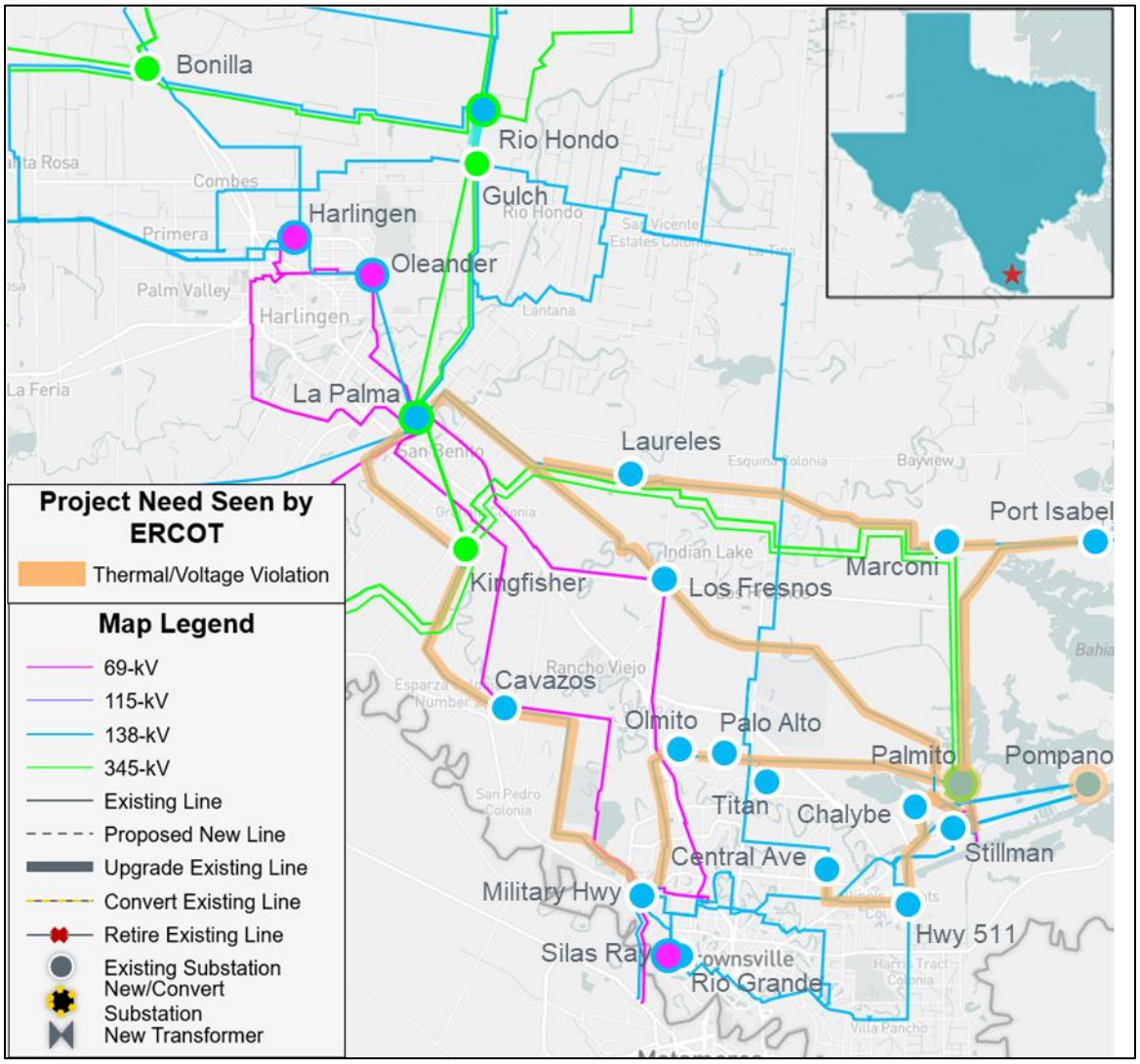


Figure 3.1: Study Area Map Showing Project Need Seen by ERCOT

4 Description of Project Options

ERCOT evaluated ten system improvement options to address the thermal overloads and voltage violation that were observed in the study base case. All ten options resolved the thermal overloads and voltage violation in the study area. Detailed maps of each option are provided in Appendix B. ERCOT recommends that any STATCOM additions have grid-forming-like capabilities to operate reliably at weak grid conditions and support the system strength.

Option 1 consists of the following:

- Rebuild the existing Laureles to Marconi 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 8.4-mile;

- Rebuild the existing Laureles to La Palma 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 9.4-mile;
- Rebuild the existing Central Ave to Coffeeport 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 2.4-mile;
- Rebuild the existing Highway 511 to Chalybe 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 4.5-mile;
- Rebuild the existing Highway 511 to Coffeeport 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 1.1-mile;
- Rebuild the existing Titan to Palo Alto 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 2.5-mile;
- Rebuild the existing Titan to Chalybe 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 7.3-mile;
- Replace two existing Military Hwy 138-kV bus ties with ones with normal and emergency ratings of at least 717 MVA;
- Rebuild the existing Palo Alto to Olmito 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 0.4-mile;
- Rebuild the existing Marconi to Port Isabel 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 6.2-mile;
- Rebuild the existing Military to Olmito 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 5.5-mile;
- Rebuild the existing La Palma to Fresno 138-kV single-circuit transmission line with normal and emergency ratings of at least 535 MVA, approximately 10.3-mile;
- Rebuild the existing La Palma to Villa Cavazos 138-kV single-circuit transmission line with normal and emergency ratings of at least 535 MVA, approximately 12.2-mile;
- Rebuild the existing Harlingen to Oleander 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 3.3-mile;
- Rebuild the existing Fresno to Stillman 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 12.0-mile;
- Rebuild the existing Port Isabel to Chalybe 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 12.9-mile;
- Rebuild the existing Military to Villa Cavazos 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 10.0-mile;
- Rebuild the existing Weslaco to Vertrees 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 6.0-mile;
- Rebuild the existing Vertrees to Stewart 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 6.9-mile;
- Rebuild the existing Palmito to Stillman 138-kV double-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 0.43-mile;
- Replace both 345/138-kV 3-winding autotransformers at Palmito with ones with normal and emergency ratings of at least 675-MVA; and

- Expand the existing Chalybe 138-kV substation to install two +/-150 MVAr STATCOMs.

Option 2 (AEPSC Proposed Solution) consists of the following:

- Expand the existing Chalybe 138-kV substation to install a new 345-kV ring-bus arrangement, with two 345/138-kV autotransformers with normal and emergency ratings of at least 675 MVA;
- Construct a new Chalybe to Kingfisher 345-kV double-circuit transmission line with normal and emergency ratings of at least at least 2668 MVA per circuit, on a new ROW, approximately 22.0-mile;
- Construct a new Chalybe to Palmito 345-kV double-circuit transmission line with normal and emergency ratings of at least 2668 MVA per circuit, on a new ROW, approximately 2.0-mile;
- Construct a new Chalybe to Stillman 138-kV single-circuit transmission line with normal and emergency ratings of at least 987 MVA, on a new ROW, approximately 2.0-mile;
- Rebuild the existing La Palma to Fresno 138-kV single-circuit transmission line with normal and emergency ratings of at least 535 MVA, approximately 10.3-mile;
- Rebuild the existing Fresno to Stillman 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 12.0-mile; and
- Expand the existing Chalybe 138-kV substation to install two +/-150 MVAr STATCOMs.

Option 2A consists of the following:

- Expand the existing Chalybe 138-kV substation to install a new 345-kV ring-bus arrangement, with two 345/138-kV autotransformers with normal and emergency ratings of at least 675 MVA;
- Construct a new Chalybe to Kingfisher 345-kV double-circuit transmission line with normal and emergency ratings of at least 2668 MVA per circuit, on a new ROW, approximately 22.0-mile;
- Construct a new Chalybe to Palmito 345-kV double-circuit transmission line with normal and emergency ratings of at least 2668 MVA per circuit, on a new ROW, approximately 2.0-mile;
- Construct a new Chalybe to Stillman 138-kV single-circuit transmission line with normal and emergency ratings of at least 987 MVA, on a new ROW, approximately 2.0-mile;
- Rebuild the existing La Palma to Fresno 138-kV single-circuit transmission line with normal and emergency ratings of at least 535 MVA, approximately 10.3-mile;
- Rebuild the existing Fresno to Stillman 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 12.0-mile;
- Rebuild the existing Military to Villa Cavazos 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 10.0-mile;
- Rebuild the existing La Palma to Villa Cavazos 138-kV single-circuit transmission line with normal and emergency ratings of at least 535 MVA, approximately 12.2-mile; and

- Expand the existing Chalybe 138-kV substation to install two +/-150 MVAr STATCOMs.

Option 3 consists of the following:

- Expand the existing Chalybe 138-kV substation to install a new 345-kV ring-bus arrangement, with two 345/138-kV autotransformers with normal and emergency ratings of at least 675 MVA;
- Replace both 345/138-kV 3-winding autotransformers at Palmito with ones with normal and emergency ratings of at least 675-MVA;
- Construct a new Chalybe to Kingfisher 345-kV double-circuit transmission line with normal and emergency ratings of at least 2668 MVA per circuit, on a new ROW, approximately 22.0-mile;
- Rebuild the existing La Palma to Fresno 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 10.3-mile;
- Rebuild the existing Fresno to Stillman 12.0-mile 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 12.0-mile;
- Rebuild the existing Military to Olmito 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 5.5-mile;
- Rebuild the existing Palo Alto to Olmito 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 0.4-mile;
- Rebuild the existing Titan to Palo Alto 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 2.5-mile;
- Rebuild the existing Titan to Chalybe 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 7.3-mile; and
- Expand the existing Chalybe 138-kV substation to install two +/-150 MVAr STATCOMs.

Option 4 consists of the following:

- Install two additional 345/138-kV 3-winding autotransformers with normal and emergency ratings of at least 450 MVA at Palmito;
- Construct a new Palmito to Rio Hondo 345-kV double-circuit transmission line with normal and emergency ratings of at least 2668 MVA per circuit, on a new ROW, approximately 29.8-mile;
- Construct a new Chalybe to Palmito 138-kV single-circuit transmission line with normal and emergency ratings of at least 956 MVA, on a new ROW, approximately 2.0-mile;
- Construct a new Palmito to Stillman 138-kV single-circuit transmission line with normal and emergency ratings of at least 516 MVA, on a new ROW, approximately 0.4-mile; and
- Expand the existing Chalybe 138-kV substation to install two +/-150 MVAr STATCOMs.

Option 5 consists of the following:

- Install two additional 345/138-kV 3-winding autotransformers with normal and emergency ratings of at least 450 MVA at Palmito;

- Construct a new Palmito to Bonilla 345-kV double-circuit transmission line with normal and emergency ratings of at least 2668 MVA per circuit, on a new ROW, approximately 39.0-mile;
- Construct a new Chalybe to Palmito 138-kV single-circuit transmission line with normal and emergency ratings of at least 956 MVA, on a new ROW, approximately 2.0-mile;
- Construct a new Palmito to Stillman 138-kV single-circuit transmission line with normal and emergency ratings of at least 516 MVA, on a new ROW, approximately 0.4-mile; and
- Expand the existing Chalybe 138-kV substation to install two +/-150 MVAr STATCOMs.

Option 5A consists of the following:

- Install two additional 345/138-kV 3-winding autotransformers with normal and emergency ratings of at least 450 MVA at Palmito;
- Construct a new Palmito to Bonilla 345-kV double-circuit transmission line with normal and emergency ratings of at least 2668 MVA per circuit, on a new ROW, approximately 39.0-mile;
- Construct a new Chalybe to Palmito 138-kV single-circuit transmission line with normal and emergency ratings of at least 956 MVA, on a new ROW, approximately 2.0-mile;
- Construct a new Palmito to Stillman 138-kV single-circuit transmission line with normal and emergency ratings of at least 516 MVA, on a new ROW, approximately 0.4-mile;
- Construct a new Chalybe to Stillman 138-kV single-circuit transmission line with normal and emergency ratings of at least 987 MVA, on a new ROW, approximately 2.0-mile;
- Rebuild the existing Military to Villa Cavazos 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 10.0-mile;
- Rebuild the existing Fresno to Stillman 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 12.0-mile;
- Rebuild the existing La Palma to Fresno 138-kV single-circuit transmission line with normal and emergency ratings of at least 535 MVA, approximately 10.3-mile;
- Rebuild the existing La Palma to Villa Cavazos 138-kV single-circuit transmission line with normal and emergency ratings of at least 535 MVA, approximately 12.2-mile; and
- Expand the existing Chalybe 138-kV substation to install two +/-150 MVAr STATCOMs.

Option 6 consists of the following:

- Install two 345/138-kV autotransformers with normal and emergency ratings of at least 675 MVA at Military Hwy;
- Install one additional 345/138-kV 3-winding autotransformer with normal and emergency ratings of at least 450 MVA at Palmito;
- Add a 345-kV substation named Landrum on the North Edinburg to Kingfisher 345-kV double-circuit transmission line;

- Construct a new Landrum to Military Hwy 345-kV double-circuit transmission line with normal and emergency ratings of at least 2668 MVA per circuit, on a new ROW, approximately 16.0-mile;
- Construct a new Chalybe to Palmito 138-kV single-circuit transmission line with normal and emergency ratings of at least 956 MVA, on a new ROW, approximately 2.0-mile;
- Construct a new Chalybe to Stillman 138-kV single-circuit transmission line with normal and emergency ratings of at least 987 MVA, on a new ROW, approximately 2.0-mile;
- Replace two existing Military Hwy 138-kV bus ties with ones with normal and emergency ratings of at least 717 MVA;
- Rebuild the existing Military to Olmito 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 5.5-mile;
- Rebuild the existing Palo Alto to Olmito 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 0.4-mile;
- Rebuild the existing Titan to Palo Alto 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 2.5-mile;
- Rebuild the existing Titan to Chalybe 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 7.3-mile;
- Rebuild the existing Military Hwy to Silas Ray 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 2.3-mile;
- Rebuild the existing Silas Ray to Rio Grande 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 0.6-mile; and
- Expand the existing Chalybe 138-kV substation to install two +/-150 MVAr STATCOMs.

Option 7 consists of the following:

- Install two additional 345/138-kV 3-winding autotransformers with normal and emergency ratings of at least 450 MVA at Palmito;
- Construct a new Palmito to Rio Hondo 345-kV double-circuit transmission line with normal and emergency ratings of at least 2668 MVA per circuit, on a new ROW, approximately 29.8-mile;
- Rebuild the existing Rio Hondo to Gulch 345-kV single-circuit transmission line with normal and emergency ratings of at least 2668 MVA, on a new ROW, approximately 1.0-mile;
- Construct a new Chalybe to Palmito 138-kV single-circuit transmission line with normal and emergency ratings of at least 956 MVA, on a new ROW, approximately 2.0-mile;
- Construct a new Palmito to Stillman 138-kV single-circuit transmission line with normal and emergency ratings of at least 516 MVA, on a new ROW, approximately 0.4-mile;
- Construct a new Chalybe to Stillman 138-kV single-circuit transmission line with normal and emergency ratings of at least 987 MVA, on a new ROW, approximately 2.0-mile;
- Rebuild the existing Military to Villa Cavazos 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 10.0-mile;

- Rebuild the existing Fresno to Stillman 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 12.0-mile;
- Rebuild the existing La Palma to Fresno 138-kV single-circuit transmission line with normal and emergency ratings of at least 535 MVA, approximately 10.3-mile;
- Rebuild the existing La Palma to Villa Cavazos 138-kV single-circuit transmission line with normal and emergency ratings of at least 535 MVA, approximately 12.2-mile; and
- Expand the existing Chalybe 138-kV substation to install two +/-150 MVAr STATCOMs.

Option 8 consists of the following:

- Add a 345-kV and 138-kV substation named Olmito West between Cavazos and Olmito;
- Install two 345/138-kV autotransformers with normal and emergency ratings of at least 675 MVA at Olmito West;
- Install one additional 345/138-kV 3-winding autotransformer with normal and emergency ratings of at least 450 MVA at Palmito;
- Add a 345-kV substation named Palmer on the North Edinburg to Kingfisher 345-kV double-circuit transmission line;
- Construct a new Palmer to Olmito West 345-kV double-circuit transmission line with normal and emergency ratings of at least 2668 MVA per circuit, on a new ROW, approximately 8.1-mile;
- Construct a new Olmito West to Olmito 138-kV single-circuit transmission line with normal and emergency ratings of at least 956 MVA, on a new ROW, approximately 2.7-mile;
- Construct a new Olmito West to Cavazos 138-kV single-circuit transmission line with normal and emergency ratings of at least 956 MVA, on a new ROW, approximately 4.0-mile;
- Construct a new Chalybe to Palmito 138-kV single-circuit transmission line with normal and emergency ratings of at least 956 MVA, on a new ROW, approximately 2.0-mile;
- Construct a new Chalybe to Stillman 138-kV single-circuit transmission line with normal and emergency ratings of at least 987 MVA, on a new ROW, approximately 2.0-mile;
- Rebuild the existing Military to Olmito 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 5.5-mile;
- Rebuild the existing Palo Alto to Olmito 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 0.4-mile;
- Rebuild the existing Titan to Palo Alto 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 2.5-mile;
- Rebuild the existing Titan to Chalybe 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 7.3-mile;
- Rebuild the existing Military to Villa Cavazos 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 10.0-mile;
- Rebuild the existing Fresno to Stillman 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 12.0-mile;

- Rebuild the existing La Palma to Fresno 138-kV single-circuit transmission line with normal and emergency ratings of at least 535 MVA, approximately 10.3-mile;
- Rebuild the existing La Palma to Villa Cavazos 138-kV single-circuit transmission line with normal and emergency ratings of at least 535 MVA, approximately 12.2-mile; and
- Expand the existing Chalybe 138-kV substation to install two +/-150 MVAr STATCOMs.

5 Option Evaluations

ERCOT performed reliability analysis, planned maintenance outage evaluation, and long-term load-serving capability analysis to evaluate the options and to identify any reliability impact of the options in the study area. Based on the results of these analyses, short-listed options were selected for further evaluations. This section details these studies and their results and compares the short-listed options.

5.1 Results of Reliability Analysis

All ten options were evaluated based on the contingencies described in the methodology section of the report, and no reliability criteria violations were identified for any option as shown in Table 5.1.

Table 5.1: Results of Initial Reliability Assessment of All Ten Options

		N-1		X-1 + N-1		G-1 + N-1	
Option	Unsolved Power Flow	Thermal Overload	Voltage Violation	Thermal Overload	Voltage Violation	Thermal Overload	Voltage Violation
1	None	None	None	None	None	None	None
2	None	None	None	None	None	None	None
2A	None	None	None	None	None	None	None
3	None	None	None	None	None	None	None
4	None	None	None	None	None	None	None
5	None	None	None	None	None	None	None
5A	None	None	None	None	None	None	None
6	None	None	None	None	None	None	None
7	None	None	None	None	None	None	None
8	None	None	None	None	None	None	None

5.2 Planned Maintenance Outage Evaluation

Based on a review of the system topology of the area, ERCOT conducted an N-2 contingency analysis for each feasible option to represent system element outage(s) under planned maintenance condition (N-1-1) in the area. Then, each N-2 violation was run as an N-1-1 contingency scenario, with system adjustments between the contingencies. The transmission elements in the local area of the Brownsville Area Improvements Project were monitored in the maintenance outage evaluation.

As shown in Table 5.2, the results of this maintenance assessment indicated that Option 2 and Option 5 both needed modifications to perform satisfactorily.

Table 5.2: Results of Planned Maintenance Outage Evaluation for All Feasible Options

Option	Voltage Violations	Thermal Overloads	Unsolved Power Flow
1	7	3	6
2	None	2	None
2A	None	None	None
3	1	2	None
5	None	5	None
5A	None	None	None
7	None	None	None
8	None	None	None

5.3 Short-listed Options

Preliminary feasibility evaluations performed by AEPSC indicated that Option 4 and Option 6 were infeasible. Based on the review of the results shown in Sections 5.1 and 5.2, Option 2A, Option 5A, Option 7, and Option 8 were selected as short-listed options for further evaluations. These four options are illustrated in Figures 5.1, 5.2, 5.3, and 5.4.

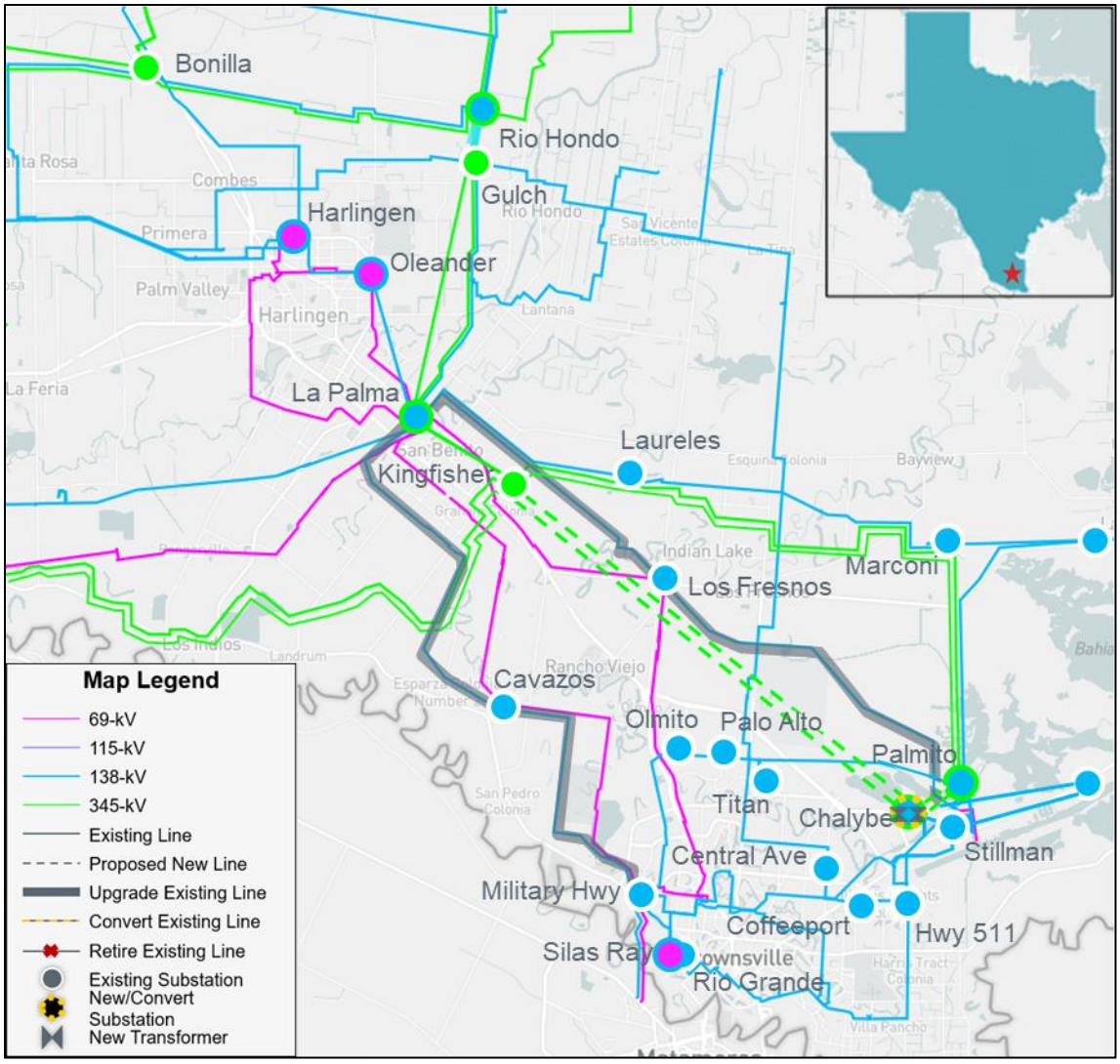


Figure 5.1: Map of Option 2A

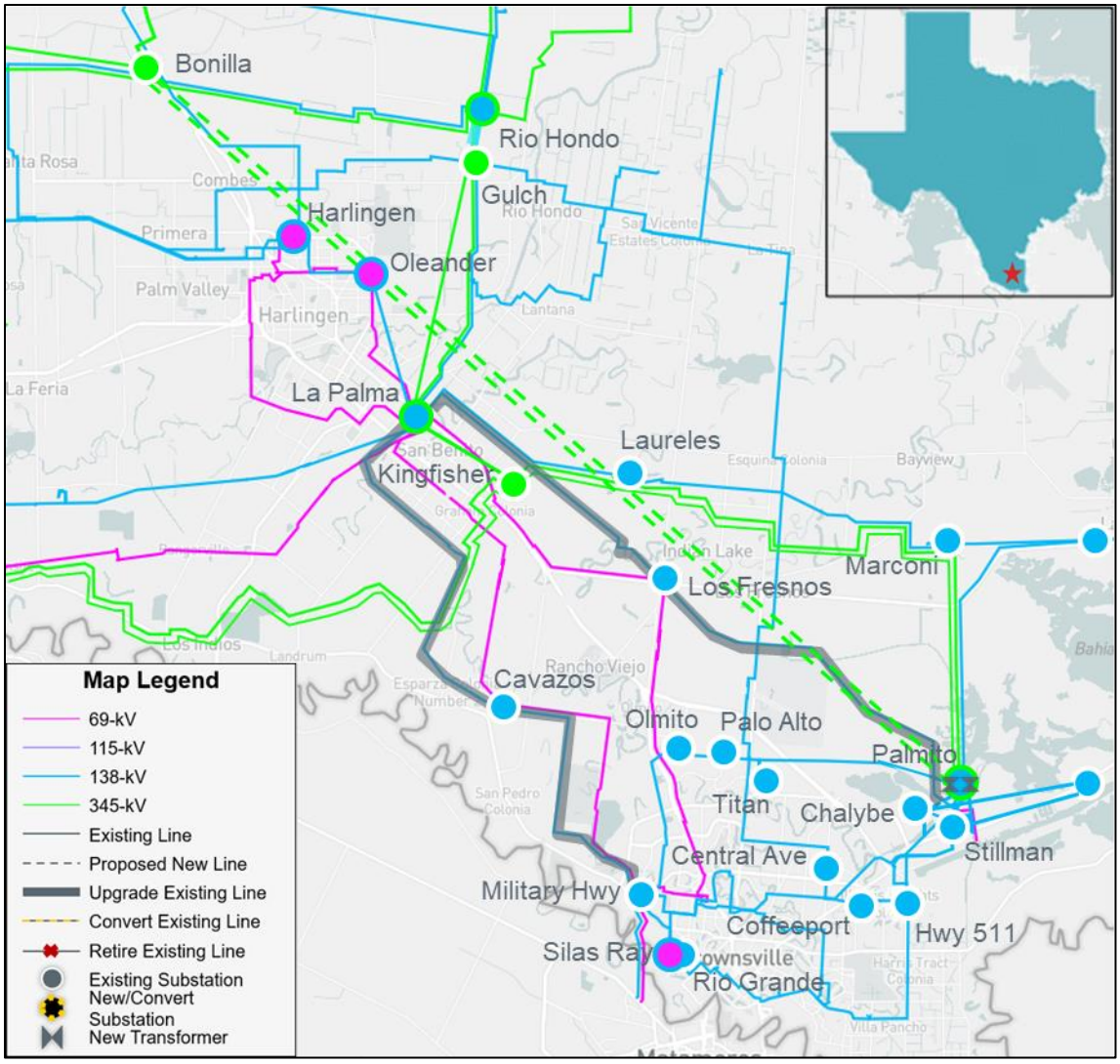


Figure 5.2: Map of Option 5A

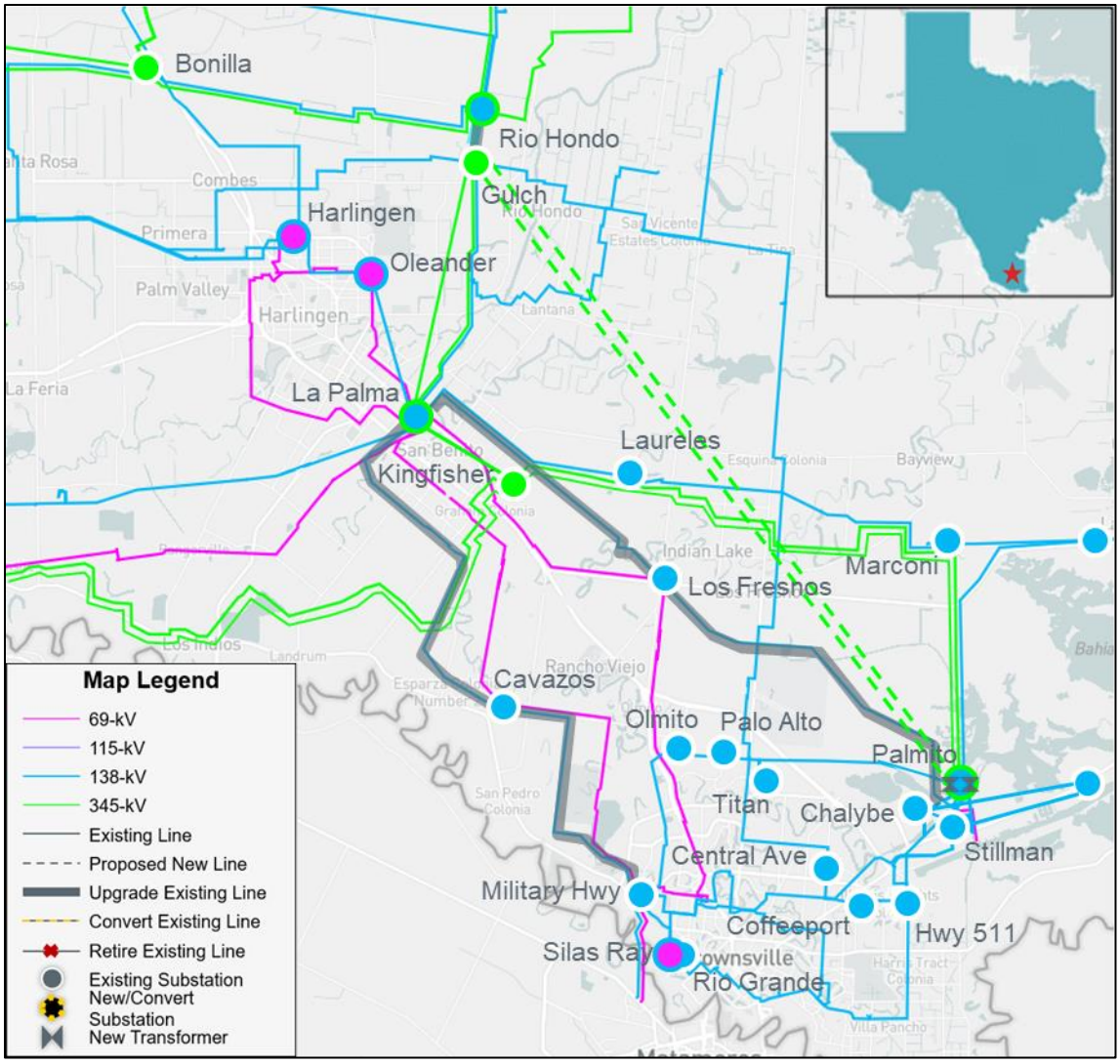


Figure 5.3: Map of Option 7

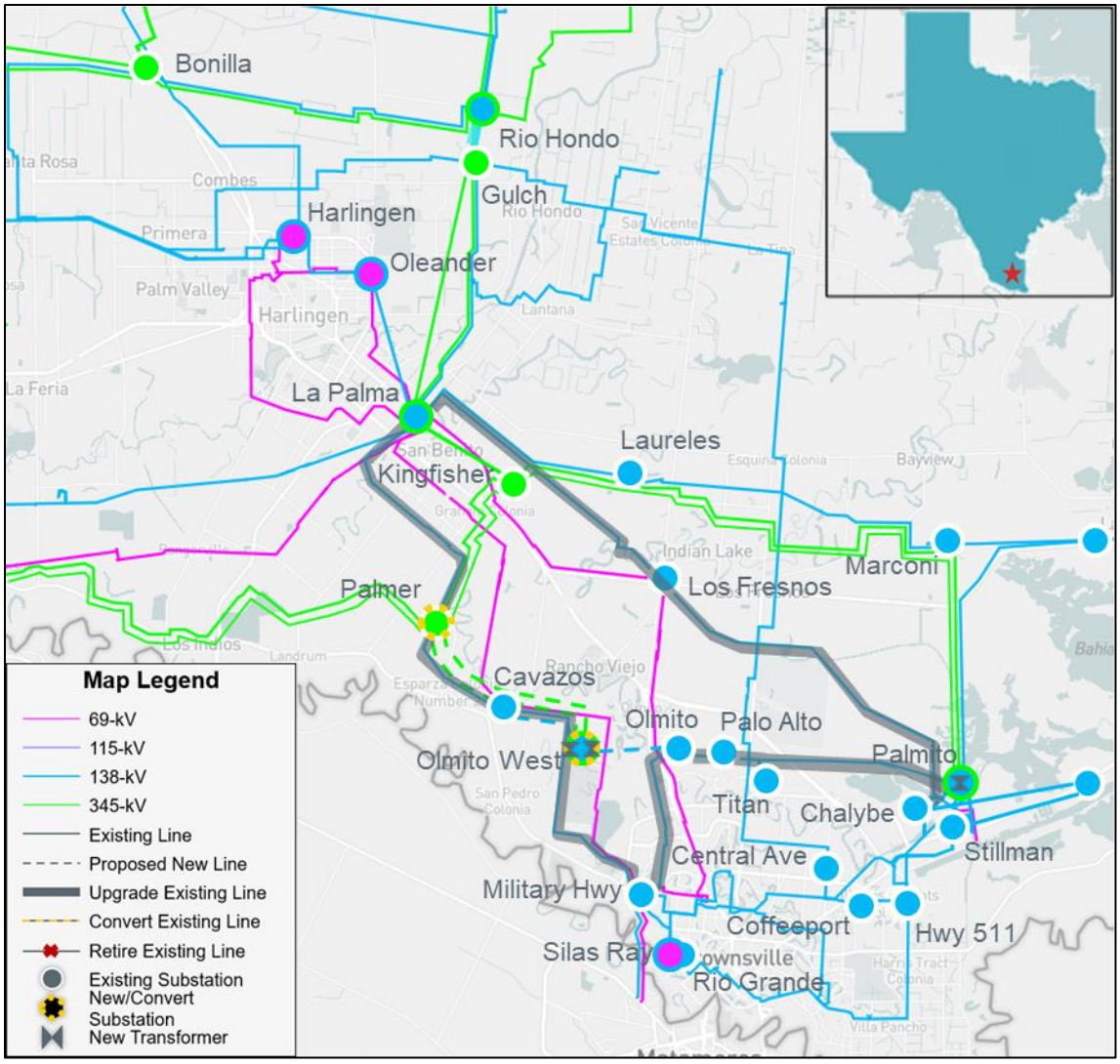


Figure 5.4: Map of Option 8

5.4 Long-Term Load-Serving Capability Analysis

ERCOT performed a long-term load-serving capability assessment to compare the performance of the study options. ERCOT increased load at substations within the Brownsville area and decreased conforming load outside of the South Weather Zone to balance power. The results of the long-term load-serving capability assessment are shown in Table 5.4.

The results show all short-listed options have similar performance.

Table 5.4: Results of Long-Term Load-Serving Capability Assessment of All Short-Listed Options

Option	Incremental Load-Serving Capability (~MW)
2A	637
5A	651
7	650
8	615

5.5 Cost Estimate and Feasibility Assessment

AEPSC, along with Sharyland Utilities (Sharyland) and Brownsville Public Utilities Board (BPUB) performed feasibility assessments and provided cost estimates for the four short-listed options. Table 5.5 summarizes the cost estimate, estimated mileage of CCN required, and option feasibility for the four short-listed options.

Table 5.5: Cost Estimates and Feasibility for the Short-Listed Options

Option	Cost Estimates (~$M)	CCN Required (~Miles)	Feasible
2A	423.8	Yes (26.0)	Feasible
5A	458.3	Yes (43.4)	Feasible
7	427.0	Yes (33.3)	Feasible
8	501.6	Yes (18.8)	Feasible

6 Comparison of Short-listed Options

The comparison of Options 2A, 5A, 7, and 8 with corresponding cost estimates provided by AEPSC, Sharyland, and BPUB are summarized in Table 6.1.

Table 6.1: Comparison of the Short-Listed Options

	Option 2A	Option 5A	Option 7	Option 8
Meets ERCOT and NERC Reliability Criteria	Yes	Yes	Yes	Yes
Improves Long-Term Load-Serving Capability	Yes	Yes	Yes	Yes
Improves Operational Flexibility	Yes	Yes	Yes	Yes
Requires CCN (~miles)	Yes (26.0)	Yes (43.4)	Yes (33.3)	Yes (18.8)
Project Feasibility	Yes	Yes	Yes	Yes
Cost Estimate (~$M)	423.8	458.3	427.0	501.6

ERCOT recommends Option 2A as the preferred option to address the reliability needs in the Brownsville area based on the following considerations:

- Addresses the reliability violations;
- Is the least expensive option;
- Requires less CCN mileage than Option 5A or Option 7;
- Provides additional operational flexibility; and

- Improves long-term load-serving capability.

7 Additional Analysis and Assessment

The preferred option (Option 2A, approximately $423.8 Million) is categorized as a Tier 1 project, pursuant to ERCOT Protocol 3.11.4.3(1)(a). ERCOT performed generation and load sensitivity studies to identify the preferred option performance, as required under Planning Guide Section 3.1.3(4). Additionally, a Sub-synchronous Resonance (SSR) Assessment was performed.

7.1 Generation Addition Sensitivity Analysis

ERCOT performed a generation addition sensitivity analysis based on Planning Guide Section 3.1.3(4)(a).

Based on a review of the July 2024 GIS[8] report, eight units were found within the Brownsville area which could have an impact on the identified reliability issues. The generators listed in Table 7.1 were added to the Option 2A case and were modeled following the 2024 RTP methodology.

Table 7.1: List of Units that Could have an Impact on the Identified Reliability Issues

GINR	Unit Name	Fuel Type	Capacity (~MW)	County
19INR0022	Monte Alto I	WIN	141.5	Willacy
19INR0023	Monte Alto 2 Wind	WIN	307.9	Willacy
20INR0086	Arroyo Solar	SOL	180.0	Cameron
22INR0401	Eval Storage	OTH	255.0	Cameron
22INR0468	Lower Rio BESS	OTH	60.4	Hidalgo
24INR0294	Citrus Flatts BESS	OTH	100.8	Cameron
24INR0306	Arroyo Storage	OTH	183.8	Cameron
24INR0491	Gunnar BESS	OTH	203.0	Hidalgo

After the addition of the units to the Option 2A case, no new thermal or voltage violations were identified.

7.2 Load Scaling Sensitivity Analysis

Planning Guide Section 3.1.3(4)(b) requires evaluation of the potential impact of load scaling on the criteria violations seen in this EIR. ERCOT concluded that the load scaling would not have a material impact on the project need because the Brownsville area is at the extreme Southeastern portion of the ERCOT system. Further, this project is local in nature and the need is based upon new large load in the area. The load scaling outside the South and South Central Weather Zones would not have a material impact on the need of the recommended project.

[8] GIS Report: https://www.ercot.com/mp/data-products/data-product-details?id=PG7-200-ER

7.3 Sub-synchronous Resonance (SSR) Assessment

Pursuant to Nodal Protocol Section 3.22.1.3(2), ERCOT conducted a sub-synchronous-resonance (SSR) screening for the preferred option (Option 2A) and found no adverse SSR impacts to the existing and planned generation resources in the study area.

8 Congestion Analysis

ERCOT conducted a congestion analysis to identify any potential impact on system congestion related to the addition of the recommend project, Option 2A, using the 2023 RTP 2028 economic study case.

The results of congestion analysis indicated Option 2A would cause one new congestion as shown in Table 8.1.

Table 8.1: List of New Congestion Due to Transmission Upgrade of Option 2A

Monitored Line	% Time of Congestion	New / Existing
Lon Hill to White Point 345-kV single-circuit transmission line	6.0	New

An additional test was conducted by upgrading the 345-kV single-circuit transmission line from Lon Hill to White Point to see if this alleviated the new congestion. Based on the results summarized in Table 8.2, the additional upgrade did not yield sufficient economic benefit. Therefore, no upgrades will be recommended to solve this new congestion as part of Option 2A.

Table 8.2: Test Results with Lon Hill to White Point 345-kV Line Upgrade

Upgrade Tested	Mileage (~mi)	Passed Production Cost Savings Test	Passed Generation Revenue Reduction Test
Lon Hill to White Point 345-kV single-circuit transmission line	20.5	No	No

9 Conclusion

ERCOT evaluated ten transmission upgrade options to resolve the thermal overloads and voltage violation in the Brownsville area. Based on the results of the independent review, ERCOT recommends Option 2A as the preferred solution because it addresses the thermal overloads and voltage violation with no reliability issues, is the least expensive option, and requires less CCN mileage than Option 5A or Option 7. Option 2A also provides additional operational flexibility and improves long-term load-serving capability.

Option 2A consists of the following upgrades and is estimated to cost $423.8 Million:

- Expand the existing Chalybe 138-kV substation to install a new 345-kV ring-bus arrangement, with two 345/138-kV autotransformers with normal and emergency ratings of at least 675 MVA;

- Construct a new Chalybe to Kingfisher 345-kV double-circuit transmission line with normal and emergency ratings of at least 2668 MVA per circuit, on a new ROW, approximately 22.0-mile;
- Construct a new Chalybe to Palmito 345-kV double-circuit transmission line with normal and emergency ratings of at least 2668 MVA per circuit, on a new ROW, approximately 2.0-mile;
- Construct a new Chalybe to Stillman 138-kV single-circuit transmission line with normal and emergency ratings of at least 987 MVA, on a new ROW, approximately 2.0-mile;
- Rebuild the existing La Palma to Fresno 138-kV single-circuit transmission line with normal and emergency ratings of at least 535 MVA, approximately 10.3-mile;
- Rebuild the existing Fresno to Stillman 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 12.0-mile;
- Rebuild the existing Military to Villa Cavazos 138-kV single-circuit transmission line with normal and emergency ratings of at least 717 MVA, approximately 10.0-mile;
- Rebuild the existing La Palma to Villa Cavazos 138-kV single-circuit transmission line with normal and emergency ratings of at least 535 MVA, approximately 12.2-mile; and
- Expand the existing Chalybe 138-kV substation to install two +/-150 MVAr STATCOMs.

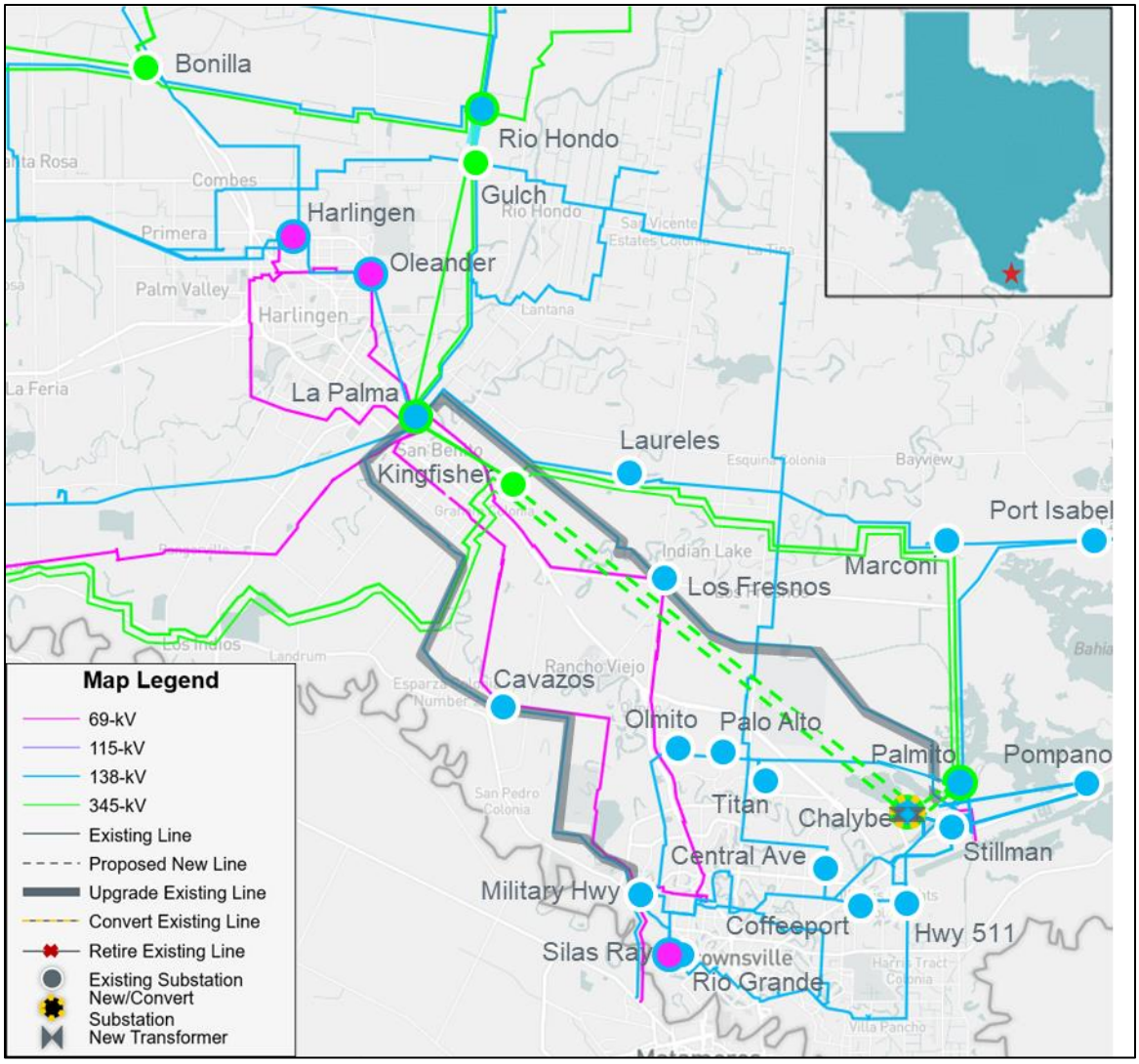


Figure 9.1: Map of Option 2A

ERCOT recommends that any STATCOM additions have grid-forming-like capabilities to operate reliably at weak grid conditions and support the system strength.

The cost estimate for the project is approximately $423.8 Million and the project is classified as a Tier 1 project per ERCOT Protocol Section 3.11.4.3(1)(a). The project is recommended for construction to meet a May 2029 ISD. AEPSC has advised that this date is subject to change based on customer changes and the CCN process.

A CCN application will be required for the new 345-kV double-circuit transmission line from Chalybe to Kingfisher, the new 345-kV double-circuit transmission line from Chalybe to Palmito, and the new 138-kV transmission line from Chalybe to Stillman. If any long-term issues are identified regarding the outages necessary to rebuild the 138-kV transmission lines, Constraint Management Plans (CMP) will be developed as needed.

Appendix

A: Transmission and Generation Projects Added to the Economic Base Case

Table A.1: List of Transmission Projects Added to the Economic Base Case

TPIT No	Project Name	Tier	Project ISD	County
62666	Upgrade and convert McGregor – Waco West Line	Tier 4	12/15/2024	McLennan
66216	Upgrade and convert Waco West – Temple 69 kV Line to 138 kV	Tier 4	6/15/2024	McLennan
71912A	Rebuild the Killeen Fort Hood – Killeen Taft 138 kV Line	Tier 4	5/15/2026	Bell
67992	CPSE_345KV_Howard_Switching_Station_ALL	Tier 3	2/1/2024	Bexar
71871	CPSE_Cagnon to Shepherd Rd Rebuild Phase A	Tier 4	5/1/2023	Bexar
67329	STEC_67329_Cruce-SanMiguel	Tier 1	6/1/2027	Bexar, Atascosa
23RPG024	Big Foot to Dilley Switch 138-kV Conversion Project	Tier 4	8/30/2026	Frio
73063	AEP_TCC_BigFoot_LytleConversion	Tier 4	9/20/2025	Medina, Frio
67915	AEP_TCC_Asherton-West Batesville138kVLineRebuild	Tier 3	12/30/2028	Dimmit, Zavala
22RPG026	Wimberley Loop project	Tier 2	5/1/2027	Blanco, Hays
23RPG013	Silverleaf and Cowpen 345/138-kV Stations Project	Tier 1	6/1/2027	Reeves, Ward
23RPG018	Arlington Reliability Enhancement Project	Tier 2	5/1/2026	Tarrant, Dallas
23RPG023	Pecos County Transmission Improvement Project	Tier 1	8/31/2026	Pecos
23RPG028	Rio Medina Project	Tier 2	1/1/2027	Medina
23RPG002	Hamlin to Roby 69 kV Line Rebuild Project	Tier 4	11/1/2026	Jones, Fisher
23RPG008	Fort Stockton Plant to Lynx 138-kV Line Rebuild Project	Tier 4	5/31/2025	Pecos
23RPG009	Spraberry to Polecat 138-kV Line Rebuild Project	Tier 3	Summer 2024	Midland, Glasscock
23RPG010	Big Spring West to Stanton East 138-kV Line Rebuild Project	Tier 3	Summer 2024	Martin, Howard
23RPG014	Lamesa to Jim Payne POI to Paul Davis Tap 138-kV Line Rebuild Project	Tier 3	Summer 2024	Dawson, Martin
23RPG016	Tributary Switch – Vincent Rebuild Project	Tier 3	12/31/2024	Howard
23RPG001	Bessel to Falfurrias 138 kV Line Rebuild Project	Tier 4	4/30/2026 11/30/2026	Nueces, Kleberg, Brooks, Jim Wells
23RPG003	Eagle Ford Large Load Interconnection Project	Tier 3	12/4/2025	DeWitt
23RPG004	Lockhart to Luling 69-kV Transmission Line Overhaul Project	Tier 4	6/30/2025	Caldwell
23RPG012	Stone Lake Area Upgrades Project	Tier 3	Summer 2024 Summer 2025	Harris
23RPG015	Cuero Substation Upgrade Project	Tier 4	5/15/2024	DeWitt
23RPG017	Watermill 345/138-kV Switch Project	Tier 3	5/1/2025	Dallas
23RPG020	Hackberry Switch to DFW D East 2 138-kV Double-Circuit Line Section Project	Tier 3	12/1/2025	Dallas
23RPG021	West Columbia to Big Creek ckt 89 Reconductor Project	Tier 4	Summer 2026	Fort Bend, Brazoria

TPIT No	Project Name	Tier	Project ISD	County
23RPG025	Britmoore to Bellaire Ckt 24 Upgrade Project	Tier 3	Summer 2025	Harris
23RPG030	Walleye Creek 345/138-kV Switch Project	Tier 3	5/1/2025	Milam
23RPG031	345 kV Jeanetta Autotransformer Upgrades Project	Tier 3	Summer 2025	Harris
23RPG033	Watermill to Seagoville 138 kV Line Project	Tier 3	12/1/2025	Dallas
24RPG002	Rockhound 345/138-kV Switch and Grey Well Draw to Buffalo 2nd 138-kV Circuit Project	Tier 3	12/1/2024	Martin, Midland
24RPG005	Montfort Switch to Shankle Switch 138-kV Line Project	Tier 3	12/1/2025	Ellis, Navarro

Table A.2: List of Generation Added to the Economic Base Case

GINR	Project Name	Fuel	Project COD	Capacity (~MW)	County
14INR0033	Goodnight Wind	Wind	2/14/2024	258.1	Armstrong
19INR0054	Monte Cristo 1 Wind	Wind	9/30/2025	236.9	Hidalgo
19INR0134	Cottonwood Bayou Solar	Solar	8/13/2024	351.4	Brazoria
19INR0203	Angelo Solar	Solar	8/12/2024	195.4	Tom Green
20INR0040	Montgomery Ranch Wind	Wind	9/1/2024	200.2	Foard
20INR0208	Signal Solar	SOL	3/15/2025	51.8	Hunt
20INR0210	Hopkins Solar	Solar	12/30/2023	253.1	Hopkins
20INR0248	Second Division Solar	Solar	9/17/2024	100.3	Brazoria
21INR0302	Aureola Solar	Solar	6/28/2024	203.0	Milam
21INR0303	Mandorla Solar	Solar	11/29/2024	254.0	Milam
21INR0304	Halo Solar	Solar	6/20/2024	254.0	Bell
21INR0325	Sheep Creek Wind	Wind	1/31/2024	153.0	Callahan
21INR0368	Eliza Solar	Solar	11/1/2024	151.6	Kaufman
21INR0389	Hollywood Solar	Solar	6/30/2024	353.4	Wharton
21INR0424	Tierra Bonita Solar	Solar	10/29/2024	306.9	Pecos
21INR0450	Danish Fields Storage	Battery	3/6/2024	152.4	Wharton
21INR0505	Ramsey Storage	Battery	12/31/2025	510.4	Wharton
21INR0511	Wolf Ridge Repower	Wind	4/2/2024	9.0	Cooke
21INR0515	Roadrunner Crossing Wind II SLF	Wind	1/20/2025	126.7	Eastland
22INR0251	Shaula I Solar	Solar	10/30/2025	205.2	DeWitt
22INR0260	Eliza Storage	Battery	11/1/2024	100.2	Kaufman
22INR0261	Dorado Solar	Solar	12/31/2025	406.3	Callahan
22INR0267	Shaula II Solar	Solar	5/30/2026	205.2	DeWitt
22INR0353	BRP Carina BESS	Battery	12/31/2024	151.9	Nueces
22INR0354	XE MURAT Solar	Solar	5/13/2024	60.4	Harris
22INR0366	LIBRA BESS	Battery	1/26/2024	206.2	Guadalupe
22INR0422	Ferdinand Grid BESS	Battery	5/31/2026	202.7	Bexar
22INR0502	Shamrock	Wind	4/19/2024	223.9	Crockett
22INR0555	Guevara Storage	Battery	7/15/2025	125.4	Rockwall
23INR0026	Baker Branch Solar	Solar	8/1/2024	469.4	Lamar
23INR0054	Tanglewood Solar	Solar	1/16/2025	257.0	Brazoria

GINR	Project Name	Fuel	Project COD	Capacity (~MW)	County
23INR0062	Noria Storage	Battery	9/1/2025	75.0	Nueces
23INR0091	Cascade Solar	Solar	12/31/2024	254.2	Brazoria
23INR0114	True North Solar	Solar	6/30/2024	238.3	Falls
23INR0154	Ebony Energy Storage	Battery	5/6/2024	203.5	Comal
23INR0159	Five Wells Storage	Battery	12/30/2023	220.8	Bell
23INR0219	Dogfish BESS	Battery	12/31/2024	75.0	Pecos
23INR0239	Giga Texas Energy Storage	Battery	1/31/2024	131.1	Travis
23INR0296	Trojan Solar	Solar	2/28/2026	151.3	Cooke
23INR0331	Talitha BESS	Battery	6/30/2024	61.4	Jim Wells
23INR0349	Tokio Solar	Solar	8/25/2025	177.6	McLennan
23INR0367	Fewell Solar	Solar	9/9/2025	203.5	Limestone
23INR0381	Soportar ESS	Battery	3/15/2025	102.1	Bexar
23INR0387	Pioneer DJ Wind	WIN	5/3/2024	140.3	Midland
23INR0408	TECO GTG2	GAS	1/30/2024	50.0	Harris
23INR0418	Angelo Storage	Battery	5/3/2024	103.0	Tom Green
23INR0460	GULF STAR STORAGE	Battery	6/25/2024	301.0	Wharton
23INR0470	BoCo BESS	Battery	6/22/2024	155.5	Borden
23INR0525	Pyron Wind Repower	WIN	2/1/2024	19.9	Nolan
23INR0637	Goodnight Wind II	WIN	12/30/2024	258.3	Armstrong
24INR0010	Pinnington Solar	Solar	10/15/2025	666.1	Jack
24INR0015	Five Wells Solar	Solar	12/29/2023	322.8	Bell
24INR0038	SP Jaguar Solar	Solar	6/30/2025	300.0	McLennan
24INR0039	SP Jaguar BESS	Battery	6/30/2025	300.0	McLennan
24INR0070	Sypert Branch Solar Project	Solar	6/1/2025	261.8	Milam
24INR0100	Sheep Creek Storage	Battery	7/1/2024	142.1	Callahan
24INR0109	Oriana BESS	Battery	7/2/2025	60.3	Victoria
24INR0138	Midpoint Storage	Battery	8/30/2025	52.2	Hill
24INR0139	Midpoint Solar	Solar	8/30/2025	103.8	Hill
24INR0140	Gaia Storage	Battery	7/31/2025	76.8	Navarro
24INR0141	Gaia Solar	Solar	7/31/2025	152.7	Navarro
24INR0265	Ironman BESS	Battery	11/1/2024	304.2	Brazoria
24INR0273	Al Pastor BESS	Battery	8/16/2024	103.1	Dawson
24INR0281	Red Egret BESS	Battery	6/1/2025	310.6	Galveston
24INR0295	Lucky Bluff BESS	Battery	5/31/2025	100.8	Erath
24INR0312	Wigeon Whistle BESS	Battery	9/1/2024	122.9	Collin
24INR0337	Eldora Solar	Solar	6/30/2026	200.9	Matagorda
24INR0338	Eldora BESS	Battery	6/30/2026	201.3	Matagorda
24INR0436	Carambola BESS	Battery	5/31/2026	97.4	Hidalgo
25INR0105	Diver Solar	Solar	6/30/2026	228.2	Limestone
25INR0162	SOHO II BESS	Battery	1/1/2025	206.3	Brazoria
25INR0223	Uhland Maxwell	GAS	4/15/2025	188.4	Caldwell
25INR0232	Isaac Solar	Solar	3/31/2026	51.6	Matagorda

GINR	Project Name	Fuel	Project COD	Capacity (~MW)	County
25INR0328	Longbow BESS	Battery	11/13/2024	180.8	Brazoria
23INR0403	Connolly Storage	Battery	8/18/2023	125.4	Wise
24INR0147	Holy ESS	Battery	1/19/2023	209.3	Harris
24INR0397	Destiny Storage	Battery	9/21/2023	201.1	Harris
20INR0217	CAROL wind	Wind	1/31/2024	165.4	Potter
21INR0240	La Casa Wind	Wind	1/4/2024	148.4	Stephens
21INR0379	Ash Creek Solar	Solar	1/17/2024	417.7	Hill
23INR0030	Langer Solar	Solar	1/5/2024	249.8	Bosque
23INR0070	Chillingham Solar	Solar	1/30/2024	352.4	Bell
23INR0336	Bypass Battery Storage	Battery	1/9/2024	206.9	Fort Bend
24INR0632	Cedro Hill Wind Repower	Wind	1/30/2024	9.93	Webb
26INR0042	Valhalla Solar	Solar	1/5/2024	306.8	Brazoria
23INR0044	Parliament Solar U1	Solar	12/31/2024	250.4	Waller
23INR0044	Parliament Solar U2	Solar	12/31/2024	234.2	Waller
24INR0023	Compadre Solar U1	Solar	12/25/2024	194.7	Hill
24INR0023	Compadre Solar U2	Solar	12/25/2024	211.5	Hill
24INR0208	Eastbell Milam Solar II	Solar	12/20/2024	151.0	Milam
24INR0329	XE Murat Storage	Battery	12/14/2024	60.1	Harris
24INR0605	TEXAS GULF SULPHUR REPOWER	NG	6/25/2024	94.0	Wharton
16INR0049	Nazareth Solar	Solar	3/24/2025	204.0	Castro
21INR0428	Nabatoto Solar North U1	Solar	2/1/2026	224.8	Leon
21INR0428	Nabatoto Solar North U2	Solar	2/1/2026	140.9	Leon
24INR0395	Berkman Storage	Battery	4/30/2026	150.9	Galveston

B: Detailed Maps of Project Options

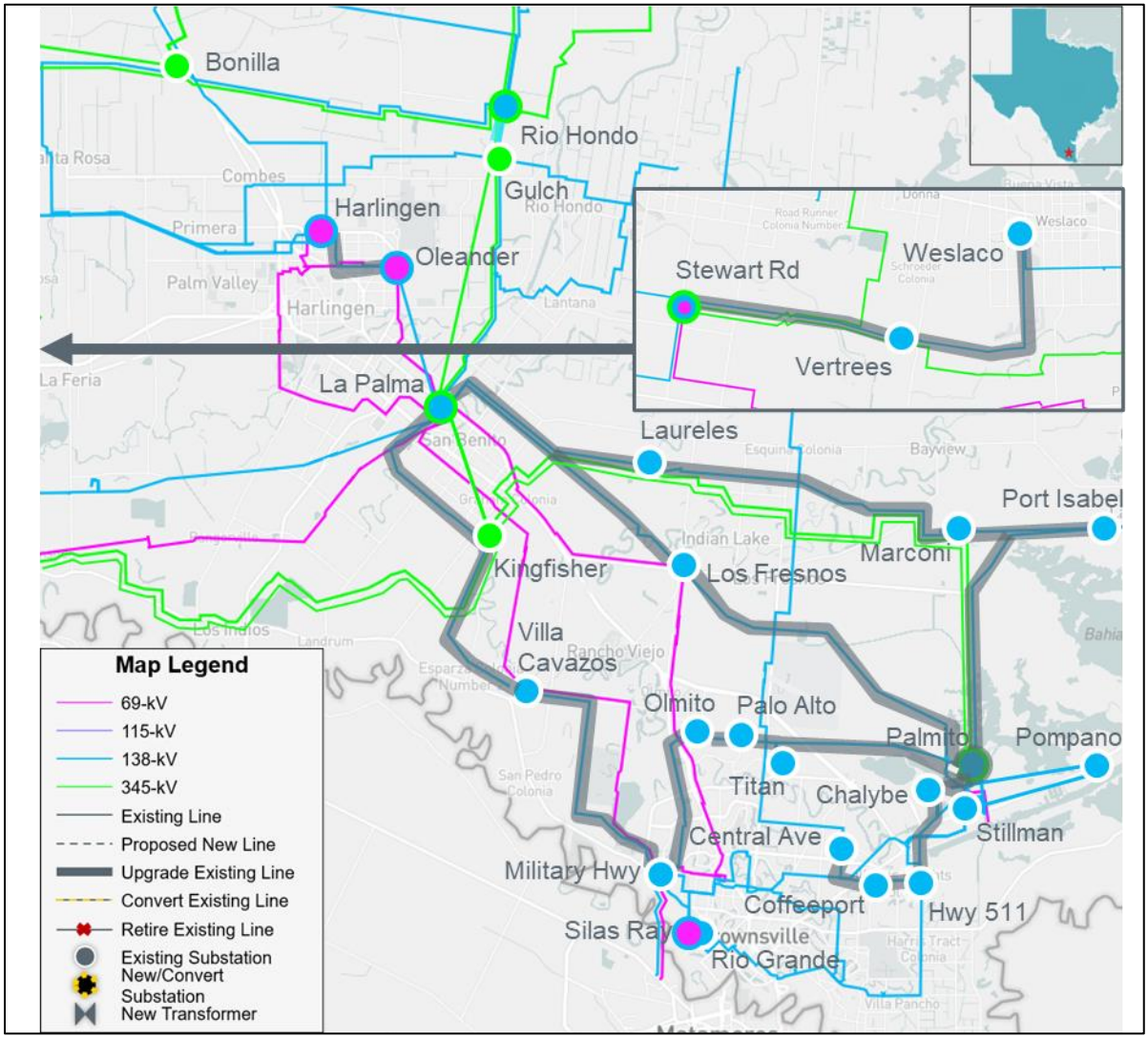


Figure B.1: Map of Option 1

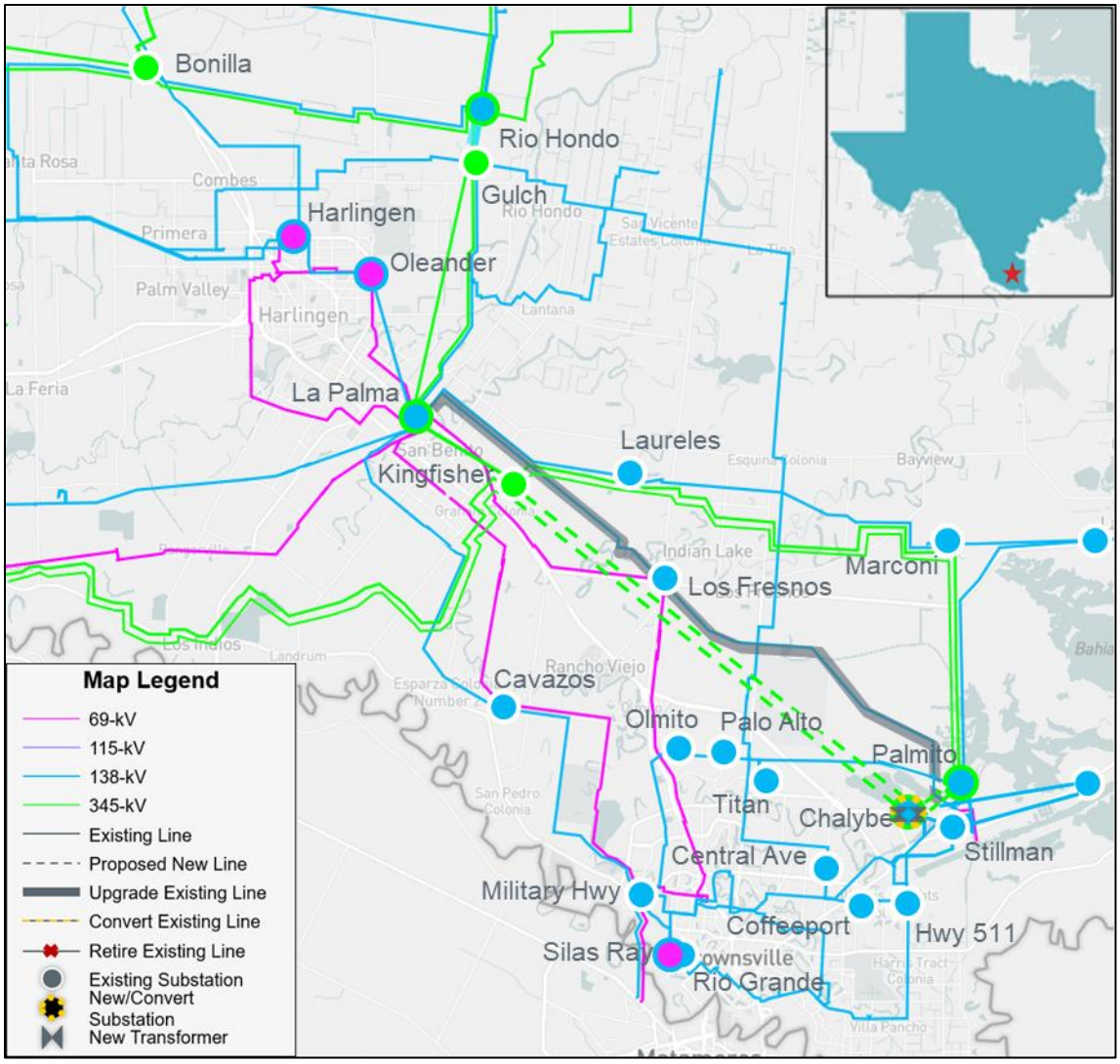


Figure B.2: Map of Option 2

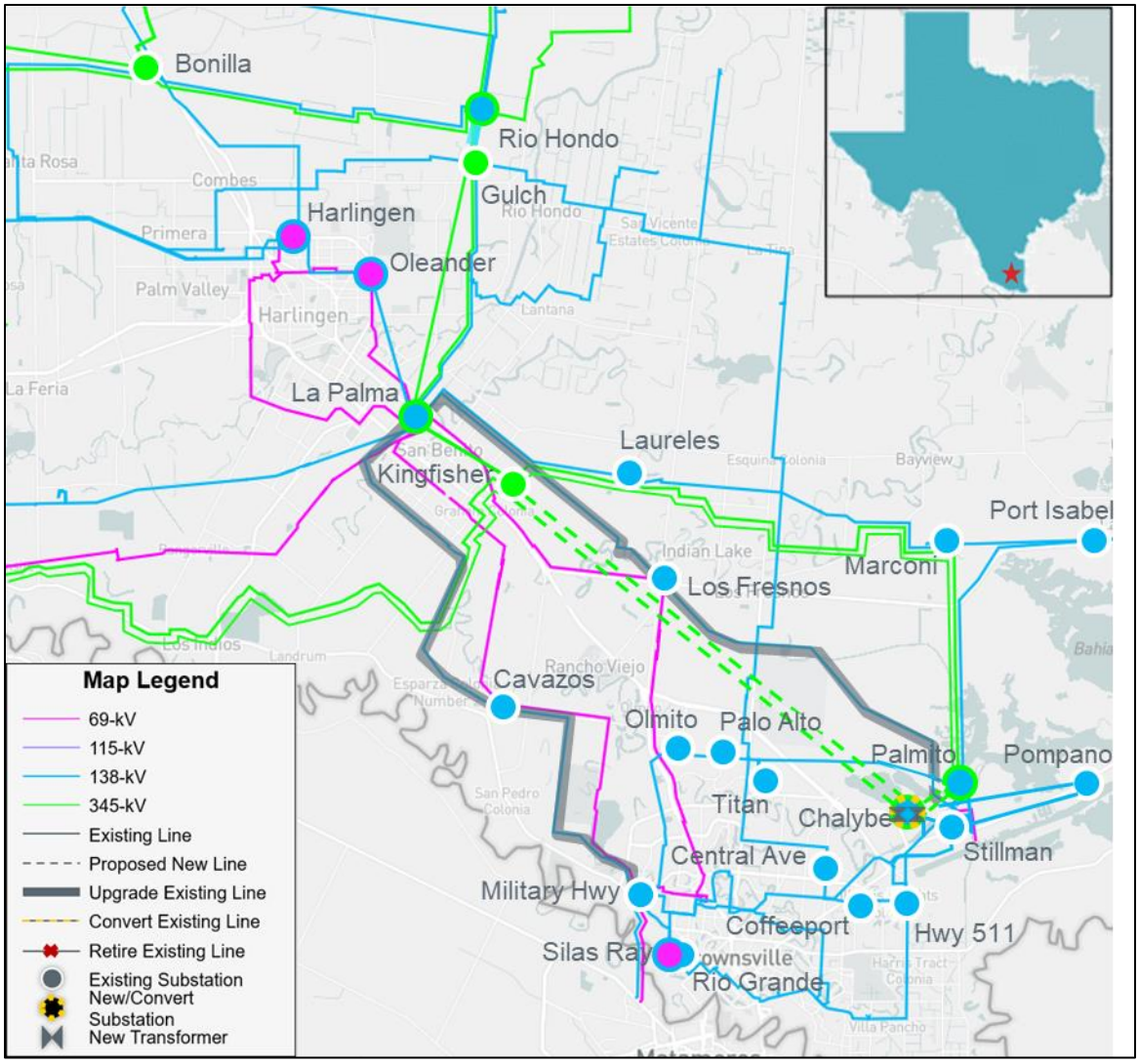


Figure B.2A: Map of Option 2A

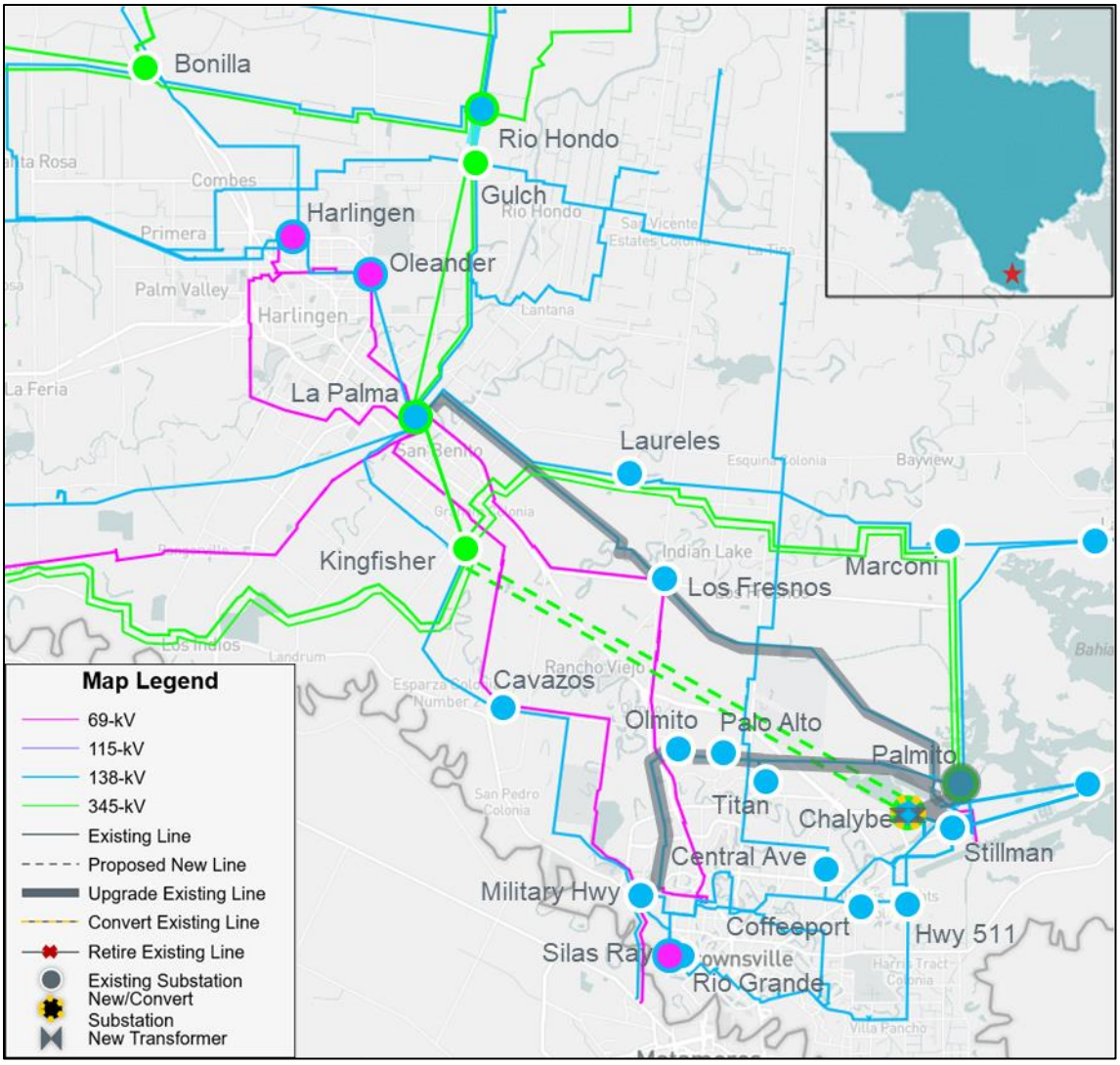


Figure B.3: Map of Option 3

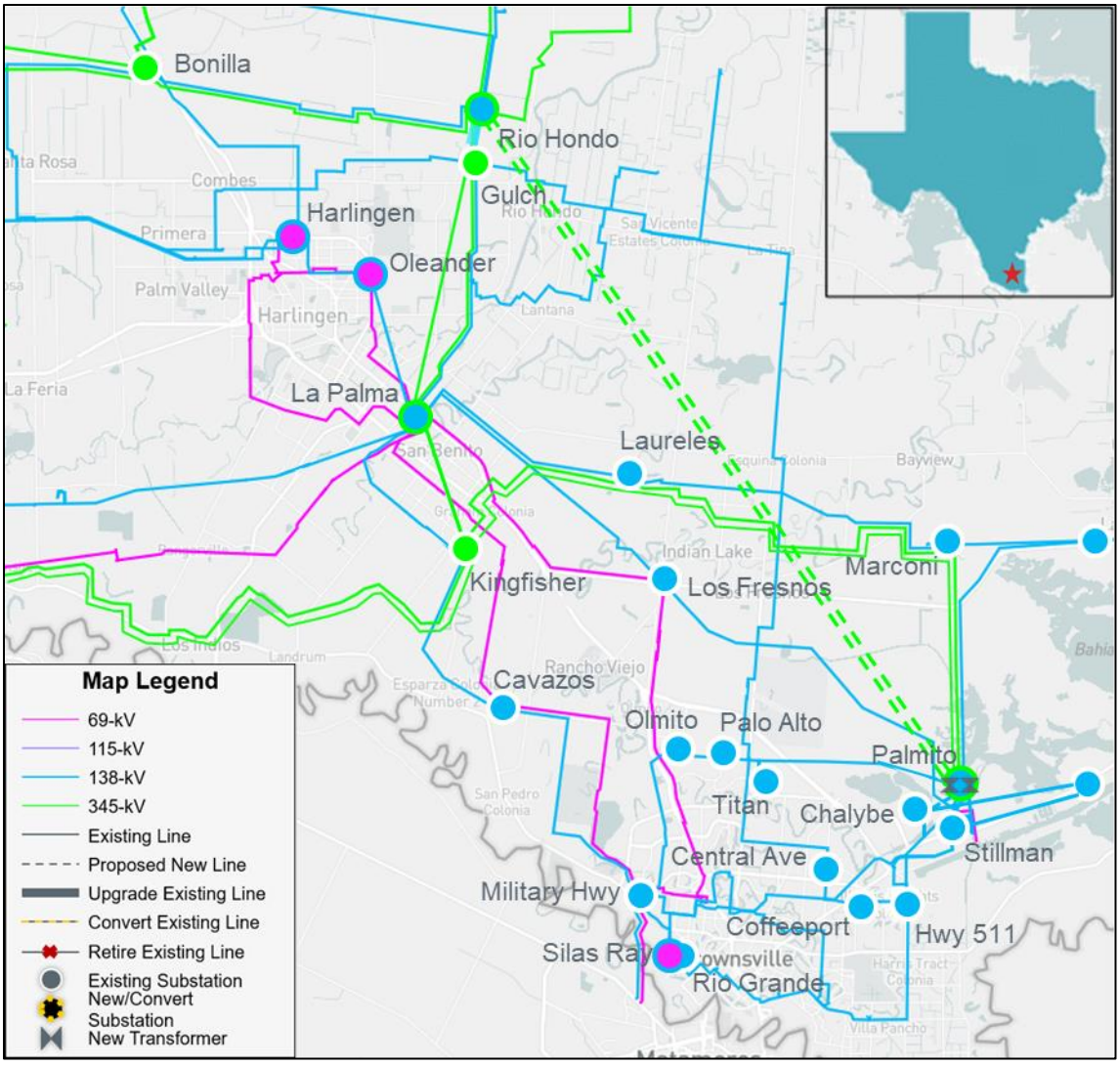


Figure B.4: Map of Option 4

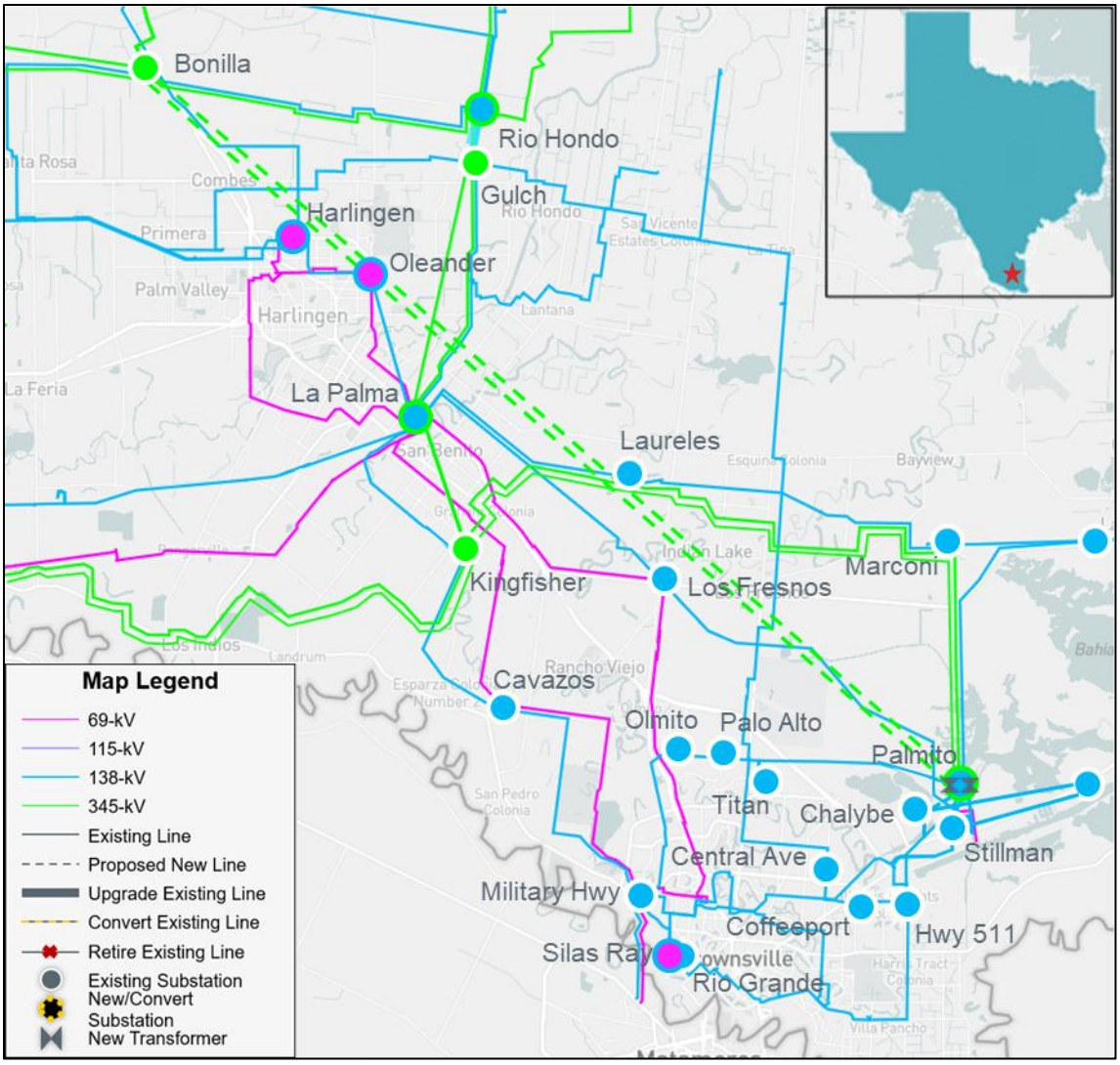


Figure B.5: Map of Option 5

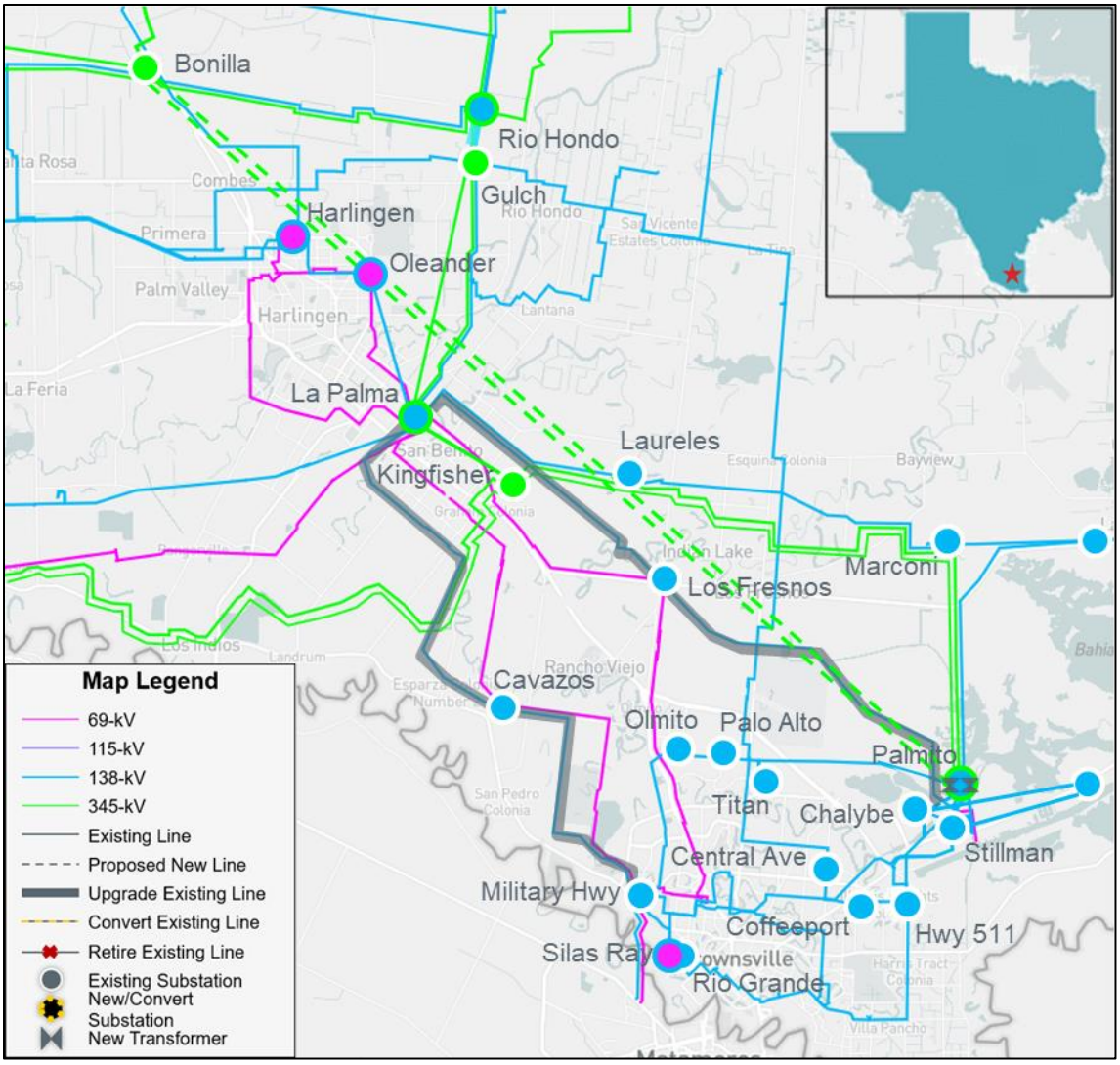
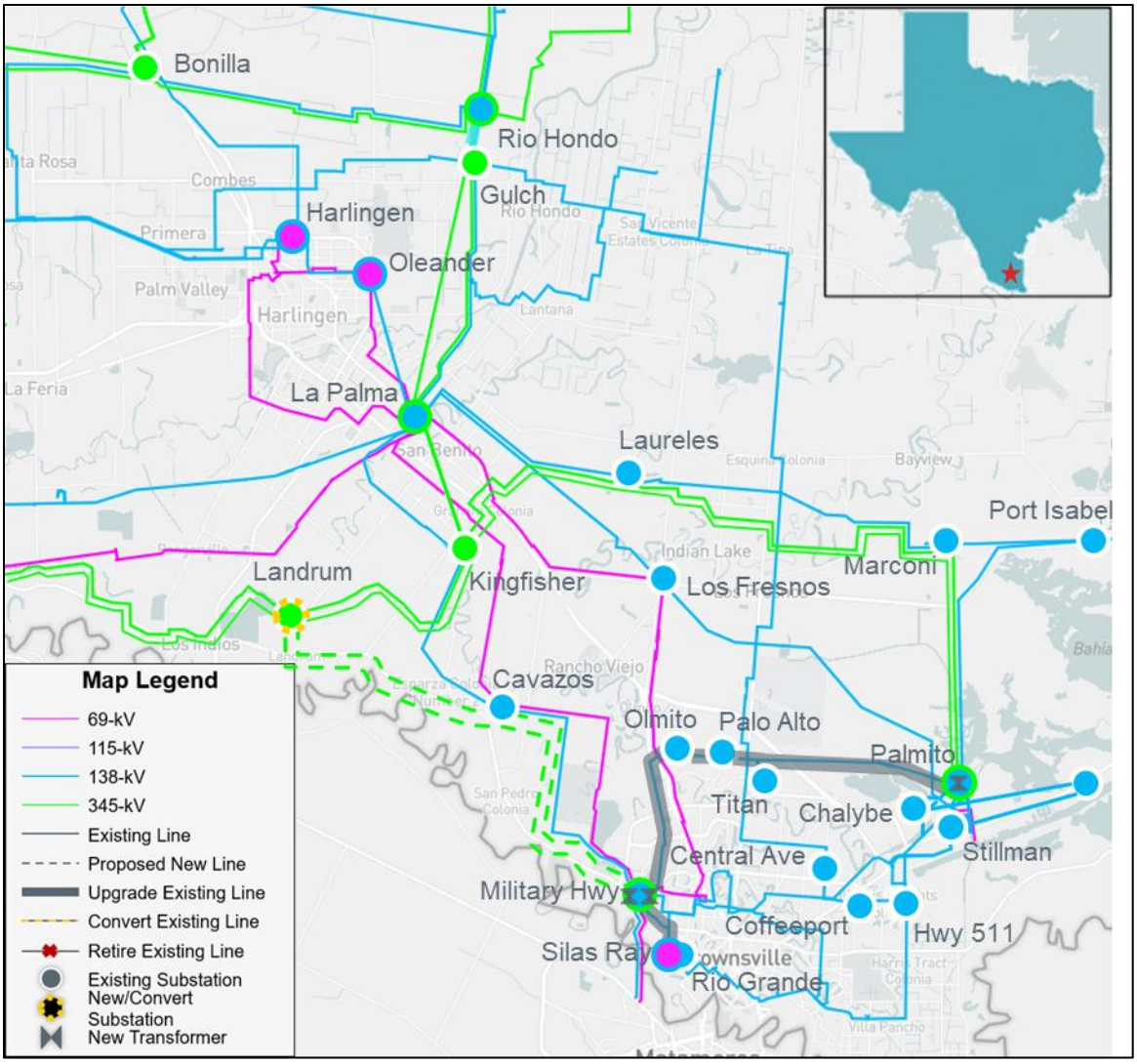


Figure B.5A: Map of Option 5A



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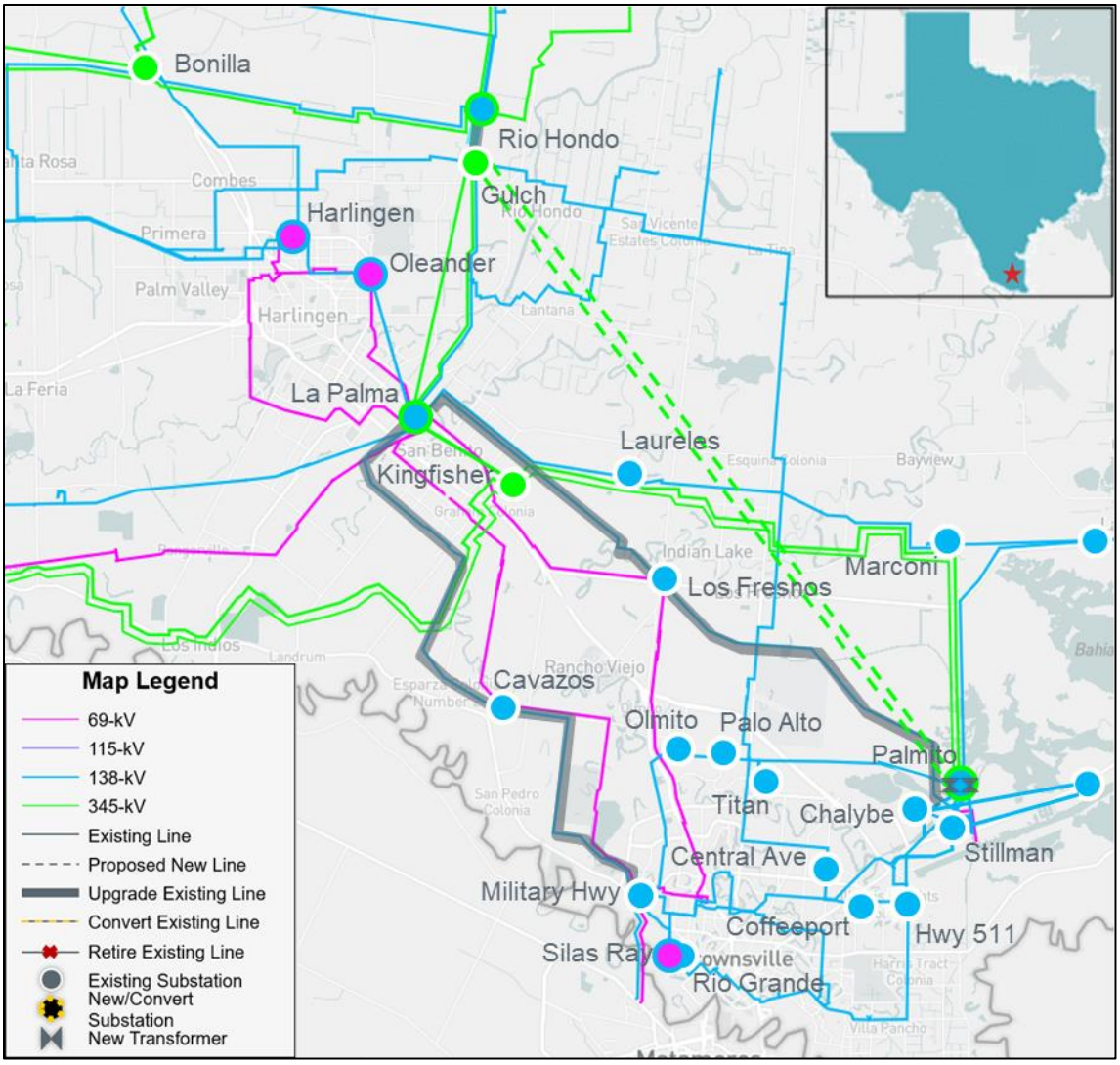

Figure B.7: Map of Option 7

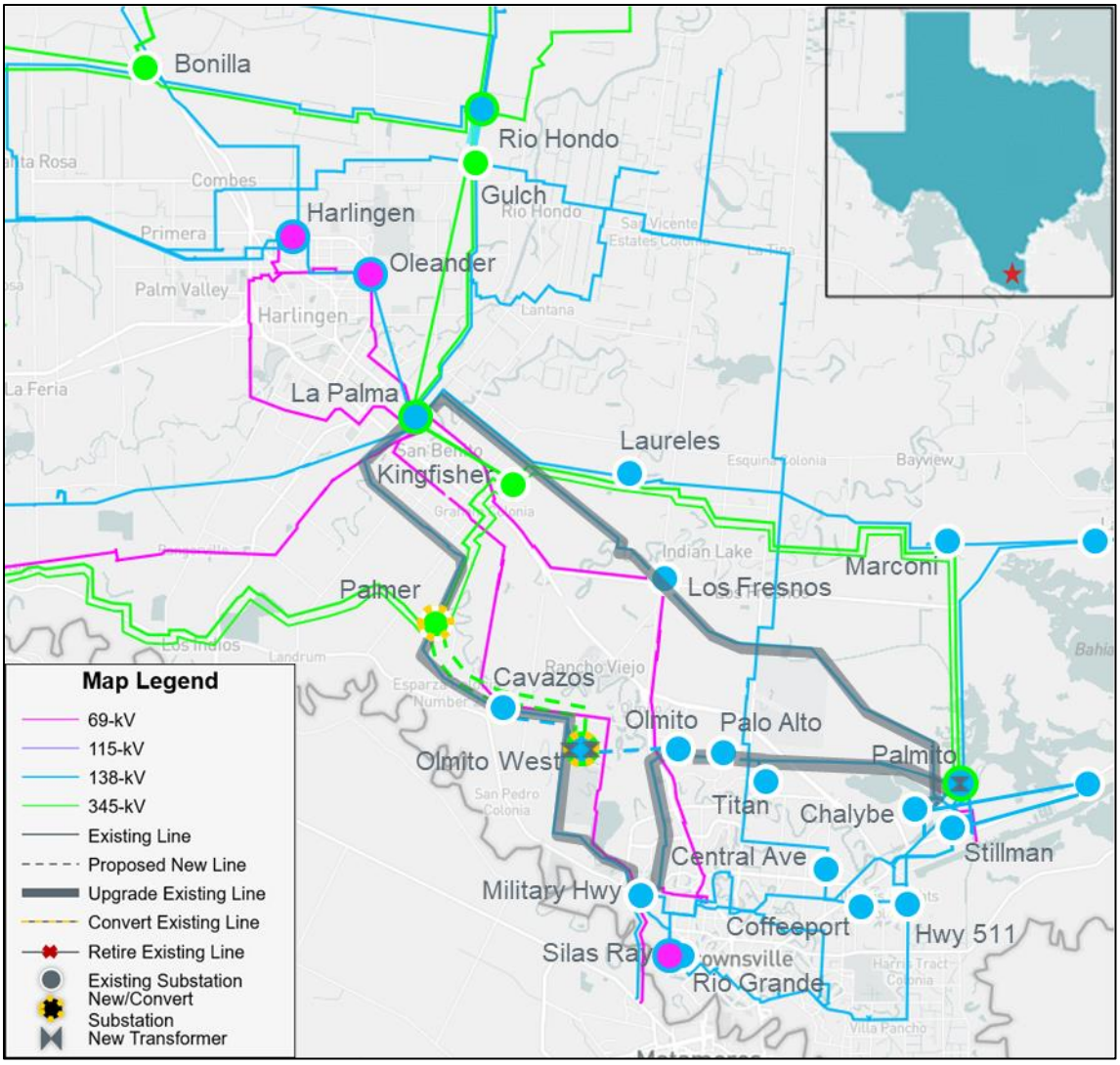

Figure B.8: Map of Option 8

C: Attachments

Table C.1: Project Related Document

No	Document Name	Attachment
1	Brownsville Area Improvements Project	AEPSC Brownsville Area Improvements