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Item 5.3: 25RPG009 Oncor and LCRA TSC Muscovy and Voss Lake 345/138-kV Regional Planning Group (RPG) Project

Kristi Hobbs
Vice President, System Planning and Weatherization

Board of Directors Meeting

June 1-2, 2026

Purpose

Provide an overview of the $1.457 billion Oncor and LCRA TSC Muscovy and Voss Lake 345/138-kV Tier 1 Reliability Project (Option 7A). Per ERCOT Protocol Section 3.11.4.7 Tier 1 projects require Board endorsement.

Voting Items

ERCOT staff requests and recommends that the Board of Directors (Board) endorse the Oncor and LCRA TSC Muscovy and Voss Lake 345/138-kV RPG Project (Option 7A) based on North American Electric Reliability Corporation (NERC) and Electric Reliability Council of Texas, Inc (ERCOT) reliability planning criteria.

Key Takeaways

- Ensuring ERCOT's leadership for grid reliability and resilience, the Project has completed RPG review and received an independent assessment from ERCOT staff and unopposed endorsement with one abstention by the Technical Advisory Committee (TAC).
- ERCOT studied several options and recommends Option 7A as it addresses all project needs in the study area, meets ERCOT and NERC reliability criteria, improves long-term load-serving capability, supports future load growth in the area and is feasible for construction.

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Oncor and LCRA TSC Muscovy and Voss Lake 345/138-kV RPG Project

Oncor and LCRA TSC submitted the Muscovy and Voss Lake 345/138-kV RPG Project (25RPG009) for Reginal Planning Group (RPG) review in April 2025.

The purpose of the project is to address the reliability issues in Williamson and Milam counties in the South Central Weather Zone.

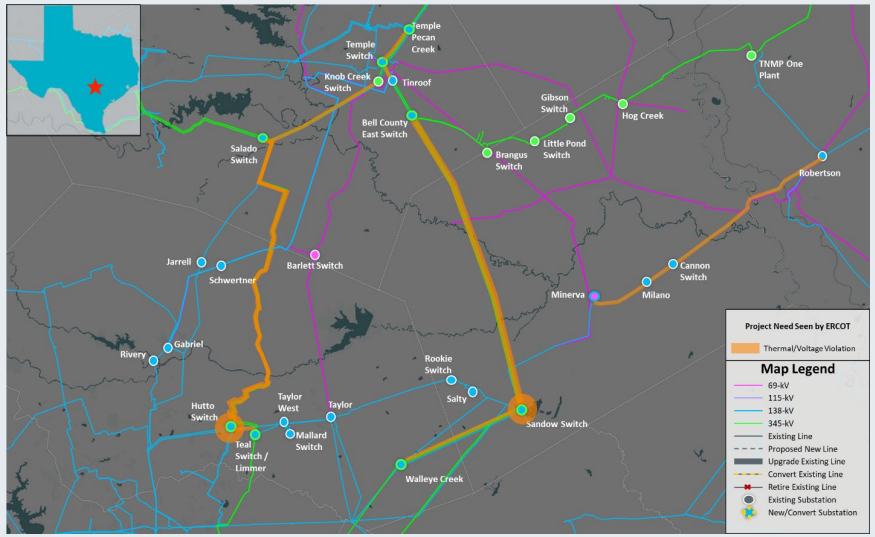
ERCOT performed an independent review of the project and identified thermal overloads, voltage violations and unsolved power flows in Bell, Milam, Williamson, Bastrop, Travis, Hays, Caldwell and Robertson counties in the North Central, South Central and East Weather Zones.

ERCOT's Independent Review (EIR) was separated into two Phases to resolve the violations identified in Study Area 1 – North of Hutto and Study Area 2 – South of Hutto.

ERCOT's endorsement of the project is based on the reliability need to relieve **thermal overloads** on ~156.5 miles of 345-kV, ~56.0 miles of 138-kV, ~1 miles of 69-kV, eight (8) 345/138-kV transformers, 123 **voltage violations** and 3 **unsolved power flows** in Study Area 1 – North of Hutto to meet NERC and ERCOT reliability planning criteria.

Key Takeaway: The Oncor and LCRA TSC Muscovy and Voss Lake 345/138-kV Project (Option 7A) addresses the reliability issues identified in Study Area 1 – North of Hutto.

Reliability Violations Seen by ERCOT in Study Area 1 – North of Hutto



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Oncor and LCRA TSC Muscovy and Voss Lake 345/138-kV RPG Project (cont.)

Estimated Cost: approximately $1.457 billion

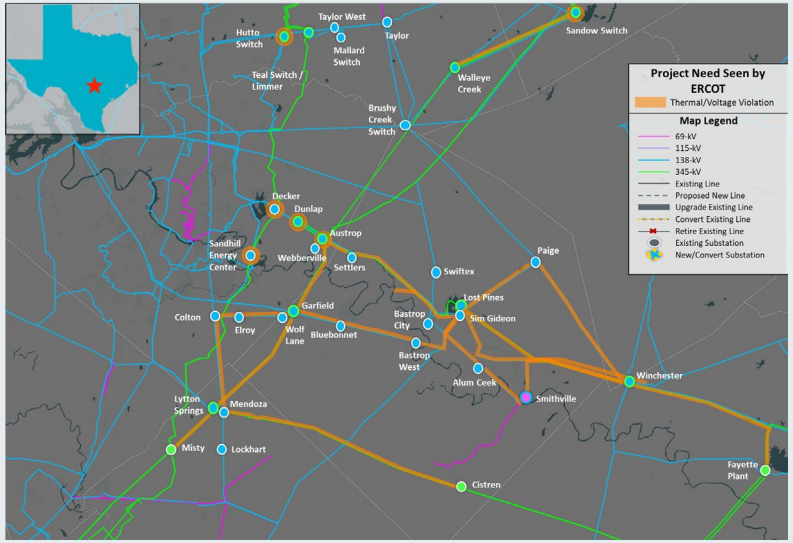
- Updated CPS's initial cost estimate (approximately $388.94 million);
- A subset of upgrades identified in Oncor Set 1 North Central and South Central Texas Reliability Project (25RPG041) were included as part of this project (approximately $603.33 million); and
- Approximately $465.20 million in upgrades to address additional reliability violations under peak load conditions.

ERCOT Presented the project and TAC voted unopposed with one abstention to endorse the project on May 19, 2026.

ERCOT will be conducting an additional independent review to address the need in Study Area 2 – South of Hutto. The evaluation of Study Area 2 will be conducted after the completion of Study Area 1.

Key Takeaway: The Oncor and LCRA TSC Muscovy and Voss Lake 345/138-kV Project (Option 7A) has completed RPG review and received unopposed endorsement with one abstention by TAC.

Reliability Violations Seen by ERCOT in Study Area 2 – South of Hutto



Basis for ERCOT Board Endorsement

ERCOT's independent review identified a reliability need for the Oncor and LCRA TSC Muscovy and Voss Lake 345/138-kV Project (Option 7A) to satisfy:

NERC TPL-001-5.1 Table 1 Reliability Criteria for category:

- P0, P1, P3, P6-2 and P7 contingencies

ERCOT Planning Guide Section Reliability Performance Criteria contingency:

- 4.1.1.2(1)(a): The contingency is a loss of a common tower outage
- 4.1.1.2(1)(d): The contingency is a loss of a single generator followed by a single transmission element or common tower outage
- 4.1.1.2(1)(e): The contingency is a loss of a single transformer followed by a single transmission element or common tower outage

Key Takeaway: The Oncor and LCRA TSC Muscovy and Voss Lake 345/138-kV Project (Option 7A) is needed to reliably meet NERC and ERCOT Planning Guide criteria.

Overall Project Summary

Approximately 159 circuit-miles of new 345-kV transmission lines;

Approximately 100.8 circuit-miles of rebuilt 345-kV transmission lines;

Approximately 45.4 circuit-miles of rebuilt 138-kV transmission lines;

Construct three (3) new 345/138-kV Stations;

Construct one (1) new 345-kV Station;

Install five (5) new 345/138-kV auto transformers; and

Install sized capacitors totaling 110.4 MVAr.

A Certificate of Convenience and Necessity (CCN) is needed for the construction of the new Limmer to Muscovy Switch 345-kV line, Voss Lake switch to Walleye Creek Switch 345-kV line, Muscovy Switch to Voss Lake Switch 345-kV line, two new Tower Switch to Knob Creek Switch 345-kV lines, Salado Switch to Tower Switch 345-kV line, Temple Switch to Tower Switch 345-kV line, Temple Switch to Temple Pecan Switch 345-kV line on separate structures, Hutto Switch to Limmer 345-kV line on separate structures, Salado Switch to Gabriel 345-kV line and the Gabriel to Hutto Switch 345-kV line, due to total approximately 97.3 miles of new right of way (ROW).

Key Takeaway: The Oncor and LCRA TSC Muscovy and Voss Lake 345/138-kV Project (Option 7A) will require a CCN due to approximately 97.3 miles of new ROW.

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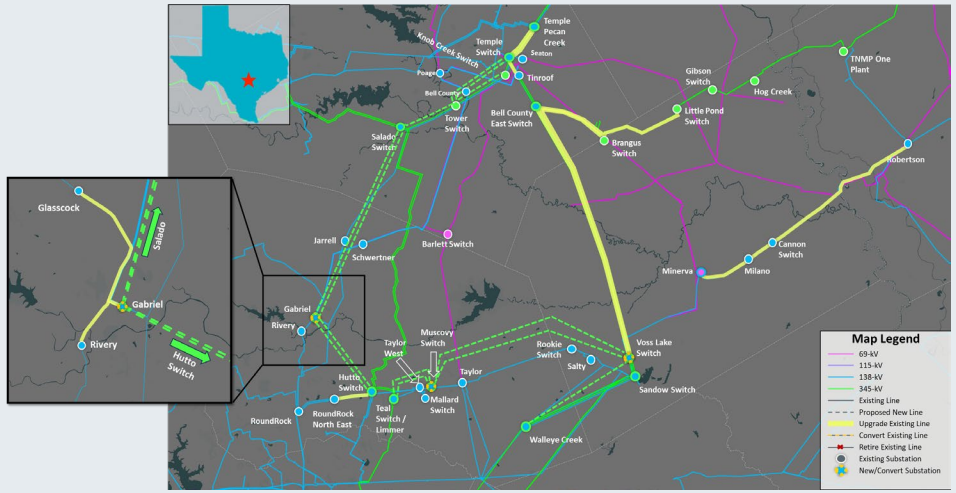
Request for Board Vote

ERCOT staff requests and recommends that the Board endorse the need for the Oncor and LCRA TSC Muscovy and Voss Lake 345/138-kV Project (Option 7A) based on NERC and ERCOT reliability planning criteria.

The ERCOT Independent Review (EIR) is included as **Attachment A** to the Board Decision Template.

Key Takeaway: ERCOT studied several options and recommends Option 7A as it addresses all project needs, meets ERCOT and NERC Reliability Standard, improves long-term load-serving capability, supports future load growth in the area and is feasible for construction.

ERCOT Recommendation



Date: May 22, 2026
To: Board of Directors
From: Kristi Hobbs, Vice President, System Planning and Weatherization (ERCOT)
Subject: 25RPG009 Oncor and LCRA TSC Muscovy and Voss Lake 345/138-kV Regional Planning Group (RPG) Project

Issue for the ERCOT Board of Directors

ERCOT Board of Directors Meeting Date: June 1-2, 2026

Item No.: 5.3

Issue:
Whether the Board of Directors (Board) of Electric Reliability Council of Texas, Inc. (ERCOT) should accept the recommendation of ERCOT staff to endorse the need for the Tier 1 Oncor and LCRA TSC Muscovy and Voss Lake 345/138-kV Regional Planning Group (RPG) Project in order to meet the reliability requirements for the ERCOT System and address thermal overloads, voltage violations and unsolved power in Bell, Milam, Williamson, Bastrop, Travis, Hays, Caldwell and Robertson counties in the North Central, South Central and East Weather Zones, which ERCOT staff has independently reviewed and which the Technical Advisory Committee (TAC) has voted unopposed with one abstention to endorse.

Background/History:
Oncor and LCRA TSC proposed the Muscovy and Voss Lake 345/138-kV Project in April 2025, a $381.83 million, Tier 1 project with the expected in-service date (ISD) of December 2028, to meet reliability planning criteria in Williamson and Milam counties in the South Central Weather Zone. 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 Oncor and LCRA TSC Muscovy and Voss Lake 345/138-kV Project and identified thermal overloads, voltage violations and unsolved power flows in Bell, Milam, Williamson, Bastrop, Travis, Hays, Caldwell and Robertson counties. ERCOT divided the observed violations into two study areas, study area 1, consisting of Bell, Milam, Williamson and Robertson counties, and study area 2, consisting of Bastrop, Travis, Hays and Caldwell counties. The ERCOT project recommendation (Option 7A), a $1.457 billion, Tier 1 project with the expected ISD of December 2031 addresses the need in study area 1, consisting of Bell, Milam,

Williamson and Robertson counties, for a project under North American Electric Reliability Corporation (NERC) and ERCOT Planning Criteria to address thermal overloads on approximately 156.5 miles of 345-kV, 56.0 miles of 138-kV, 1 miles of 69-kV, eight (8) 345/138-kV transformers, 123 voltage violations and 3 unsolved power flows in Bell, Milam, Williamson and Robertson counties with the following ERCOT System improvements:

- Establish the new Muscovy 345/138-kV Switch by installing ten 345-kV, 5000 A and twelve 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, for approximately 3.3 miles east of the 345-kV Limmer Substation (LCRA TSC) and 138-kV Teal Switch (Oncor);
    - Install two 345/138-kV autotransformers with normal rating of 700 MVA and emergency rating of 750 MVA;
    - Install three 36.8 MVAr capacitor banks;
    - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV;
- Construct a new 345-kV double-circuit transmission line which will require a CCN from Limmer Substation (LCRA TSC) to Muscovy Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 4 miles;
- Construct a loop of the existing Teal Switch to Pintail Switch 138-kV double-circuit transmission line with a normal and emergency ratings of at least 614 MVA into the new Muscovy 138-kV Switch, for approximately 0.1 miles;
- Establish the new Voss Lake 345/138-kV Switch by installing ten 345-kV, 5000 A and nine 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, for approximately 1.9 miles north of Sandow 345/138-kV Switch;
    - Install one 345/138-kV autotransformer with normal ratings of at least 700 MVA and emergency ratings of at least 750 MVA;
    - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV;
- Construct a loop of the existing Sandow Switch to Bell County East Switch 345-kV double-circuit transmission line into the Voss Lake 345- kV Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 0.1 miles;
- Construct a loop of the existing Sandow Switch to Temple Switch 138-kV transmission line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, for approximately 0.1 miles;
- Construct a loop of the existing Sandow Switch to Minerva Switch 138-kV transmission line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, for approximately 0.1 miles;

- Construct a new 345-kV transmission line which will require a CCN from Voss Lake Switch to Walleye Creek Switch with a normal and emergency ratings of at least 2,987 MVA or greater on double-circuit structures with one circuit installed initially, for approximately 2 miles;
- Construct a new 345-kV double-circuit transmission line which will require a CCN from Muscovy Switch to Voss Lake Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 25 miles;
- Install terminal equipment in existing bays at Limmer Substation to connect both circuits of the new 345-kV double-circuit transmission line to Muscovy Switch, including two 345-kV, 5000 A circuit breakers and associated equipment. All associated terminal equipment will have a minimum rating of 5000 A;
- Establish the Tower 345-kV Switch by installing ten 345-kV, 5000 A circuit breakers in a breaker-and-a-half bus arrangement;
    - Loop the existing Salado Switch to Knob Creek Switch 345-kV transmission line into Tower 345-kV Switch to create the new Salado Switch to Tower Switch 345-kV transmission line, for approximately 12.4 miles and Tower Switch to Temple Switch 345-kV transmission line, for approximately 2.9 miles;
    - Construct two new 345-kV single-circuit transmission lines from Tower Switch to Knob Creek Switch on independent, single-circuit structures with a normal and emergency rating 2,987 MVA, for approximately 1.2 miles, this upgrade will require a CCN;
    - Rebuild the Salado Switch to Tower Switch 345-kV transmission line using double-circuit capable structures with two circuits installed with normal and emergency rating 2,987 MVA, for approximately 12.4 miles, this upgrade will require a CCN;
    - Rebuild the Tower Switch to Temple Switch 345-kV transmission line using double-circuit capable structures with two circuits installed with normal and emergency rating 2,987 MVA, for approximately 2.9 miles, this upgrade will require a CCN;
    - Ensure all associated terminal equipment to meet or exceed 5000 A (2,987 MVA);
- Rebuild the Bell County East Switch to Voss Lake Switch 345-kV double-circuit transmission line with a normal and emergency rating of 1,912 MVA, for approximately 29.6 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);

- Rebuild the Minerva Switch to Robertson 138-kV transmission line using double-circuit capable structures with one circuit installed with a normal and emergency rating of 614 MVA, for approximately 29.1 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);
- Rebuild the Temple Switch to Tinroof 138-kV transmission line using double-circuit capable structures with one circuit installed with a normal and emergency rating of 614 MVA, for approximately 1.85 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);
- Rebuild the Bell County East Switch to Little Pond 345-kV transmission line with a normal and emergency rating of 1,912 MVA, for approximately 17.75 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);
- Rebuild the Bell County East Switch to Brangus 345-kV transmission line with a normal and emergency rating of 1,912 MVA, for approximately 8.8 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);
- Rebuild the Temple Switch to Temple Pecan Creek Switch 345-kV double-circuit transmission line with a normal and emergency rating 2,987 MVA, on separate structures, for approximately 4.5 miles, and ensure all associated terminal equipment to meet or exceed 5000 A (2,987 MVA);
- Rebuild the Hutto to Round Rock Northeast 138-kV transmission line using double-circuit capable structures with normal and emergency rating of 614 MVA, for approximately 5.3 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);
- Rebuild Hutto to Limmer 345-kV double-circuit transmission line on separate structures, for approximately 3 miles, this upgrade will require a CCN;
- Establish a new 345-kV yard at Gabriel Substation by installing ten 345-kV, 5000 A circuit breakers in a breaker-and-a-half bus arrangement;
    - Install two 345/138-kV autotransformers with normal rating of 672 MVA and emergency rating of 739 MVA;
    - Construct a new 345-kV double-circuit transmission line from Salado to Gabriel Substation with normal and emergency rating 2,987 MVA, for approximately 28.5 miles, this upgrade will require a CCN;
    - Construct a new 345-kV double-circuit transmission line from Gabriel Substation to Hutto Switch with normal and emergency rating 2,987 MVA, for approximately 12.6 miles, this upgrade will require a CCN;

- Rebuild the Gabriel to Rivery 138-kV transmission line using double-circuit capable structures with one circuit installed with normal and emergency rating 614 MVA, for approximately 2.5 miles, and ensure all associated terminal equipment to meet or exceed 3000 A (717 MVA); and
- Rebuild the Gabriel to Glasscock 138-kV transmission line using double-circuit capable structures with one circuit installed with normal and emergency rating 614 MVA, for approximately 6.6 miles, and ensure all associated terminal equipment to meet or exceed 3000 A (717 MVA).

ERCOT's independent review verified the reliability need for the Oncor and LCRA TSC Muscovy and Voss Lake 345/138-kV Project to satisfy ERCOT Planning Guide Section 4.1.1.2(1)(a), Reliability Performance Criteria, contingency is a loss of a common tower outage, 4.1.1.2(1)(d), Reliability Performance Criteria, contingency for the loss of a single generator followed by a single transmission element or common tower outage and 4.1.1.2(1)(e), Reliability Performance Criteria, contingency for the loss of a single transformer followed by a single transmission element or common tower outage.

RPG considered project overviews during meetings in May 2025 and May 2026. Between May 2025 and May 2026, ERCOT staff presented scope and status updates at RPG meetings in May, June, July, October 2025, January, March, April and May 2026. 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 May 19, 2026, TAC unopposed with one abstention 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.

ERCOT's assessment of the Subsynchronous Oscillations (SSO) of existing facilities, conducted pursuant to Protocol Section 3.22.1.3, Transmission Project Assessment, yielded no adverse SSO 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, indicated no significant new congestion in the area with the addition of the Oncor and LCRA TSC Muscovy and Voss Lake 345/138-kV Project (Option 7A).

The report describing the ERCOT Independent Review of the Oncor and LCRA TSC Muscovy and Voss Lake 345/138-kV Project (Option 7A), including ERCOT staff's recommendation, is included as ***Attachment A***.

Key Factors Influencing Issue:

1. ERCOT System improvements are needed to meet reliability planning criteria in Bell, Milam, Williamson and Robertson counties in the North Central, South Central and East Weather Zones.
2. ERCOT staff found the recommended set of improvements to be the most efficient solution for meeting the planning reliability criteria, addressing thermal overloads, voltage violations and unsolved power flows.
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 unopposed with one abstention to endorse the Tier 1 Oncor and LCRA TSC Muscovy and Voss Lake 345/138-kV Regional Planning Group (RPG) Project (Option 7A), as recommended by ERCOT, on May 19, 2026.

Conclusion/Recommendation:

ERCOT staff recommends that the Board endorse the need for the Tier 1 Oncor and LCRA TSC Muscovy and Voss Lake 345/138-kV RPG Project (Option 7A), which ERCOT staff has independently reviewed, and which TAC has voted unopposed with one abstention to endorse based on North American Electric Reliability Corporation (NERC) and 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 recommendation to endorse the need for the Tier 1 Oncor and LCRA TSC Muscovy and Voss Lake 345/138-kV Regional Planning Group Project (Option 7A), which ERCOT staff has independently reviewed and which the Technical Advisory Committee (TAC) has voted unopposed with one abstention to endorse based on North American Electric Reliability Corporation (NERC) and ERCOT reliability planning criteria;

THEREFORE, BE IT RESOLVED, that ERCOT is hereby authorized and approved to endorse the need for the Tier 1 Oncor and LCRA TSC Muscovy and Voss Lake 345/138-kV Regional Planning Group Project (Option 7A), which ERCOT staff has independently reviewed, and which TAC has voted unopposed with one abstention to endorse based on NERC and ERCOT reliability planning criteria.

CORPORATE SECRETARY'S CERTIFICATE

I, Brandon Gleason, Assistant Corporate Secretary of ERCOT, do hereby certify that, at its June 1-2, 2026 meeting, the Board passed a motion approving the above Resolution by _____.

IN WITNESS WHEREOF, I have hereunto set my hand this ___ day of _____, 2026.

_____

Brandon Gleason

Assistant Corporate Secretary

ERCOT Independent Review (EIR) of the Oncor Electric Delivery Company LLC (Oncor) and LCRA Transmission Services Corporation (LCRA TSC) Muscovy and Voss Lake 345/138-kV Project (25RPG009)

May 22, 2026

Document Revisions

Date	Version	Description	Authors
05/22/2026	1	Final	Abishek Penti
		Reviewed by	Robert Golen, Prabhu Gnanam

Executive Summary

Oncor Electric Delivery Company LLC (Oncor) and LCRA Transmission Services Corporation (LCRA TSC) submitted the Muscovy and Voss Lake 345/138-kV Project to the Electric Reliability Council of Texas' (ERCOT) Regional Planning Group (RPG) in April 2025. Oncor and LCRA TSC proposed this project to address North American Electric Reliability Corporation (NERC) Reliability Standard TPL-001-5.1 and ERCOT Planning Guide reliability criteria thermal overloads in Williamson and Milam counties in the South Central Weather Zone.

Oncor and LCRA TSC's proposed project was estimated to cost approximately $381.83 million, was classified as a Tier 1 project under ERCOT Nodal Protocol Section 3.11.4.3 and will require a Certificate of Convenience and Necessity (CCN) application.

ERCOT performed an independent review through which it identified reliability needs (thermal overloads, voltage violations and unsolved power flows) in the proposed project area and evaluated ten transmission project options to resolve the identified reliability needs.

ERCOT's review of the project area identified reliability issues not addressed by the initial Oncor and LCRA TSC Muscovy and Voss Lake 345-kV Project submission. ERCOT's 2024 and 2025 Regional Transmission Plans (RTP) identified upgrades to address most of the additional reliability issues in project area. These upgrades were included as part of the Oncor Set 1 North Central & South Central Texas Reliability Project (25RPG041) and were included in the option development. Due to the increase of Large Loads modeled in the study case, additional upgrades are needed to resolve the remaining reliability issues identified in the project area.

Based on the ERCOT Independent Review's (EIR) study results described in Section 5 and 6 of this report, ERCOT recommends Option 7A to address the identified reliability issues. Option 7A consists of the following:

- Establish the new Muscovy 345/138-kV Switch by installing ten 345-kV, 5000 A and twelve 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, for approximately 3.3 miles east of the 345-kV Limmer Substation (LCRA TSC) and 138-kV Teal Switch (Oncor);

  - Install two 345/138-kV autotransformers with normal rating of 700 MVA and emergency rating of 750 MVA;
  - Install three 36.8 MVAr capacitor banks;
  - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV;
- Construct a new 345-kV double-circuit transmission line which will require a CCN from Limmer Substation (LCRA TSC) to Muscovy Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 4 miles;
- Construct a loop of the existing Teal Switch to Pintail Switch 138-kV double-circuit transmission line with a normal and emergency ratings of at least 614 MVA into the new Muscovy 138-kV Switch, for approximately 0.1 miles;
- Establish the new Voss Lake 345/138-kV Switch by installing ten 345-kV, 5000 A and nine 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, for approximately 1.9 miles north of Sandow 345/138-kV Switch;
  - Install one 345/138-kV autotransformer with normal ratings of at least 700 MVA and emergency ratings of at least 750 MVA;
  - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV;
- Construct a loop of the existing Sandow Switch to Bell County East Switch 345-kV double-circuit transmission line into the Voss Lake 345-kV Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 0.1 miles;
- Construct a loop of the existing Sandow Switch to Temple Switch 138-kV transmission line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, for approximately 0.1 miles;
- Construct a loop of the existing Sandow Switch to Minerva Switch 138-kV transmission line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, for approximately 0.1 miles;
- Construct a new 345-kV transmission line which will require a CCN from Voss Lake Switch to Walleye Creek Switch with a normal and emergency ratings of at least 2,987 MVA or greater on double-circuit structures with one circuit installed initially, for approximately 2 miles;
- Construct a new 345-kV double-circuit transmission line which will require a CCN from Muscovy Switch to Voss Lake Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 25 miles;
- Install terminal equipment in existing bays at Limmer Substation to connect both circuits of the new 345-kV double-circuit transmission line to Muscovy Switch, including two 345-kV, 5000 A circuit breakers and associated equipment. All associated terminal equipment will have a minimum rating of 5000 A;
- Establish the Tower 345-kV Switch by installing ten 345-kV, 5000 A circuit breakers in a breaker-and-a-half bus arrangement;

  - Loop the existing Salado Switch to Knob Creek Switch 345-kV transmission line into Tower 345-kV Switch to create the new Salado Switch to Tower Switch 345-kV transmission line, for approximately 12.4 miles and Tower Switch to Temple Switch 345-kV transmission line, for approximately 2.9 miles;
  - Construct two new 345-kV single-circuit transmission lines from Tower Switch to Knob Creek Switch on independent, single-circuit structures with a normal and emergency rating 2,987 MVA, for approximately 1.2 miles, this upgrade will require a CCN;
  - Rebuild the Salado Switch to Tower Switch 345-kV transmission line using double-circuit capable structures with two circuits installed with normal and emergency rating 2,987 MVA, for approximately 12.4 miles, this upgrade will require a CCN;
  - Rebuild the Tower Switch to Temple Switch 345-kV transmission line using double-circuit capable structures with two circuits installed with normal and emergency rating 2,987 MVA, for approximately 2.9 miles, this upgrade will require a CCN;
  - Ensure all associated terminal equipment to meet or exceed 5000 A (2,987 MVA);
- Rebuild the Bell County East Switch to Voss Lake Switch 345-kV double-circuit transmission line with a normal and emergency rating of 1,912 MVA, for approximately 29.6 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);
- Rebuild the Minerva Switch to Robertson 138-kV transmission line using double-circuit capable structures with one circuit installed with a normal and emergency rating of 614 MVA, for approximately 29.1 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);
- Rebuild the Temple Switch to Tinroof 138-kV transmission line using double-circuit capable structures with one circuit installed with a normal and emergency rating of 614 MVA, for approximately 1.85 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);
- Rebuild the Bell County East Switch to Little Pond 345-kV transmission line with a normal and emergency rating of 1,912 MVA, for approximately 17.75 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);
- Rebuild the Bell County East Switch to Brangus 345-kV transmission line with a normal and emergency rating of 1,912 MVA, for approximately 8.8 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at

a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);

- Rebuild the Temple Switch to Temple Pecan Creek Switch 345-kV double-circuit transmission line with a normal and emergency rating 2,987 MVA, on separate structures, for approximately 4.5 miles, and ensure all associated terminal equipment to meet or exceed 5000 A (2,987 MVA);
- Rebuild the Hutto to Round Rock Northeast 138-kV transmission line using double-circuit capable structures with normal and emergency rating of 614 MVA, for approximately 5.3 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);
- Rebuild Hutto to Limmer 345-kV double-circuit transmission line on separate structures, for approximately 3 miles, this upgrade will require a CCN;
- Establish a new 345-kV yard at Gabriel Substation by installing ten 345-kV, 5000 A circuit breakers in a breaker-and-a-half bus arrangement;
    - Install two 345/138-kV autotransformers with normal rating of 672 MVA and emergency rating of 739 MVA;
    - Construct a new 345-kV double-circuit transmission line from Salado to Gabriel Substation with normal and emergency rating 2,987 MVA, for approximately 28.5 miles, this upgrade will require a CCN;
    - Construct a new 345-kV double-circuit transmission line from Gabriel Substation to Hutto Switch with normal and emergency rating 2,987 MVA, for approximately 12.6 miles, this upgrade will require a CCN;
- Rebuild the Gabriel to Rivery 138-kV transmission line using double-circuit capable structures with one circuit installed with normal and emergency rating 614 MVA, for approximately 2.5 miles, and ensure all associated terminal equipment to meet or exceed 3000 A (717 MVA); and
- Rebuild the Gabriel to Glasscock 138-kV transmission line using double-circuit capable structures with one circuit installed with normal and emergency rating 614 MVA, for approximately 6.6 miles, and ensure all associated terminal equipment to meet or exceed 3000 A (717 MVA).

The cost estimate for this Tier 1 project using Option 7A is approximately $1.457 billion and the expected in-service date (ISD) for the recommended project is December 2031. One or multiple CCN applications will be required for the construction of the new Limmer to Muscovy Switch 345-kV double-circuit transmission line, Voss Lake Switch to Walleye Creek Switch 345-kV single-circuit transmission line, Muscovy Switch to Voss Lake Switch 345-kV double-circuit transmission line, two new Tower Switch to Knob Creek Switch 345-kV single-circuit transmission lines, Salado Switch to Tower Switch 345-kV double-circuit transmission line, Temple Switch to Tower Switch 345-kV single-circuit

transmission line, Temple Switch to Temple Pecan Switch 345-kV double-circuit transmission line on separate structures, Hutto Switch to Limmer 345-kV double-circuit transmission line on separate structures, Salado Switch to Gabriel 345-kV double-circuit transmission line and Gabriel to Hutto Switch 345-kV double-circuit transmission line due to total approximately 97.3 miles of new right of way (ROW).

Table of Contents

1. Introduction

In April 2025, Oncor Electric Delivery Company LLC (Oncor) and LCRA Transmission Services Corporation (LCRA TSC) submitted the Muscovy and Voss Lake 345/138-kV Project to the Electric Reliability Council of Texas' (ERCOT) Regional Planning Group (RPG) to address North American Electric Reliability Corporation (NERC) Reliability Standard TPL-001-5.1 and ERCOT Planning Guide reliability criteria thermal overloads under various contingency conditions in Williamson and Milam counties in the South Central Weather Zone.

Oncor and LCRA TSC's proposed project was classified as a Tier 1 project under ERCOT Nodal Protocol Section 3.11.4.3, with an estimated cost of approximately $381.83 million. A Certificate of Convenience and Necessity (CCN) application would be required, and the expected in-service date (ISD) for this project is December 2028.

ERCOT separated the study area into two study areas. Study area 1 includes all the transmission elements north of Hutto as shown in Figure 1.1. Study area 2 includes all the transmission elements south of Hutto as shown in Figure 1.2. ERCOT conducted phase 1 of this independent review to identify reliability needs in study area 1 and evaluated ten transmission upgrade options. The reliability needs identified in the study area 2, and will be addressed separately in phase 2 of the independent review.

This report describes the study assumptions, methodology, and the results of phase 1 ERCOT Independent Review (EIR) of the project.

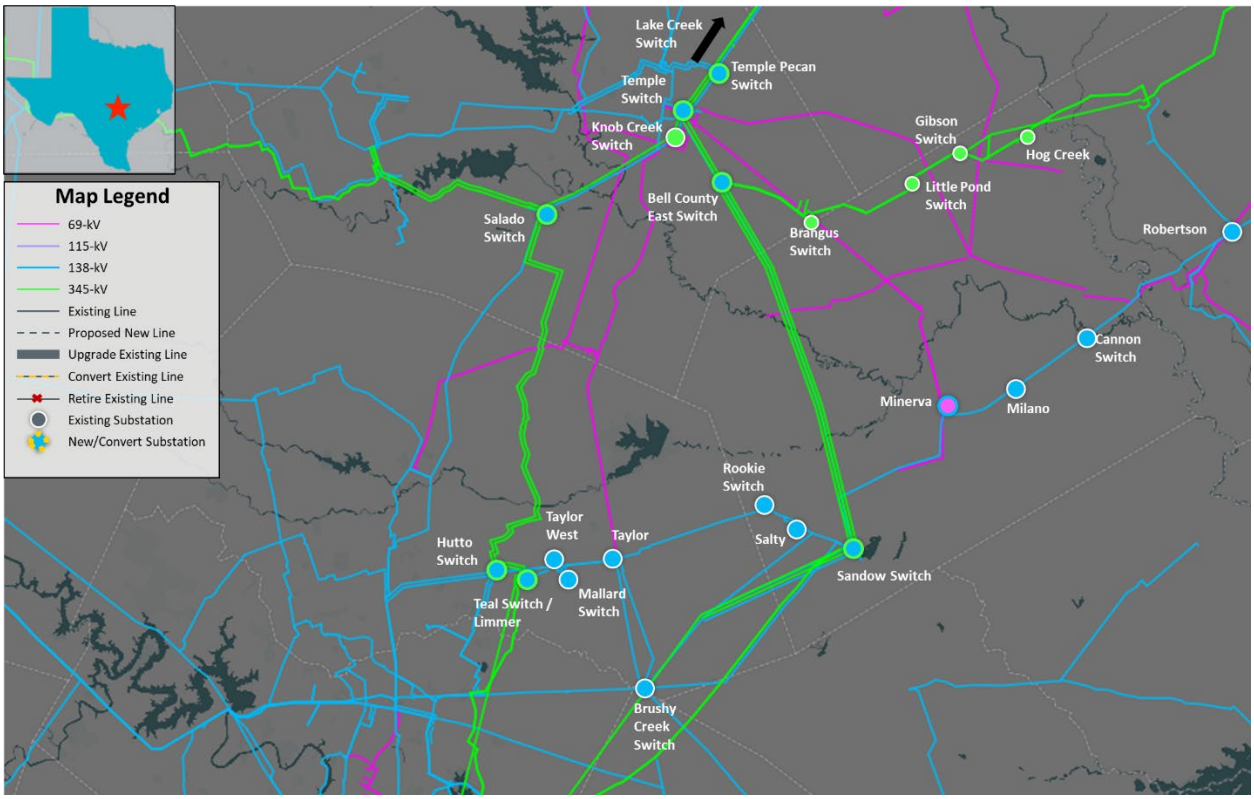


Figure 1.1: Map of Transmission System of Study Area 1 – North of Hutto

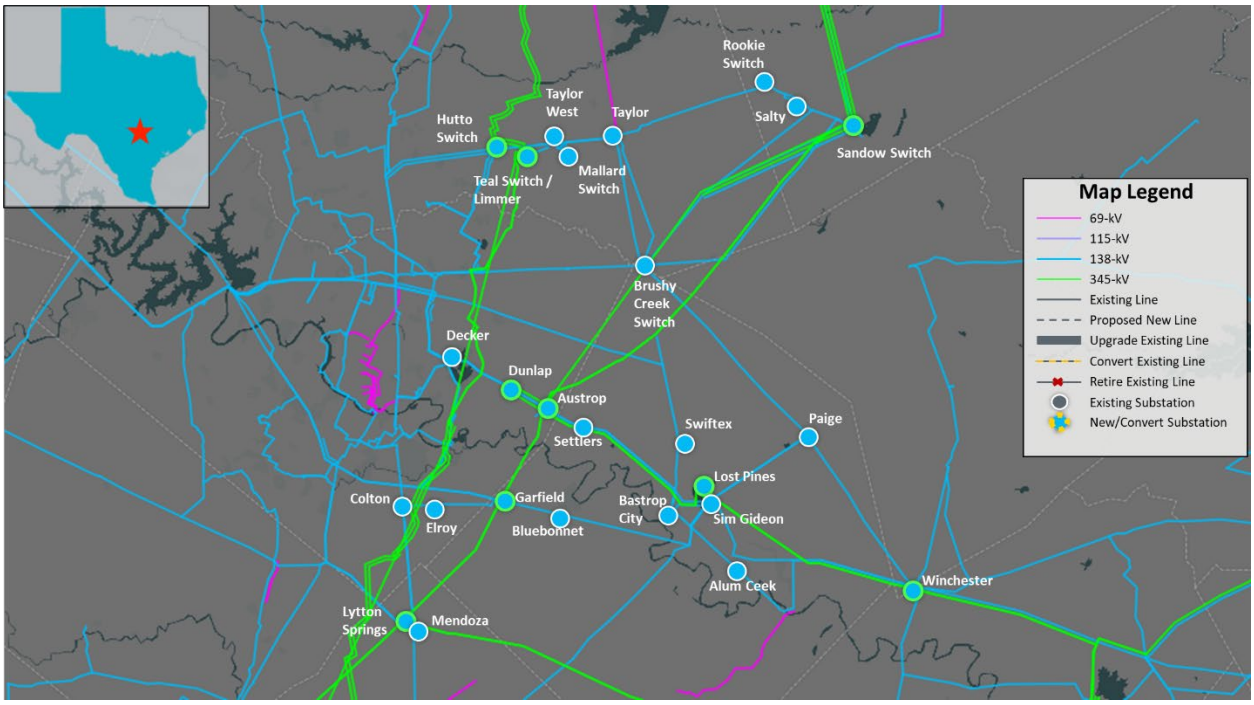


Figure 2.2: Map of Transmission System of Study Area 2 – South of Hutto

2. Study Assumptions and Methodology

ERCOT performed studies under various system conditions to identify any reliability issues and to determine transmission upgrades to support the proposed Muscovy and Voss Lake 345-kV Project, if an upgrade is deemed necessary. This section describes the study assumptions and criteria used to conduct the EIR.

2.1. Study Assumptions for Reliability Analysis

This project is in the South Central Weather Zone in Williamson and Milam counties. Bell, Robertson, Bastrop, Caldwell, Travis and Hays counties in East and North Central Weather Zones 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 2024 Regional Transmission Plan (RTP) cases, published on the Market Information System (MIS) on December 20, 2024, were used as reference cases in this study. The 2029 Summer Peak Load case was selected for the long-term outlook. The steady-state study base case was constructed by updating transmission, generation, and load data of the 2029 Summer Peak Load case noted below:

- Case: 2024RTP_2029_SUM_ 12202024[1].

2.1.2. Transmission Topology

RPG approved projects and Transmission projects within the study area with ISDs by December 1, 2028, were added to the study base case. The ERCOT Transmission Project Information and Tracking (TPIT)[2] report posted in February 2025 was used as reference to identify the applicable project added to the study base case, as listed in Table 2.1.

[1] 2024 Regional Transmission Plan Postings: https://mis.ercot.com/secure/data-products/grid/regional-planning
[2] February 2025 TPIT Report: https://www.ercot.com/gridinfo/planning

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

TPIT No	Project Name	Tier	Project ISD	TSP
24RPG001	Temple Area Project	Tier 1	Dec-28	Oncor
24RPG013	FPP Yard 2 to Lytton Springs Transmission Line Overhaul Project	Tier 4	May-26	LCRA TSC, AEN
24RPG014	Sim Gideon to Cedar Hill Transmission Line Upgrade Project	Tier 3	May-27	LCRA TSC
24RPG018	Salado Switch to Hutto Switch 138-kV Line Project	Tier 3	May-27	Oncor
25RPG006	Resubmission for Salado Switch to Hutto Switch 138-kV Line Project	Tier 3	May-27	Oncor, LCRA TSC
72588A	Trading Post to Cedar Valley Storm Hardening	Tier 4	May-25	PEC
86319	AEN_Garfield_HiCross_CKT_963_Reconductor	Tier 4	Jun-25	AEN
86325	AEN_McNeil_Magnesium_Plant_Ckt_977_RECONDUCTOR	Tier 4	Jun-25	AEN
87758	Badger 345 kV Switch	Tier 4	Dec-25	Oncor
87395	Caldwell Substation Addition	Tier 4	Mar-26	LCRATSC
86323	AEN_MagnesiumPlant_Northland_Ckt_979_RECONDUCTOR	Tier 4	Jun-26	AEN
86912	BEPC_TPIT_86912_Gabriel_Schwertner	Tier 4	Mar-27	BEPC
87673	Rebuild the Salado - Bell County 138 kV Line	Tier 1	May-27	Oncor
87770	Establish a 110.4 MVAR Capacitor Bank at Midnight 138 kV Substation	Tier 4	May-27	Oncor
87768	Establish a 110.4 MVAR Capacitor Bank at Pintail 138 kV Switch	Tier 4	May-27	Oncor
87677	Rebuild the Fryers Creek - Temple 138 kV Line	Tier 1	May-27	Oncor
87675	Rebuild the Bell County - Fryers Creek 138 kV Line	Tier 1	May-27	Oncor
85973	Georgetown - Rivery Transmission Line Upgrade	Tier 4	May-26	LCRA TSC
80546C	Upgrade the Hutto & Round Rock - Salado 138 kV Line	Tier 3	May-26	Oncor
80546E	Upgrade the Hutto & Round Rock - Salado 138 kV Line	Tier 3	May-27	Oncor
86331	AEN_Wheless_Mueller_Ckt_1016_Reconductor	Tier 4	Jun-27	AEN
86321	AEN_Lakeshore_Northland_Ckt_916_Reconductor	Tier 4	Jun-27	AEN
86327	AEN_New_138kV_Southshore_Substation_Addition	Tier 4	Sep-27	AEN

86317	AEN_DP_OnionCreek_Ckt_924_Reconductor	Tier 4	Sep-27	AEN
86333	AEN_OnionCreek_StoneyRidge_Ckt_1026_Reconductor	Tier 4	Sep-27	AEN
87367	BEPC_TPIT_87367_TempleAreaImprovements	Tier 1	Oct-27	BEPC
87699	Belton - Killeen 138 kV Line via Belton Southwest	Tier 1	Dec-27	Oncor
80546D	Upgrade the Hutto & Round Rock - Salado 138 kV Line	Tier 3	Dec-27	Oncor
87707	Salado 345/138 kV Autotransformer #1 and #2	Tier 1	Dec-27	Oncor
87701	Establish the Watercrest 138 kV Switch	Tier 1	May-28	Oncor
86838	AEN_JustinLane_KoenigLane_Ckt__conversion_to_138kV	Tier 4	Jun-28	AEN
86315	AEN_Barton_Vega_Ckt_928_Reconductor	Tier 4	Jun-28	AEN
72588B	Trading Post to Cedar Valley Storm Hardening	Tier 4	Sep-24	PEC

Table 2.2 lists the Transmission projects identified as placeholder projects in the 2024 RTP in the study area that have not been approved by RPG and were therefore removed from the study base case.

Table 2.2: List of Transmission Projects Removed from the Study Base Case

RTP Project Index	Project Name	County
2022-SC7	Decker (9188) 138-kV Bus Tie Breaker Upgrade	Travis
2023-SC3	Dessau (9193) to McNeil AEN (9076) 138-kV Circuit 2 Upgrade	Travis
2023-SC15	Sim Gideon Area 138-kV Line Upgrades	Bastrop, Fayette, Williamson
2023-SC17	Georgetown Area 138-kV Line Upgrades	Williamson
2024-SC2	Trading Post (70505) 138-kV Cap Bank Addition	Travis
2024-SC8	Milano (64) to Minerva (3683) and Cannon (3707) 138-kV Line Upgrades	Milam
2024-SC11	Vega (9285) to Barton (9158) 138-kV Line Upgrade	Travis
2024-SC14	Elroy (7209) 138-kV Cap Bank Addition	Travis

RTP Project Index	Project Name	County
2024-SC16	Limmer (7341) 345-kV Cap Bank Addition	Williamson
2024-SC17	SLR AMLC (3740) 138-kV Cap Bank Addition	Milam
2024-SC19	Hillje (44200) to Zorn (7042) 345-kV Line Upgrades	Wharton, Fayette, Bastrop, Caldwell, Guadalupe
2024-SC20	Lytton Area 138-kV Line Upgrades	Caldwell, Travis, Bastrop
2024-SC21	Austrop (9328) to Dunlap (9045) 138-kV Double Circuit Line Addition	Travis
2024-SC22	Austrop 345/138-kV Transformer Addition	Travis
2024-SC23	Dunlap 345/138-kV Transformer Addition	Travis
2024-SC24	Gillelend Creek (7340) 345-kV Cap Bank Addition	Travis
2024-SC27	Lytton Springs (9074) to Garfield (7048) to Austrop (7040) 345-kV Line Upgrades	Caldwell, Bastrop, Travis
2024-SC28	Voss Lake 345/138-kV Substation Expansion and Bell County East (3687) to Voss Lake (3751) 345- kV Double Circuit Line Upgrade	Milam
2024-SC29	Muscovy 345/138-kV Substation Addition and Salado (3699) to Muscovy (3700) to Voss Lake (3751) 345-kV Double Circuit Addition	Bell, Williamson, Milam
2024-SC32	McNeil AEN (9076) 138-kV Bus Tie Breaker Upgrade	Travis
2024-E4	Bryan Area Project	Brazos, Burleson, Robertson
2024-E4	Knob Creek Switch (3413) to Salado Switch (3699) 345-kV Line Upgrade	Bell
2024-NC23	Bale (3711) to St Johns Switch (3384) to Lake Creek SES (3409) 345-kV Line Upgrades	Falls, McLennan
2024-NC24	Lake Creek SES (3410) to Riesel Switch (3702) 138-kV Line Upgrade	Falls, McLennan
2024-NC37	Bell East (3687) to Salado (3699) 345-kV Line Addition	Bell, Williamson
2024-NC43	Temple Switch (3415) to Belton (3610) 138-kV Line Upgrades	Bell
2024-NC60	Bell County East Switch (3687) to Littlepond (3377) , and Bell County East Switch (3687) to Brangus Switch (3705) 345-kV Line Upgrades	Milam, Bell

2.1.3. Generation

Based on the April 2025 Generator Interconnection Status (GIS)[3] report posted on the ERCOT website on May 6, 2025, generators in the study area that met ERCOT Planning Guide Section 6.9(1) conditions with a commercial operations date (COD) prior to December 2028 were added to the study base case. These generation additions are listed in Table 2.3. All new generation dispatches were kept consistent with the 2024 RTP methodology.

Table 2.3: List of Generation Added to the Study Base Case Based on the April 2025 GIS Report

GINR	Project Name	Fuel	Project COD	Max Capacity (~MW)	County
22INR0503	Tidwell Prairie II Batt	OTH	03/01/2026	203.6	Robertson
22INR0504	Barton Branch IA	OTH	03/01/2026	203.6	Robertson
23INR0079	Chillingham Storage	OTH	07/15/2025	153.9	Bell
23INR0118	Blevins Solar	SOL	10/30/2025	271.6	Falls
23INR0119	Blevins Storage	OTH	07/28/2025	181.3	Falls
23INR0235	Hoyte Solar	SOL	12/15/2026	206.8	Milam
23INR0249	Limewood Solar	SOL	12/31/2025	204.6	Bell
23INR0344	Hermes Solar	SOL	09/30/2025	100.4	Bell
24INR0031	Stoneridge Solar	SOL	04/30/2025	201.6	Milam
24INR0166	Stillhouse Solar	SOL	09/02/2025	210.8	Bell
24INR0169	Yaupon Storage SLF	OTH	07/01/2028	102.0	Milam
24INR0365	Hermes Storage	OTH	09/30/2025	100.4	Bell
25INR0389	Stoneridge BESS	OTH	09/01/2025	101.9	Milam
22INR0605	Camino Santiago Solar	SOL	02/18/2027	196.3	Milam
24INR0476	DOS RIOS ENERGY STORAGE SLF	OTH	03/15/2027	164.5	Milam

[3] April 2025 GIS Report: https://www.ercot.com/mp/data-products/data-product-details?id=PG7-200-ER

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 2.4 were opened (turned off) in the study base case to reflect their mothballed/retired status.

Table 2.4: List of Generation Opened to Reflect Mothballed/Retired/Forced Outage Status

Bus No	Unit Name	Max Capacity (~MW)	Weather Zone
110205	BYU_BYU_G8	4.0	Coast
110124	DOWGEN_DOW_G66	95.6	Coast
151361	CHISMGRD_G1	20.3	North Central

Generation listed in Table 2.5 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 2.5: 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

2.1.4. Loads

Loads in the study area were revised based on the information provided in the Transmission Service Provider (TSP) Attestation Letters from both Oncor and LCRA TSC. The additional load shown in Table 2.6 was included in the 2024 RTP 2029 Summer Peak Load study case. No load adjustments outside of East, North Central and South Central Weather Zones were needed to maintain the minimum reserve requirements consistent with the 2024 RTP methodology.

Table 2.6: Additional Load by TSP

TSP	Year	Load (~MW)
Oncor	2029	600
LCRA TSC	2029	3,573[4]

[4] Large Load Interconnection numbers: LLI-1987, LLI-118, LLI-2002, LLI-2058, LLI-2162, LLI-2296, LLI-2295, LLI-1975, LLI-1976, LLI-2029, and LLI-2162.

2.2. Long-Term Load-Serving Capability Assessment

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

Incremental load serving capability was evaluated to assess the long-term load-serving capability. Load in the study area was increased (customer designated as non-scalable remained at the same level as in the study base case), and conforming loads outside of Williamson County were decreased to balance power.

2.3. Maintenance Outage Scenario

ERCOT performed a maintenance outage evaluation based on historic off-peak system load. Conforming loads in the East, North Central and South Central Weather Zones were scaled down to 75.6%, 82%, and 80.3% of the summer peak load, respectively, to create the off-peak case. Loads designated as non-scalable remained at the same level as the base case. Next, ERCOT Planning Guide Section 4.1.1.8 Maintenance Outage Reliability Criteria was evaluated to identify and address violations.

2.4. Study Assumptions for Congestion Analysis

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

The 2025 RTP 2030 sensitivity economic study case was updated based on the March 2026 GIS[5] report for generation updates and the February 2025 TPIT[6] reports for transmission updates to conduct congestion analysis. The 2030 study year was selected based on the proposed ISD of the project.

All transmission projects listed in Table 2.1 were added to the economic base case and the RTP projects listed in Table 2.2 were removed from the economic base case.

New generation unit additions listed in Table A.1 in Appendix A were added to the economic base case and all generation units listed in Table 2.4 were opened (turned off) in the study base case to reflect their mothballed/retired status. Furthermore, the

[5] GIS Report: https://www.ercot.com/mp/data-products/data-product-details?id=PG7-200-ER
[6] TPIT Report: https://www.ercot.com/gridinfo/planning

generation units listed in Table 2.5 were removed from seasonal settings in the study base case as these resources are returning to year-round service.

2.5. Methodology

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

2.5.1. Contingencies and Criteria

The reliability assessments were performed based on NERC Reliability Standard TPL-001-5.1, ERCOT Protocols[7], and the ERCOT Planning Guide[8].

Contingencies[9] 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 (Extra High Voltage (EHV) only);
- P3: (G-1+N-1) (G-1: generation outages) {Bastrop Energy Center, Giga Energy Storage, East Backland Solar, Garfield Generator, and Lost Pines Generator}; and
- P6-2: (X-1+N-1) (X-1: 345/138-kV transformers only) {Sandow, Hutto, Teal, Austrop, Dunlap, Gilleland Creek, Muscovy, Lytton, Salado, Temple, Temple Pecan, and Voss Lake autotransformers}.

All 60-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

[7] ERCOT Protocols: https://www.ercot.com/mktrules/nprotocols/current
[8] ERCOT Planning Guide: http://www.ercot.com/mktrules/guides/planning/current
[9] Details of each event and contingency category are defined in the NERC reliability standard TPL-001-5.1

- 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 24 for Security Constrained Optimal Power Flow and steady-state contingency analysis; and
- UPLAN version 12.3.0.30786 to perform the congestion analysis.

3. Project Need

A steady-state reliability analysis was performed in accordance with NERC TPL-001-5.1 and ERCOT Planning Guide, as described in Section 2.5 of this report. This analysis indicated thermal overloads, voltage violations, and unsolved power flows in study area 1, consisting of Bell, Milam, Williamson and Robertson counties, and study area 2, consisting of Bastrop, Travis, Hays and Caldwell counties under NERC P1(N-1), P7(N-1), P3(G-1+N-1), and P6-2(X-1+N-1) conditions. These issues are summarized in Table 3.1 and Table 3.2. The detailed thermal overloads in study area 1 are listed in Table 3.3 and study area 2 are listed in Table 3.4. The voltage violations and unsolved power flows for study area 1 and study area 2 are listed in Table B.1.1, Table B.1.2, Table B.1.3 and Table B.1.4 in the Appendix B of this document, respectively.

Oncor and LCRA TSC submitted the Muscovy and Voss Lake 345/138-kV Project to address post-contingency and thermal overloads and voltage violations in Williamson and Milam counties due to significant and rapid load growth. ERCOT's review of the study area identified reliability issues not addressed by the initial RPG submission. ERCOT's 2024 and 2025 RTP identified upgrades to address most of the additional reliability issues in study area 1. These upgrades were included as part of the Oncor Set 1 North Central and South Central Texas Reliability Project (25RPG041) and were included in the option development for phase 1. Due to the increase of Large Loads modeled in the study case, additional upgrades were identified to resolve the remaining reliability issues identified in study area 1. Phase 1 of this EIR addresses the reliability violations identified in study area 1.

Table 3.1: Violations Observed Under NERC Reliability Standard TPL-001-5.1 and ERCOT Planning Guide in the Study Area 1 – North of Hutto

NERC Contingency Category	Thermal Overloads	Voltage Violations	Unsolved Power Flow
P0: N-0	2	7	None
P1, P2-1, P7: N-1	10	97	2
P2-2, P2-3, P4, P5	3	None	3
P3: (G-1+N-1)	7	6	1
P6-2: (X-1+N-1)	6	13	None

Table 3.2: Violations Observed Under NERC Reliability Standard TPL-001-5.1 and ERCOT Planning Guide in the Study Area 2 – South of Hutto

NERC Contingency Category	Thermal Overloads	Voltage Violations	Unsolved Power Flow
P0: N-0	14	120	None
P1, P2-1, P7: N-1	12	111	9
P2-2, P2-3, P4, P5	None	None	None
P3: (G-1+N-1)	2	4	2
P6-2: (X-1+N-1)	6	9	None

Table 3.3: Thermal Overloads Observed in the Study Area 1 – North of Hutto

NERC Contingency Category	Overloaded Element	Voltage Level (kV)	Length (~miles)	Max Loading (%)
P0: N-0	Milano (64) to Minerva (3683) Circuit 1	138	6.7	101.3
P0: N-0	KnobCreek (3413) to Salado (3699) Circuit 1	345	13.8	110.7
P7: N-1	Robertson (32) to Cannon (3707) Circuit 1	138	18.5	111.1
P7: N-1	Canon (3707) to Milano (64) Circuit 1	138	3.2	129.9
P7: N-1	Hutto (3666) to Teal (3362) Circuit 1	138	2.9	132.3
P7: N-1	Temple Pecan (3412) to Temple Switch (3414) Circuit 1	345	4.4	102.5
P1: N-1	Temple Switch (3415) to Boggy (3493) Circuit 1	138	4.5	106.9
P1: N-1	Boggy (3493) to NewBC (990132) Circuit 1	138	3.2	101.1
P1: N-1	Bell East (3687) to Sandow (13429) Circuit 1	345	31.5	133.1
P1: N-1	Bell East (3687) to Sandow (13429) Circuit 2	345	31.5	133.1

NERC Contingency Category	Overloaded Element	Voltage Level (kV)	Length (~miles)	Max Loading (%)
P7: N-1	Salado (3699) to Hutto Switch (3696) Circuit 1	345	36.9	102.0
P7: N-1	Salado (3699) to Hutto Switch (3696) Circuit 2	345	36.9	102.0
P3: (G-1+N-1)	Temple Switch Auto Transformer #1	345/138	-	133.9
P3: (G-1+N-1)	Temple Switch Auto Transformer #2	345/138	-	118.6
P3: (G-1+N-1)	Poage (124) to Temple Avenue (3636) Circuit 1	138	3.3	103.7
P3: (G-1+N-1)	Hutto Auto Transformer #2	345/138	-	103.7
P3: (G-1+N-1)	Hutto Auto Transformer #1	345/138	-	104.5
P3: (G-1+N-1)	Sandow Auto Transformer #2	345/138	-	102.9
P3: (G-1+N-1)	Sandow Auto Transformer #3	345/138	-	101.8
P6-2: (X-1+N-1)	Temple (3415) to Tinroof (3485) Circuit 1	138	1.9	117.6
P6-2: (X-1+N-1)	Boggy (3493) to Boggy (3496) Circuit 1	69	1.0	102.0
P6-2: (X-1+N-1)	Seaton (130) to Poage (124) Circuit 1	138	11.8	105.3
P6-2: (X-1+N-1)	Sandow (13429) to Tortoise (3717) Circuit 1	345	1.5	115.3
P6-2: (X-1+N-1)	Sandow Auto Transformer #1	345/138	-	130.3
P6-2: (X-1+N-1)	Teal Auto Transformer #1	345/138	-	106.8

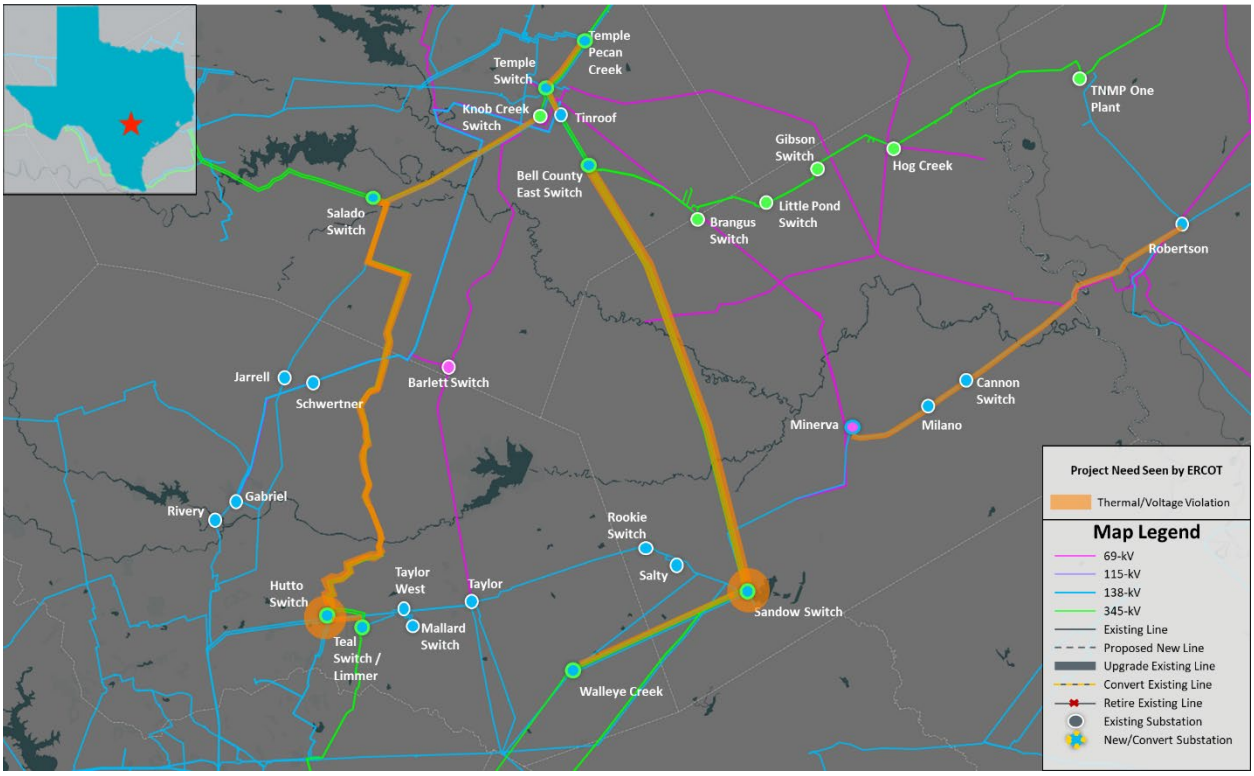


Figure 3.1: Study Area Map Showing Project Need

Table 3.4: Thermal Overloads Observed in the Study Area 2 – South of Hutto

NERC Contingency Category	Overloaded Element	Voltage Level (kV)	Length (~miles)	Max Loading (%)
P0: N-0	Colton (7208) to Elroy (7209) Circuit 1	138	3.3	204.81
P0: N-0	Colton (7208) to Mendoza (7325) Circuit 1	138	9.6	198.86
P0: N-0	Elroy (7209) to Wolf Lane (7212) Circuit 1	138	3.8	203.40
P0: N-0	Wild Wood (7210) to wolf Lane_1Y (7212) Circuit 1	138	5.9	141.32
P0: N-0	Wild Wood (7210) to Bluebonnet (7556) Circuit 1	138	2.4	147.43
P0: N-0	Winchester (7306) to Page (7308) Circuit 1	138	14.9	115.46
P0: N-0	Winchester (7306) to Sim Gideon (7310) Circuit 1	138	20.7	119.39
P0: N-0	Sim Gideon (7310) to Settlers (7327) Circuit 1	138	7.8	134.08
P0: N-0	Sim Gideon (7310) to Bastrop West (7555) Circuit 1	138	6.8	144.15
P0: N-0	Mendoza (7325) to Lytton (9075) Circuit 1	138	0.6	129.11

NERC Contingency Category	Overloaded Element	Voltage Level (kV)	Length (~miles)	Max Loading (%)
P0: N-0	Settlers (7327) to Austrop (9328) Circuit 1	138	7.8	103.41
P0: N-0	Webberville (7329) to Austrop (9328) Circuit 1	138	0.2	113.20
P0: N-0	Bastrop West (7555) to Blue Bonnet (7556) Circuit 1	138	6.1	168.82
P7: N-1	Austrop Auto Transformer #1	345/138	-	118.30
P7: N-1	Austrop Auto Transformer #2	345/138	-	115.94
P7: N-1	Misty (7051) to Lytton (9074) Circuit 1	345	7.9	118.63
P7: N-1	Winchester (7306) to Smithville (7314) Circuit 1	138	14.5	118.04
P7: N-1	Paige (7308) to Sim Gideon(7310) Circuit 2	138	9.8	135.31
P7: N-1	Alum Creek (7318) to Sim Gideon (7310) Circuit 1	138	7.8	106.14
P7: N-1	Sim Gideon (7310) to Bastrop City (7322) Circuit 1	138	4.2	212.66
P7: N-1	Smithville (7314) to Alum Creek (7318) Circuit 1	138	6.0	109.74
P7: N-1	Holman (9073) to Cistern (9043) Circuit 1	345	25.5	101.44
P7: N-1	Cistern (9043) to Lytton (9074) Circuit 1	345	25.0	116.50
P7: N-1	Austrop Auto Transformer #1	345/138	-	114.98
P7: N-1	Austrop Auto Transformer #2	345/138	-	112.65
P3: (G-1+N-1)	Austrop (7040) to Garfield (7048) Circuit 1	345	8.4	124.35
P3: (G-1+N-1)	Sim Gideon (7310) to Bastrop City (7322) Circuit 1	138	4.2	213.84
P6-2: (X-1+N-1)	Cedar Hill (7331) to Manor (7330) Circuit 1	138	8.2	104.22
P6-2: (X-1+N-1)	Lytton Auto Transformer 3	345/138	-	100.34
P6-2: (X-1+N-1)	Austrop (9328) to Settlers (7327) Circuit 1	138	7.8	208.09
P6-2: (X-1+N-1)	Dunlap Auto Transformer #2	345/138	-	117.58
P6-2: (X-1+N-1)	Dunlap Auto Transformer #1	345/138	-	111.49
P6-2: (X-1+N-1)	Lytton (9074) to Misty (7051) Circuit 1	345	7.9	118.98

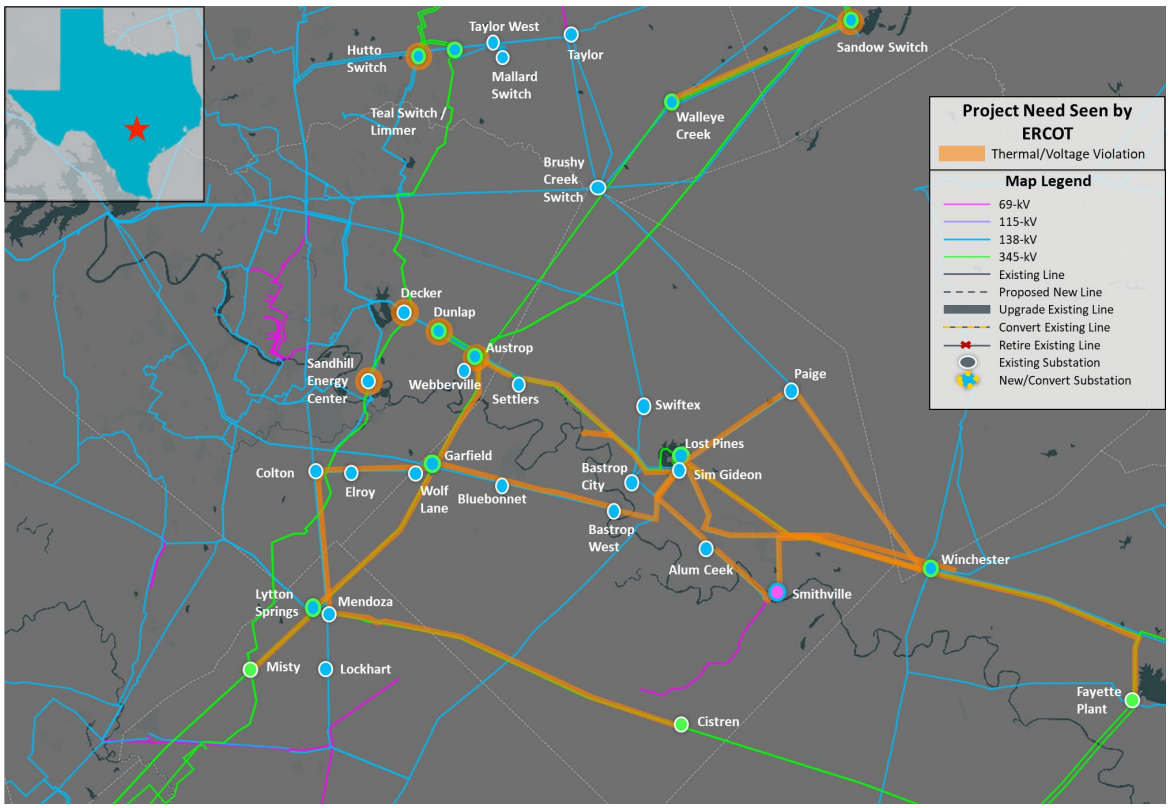


Figure 3.2: Study Area Map Showing Project Need

4. Description of Project Options

ERCOT evaluated ten system improvement options to address the thermal overloads, voltage violations and unsolved power flows that were observed in the study base case in the project study area.

Option 1 (Oncor and LCRA TSC proposed solution) consists of the following:

- Establish the new Muscovy 345/138-kV Switch by installing ten 345-kV, 5000 A and twelve 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, for approximately 3.3 miles east of the 345-kV Limmer Substation (LCRA TSC) and 138-kV Teal Switch (Oncor);
    - Install two 345/138-kV autotransformers with normal rating of 700 MVA and emergency rating of 750 MVA;
    - Install three 36.8 MVAr capacitor banks;
    - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV;
- Construct a new 345-kV double-circuit transmission line which will require a CCN from Limmer Substation (LCRA TSC) to Muscovy Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 4 miles;
- Construct a loop of the existing Teal Switch to Pintail Switch 138-kV double-circuit transmission line with a normal and emergency ratings of at least 614 MVA into the new Muscovy 138-kV Switch, for approximately 0.1 miles;
- Establish the new Voss Lake 345/138-kV Switch by installing ten 345-kV, 5000 A and nine 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, for approximately 1.9 miles north of Sandow 345/138-kV Switch;
    - Install one 345/138-kV autotransformer with normal ratings of at least 700 MVA and emergency ratings of at least 750 MVA;
    - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV;
- Construct a loop of the existing Sandow Switch to Bell County East Switch 345-kV double-circuit transmission line into the Voss Lake 345- kV Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 0.1 miles;
- Construct a loop of the existing Sandow Switch to Temple Switch 138-kV transmission line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, for approximately 0.1 miles;
- Construct a loop of the existing Sandow Switch to Minerva Switch 138-kV transmission line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, for approximately 0.1 miles;

- Construct a new 345-kV transmission line which will require a CCN from Voss Lake Switch to Walleye Creek Switch with a normal and emergency ratings of at least 2,987 MVA or greater on double-circuit structures with one circuit installed initially, for approximately 2 miles;
- Construct a new 345-kV double-circuit transmission line which will require a CCN from Muscovy Switch to Voss Lake Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 25 miles; and
- Install terminal equipment in existing bays at Limmer Substation to connect both circuits of the new 345-kV double-circuit transmission line to Muscovy Switch, including two 345-kV, 5000 A circuit breakers and associated equipment. All associated terminal equipment will have a minimum rating of 5000 A;

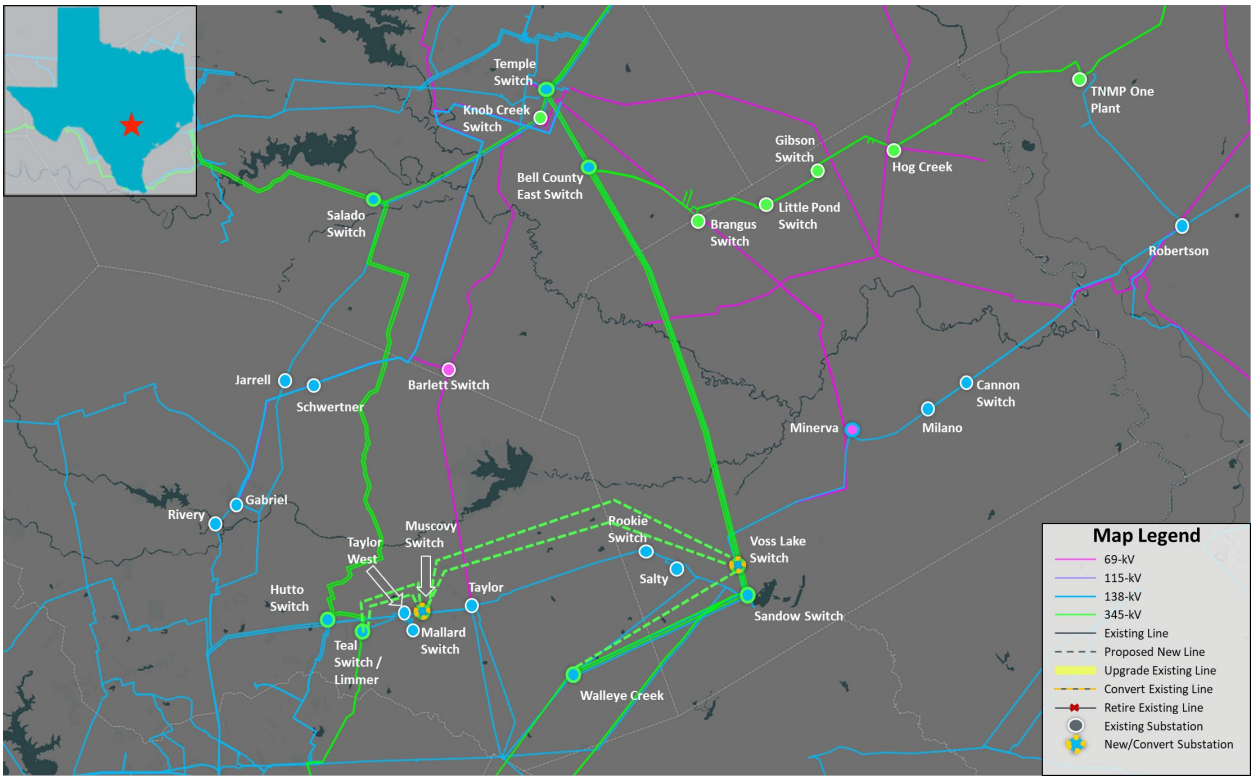


Figure 4.1: Map of Option 1

Option 2 consists of the following:

- Establish the new Muscovy 345/138-kV Switch by installing ten 345-kV, 5000 A and twelve 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, for approximately 3.3 miles east of the 345-kV Limmer Substation (LCRA TSC) and 138-kV Teal Switch (Oncor);
    - Install two 345/138-kV autotransformers with normal rating of 700 MVA and emergency rating of 750 MVA;

  - Install three 36.8 MVAr capacitor banks;
  - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV;
- Construct a new 345-kV double-circuit transmission line which will require a CCN from Limmer Substation (LCRA TSC) to Muscovy Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 4 miles;
- Construct a loop of the existing Teal Switch to Pintail Switch 138-kV double-circuit transmission line with a normal and emergency ratings of at least 614 MVA into the new Muscovy 138-kV Switch, for approximately 0.1 miles;
- Establish the new Voss Lake 345/138-kV Switch by installing ten 345-kV, 5000 A and nine 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, for approximately 1.9 miles north of Sandow 345/138-kV Switch;
  - Install one 345/138-kV autotransformer with normal ratings of at least 700 MVA and emergency ratings of at least 750 MVA;
  - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV;
- Construct a loop of the existing Sandow Switch to Bell County East Switch 345-kV double-circuit transmission line into the Voss Lake 345- kV Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 0.1 miles;
- Construct a loop of the existing Sandow Switch to Temple Switch 138-kV transmission line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, for approximately 0.1 miles;
- Construct a loop of the existing Sandow Switch to Minerva Switch 138-kV transmission line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, for approximately 0.1 miles;
- Construct a new 345-kV transmission line which will require a CCN from Voss Lake Switch to Walleye Creek Switch with a normal and emergency ratings of at least 2,987 MVA or greater on double-circuit structures with one circuit installed initially, for approximately 2 miles;
- Construct a new 345-kV double-circuit transmission line which will require a CCN from Muscovy Switch to Voss Lake Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 25 miles;
- Install terminal equipment in existing bays at Limmer Substation to connect both circuits of the new 345-kV double-circuit transmission line to Muscovy Switch, including two 345-kV, 5000 A circuit breakers and associated equipment. All associated terminal equipment will have a minimum rating of 5000 A;
- Establish the Tower 345-kV Switch by installing ten 345-kV, 5000 A circuit breakers in a breaker-and-a-half bus arrangement;

  - Loop the existing Salado Switch to Knob Creek Switch 345-kV transmission line into Tower 345-kV Switch to create the new Salado Switch to Tower Switch 345-kV transmission line, for approximately 12.4 miles and Tower Switch to Temple Switch 345-kV transmission line, for approximately 2.9 miles;
  - Construct two new 345-kV single-circuit transmission lines from Tower Switch to Knob Creek Switch on independent, single-circuit structures with a normal and emergency rating 2,987 MVA, for approximately 1.2 miles, this upgrade will require a CCN;
  - Rebuild the Salado Switch to Tower Switch 345-kV transmission line using double-circuit capable structures with two circuits installed with normal and emergency rating 2,987 MVA, for approximately 12.4 miles, this upgrade will require a CCN;
  - Rebuild the Tower Switch to Temple Switch 345-kV transmission line using double-circuit capable structures with two circuits installed with normal and emergency rating 2,987 MVA, for approximately 2.9 miles, this upgrade will require a CCN;
  - Ensure all associated terminal equipment to meet or exceed 5000 A (2,987 MVA);
- Rebuild the Bell County East Switch to Voss Lake Switch 345-kV double-circuit transmission line with a normal and emergency rating of 1,912 MVA, for approximately 29.6 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);
- Rebuild the Minerva Switch to Robertson 138-kV transmission line using double-circuit capable structures with one circuit installed with a normal and emergency rating of 614 MVA, for approximately 29.1 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA); and
- Rebuild the Temple Switch to Tinroof 138-kV transmission line using double-circuit capable structures with one circuit installed with a normal and emergency rating of 614 MVA, for approximately 1.85 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA).

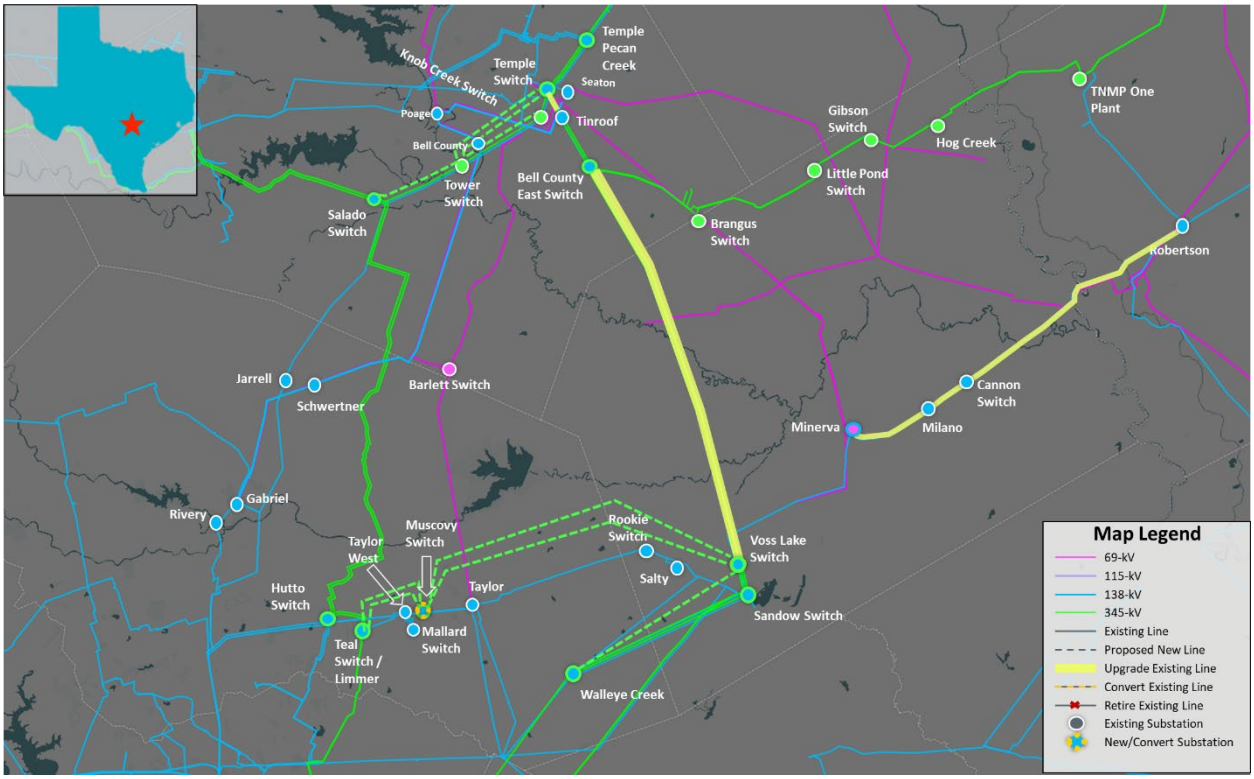


Figure 4.2: Map of Option 2

Option 3 consists of the following:

- Establish the new Muscovy 345/138-kV Switch by installing ten 345-kV, 5000 A and twelve 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, for approximately 3.3 miles east of the 345-kV Limmer Substation (LCRA TSC) and 138-kV Teal Switch (Oncor);
    - Install two 345/138-kV autotransformers with normal rating of 700 MVA and emergency rating of 750 MVA;
    - Install three 36.8 MVAr capacitor banks;
    - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV;
- Construct a new 345-kV double-circuit transmission line which will require a CCN from Limmer Substation (LCRA TSC) to Muscovy Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 4 miles;
- Construct a loop of the existing Teal Switch to Pintail Switch 138-kV double-circuit transmission line with a normal and emergency ratings of at least 614 MVA into the new Muscovy 138-kV Switch, for approximately 0.1 miles;

- Establish the new Voss Lake 345/138-kV Switch by installing ten 345-kV, 5000 A and nine 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, for approximately 1.9 miles north of Sandow 345/138-kV Switch;
    - Install one 345/138-kV autotransformer with normal ratings of at least 700 MVA and emergency ratings of at least 750 MVA;
    - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV;
- Construct a loop of the existing Sandow Switch to Bell County East Switch 345-kV double-circuit transmission line into the Voss Lake 345- kV Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 0.1 miles;
- Construct a loop of the existing Sandow Switch to Temple Switch 138-kV transmission line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, for approximately 0.1 miles;
- Construct a loop of the existing Sandow Switch to Minerva Switch 138-kV transmission line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, for approximately 0.1 miles;
- Construct a new 345-kV transmission line which will require a CCN from Voss Lake Switch to Walleye Creek Switch with a normal and emergency ratings of at least 2,987 MVA or greater on double-circuit structures with one circuit installed initially, for approximately 2 miles;
- Construct a new 345-kV double-circuit transmission line which will require a CCN from Muscovy Switch to Voss Lake Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 25 miles;
- Install terminal equipment in existing bays at Limmer Substation to connect both circuits of the new 345-kV double-circuit transmission line to Muscovy Switch, including two 345-kV, 5000 A circuit breakers and associated equipment. All associated terminal equipment will have a minimum rating of 5000 A;
- Establish the Tower 345-kV Switch by installing ten 345-kV, 5000 A circuit breakers in a breaker-and-a-half bus arrangement;
    - Loop the existing Salado Switch to Knob Creek Switch 345-kV transmission line into Tower 345-kV Switch to create the new Salado Switch to Tower Switch 345-kV transmission line, for approximately 12.4 miles and Tower Switch to Temple Switch 345-kV transmission line, for approximately 2.9 miles;
    - Construct two new 345-kV single-circuit transmission lines from Tower Switch to Knob Creek Switch on independent, single-circuit structures with a normal and emergency rating 2,987 MVA, for approximately 1.2 miles, this upgrade will require a CCN;
    - Rebuild the Salado Switch to Tower Switch 345-kV transmission line using double-circuit capable structures with two circuits installed with normal and

emergency rating 2,987 MVA, for approximately 12.4 miles, this upgrade will require a CCN;

- Rebuild the Tower Switch to Temple Switch 345-kV transmission line using double-circuit capable structures with two circuits installed with normal and emergency rating 2,987 MVA, for approximately 2.9 miles, this upgrade will require a CCN;
- Ensure all associated terminal equipment to meet or exceed 5000 A (2,987 MVA);

- Rebuild the Bell County East Switch to Voss Lake Switch 345-kV double-circuit transmission line with a normal and emergency rating of 1,912 MVA, for approximately 29.6 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);
- Rebuild the Minerva Switch to Robertson 138-kV transmission line using double-circuit capable structures with one circuit installed with a normal and emergency rating of 614 MVA, for approximately 29.1 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);
- Rebuild the Temple Switch to Tinroof 138-kV transmission line using double-circuit capable structures with one circuit installed with a normal and emergency rating of 614 MVA, for approximately 1.85 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);
- Rebuild the Bell County East Switch to Little Pond 345-kV transmission line with a normal and emergency rating of 1,912 MVA, for approximately 17.75 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);
- Rebuild the Bell County East Switch to Brangus 345-kV transmission line with a normal and emergency rating of 1,912 MVA, for approximately 8.8 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);
- Rebuild the Temple Switch to Temple Pecan Creek Switch 345-kV double-circuit transmission line with a normal and emergency rating 2,987 MVA, on separate structures, for approximately 4.5 miles, and ensure all associated terminal equipment to meet or exceed 5000 A (2,987 MVA);
- Rebuild the Hutto to Round Rock Northeast 138-kV transmission line using double-circuit capable structures with normal and emergency rating of 614 MVA, for approximately 5.3 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);
- Rebuild Hutto to Limmer 345-kV double-circuit transmission line on separate structures, for approximately 3 miles, this upgrade will require a CCN; and

- Rebuild the 36.9 miles Hutto to Salado 345-kV double-circuit transmission line using a conductor rated 5000 A or greater (normal and emergency rating 2,987 MVA) and ensure all associated terminal equipment to meet or exceed 5000 A (2,987 MVA).

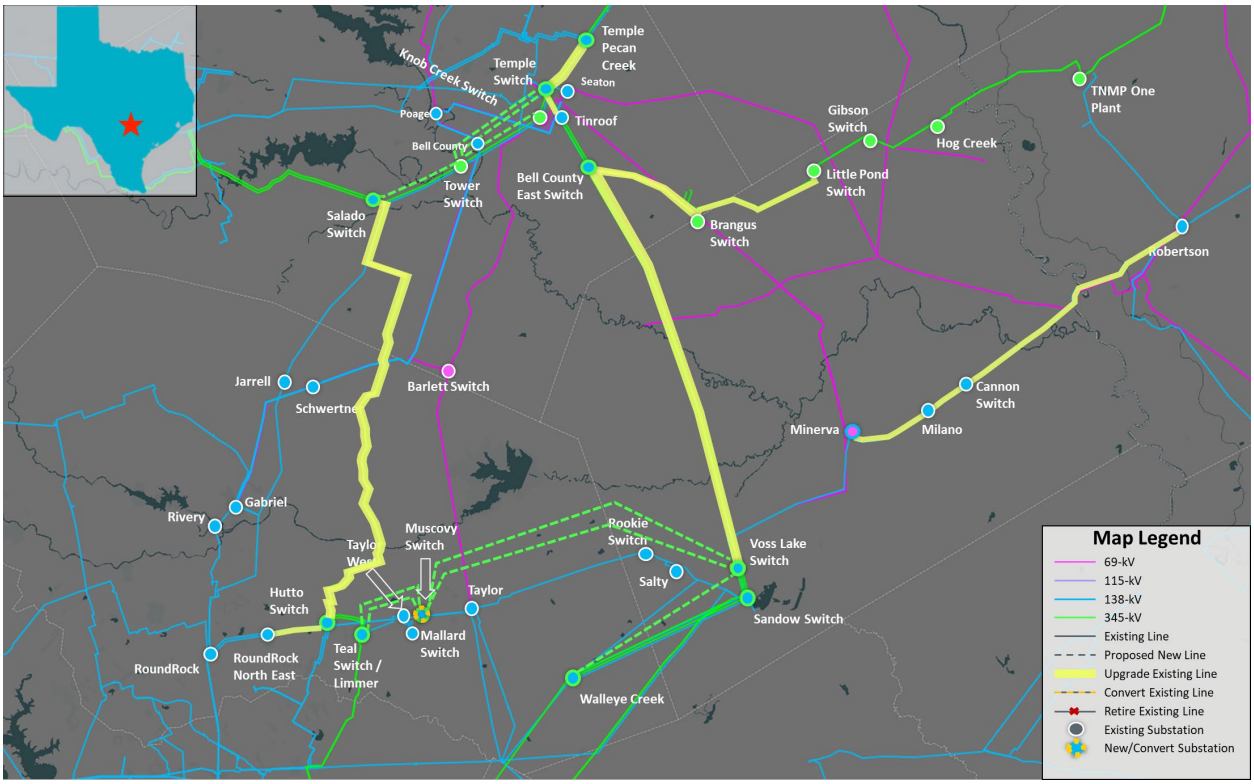


Figure 4.3: Map of Option 3

Option 4 consists of the following:

- Establish the new Muscovy 345/138-kV Switch by installing ten 345-kV, 5000 A and twelve 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, for approximately 3.3 miles east of the 345-kV Limmer Substation (LCRA TSC) and 138-kV Teal Switch (Oncor);
    - Install two 345/138-kV autotransformers with normal rating of 700 MVA and emergency rating of 750 MVA;
    - Install three 36.8 MVAr capacitor banks;
    - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV;
- Construct a new 345-kV double-circuit transmission line which will require a CCN from Limmer Substation (LCRA TSC) to Muscovy Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 4 miles;

- Construct a loop of the existing Teal Switch to Pintail Switch 138-kV double-circuit transmission line with a normal and emergency ratings of at least 614 MVA into the new Muscovy 138-kV Switch, for approximately 0.1 miles;
- Establish the new Voss Lake 345/138-kV Switch by installing ten 345-kV, 5000 A and nine 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, for approximately 1.9 miles north of Sandow 345/138-kV Switch;
    - Install one 345/138-kV autotransformer with normal ratings of at least 700 MVA and emergency ratings of at least 750 MVA;
    - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV;
- Construct a loop of the existing Sandow Switch to Bell County East Switch 345-kV double-circuit transmission line into the Voss Lake 345- kV Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 0.1 miles;
- Construct a loop of the existing Sandow Switch to Temple Switch 138-kV transmission line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, for approximately 0.1 miles;
- Construct a loop of the existing Sandow Switch to Minerva Switch 138-kV transmission line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, for approximately 0.1 miles;
- Construct a new 345-kV transmission line which will require a CCN from Voss Lake Switch to Walleye Creek Switch with a normal and emergency ratings of at least 2,987 MVA or greater on double-circuit structures with one circuit installed initially, for approximately 2 miles;
- Construct a new 345-kV double-circuit transmission line which will require a CCN from Muscovy Switch to Voss Lake Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 25 miles;
- Install terminal equipment in existing bays at Limmer Substation to connect both circuits of the new 345-kV double-circuit transmission line to Muscovy Switch, including two 345-kV, 5000 A circuit breakers and associated equipment. All associated terminal equipment will have a minimum rating of 5000 A;
- Establish the Tower 345-kV Switch by installing ten 345-kV, 5000 A circuit breakers in a breaker-and-a-half bus arrangement;
    - Loop the existing Salado Switch to Knob Creek Switch 345-kV transmission line into Tower 345-kV Switch to create the new Salado Switch to Tower Switch 345-kV transmission line, for approximately 12.4 miles and Tower Switch to Temple Switch 345-kV transmission line, for approximately 2.9 miles;
    - Construct two new 345-kV single-circuit transmission lines from Tower Switch to Knob Creek Switch on independent, single-circuit structures with

a normal and emergency rating 2,987 MVA, for approximately 1.2 miles, this upgrade will require a CCN;

- Rebuild the Salado Switch to Tower Switch 345-kV transmission line using double-circuit capable structures with two circuits installed with normal and emergency rating 2,987 MVA, for approximately 12.4 miles, this upgrade will require a CCN;
- Rebuild the Tower Switch to Temple Switch 345-kV transmission line using double-circuit capable structures with two circuits installed with normal and emergency rating 2,987 MVA, for approximately 2.9 miles, this upgrade will require a CCN;
- Ensure all associated terminal equipment to meet or exceed 5000 A (2,987 MVA);

- Rebuild the Bell County East Switch to Voss Lake Switch 345-kV double-circuit transmission line with a normal and emergency rating of 1,912 MVA, for approximately 29.6 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);
- Rebuild the Minerva Switch to Robertson 138-kV transmission line using double-circuit capable structures with one circuit installed with a normal and emergency rating of 614 MVA, for approximately 29.1 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);
- Rebuild the Temple Switch to Tinroof 138-kV transmission line using double-circuit capable structures with one circuit installed with a normal and emergency rating of 614 MVA, for approximately 1.85 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);
- Rebuild the Bell County East Switch to Little Pond 345-kV transmission line with a normal and emergency rating of 1,912 MVA, for approximately 17.75 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);
- Rebuild the Bell County East Switch to Brangus 345-kV transmission line with a normal and emergency rating of 1,912 MVA, for approximately 8.8 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);
- Rebuild the Temple Switch to Temple Pecan Creek Switch 345-kV double-circuit transmission line with a normal and emergency rating 2,987 MVA, on separate structures, for approximately 4.5 miles, and ensure all associated terminal equipment to meet or exceed 5000 A (2,987 MVA);
- Rebuild the Hutto to Round Rock Northeast 138-kV transmission line using double-circuit capable structures with normal and emergency rating of 614 MVA, for

approximately 5.3 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);

- Rebuild Hutto to Limmer 345-kV double-circuit transmission line on separate structures, for approximately 3 miles, this upgrade will require a CCN;
- Establish a new Hutto West 345-kV Switch by installing ten 345-kV, 5000 A circuit breakers in a breaker-and-a-half bus arrangement.
    - Install two 345/138-kV autotransformers with normal rating of 700 MVA and emergency rating of 750 MVA;
    - Construct a new 345-kV double-circuit transmission line from Salado to Hutto West Switch with normal and emergency rating 2,987 MVA, for approximately 38.9 miles, this upgrade will require a CCN;
    - Construct a new 345-kV double-circuit transmission line from Hutto West to Hutto Switch with normal and emergency rating 2,987 MV, for approximately 10.25 miles, this upgrade will require a CCN;
    - Construct a loop of the existing Round Rock Westing House to Round Rock 138-kV transmission line into the Hutto West 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, for approximately 0.1 miles;
    - Construct a loop of the existing Round Rock Westing House to Midnight 138-kV transmission line into the Hutto West 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, for approximately 0.1 miles; and
    - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV.

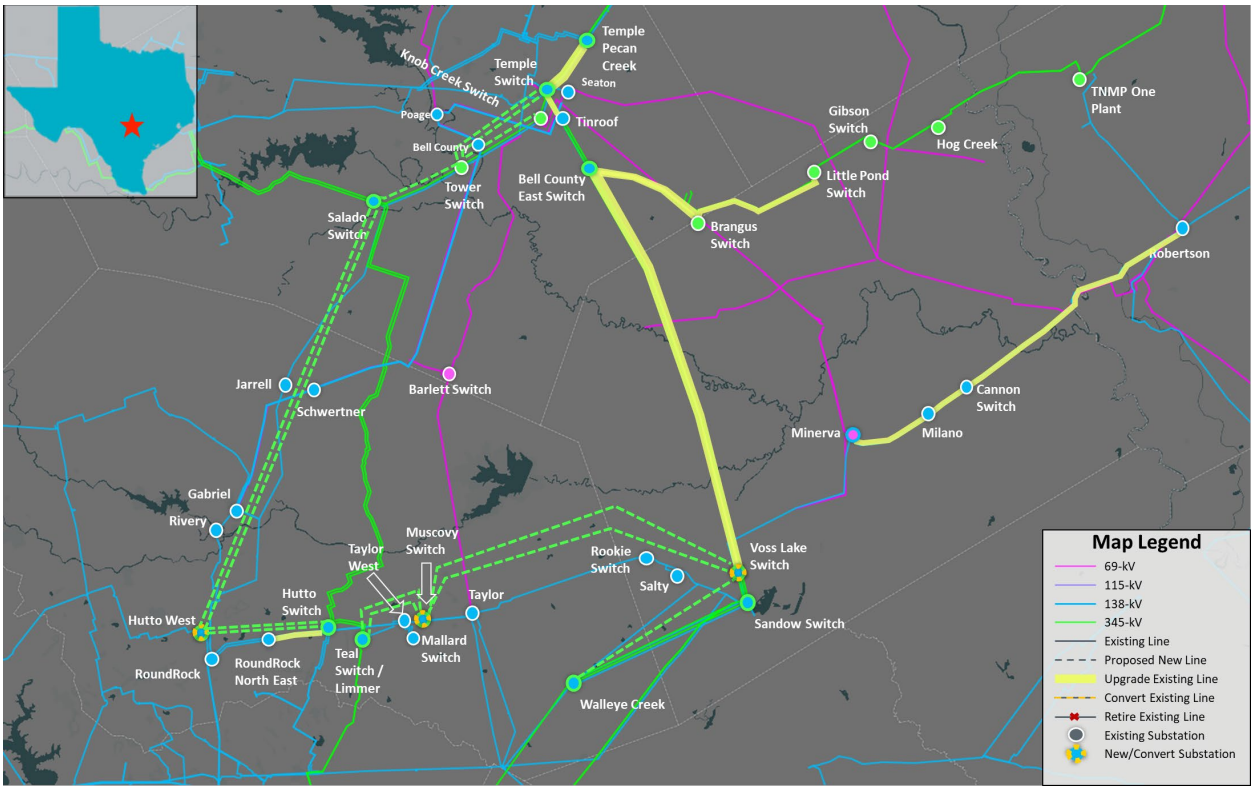


Figure 4.4: Map of Option 4

Option 4A consists of the following:

- Establish the new Muscovy 345/138-kV Switch by installing ten 345-kV, 5000 A and twelve 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, for approximately 3.3 miles east of the 345-kV Limmer Substation (LCRA TSC) and 138-kV Teal Switch (Oncor);
    - Install two 345/138-kV autotransformers with normal rating of 700 MVA and emergency rating of 750 MVA;
    - Install three 36.8 MVAr capacitor banks;
    - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV;
- Construct a new 345-kV double-circuit transmission line which will require a CCN from Limmer Substation (LCRA TSC) to Muscovy Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 4 miles;
- Construct a loop of the existing Teal Switch to Pintail Switch 138-kV double-circuit transmission line with a normal and emergency ratings of at least 614 MVA into the new Muscovy 138-kV Switch, for approximately 0.1 miles;

- Establish the new Voss Lake 345/138-kV Switch by installing ten 345-kV, 5000 A and nine 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, for approximately 1.9 miles north of Sandow 345/138-kV Switch;
    - Install one 345/138-kV autotransformer with normal ratings of at least 700 MVA and emergency ratings of at least 750 MVA;
    - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV;
- Construct a loop of the existing Sandow Switch to Bell County East Switch 345-kV double-circuit transmission line into the Voss Lake 345- kV Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 0.1 miles;
- Construct a loop of the existing Sandow Switch to Temple Switch 138-kV transmission line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, for approximately 0.1 miles;
- Construct a loop of the existing Sandow Switch to Minerva Switch 138-kV transmission line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, for approximately 0.1 miles;
- Construct a new 345-kV transmission line which will require a CCN from Voss Lake Switch to Walleye Creek Switch with a normal and emergency ratings of at least 2,987 MVA or greater on double-circuit structures with one circuit installed initially, for approximately 2 miles;
- Construct a new 345-kV double-circuit transmission line which will require a CCN from Muscovy Switch to Voss Lake Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 25 miles;
- Install terminal equipment in existing bays at Limmer Substation to connect both circuits of the new 345-kV double-circuit transmission line to Muscovy Switch, including two 345-kV, 5000 A circuit breakers and associated equipment. All associated terminal equipment will have a minimum rating of 5000 A;
- Establish the Tower 345-kV Switch by installing ten 345-kV, 5000 A circuit breakers in a breaker-and-a-half bus arrangement;
    - Loop the existing Salado Switch to Knob Creek Switch 345-kV transmission line into Tower 345-kV Switch to create the new Salado Switch to Tower Switch 345-kV transmission line, for approximately 12.4 miles and Tower Switch to Temple Switch 345-kV transmission line, for approximately 2.9 miles;
    - Construct two new 345-kV single-circuit transmission lines from Tower Switch to Knob Creek Switch on independent, single-circuit structures with a normal and emergency rating 2,987 MVA, for approximately 1.2 miles, this upgrade will require a CCN;
    - Rebuild the Salado Switch to Tower Switch 345-kV transmission line using double-circuit capable structures with two circuits installed with normal and

emergency rating 2,987 MVA, for approximately 12.4 miles, this upgrade will require a CCN;

- Rebuild the Tower Switch to Temple Switch 345-kV transmission line using double-circuit capable structures with two circuits installed with normal and emergency rating 2,987 MVA, for approximately 2.9 miles, this upgrade will require a CCN;
- Ensure all associated terminal equipment to meet or exceed 5000 A (2,987 MVA);

- Rebuild the Bell County East Switch to Voss Lake Switch 345-kV double-circuit transmission line with a normal and emergency rating of 1,912 MVA, for approximately 29.6 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);
- Rebuild the Minerva Switch to Robertson 138-kV transmission line using double-circuit capable structures with one circuit installed with a normal and emergency rating of 614 MVA, for approximately 29.1 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);
- Rebuild the Temple Switch to Tinroof 138-kV transmission line using double-circuit capable structures with one circuit installed with a normal and emergency rating of 614 MVA, for approximately 1.85 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);
- Rebuild the Bell County East Switch to Little Pond 345-kV transmission line with a normal and emergency rating of 1,912 MVA, for approximately 17.75 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);
- Rebuild the Bell County East Switch to Brangus 345-kV transmission line with a normal and emergency rating of 1,912 MVA, for approximately 8.8 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);
- Rebuild the Temple Switch to Temple Pecan Creek Switch 345-kV double-circuit transmission line with a normal and emergency rating 2,987 MVA, on separate structures, for approximately 4.5 miles, and ensure all associated terminal equipment to meet or exceed 5000 A (2,987 MVA);
- Rebuild the Hutto to Round Rock Northeast 138-kV transmission line using double-circuit capable structures with normal and emergency rating of 614 MVA, for approximately 5.3 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);
- Rebuild Hutto to Limmer 345-kV double-circuit transmission line on separate structures, for approximately 3 miles, this upgrade will require a CCN;

- Establish a new Hutto West 345-kV Switch by installing ten 345-kV, 5000 A circuit breakers in a breaker-and-a-half bus arrangement.
    - Install two 345/138-kV autotransformers with normal rating of 700 MVA and emergency rating of 750 MVA;
    - Construct a new 345-kV double-circuit transmission line from Salado to Hutto West Switch with normal and emergency rating 2,987 MVA, for approximately 38.9 miles, this upgrade will require a CCN;
    - Construct a new 345-kV double-circuit transmission line from Hutto West to Hutto Switch with normal and emergency rating 2,987 MV, for approximately 10.25 miles, this upgrade will require a CCN;
    - Construct a loop of the existing Round Rock Westing House to Round Rock 138-kV transmission line into the Hutto West 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, for approximately 0.1 miles;
    - Construct a loop of the existing Round Rock Westing House to Midnight 138-kV transmission line into the Hutto West 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, for approximately 0.1 miles;
    - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV;
- Loop the existing Spanish Oak to Round Rock 138-kV transmission line into the Hutto West 138-kV Switch; and
- Loop the existing Chief Brady to Round Rock 138-kV transmission line into the Hutto West 138-kV Switch.

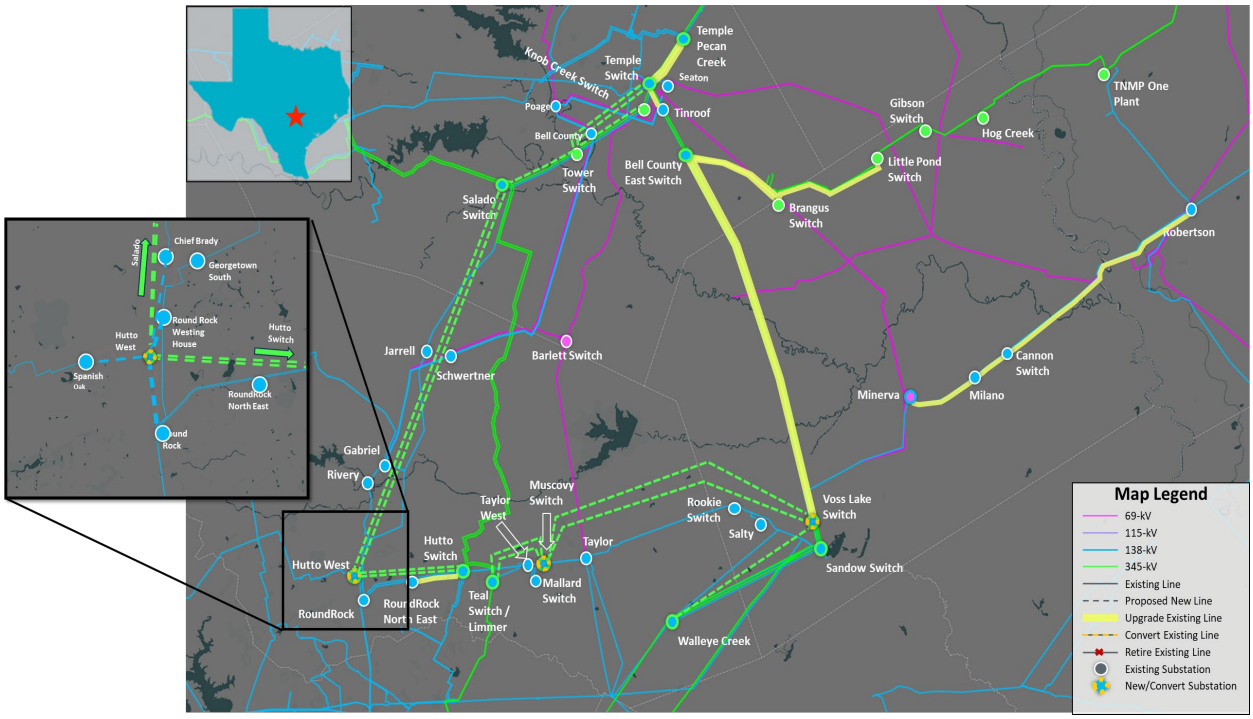


Figure 4.5: Map of Option 4A

Option 5 consists of the following:

- Establish the new Muscovy 345/138-kV Switch by installing ten 345-kV, 5000 A and twelve 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, for approximately 3.3 miles east of the 345-kV Limmer Substation (LCRA TSC) and 138-kV Teal Switch (Oncor);
    - Install two 345/138-kV autotransformers with normal rating of 700 MVA and emergency rating of 750 MVA;
    - Install three 36.8 MVAr capacitor banks;
    - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV;
- Construct a new 345-kV double-circuit transmission line which will require a CCN from Limmer Substation (LCRA TSC) to Muscovy Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 4 miles;
- Construct a loop of the existing Teal Switch to Pintail Switch 138-kV double-circuit transmission line with a normal and emergency ratings of at least 614 MVA into the new Muscovy 138-kV Switch, for approximately 0.1 miles;
- Establish the new Voss Lake 345/138-kV Switch by installing ten 345-kV, 5000 A and nine 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, for approximately 1.9 miles north of Sandow 345/138-kV Switch;

  - Install one 345/138-kV autotransformer with normal ratings of at least 700 MVA and emergency ratings of at least 750 MVA;
  - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV;
- Construct a loop of the existing Sandow Switch to Bell County East Switch 345-kV double-circuit transmission line into the Voss Lake 345- kV Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 0.1 miles;
- Construct a loop of the existing Sandow Switch to Temple Switch 138-kV transmission line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, for approximately 0.1 miles;
- Construct a loop of the existing Sandow Switch to Minerva Switch 138-kV transmission line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, for approximately 0.1 miles;
- Construct a new 345-kV transmission line which will require a CCN from Voss Lake Switch to Walleye Creek Switch with a normal and emergency ratings of at least 2,987 MVA or greater on double-circuit structures with one circuit installed initially, for approximately 2 miles;
- Construct a new 345-kV double-circuit transmission line which will require a CCN from Muscovy Switch to Voss Lake Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 25 miles;
- Install terminal equipment in existing bays at Limmer Substation to connect both circuits of the new 345-kV double-circuit transmission line to Muscovy Switch, including two 345-kV, 5000 A circuit breakers and associated equipment. All associated terminal equipment will have a minimum rating of 5000 A;
- Establish the Tower 345-kV Switch by installing ten 345-kV, 5000 A circuit breakers in a breaker-and-a-half bus arrangement;
  - Loop the existing Salado Switch to Knob Creek Switch 345-kV transmission line into Tower 345-kV Switch to create the new Salado Switch to Tower Switch 345-kV transmission line, for approximately 12.4 miles and Tower Switch to Temple Switch 345-kV transmission line, for approximately 2.9 miles;
  - Construct two new 345-kV single-circuit transmission lines from Tower Switch to Knob Creek Switch on independent, single-circuit structures with a normal and emergency rating 2,987 MVA, for approximately 1.2 miles, this upgrade will require a CCN;
  - Rebuild the Salado Switch to Tower Switch 345-kV transmission line using double-circuit capable structures with two circuits installed with normal and emergency rating 2,987 MVA, for approximately 12.4 miles, this upgrade will require a CCN;

  - Rebuild the Tower Switch to Temple Switch 345-kV transmission line using double-circuit capable structures with two circuits installed with normal and emergency rating 2,987 MVA, for approximately 2.9 miles, this upgrade will require a CCN;
  - Ensure all associated terminal equipment to meet or exceed 5000 A (2,987 MVA);
- Rebuild the Bell County East Switch to Voss Lake Switch 345-kV double-circuit transmission line with a normal and emergency rating of 1,912 MVA, for approximately 29.6 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);
- Rebuild the Minerva Switch to Robertson 138-kV transmission line using double-circuit capable structures with one circuit installed with a normal and emergency rating of 614 MVA, for approximately 29.1 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);
- Rebuild the Temple Switch to Tinroof 138-kV transmission line using double-circuit capable structures with one circuit installed with a normal and emergency rating of 614 MVA, for approximately 1.85 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);
- Rebuild the Bell County East Switch to Little Pond 345-kV transmission line with a normal and emergency rating of 1,912 MVA, for approximately 17.75 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);
- Rebuild the Bell County East Switch to Brangus 345-kV transmission line with a normal and emergency rating of 1,912 MVA, for approximately 8.8 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);
- Rebuild the Temple Switch to Temple Pecan Creek Switch 345-kV double-circuit transmission line with a normal and emergency rating 2,987 MVA, on separate structures, for approximately 4.5 miles, and ensure all associated terminal equipment to meet or exceed 5000 A (2,987 MVA);
- Rebuild the Hutto to Round Rock Northeast 138-kV transmission line using double-circuit capable structures with normal and emergency rating of 614 MVA, for approximately 5.3 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);
- Rebuild Hutto to Limmer 345-kV double-circuit transmission line on separate structures, for approximately 3 miles, this upgrade will require a CCN;
- Rebuild the Round Rock Northeast to Round Rock 138-kV transmission line using double-circuit capable structures with one circuit installed with normal and

emergency rating 614 MVA, for approximately 3.8 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);

- Construct two new 345-kV double-circuit transmission line from Tower Switch to Muscovy on double-circuit capable structures with a normal and emergency rating 2,987 MVA, for approximately 36 miles, this upgrade will require a Certificate of Convenience and Necessity (CCN); and
- Rebuild the Muscovy to Limmer 345-kV double-circuit transmission line on separate structures, for approximately 3.5 miles.

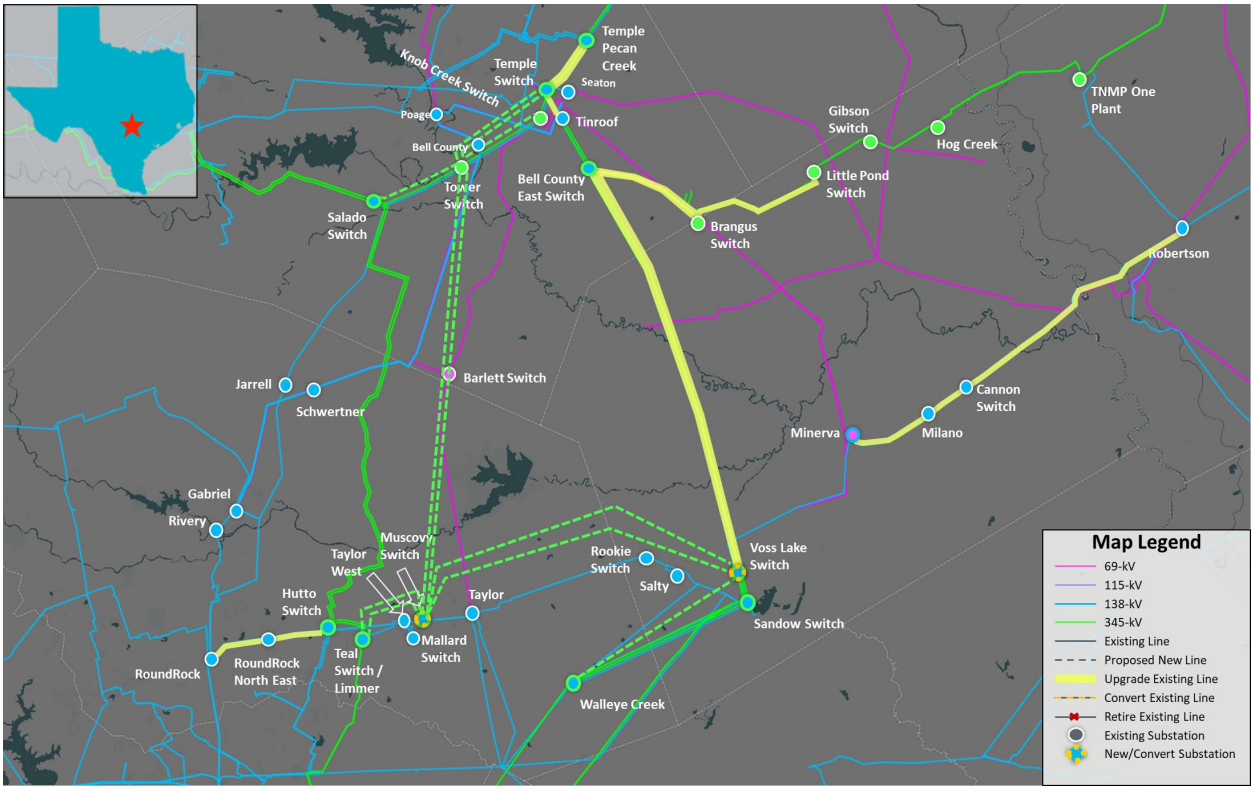


Figure 4.6: Map of Option 5

Option 6 consists of the following:

- Establish the new Ding Dong Station 345/138-kV Station;
  - Install two 345/138-kV autotransformers with normal rating of 700 MVA and emergency rating of 750 MVA;
  - Loop the existing Kill Switch to Buck House 345-kV transmission line into the new Ding Dong Station;
  - Loop the existing Russell Gap station to Kill Switch 345-kV transmission line into the new Ding Dong Station;

  - Remove the existing Solana to Cedar Valley double-circuit 138-kV transmission lines, Cedar Valley to Ding Dong 138-kV transmission line and Ding Dong to Trimmer 138-kV Transmission line;
  - Construct the following new 138-kV transmission lines;
    - Ding Dong to Solana 138-kV transmission line, for approximately 12.7-mile and Normal and emergency ratings of 418 MVA or greater;
    - Solana to Cedar Valley, for approximately 1.9-mile and Normal and emergency ratings of 418 MVA or greater;
    - Dingdong to Trimmer, for approximately 5.8-mile and Normal and emergency ratings of 418 MVA or greater;
  - Construct a new double-circuit transmission line from Solana to Schwertner 138-kV, for approximately 15.7-mile with a normal and emergency ratings of 837 MVA or greater;
- Establish the new Schwertner Station 345/138-kV Switch;
  - Install two 345/138-kV autotransformers with normal rating of 700 MVA and emergency rating of 750 MVA;
  - Loop the existing double-circuit transmission line from Salado Substation to Hutto Station into the new Schwertner Station;
  - Construct a new single-circuit 345-kV transmission line on a double-circuit capable structures which will require a CCN from Ding Dong Substation to Schwertner with a normal and emergency ratings of at least 2980 MVA or greater, for approximately 25.9 miles;
  - Construct the following new 138-kV transmission lines;
    - Schwertner Switch to Schwertner 138-kV transmission line, which will require a CCN, for approximately 5.81 miles, with a normal and emergency ratings of at least 837 MVA or greater;
    - Schwertner Switch to Bartlett switch double-circuit 138-kV transmission line, which will require a CCN, for approximately 5.81 miles, with a normal and emergency ratings of at least 837 MVA or greater;
    - Bartlett switch to Bartlett double-circuit 138-kV transmission line, which will require a CCN, for approximately 2.52 miles, with a normal and emergency ratings of at least 837 MVA or greater;
    - Schwertner switch to Solana double-circuit 138-kV transmission line, which will require a CCN, for approximately 15.7 miles, with a normal and emergency ratings of at least 837 MVA or greater;
- Establish the new Taplin Station 345/138-kV Switch;
  - Install two 345/138-kV autotransformers with normal rating of 700 MVA and emergency rating of 750 MVA;
  - Loop the existing Badger to Sandow switch double-circuit 345-kV transmission line into the new Taplin Station;

  - Construct a new single-circuit 345-kV transmission line on a double-circuit capable structures which will require a CCN from Schwertner Substation to Taplin with a normal and emergency ratings of at least 2980 MVA or greater, for approximately 19.4 miles;
  - Construct a new single-circuit 345-kV transmission line on a double-circuit capable structures which will require a CCN from Taplin to Gibson with a normal and emergency ratings of at least 2980 MVA or greater, for approximately 23.6 miles;
  - Construct a new single-circuit 345-kV transmission line on a double-circuit capable structures which will require a CCN from Gibson to Steckly Dam with a normal and emergency ratings of at least 2980 MVA or greater, for approximately 27 miles;
  - Loop the existing Rodgers to Voss Lake 138-kV transmission line into the new Taplin 138-kV station;
- Convert the existing Buck Holts 69-kV station and Silver City 69-kV Station into 138-kV station;
- Construct the following new 138-kV Transmission lines;
  - A new double-circuit 138-kV transmission line from Taplin 138-kV station to Buck Holts, for approximately 1.2 miles, with a normal and emergency ratings of at least 524 MVA or greater;
  - A new double-circuit 138-kV transmission line from Taplin 138-kV station to Silver City, for approximately 14.3 miles, with a normal and emergency ratings of at least 837 MVA or greater;
  - A new double-circuit 138-kV transmission line from Bartlett 138-kV station to Buck Holts, for approximately 14.4 miles, with a normal and emergency ratings of at least 837 MVA or greater;
- Convert existing Branchville, Baggins,Barclay, Calvert switch, Calvert, Baileyville, Pleasant grove, Midway 69-kV Stations to 138-kV Stations;
- Decommission the existing 138/69-kV Auto at Seaton station;
- Move the existing Branchville 69-kV Station to Hearne 69-kV station transmission line to Branchville 138-kV station to Hearne 138-kV station transmission line;
- Move the Barclay 69-kV Station to Seaton 69-kV station transmission line to Barclay 138-kV station to Seaton 138-kV station transmission line;
- Convert the following existing 69-kV transmission line to 138-kV transmission line;
  - Branchville to Silver City, for approximately 10.18 miles, with a normal and emergency ratings of at least 237 MVA or greater;
  - Barclays to Baggins, for approximately 8.7 miles, with a normal and emergency ratings of at least 237 MVA or greater;

  - Baggins to Silver City, for approximately 8.2 miles, with a normal and emergency ratings of at least 237 MVA or greater;
  - Silver City to Calvert Switch, for approximately 7.3 miles, with a normal and emergency ratings of at least 418 MVA or greater;
  - Calvert Switch to Calvert, for approximately 6.9 miles, with a normal and emergency ratings of at least 144 MVA or greater;
  - Calvert to BaileyVille, for approximately 0.02 miles, with a normal and emergency ratings of at least 88 MVA or greater;
  - Clavert Switch to Pleasant Grove, for approximately 7.95 miles, with a normal and emergency ratings of at least 418 MVA or greater;
  - Pleasant Grove to Midway approximately 12.45 miles, with a normal and emergency ratings of at least 418 MVA or greater;
- Move the Midway 69-kV Station to Perry 69-kV station transmission line to Midway 138-kV station to Perry 138-kV station transmission line;
- Construct a new 138-kV transmission line from Midway to Spring Valley, which will require a CCN, for approximately 18.5 miles, with a normal and emergency ratings of at least 837 MVA or greater;
- Install two 345/138-kV autotransformers at Gibson 345-kV station with the secondary terminal at Calvert Switch 138-kV station with normal rating of 700 MVA and emergency rating of 750 MVA;
- Establish the new McLarge Station 345/138-kV Switch;
  - Install two 345/138-kV autotransformers with normal rating of 700 MVA and emergency rating of 750 MVA;
  - Construct a new single-circuit 345-kV transmission line on a double-circuit capable structures which will require a CCN from Steckly Dam Station to new McLarge Station with a normal and emergency ratings of at least 2980 MVA or greater, for approximately 19.3 miles;
  - Loop the existing Judith to McGregor 138-kV transmission line into the McLarge 138-kV station;
  - Construct a new transmission line from Bewley 138-kV station to McLarge 138-kV station, for approximately 0.1 miles, with a normal and emergency ratings of at least 837 MVA or greater; and
  - Move the existing Spring Valley station to Spring Valley tap 138-kV transmission line to Spring Valley to McLarge 138-kV transmission line.

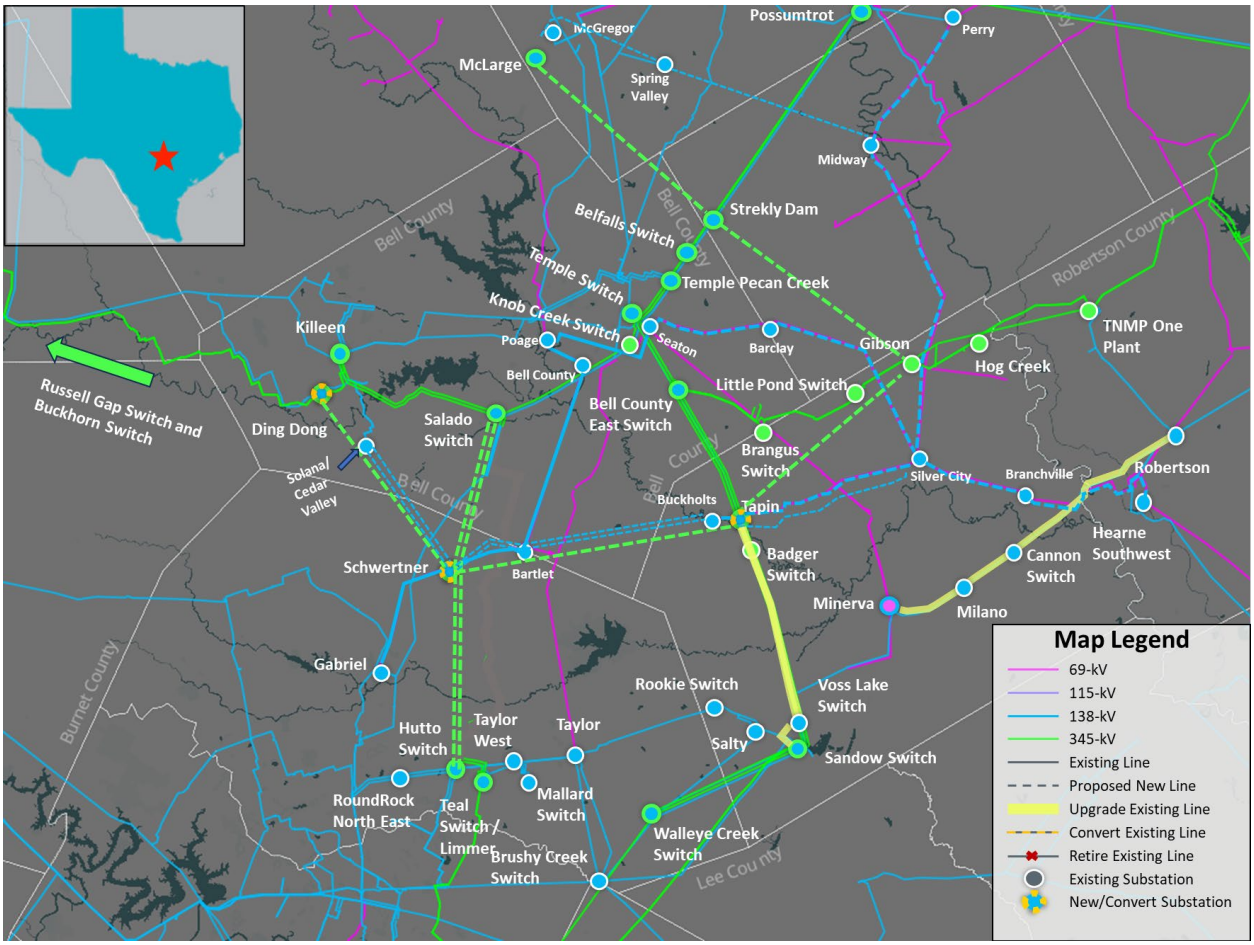


Figure 4.7: Map of Option 6

Option 7 consists of the following:

- Establish the new Muscovy 345/138-kV Switch by installing ten 345-kV, 5000 A and twelve 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, for approximately 3.3 miles east of the 345-kV Limmer Substation (LCRA TSC) and 138-kV Teal Switch (Oncor);
    - Install two 345/138-kV autotransformers with normal rating of 700 MVA and emergency rating of 750 MVA;
    - Install three 36.8 MVAr capacitor banks;
    - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV;
- Construct a new 345-kV double-circuit transmission line which will require a CCN from Limmer Substation (LCRA TSC) to Muscovy Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 4 miles;

- Construct a loop of the existing Teal Switch to Pintail Switch 138-kV double-circuit transmission line with a normal and emergency ratings of at least 614 MVA into the new Muscovy 138-kV Switch, for approximately 0.1 miles;
- Establish the new Voss Lake 345/138-kV Switch by installing ten 345-kV, 5000 A and nine 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, for approximately 1.9 miles north of Sandow 345/138-kV Switch;
    - Install one 345/138-kV autotransformer with normal ratings of at least 700 MVA and emergency ratings of at least 750 MVA;
    - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV;
- Construct a loop of the existing Sandow Switch to Bell County East Switch 345-kV double-circuit transmission line into the Voss Lake 345- kV Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 0.1 miles;
- Construct a loop of the existing Sandow Switch to Temple Switch 138-kV transmission line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, for approximately 0.1 miles;
- Construct a loop of the existing Sandow Switch to Minerva Switch 138-kV transmission line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, for approximately 0.1 miles;
- Construct a new 345-kV transmission line which will require a CCN from Voss Lake Switch to Walleye Creek Switch with a normal and emergency ratings of at least 2,987 MVA or greater on double-circuit structures with one circuit installed initially, for approximately 2 miles;
- Construct a new 345-kV double-circuit transmission line which will require a CCN from Muscovy Switch to Voss Lake Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 25 miles;
- Install terminal equipment in existing bays at Limmer Substation to connect both circuits of the new 345-kV double-circuit transmission line to Muscovy Switch, including two 345-kV, 5000 A circuit breakers and associated equipment. All associated terminal equipment will have a minimum rating of 5000 A;
- Establish the Tower 345-kV Switch by installing ten 345-kV, 5000 A circuit breakers in a breaker-and-a-half bus arrangement;
    - Loop the existing Salado Switch to Knob Creek Switch 345-kV transmission line into Tower 345-kV Switch to create the new Salado Switch to Tower Switch 345-kV transmission line, for approximately 12.4 miles and Tower Switch to Temple Switch 345-kV transmission line, for approximately 2.9 miles;
    - Construct two new 345-kV single-circuit transmission lines from Tower Switch to Knob Creek Switch on independent, single-circuit structures with

a normal and emergency rating 2,987 MVA, for approximately 1.2 miles, this upgrade will require a CCN;

- Rebuild the Salado Switch to Tower Switch 345-kV transmission line using double-circuit capable structures with two circuits installed with normal and emergency rating 2,987 MVA, for approximately 12.4 miles, this upgrade will require a CCN;
- Rebuild the Tower Switch to Temple Switch 345-kV transmission line using double-circuit capable structures with two circuits installed with normal and emergency rating 2,987 MVA, for approximately 2.9 miles, this upgrade will require a CCN;
- Ensure all associated terminal equipment to meet or exceed 5000 A (2,987 MVA);

- Rebuild the Bell County East Switch to Voss Lake Switch 345-kV double-circuit transmission line with a normal and emergency rating of 1,912 MVA, for approximately 29.6 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);
- Rebuild the Minerva Switch to Robertson 138-kV transmission line using double-circuit capable structures with one circuit installed with a normal and emergency rating of 614 MVA, for approximately 29.1 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);
- Rebuild the Temple Switch to Tinroof 138-kV transmission line using double-circuit capable structures with one circuit installed with a normal and emergency rating of 614 MVA, for approximately 1.85 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);
- Rebuild the Bell County East Switch to Little Pond 345-kV transmission line with a normal and emergency rating of 1,912 MVA, for approximately 17.75 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);
- Rebuild the Bell County East Switch to Brangus 345-kV transmission line with a normal and emergency rating of 1,912 MVA, for approximately 8.8 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);
- Rebuild the Temple Switch to Temple Pecan Creek Switch 345-kV double-circuit transmission line with a normal and emergency rating 2,987 MVA, on separate structures, for approximately 4.5 miles, and ensure all associated terminal equipment to meet or exceed 5000 A (2,987 MVA);
- Rebuild the Hutto to Round Rock Northeast 138-kV transmission line using double-circuit capable structures with normal and emergency rating of 614 MVA, for

approximately 5.3 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);

- Rebuild Hutto to Limmer 345-kV double-circuit transmission line on separate structures, for approximately 3 miles, this upgrade will require a CCN;
- Establish a new 345-kV yard at Gabriel Substation by installing ten 345-kV, 5000 A circuit breakers in a breaker-and-a-half bus arrangement;
    - Install two 345/138-kV autotransformers with normal rating of 672 MVA and emergency rating of 739 MVA;
    - Construct a new 345-kV double-circuit transmission line from Salado to Gabriel Substation with normal and emergency rating 2,987 MVA, for approximately 28.5 miles, this upgrade will require a CCN;
    - Construct a new 345-kV double-circuit transmission line from Gabriel Substation to Hutto Switch with normal and emergency rating 2,987 MVA, for approximately 12.6 miles, this upgrade will require a CCN;

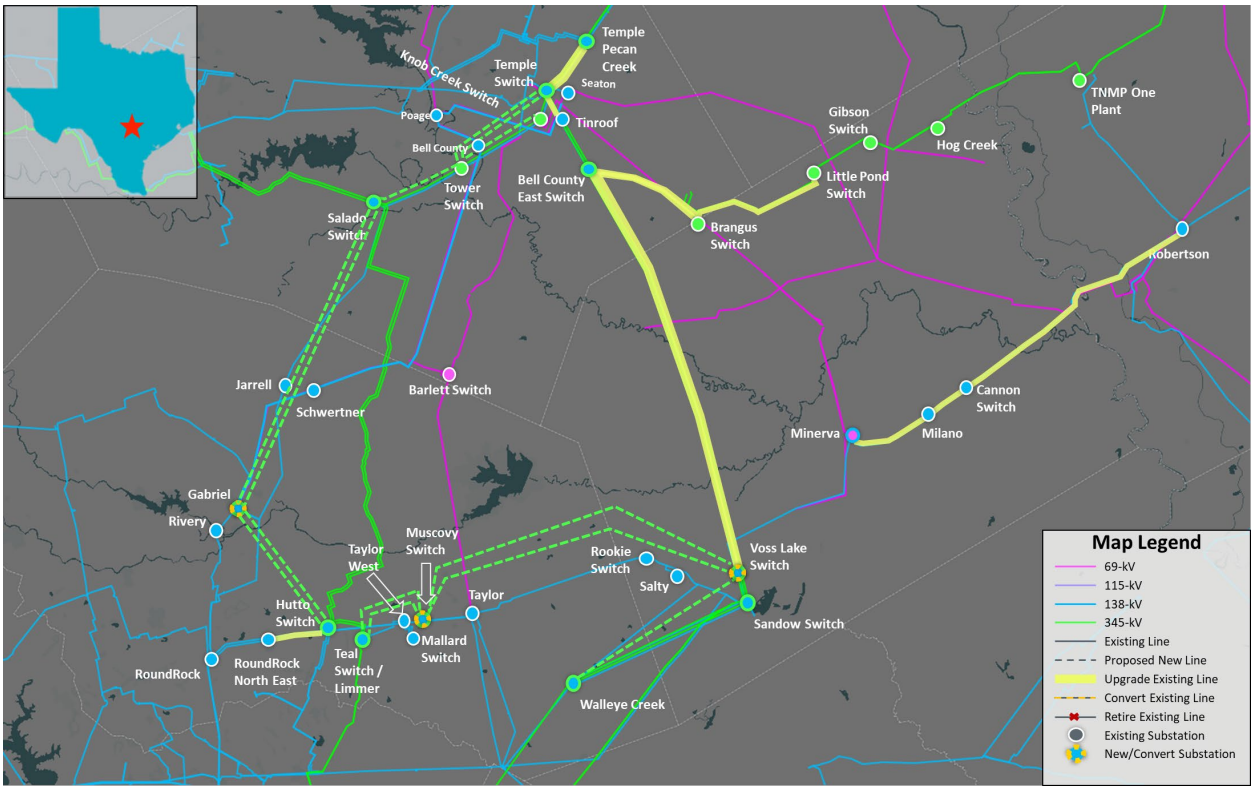


Figure 4.8: Map of Option 7

Option 7A consists of the following:

- Establish the new Muscovy 345/138-kV Switch by installing ten 345-kV, 5000 A and twelve 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, for approximately 3.3 miles east of the 345-kV Limmer Substation (LCRA TSC) and 138-kV Teal Switch (Oncor);
    - Install two 345/138-kV autotransformers with normal rating of 700 MVA and emergency rating of 750 MVA;
    - Install three 36.8 MVAr capacitor banks;
    - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV;
- Construct a new 345-kV double-circuit transmission line which will require a CCN from Limmer Substation (LCRA TSC) to Muscovy Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 4 miles;
- Construct a loop of the existing Teal Switch to Pintail Switch 138-kV double-circuit transmission line with a normal and emergency ratings of at least 614 MVA into the new Muscovy 138-kV Switch, for approximately 0.1 miles;
- Establish the new Voss Lake 345/138-kV Switch by installing ten 345-kV, 5000 A and nine 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, for approximately 1.9 miles north of Sandow 345/138-kV Switch;
    - Install one 345/138-kV autotransformer with normal ratings of at least 700 MVA and emergency ratings of at least 750 MVA;
    - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV;
- Construct a loop of the existing Sandow Switch to Bell County East Switch 345-kV double-circuit transmission line into the Voss Lake 345- kV Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 0.1 miles;
- Construct a loop of the existing Sandow Switch to Temple Switch 138-kV transmission line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, for approximately 0.1 miles;
- Construct a loop of the existing Sandow Switch to Minerva Switch 138-kV transmission line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, for approximately 0.1 miles;
- Construct a new 345-kV transmission line which will require a CCN from Voss Lake Switch to Walleye Creek Switch with a normal and emergency ratings of at least 2,987 MVA or greater on double-circuit structures with one circuit installed initially, for approximately 2 miles;
- Construct a new 345-kV double-circuit transmission line which will require a CCN from Muscovy Switch to Voss Lake Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 25 miles;

- Install terminal equipment in existing bays at Limmer Substation to connect both circuits of the new 345-kV double-circuit transmission line to Muscovy Switch, including two 345-kV, 5000 A circuit breakers and associated equipment. All associated terminal equipment will have a minimum rating of 5000 A;
- Establish the Tower 345-kV Switch by installing ten 345-kV, 5000 A circuit breakers in a breaker-and-a-half bus arrangement;
    - Loop the existing Salado Switch to Knob Creek Switch 345-kV transmission line into Tower 345-kV Switch to create the new Salado Switch to Tower Switch 345-kV transmission line, for approximately 12.4 miles and Tower Switch to Temple Switch 345-kV transmission line, for approximately 2.9 miles;
    - Construct two new 345-kV single-circuit transmission lines from Tower Switch to Knob Creek Switch on independent, single-circuit structures with a normal and emergency rating 2,987 MVA, for approximately 1.2 miles, this upgrade will require a CCN;
    - Rebuild the Salado Switch to Tower Switch 345-kV transmission line using double-circuit capable structures with two circuits installed with normal and emergency rating 2,987 MVA, for approximately 12.4 miles, this upgrade will require a CCN;
    - Rebuild the Tower Switch to Temple Switch 345-kV transmission line using double-circuit capable structures with two circuits installed with normal and emergency rating 2,987 MVA, for approximately 2.9 miles, this upgrade will require a CCN;
    - Ensure all associated terminal equipment to meet or exceed 5000 A (2,987 MVA);
- Rebuild the Bell County East Switch to Voss Lake Switch 345-kV double-circuit transmission line with a normal and emergency rating of 1,912 MVA, for approximately 29.6 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);
- Rebuild the Minerva Switch to Robertson 138-kV transmission line using double-circuit capable structures with one circuit installed with a normal and emergency rating of 614 MVA, for approximately 29.1 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);
- Rebuild the Temple Switch to Tinroof 138-kV transmission line using double-circuit capable structures with one circuit installed with a normal and emergency rating of 614 MVA, for approximately 1.85 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);
- Rebuild the Bell County East Switch to Little Pond 345-kV transmission line with a normal and emergency rating of 1,912 MVA, for approximately 17.75 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at

a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);

- Rebuild the Bell County East Switch to Brangus 345-kV transmission line with a normal and emergency rating of 1,912 MVA, for approximately 8.8 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);
- Rebuild the Temple Switch to Temple Pecan Creek Switch 345-kV double-circuit transmission line with a normal and emergency rating 2,987 MVA, on separate structures, for approximately 4.5 miles, and ensure all associated terminal equipment to meet or exceed 5000 A (2,987 MVA);
- Rebuild the Hutto to Round Rock Northeast 138-kV transmission line using double-circuit capable structures with normal and emergency rating of 614 MVA, for approximately 5.3 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);
- Rebuild Hutto to Limmer 345-kV double-circuit transmission line on separate structures, for approximately 3 miles, this upgrade will require a CCN;
- Establish a new 345-kV yard at Gabriel Substation by installing ten 345-kV, 5000 A circuit breakers in a breaker-and-a-half bus arrangement;
    - Install two 345/138-kV autotransformers with normal rating of 672 MVA and emergency rating of 739 MVA;
    - Construct a new 345-kV double-circuit transmission line from Salado to Gabriel Substation with normal and emergency rating 2,987 MVA, for approximately 28.5 miles, this upgrade will require a CCN;
    - Construct a new 345-kV double-circuit transmission line from Gabriel Substation to Hutto Switch with normal and emergency rating 2,987 MVA, for approximately 12.6 miles, this upgrade will require a CCN;
- Rebuild the Gabriel to Rivery 138-kV transmission line using double-circuit capable structures with one circuit installed with normal and emergency rating 614 MVA, for approximately 2.5 miles, and ensure all associated terminal equipment to meet or exceed 3000 A (717 MVA); and

  Rebuild the Gabriel to Glasscock 138-kV transmission line using double-circuit capable structures with one circuit installed with normal and emergency rating 614 MVA, for approximately 6.6 miles, and ensure all associated terminal equipment to meet or exceed 3000 A (717 MVA).

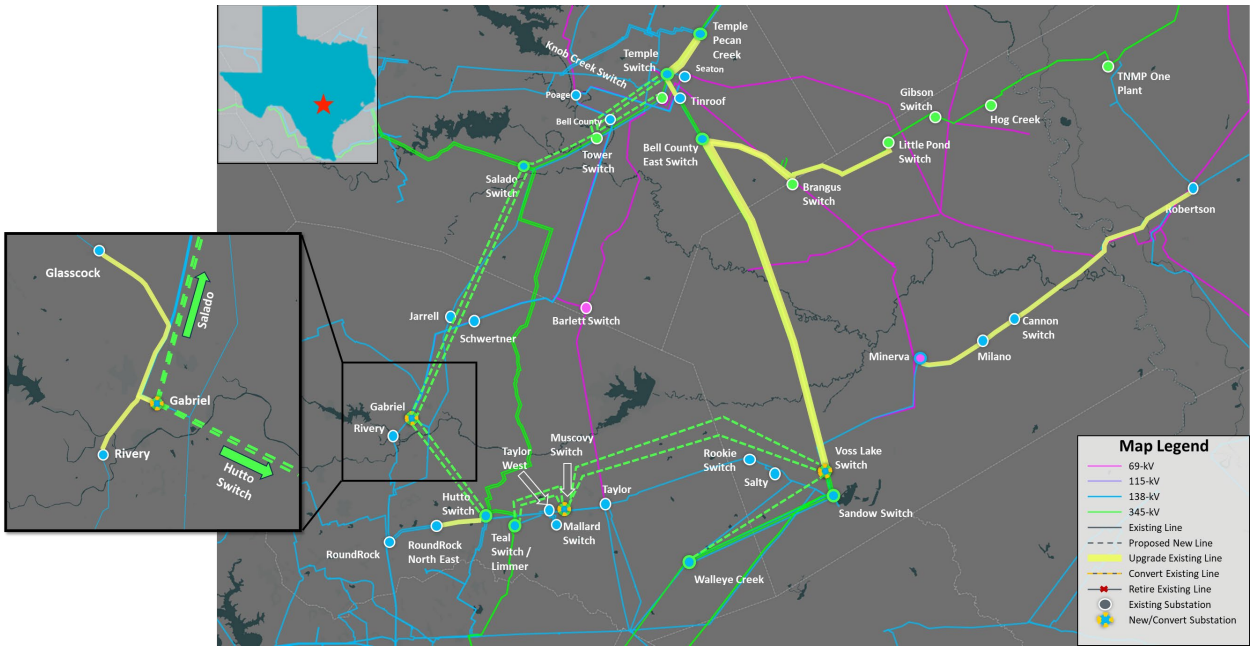


Figure 4.9: Map of Option 7A

Option 8 consists of the following:

- Establish the Tower 345-kV Switch by installing ten 345-kV, 5000 A circuit breakers in a breaker-and-a-half bus arrangement;
    - Loop the existing Salado Switch to Knob Creek Switch 345-kV transmission line into Tower 345-kV Switch to create the new Salado Switch to Tower Switch 345-kV transmission line, for approximately 12.4 miles and Tower Switch to Temple Switch 345-kV transmission line, for approximately 2.9 miles;
    - Construct two new 345-kV single-circuit transmission lines from Tower Switch to Knob Creek Switch on independent, single-circuit structures with a normal and emergency rating 2,987 MVA, for approximately 1.2 miles, this upgrade will require a CCN;
    - Rebuild the Salado Switch to Tower Switch 345-kV transmission line using double-circuit capable structures with two circuits installed with normal and emergency rating 2,987 MVA, for approximately 12.4 miles, this upgrade will require a CCN;
    - Rebuild the Tower Switch to Temple Switch 345-kV transmission line using double-circuit capable structures with two circuits installed with normal and emergency rating 2,987 MVA, for approximately 2.9 miles, this upgrade will require a CCN;
    - Ensure all associated terminal equipment to meet or exceed 5000 A (2,987 MVA);

- Rebuild the Bell County East Switch to Voss Lake Switch 345-kV double-circuit transmission line with a normal and emergency rating of 1,912 MVA, for approximately 29.6 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);
- Rebuild the Minerva Switch to Robertson 138-kV transmission line using double-circuit capable structures with one circuit installed with a normal and emergency rating of 614 MVA, for approximately 29.1 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);
- Rebuild the Temple Switch to Tinroof 138-kV transmission line using double-circuit capable structures with one circuit installed with a normal and emergency rating of 614 MVA, for approximately 1.85 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);
- Rebuild the Bell County East Switch to Little Pond 345-kV transmission line with a normal and emergency rating of 1,912 MVA, for approximately 17.75 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);
- Rebuild the Bell County East Switch to Brangus 345-kV transmission line with a normal and emergency rating of 1,912 MVA, for approximately 8.8 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);
- Rebuild the Temple Switch to Temple Pecan Creek Switch 345-kV double-circuit transmission line with a normal and emergency rating 2,987 MVA, on separate structures, for approximately 4.5 miles, and ensure all associated terminal equipment to meet or exceed 5000 A (2,987 MVA);
- Rebuild the Hutto to Round Rock Northeast 138-kV transmission line using double-circuit capable structures with normal and emergency rating of 614 MVA, for approximately 5.3 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);
- Rebuild Hutto to Limmer 345-kV double-circuit transmission line on separate structures, for approximately 3 miles, this upgrade will require a CCN; and
- Rebuild the 36.9 miles Hutto to Salado 345-kV double-circuit transmission line using a conductor rated 5000 A or greater (normal and emergency rating 2,987 MVA) and ensure all associated terminal equipment to meet or exceed 5000 A (2,987 MVA).

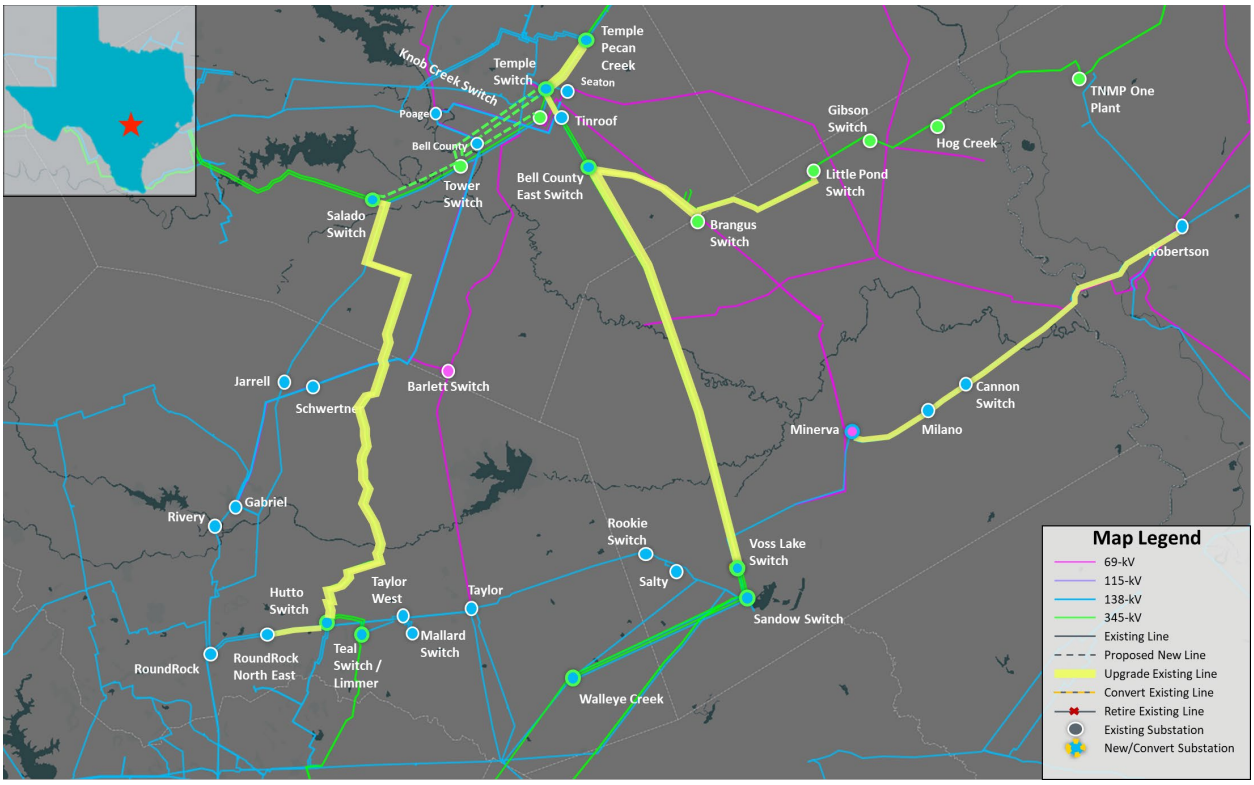


Figure 4.10: Map of Option 8

5. Option Evaluations

ERCOT performed a reliability analysis, maintenance outage evaluation, and minimum deliverability assessment to evaluate all ten project options and to identify any reliability impact of the options in the study area. This section details these studies and their results and compares each option's results.

5.1. Results of Reliability Analysis

All ten options were evaluated based on the contingencies described in the methodology section of this report. As shown in Table 5.1, Option 1, Option 2, Option 4 and Option 7 identified thermal overloads while Option 6 and Option 8 identified thermal overloads and voltage violations. No reliability criteria violation were identified for Option 3, Option 4A, Option 5 and Option 7A.

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

Option	N-0		N-1		(G-1+N-1)		(X-1+N-1)		Unsolved Power Flow
	Thermal Overload	Voltage Violation	Thermal Overload	Voltage Violation	Thermal Overload	Voltage Violation	Thermal Overload	Voltage Violation	
1	4	None	6	None	3	None	3	None	None
2	None	None	5	None	None	None	4	None	None
3	None	None	None	None	None	None	None	None	None
4	None	None	2	None	None	None	None	None	None
4A	None	None	None	None	None	None	None	None	None
5	None	None	None	None	None	None	None	None	None
6	None	None	4	None	7	3	10	3	1
7	None	None	2	None	None	None	None	None	None
7A	None	None	None	None	None	None	None	None	None
8	None	None	6	2	2	1	5	2	1

5.2. Short-Listed Options

Based on the results shown in Section 5.1, Option 3, Option 4A, Option 5 and Option 7A were selected as short-listed options for further evaluation. This section details these

evaluations and their results to compare the four short-listed options. These four short-listed options are illustrated in Figures 5.1, 5.2, 5.3 and 5.4.

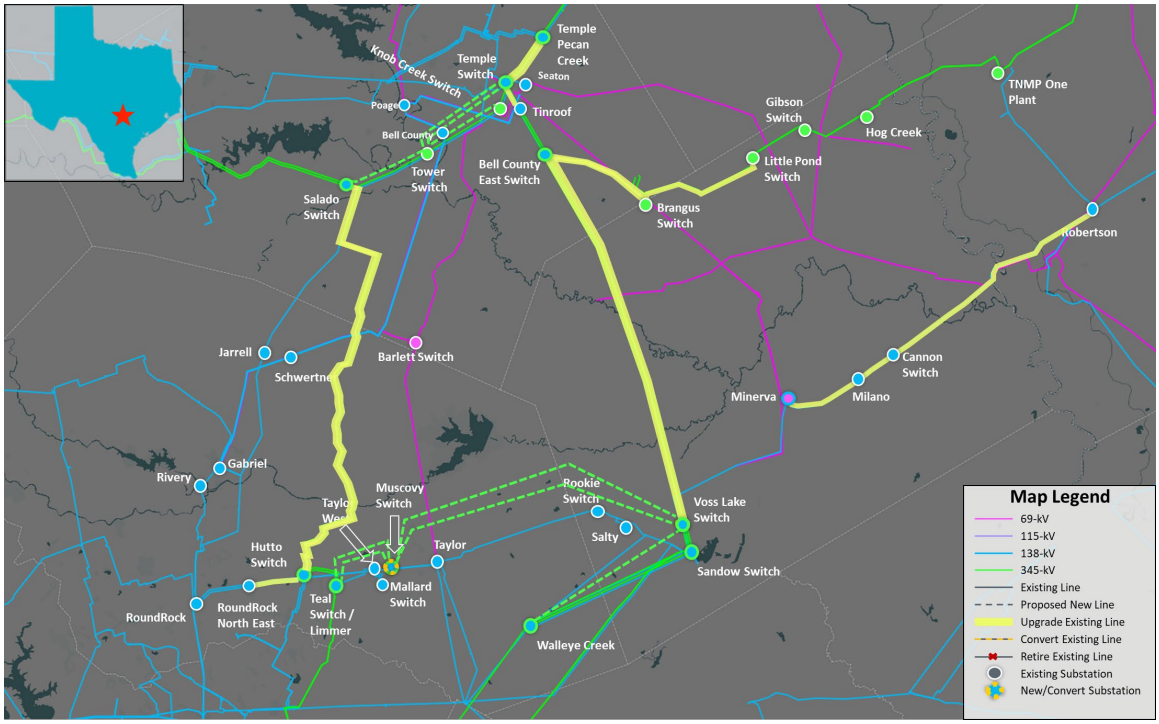


Figure 5.1: Map of Option 3

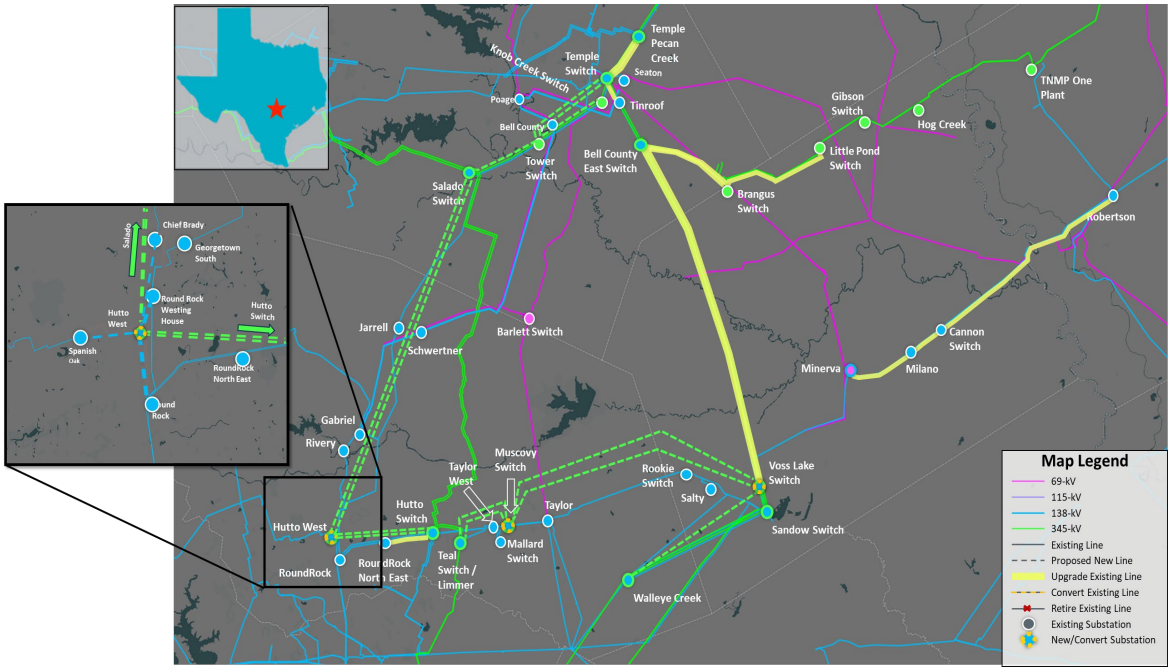


Figure 5.2: Map of Option 4A

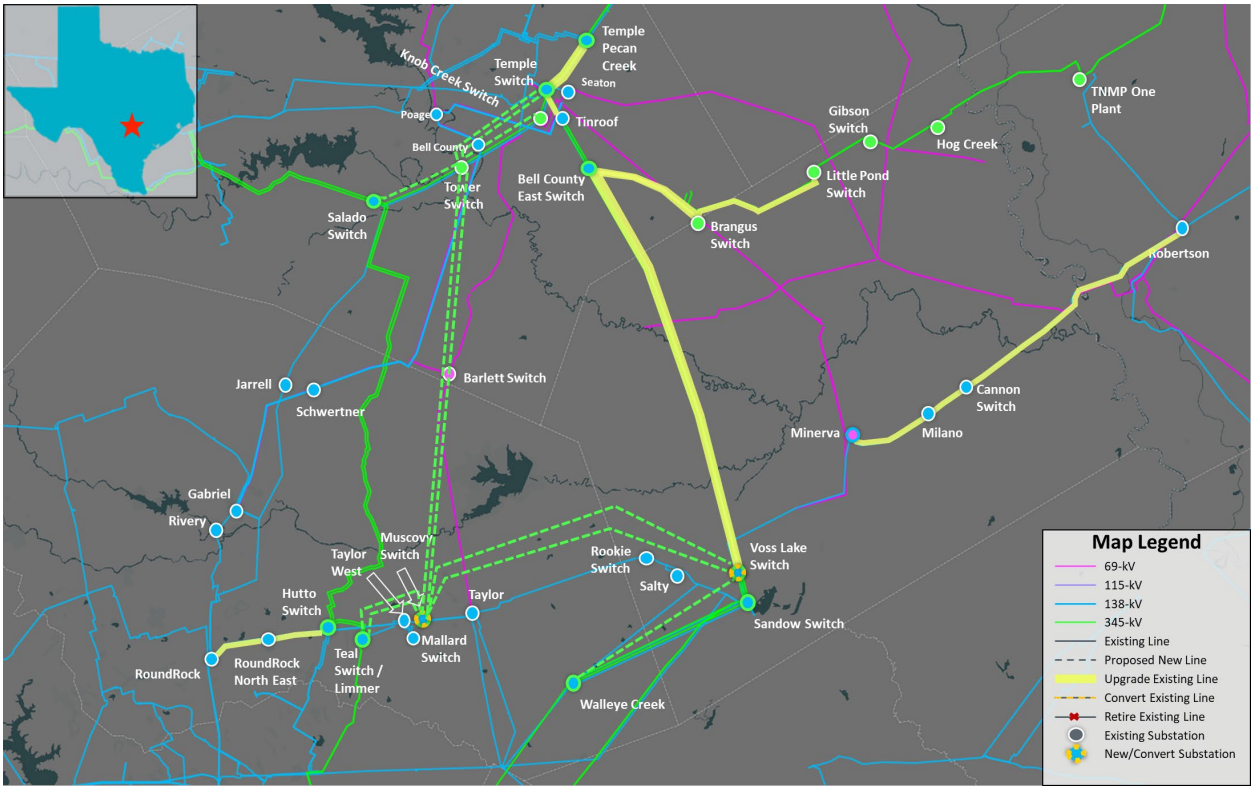


Figure 5.3: Map of Option 5

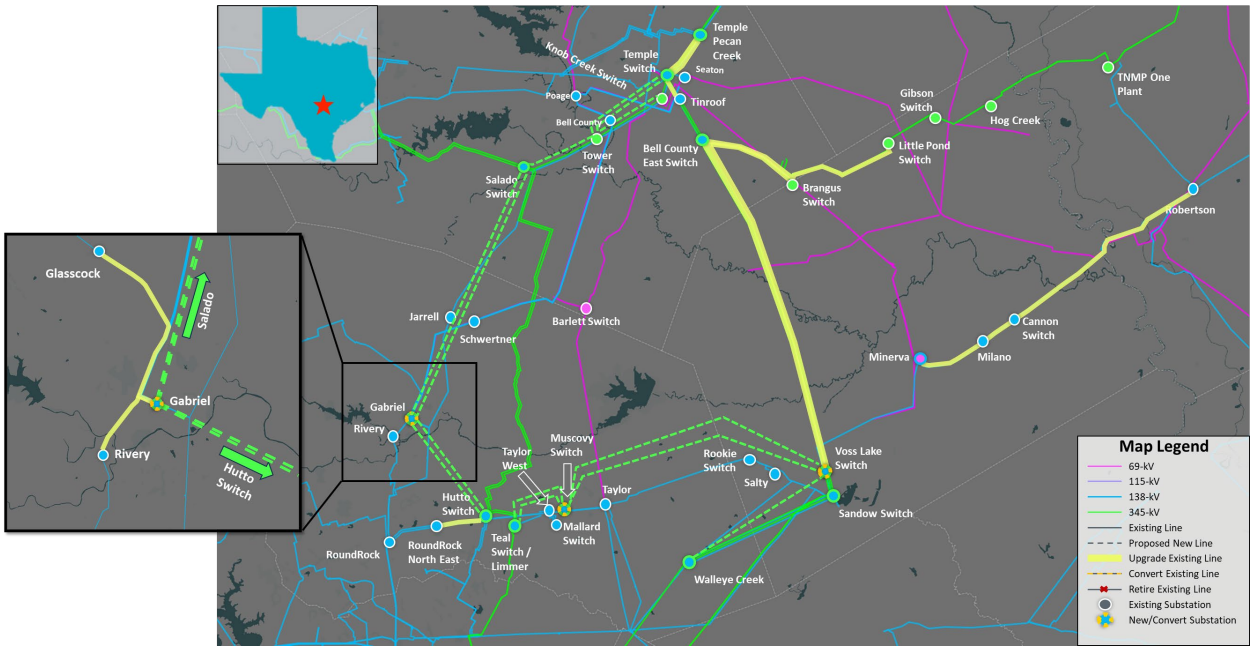


Figure 5.4: Map of Option 7A

5.3. Maintenance Outage Evaluation

Using the P1, P2.1, and P7 contingencies based on the review of the system topology of the study area, ERCOT conducted an N-2 contingency analysis for all four short-listed options to represent system element outage(s) under 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 study area were monitored in the maintenance outage evaluations.

As shown in Table 5.2, the results of the maintenance outage evaluations indicate all four options did not result in any reliability criteria violations.

Table 5.2: Results of Maintenance Outage Evaluation for the Four Short-Listed Options

Option	Voltage Violations	Thermal Overloads	Unsolved Power Flow
3	None	None	None
4A	None	None	None
5	None	None	None
7A	None	None	None

5.4. Long Term Load-Serving Capability

ERCOT conducted long-term load-serving capability assessments of the four options to compare the relative performance.

The results show that all four options provided additional long-term load-serving capability with Option 7A providing the greatest capability and Option 3 providing the least. These results are shown in Table 5.3.

Table 5.3: Results of Long-Term Load-Serving Capability Assessment of All Four Options

Option	Incremental Load-Serving Capability (~MW)
3	350
4A	550
5	450
7A	1000

5.5. Cost Estimate and Feasibility Assessment

TSPs performed feasibility assessments and provided cost estimates for the four options. Table 5.4 summarizes the cost estimate, estimated mileage of CCN required, option feasibility, and expected year of completion for the four options.

Table 5.4: Cost Estimates and Feasibility for the Four Short-Listed Options

Option	Cost Estimates (~$B)	CCN Required (~miles)	Construction Feasible	Expected ISD
3	1.272	Yes (56.2)	Yes	LCRA TSC: August 2031 Oncor: May 2031
4A	1.575	Yes (105.4)	Yes	LCRA TSC: August 2031 Oncor: December 2032
5	1.336	Yes (95.7)	Yes	LCRA TSC: August 2031 Oncor: December 2032
7A	1.457	Yes (97.3)	Yes	LCRA TSC: December 2031 Oncor: December 2031

5.6. Additional Load Sensitivity Analysis

The TSPs notified ERCOT that there are approximately 200 MW of newly contracted load in study area 1 in different locations that may connect before 2029. ERCOT did not include them in the project need analysis, because these loads were not contracted at the time of study. These new loads were added incrementally to the study area load for this additional load sensitivity analysis to compare the relative performance of four short-listed options. As shown in Table 5.5, no reliability violations in the study area were identified for Option 4A and Option 7A, while Option 3 and Option 5 identified reliability criteria (thermal overloads) violations.

Table 5.5: Results of Higher Load Sensitivity Analysis for the Four Short-Listed Options

Option	N-0		N-1		(G-1+N-1)		(X-1+N-1)		Unsolved Power Flow
	Thermal Overload	Voltage Violation	Thermal Overload	Voltage Violation	Thermal Overload	Voltage Violation	Thermal Overload	Voltage Violation	
3	None	2	None	2	None	10	4	None	None
4A	None	None	None	None	None	None	None	None	None
5	None	None	None	None	None	None	2	None	None
7A	None	None	None	None	None	None	None	None	None

6. Comparison of Short-Listed Options

A comparison of the four short-listed options evaluated is summarized in Table 6.1.

Table 6.1: Comparison of the Four Short-Listed Options

	Option 3	Option 4A	Option 5	Option 7A
Met ERCOT and NERC Reliability Criteria	Yes	Yes	Yes	Yes
Improves Long-Term Load-Serving Capability (~MW)	350	550	450	1000
Supports additional newly contracted Loads	No	Yes	No	Yes
CCN Required (~miles)	Yes (56.2)	Yes (105.4)	Yes (95.7)	Yes (97.3)
Construction Feasibility (Based on TSP assessment)	Yes	Yes	Yes	Yes
Capital Cost Estimates[10] (~$Billion)	1.272	1.549	1.336	1.457
Estimated ISD (Year)	LCRA TSC: August 2031 Oncor: May 2031	LCRA TSC: August 2031 Oncor: December 2032	LCRA TSC: August 2031 Oncor: December 2032	LCRA TSC: December 2031 Oncor: December 2031

ERCOT recommends Option 7A as the preferred option to address the reliability need in the study area based on the following considerations:

- Option 7A addresses the project need in study area 1 and meets ERCOT and NERC reliability criteria;
- Option 7A improves long-term load-serving capability and supports future load growth in the area; and
- Option 7A is feasible for construction.

[10] The cost estimates were provided by Oncor and LCRA TSC

7. Additional Analysis and Assessment

ERCOT's preferred Option 7A, with a cost estimate of approximately $1.457 billion is categorized as a Tier 1 project pursuant to ERCOT Nodal Protocol 3.11.4.3(1)(a). ERCOT performed a generation sensitivity analysis using the preferred option and considered load scaling impacts on the base case, as required under ERCOT Planning Guide Section 3.1.3(4). Additionally, a Subsynchronous Oscillations (SSO) Assessment and a Congestion Analysis were performed.

7.1. Generation Addition Sensitivity Analysis

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

Based on a review of the March 2026 GIS[11] reports, eleven (11) units were found within the study area that could have an impact on the identified reliability issues. These units, listed in Table 7.1, were added to the 2024 RTP's 2029 Summer Peak case following the 2024 RTP methodology. ERCOT determined that the addition of these generators does not impact ERCOT's preferred option (Option 7A).

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

GINR	Unit Name	Fuel Type	Max Capacity (~MW)	County
22INR0350	Sandow Solar	SOL	287.2	Milam
23INR0248	Limewood Storage	OTH	50.0	Bell
23INR0478	Rhoda Storage	OTH	141.2	Milam
23INR0502	Adelite Storage	OTH	231.9	Milam
24INR0042	Yaupon Solar SLF	SOL	200.8	Milam
25INR0100	Goldeneye BESS	OTH	201.6	Bell
25INR0382	HappyDogSolar	SOL	85.5	Milam
25INR0442	Happy Dog Storage	OTH	104.5	Milam
26INR0431	Big Rooter West Solar	SOL	403.2	Robertson

[11] February 2026 GIS Report: https://www.ercot.com/mp/data-products/data-product-details?id=PG7-200-ER

29INR0017	Big Rooter East Solar	SOL	554.7	Robertson
29INR0018	Big Rooter East Storage	OTH	201.0	Robertson

7.2. Load Scaling Sensitivity Analysis

ERCOT Planning Guide Section 3.1.3(4)(b) requires an evaluation of the potential impact of load scaling on the criteria violations seen in the 2024 RTP study. Before 2024, ERCOT's RTP adopted the methodology of developing four sets of summer peak cases with each case representing one study region for each study year. For each summer peak case, the loads outside of the study region may be scaled down from the respective non-coincident summer peak levels to maintain a certain reserve requirement. This methodology may cause a potential impact of load scaling on the criteria violations. Starting 2024, ERCOT's RTP adopted a new methodology of having one summer peak case for each study year with non-coincident peaks for each of the Weather Zones, which would eliminate the load scaling impact. As such, load scaling sensitivity analysis is no longer needed.

7.3. Subsynchronous Oscillations (SSO) Assessment

Pursuant to ERCOT Nodal Protocol Section 3.22.1.3(2), ERCOT conducted an SSO screening for the preferred Option 7A and found no adverse SSO impacts to the existing and planned generation resources in the study area.

7.4. Congestion Analysis

ERCOT conducted a congestion analysis to identify any potential impact on system congestion related to the addition of the preferred Option 7A using the 2025 RTP 2030 sensitivity economic study case.

The results of the congestion analysis indicated no additional congestion in the area due to the addition of Option 7A's recommended transmission upgrades.

8. Conclusion

ERCOT evaluated ten transmission upgrade options to resolve the thermal overloads in study area 1. Based on the results of the EIR, ERCOT recommends Option 7A as the preferred solution because it addresses all project needs in study area 1, meets ERCOT and NERC reliability criteria, improves long-term load-serving capability, supports future load growth in the area and is feasible for construction.

Option 7A consists of the following upgrades:

- Establish the new Muscovy 345/138-kV Switch by installing ten 345-kV, 5000 A and twelve 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, for approximately 3.3 miles east of the 345-kV Limmer Substation (LCRA TSC) and 138-kV Teal Switch (Oncor);
    - Install two 345/138-kV autotransformers with normal rating of 700 MVA and emergency rating of 750 MVA;
    - Install three 36.8 MVAr capacitor banks;
    - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV;
- Construct a new 345-kV double-circuit transmission line which will require a CCN from Limmer Substation (LCRA TSC) to Muscovy Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 4 miles;
- Construct a loop of the existing Teal Switch to Pintail Switch 138-kV double-circuit transmission line with a normal and emergency ratings of at least 614 MVA into the new Muscovy 138-kV Switch, for approximately 0.1 miles;
- Establish the new Voss Lake 345/138-kV Switch by installing ten 345-kV, 5000 A and nine 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, for approximately 1.9 miles north of Sandow 345/138-kV Switch;
    - Install one 345/138-kV autotransformer with normal ratings of at least 700 MVA and emergency ratings of at least 750 MVA;
    - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV;
- Construct a loop of the existing Sandow Switch to Bell County East Switch 345-kV double-circuit transmission line into the Voss Lake 345- kV Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 0.1 miles;
- Construct a loop of the existing Sandow Switch to Temple Switch 138-kV transmission line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, for approximately 0.1 miles;

- Construct a loop of the existing Sandow Switch to Minerva Switch 138-kV transmission line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, for approximately 0.1 miles;
- Construct a new 345-kV transmission line which will require a CCN from Voss Lake Switch to Walleye Creek Switch with a normal and emergency ratings of at least 2,987 MVA or greater on double-circuit structures with one circuit installed initially, for approximately 2 miles;
- Construct a new 345-kV double-circuit transmission line which will require a CCN from Muscovy Switch to Voss Lake Switch with a normal and emergency ratings of at least 2,987 MVA or greater, for approximately 25 miles;
- Install terminal equipment in existing bays at Limmer Substation to connect both circuits of the new 345-kV double-circuit transmission line to Muscovy Switch, including two 345-kV, 5000 A circuit breakers and associated equipment. All associated terminal equipment will have a minimum rating of 5000 A;
- Establish the Tower 345-kV Switch by installing ten 345-kV, 5000 A circuit breakers in a breaker-and-a-half bus arrangement;
    - Loop the existing Salado Switch to Knob Creek Switch 345-kV transmission line into Tower 345-kV Switch to create the new Salado Switch to Tower Switch 345-kV transmission line, for approximately 12.4 miles and Tower Switch to Temple Switch 345-kV transmission line, for approximately 2.9 miles;
    - Construct two new 345-kV single-circuit transmission lines from Tower Switch to Knob Creek Switch on independent, single-circuit structures with a normal and emergency rating 2,987 MVA, for approximately 1.2 miles, this upgrade will require a CCN;
    - Rebuild the Salado Switch to Tower Switch 345-kV transmission line using double-circuit capable structures with two circuits installed with normal and emergency rating 2,987 MVA, for approximately 12.4 miles, this upgrade will require a CCN;
    - Rebuild the Tower Switch to Temple Switch 345-kV transmission line using double-circuit capable structures with two circuits installed with normal and emergency rating 2,987 MVA, for approximately 2.9 miles, this upgrade will require a CCN;
    - Ensure all associated terminal equipment to meet or exceed 5000 A (2,987 MVA);
- Rebuild the Bell County East Switch to Voss Lake Switch 345-kV double-circuit transmission line with a normal and emergency rating of 1,912 MVA, for approximately 29.6 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);

- Rebuild the Minerva Switch to Robertson 138-kV transmission line using double-circuit capable structures with one circuit installed with a normal and emergency rating of 614 MVA, for approximately 29.1 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);
- Rebuild the Temple Switch to Tinroof 138-kV transmission line using double-circuit capable structures with one circuit installed with a normal and emergency rating of 614 MVA, for approximately 1.85 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);
- Rebuild the Bell County East Switch to Little Pond 345-kV transmission line with a normal and emergency rating of 1,912 MVA, for approximately 17.75 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);
- Rebuild the Bell County East Switch to Brangus 345-kV transmission line with a normal and emergency rating of 1,912 MVA, for approximately 8.8 miles (due to the existing 3200 A terminal equipment, this transmission line will be operated at a normal and emergency rating 1,912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1,912 MVA);
- Rebuild the Temple Switch to Temple Pecan Creek Switch 345-kV double-circuit transmission line with a normal and emergency rating 2,987 MVA, on separate structures, for approximately 4.5 miles, and ensure all associated terminal equipment to meet or exceed 5000 A (2,987 MVA);
- Rebuild the Hutto to Round Rock Northeast 138-kV transmission line using double-circuit capable structures with normal and emergency rating of 614 MVA, for approximately 5.3 miles, and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA);
- Rebuild Hutto to Limmer 345-kV double-circuit transmission line on separate structures, for approximately 3 miles, this upgrade will require a CCN;
- Establish a new 345-kV yard at Gabriel Substation by installing ten 345-kV, 5000 A circuit breakers in a breaker-and-a-half bus arrangement;
    - Install two 345/138-kV autotransformers with normal rating of 672 MVA and emergency rating of 739 MVA;
    - Construct a new 345-kV double-circuit transmission line from Salado to Gabriel Substation with normal and emergency rating 2,987 MVA, for approximately 28.5 miles, this upgrade will require a CCN;
    - Construct a new 345-kV double-circuit transmission line from Gabriel Substation to Hutto Switch with normal and emergency rating 2,987 MVA, for approximately 12.6 miles, this upgrade will require a CCN;
- Rebuild the Gabriel to Rivery 138-kV transmission line using double-circuit capable structures with one circuit installed with normal and emergency rating 614 MVA,

for approximately 2.5 miles, and ensure all associated terminal equipment to meet or exceed 3000 A (717 MVA); and

- Rebuild the Gabriel to Glasscock 138-kV transmission line using double-circuit capable structures with one circuit installed with normal and emergency rating 614 MVA, for approximately 6.6 miles, and ensure all associated terminal equipment to meet or exceed 3000 A (717 MVA).

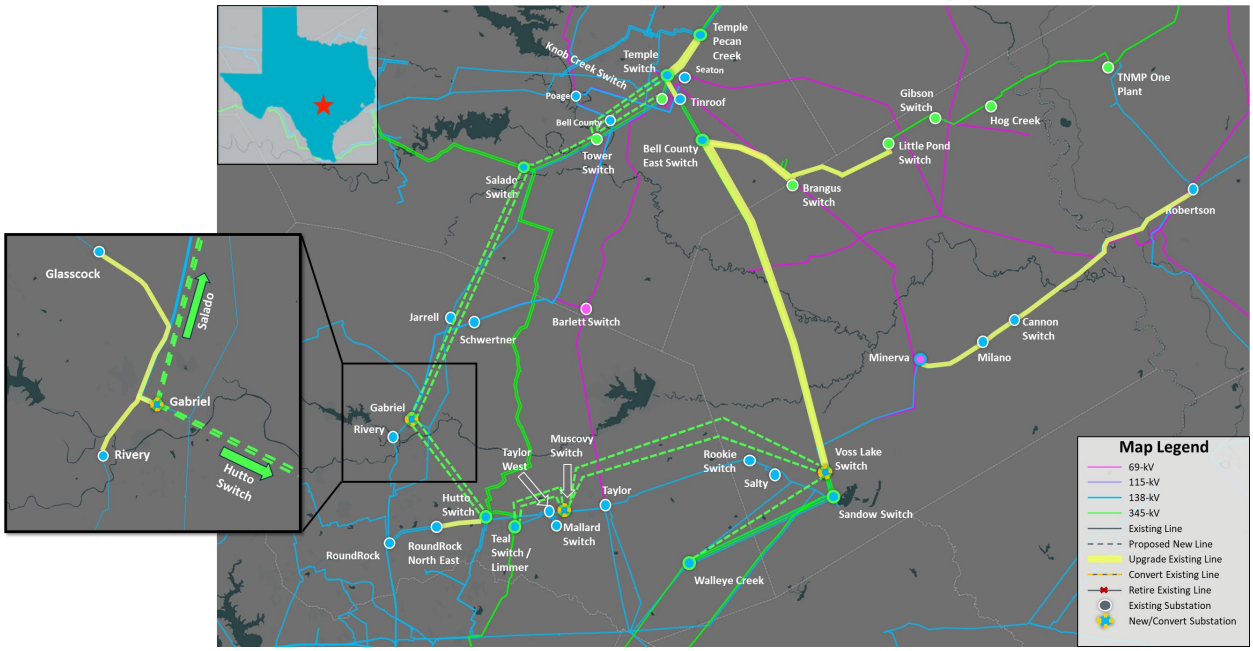


Figure 8.1: Map of Option 7A

The cost estimate for this Tier 1 project is approximately $1.457 billion and the expected ISD for the recommended project is December 2031. One or multiple CCN applications will be required for the construction of the new Limmer to Muscovy Switch 345-kV double-circuit transmission line, Voss Lake switch to Walleye Creek Switch 345-kV single-circuit transmission line, Muscovy Switch to Voss Lake Switch 345-kV double-circuit transmission line, two new Tower Switch to Knob Creek Switch 345-kV single-circuit transmission lines, Salado Switch to Tower Switch 345-kV double-circuit transmission line, Temple Switch to Tower Switch 345-kV single-circuit transmission line, Temple Switch to Temple Pecan Switch 345-kV double-circuit transmission line on separate structures, Hutto Switch to Limmer 345-kV double-circuit transmission line on separate structures, Salado Switch to Gabriel 345-kV double-circuit transmission line and Gabriel

to Hutto Switch 345-kV double-circuit transmission line due to total approximately 97.3 miles of new right of way (ROW).

9. Appendix

A: Generation Added to the Economic Base Case

Table A.1: List of Generation Added to the Economic Sensitivity Base Case Based on March 2026 GIS Report

GINR	Project Name	Fuel	Project COD	Max Capacity (~MW)	County
22INR0350	Sandow Solar	SOL	06/01/2028	287.2	Milam
22INR0503	Tidwell Prairie II Batt	OTH	07/01/2026	203.6	Robertson
22INR0504	Barton Branch IA	OTH	10/01/2026	203.6	Robertson
23INR0421	Bee Branch IA	OTH	06/01/2027	200.5	Robertson

B: Violation identified in Study Area 1 and Study Area 2

Table B.1.1: Voltage Violations Observed in the Study Area 1

NERC Contingency Category	Monitored Element	Voltage Level (kV)	Base Loading (p.u.)	Min Loading (p.u.)
P0: N-0	DBLCREEK_8 (3494)	138	0.95	0.94
P0: N-0	RNDRCKSE1_8 (3654)	138	0.95	0.94
P0: N-0	ELGIN_SUB_8 (3674)	138	0.95	0.95
P0: N-0	JV138_CAP (9009)	138	0.98	0.97
P0: N-0	JOLLYVIL (9223)	138	0.98	0.97
P0: N-0	NORTHWEST (9245)	138	0.98	0.97
P0: N-0	NORTHWES_MB2 (9246)	138	0.98	0.97
P7: N-1	BARTLETTSW (114)	138	0.92	0.82
P7: N-1	SALTY (116)	138	0.92	0.91
P7: N-1	BARTLETT (118)	138	0.92	0.82
P7: N-1	SONTERRA (121)	138	0.92	0.80
P7: N-1	SCHWERTNER (122)	138	0.92	0.80
P7: N-1	STLHOSHOLW (125)	138	0.90	0.84
P7: N-1	THRNDALNTH (127)	138	0.90	0.88
P7: N-1	BELLCNTY8 (132)	138	0.92	0.89
P7: N-1	BEULAH_5 (3307)	345	0.90	0.86

NERC Contingency Category	Monitored Element	Voltage Level (kV)	Base Loading (p.u.)	Min Loading (p.u.)
P7: N-1	TEAL_8 (3362)	138	0.90	0.74
P7: N-1	TEAL_5 (3363)	345	0.90	0.73
P7: N-1	SKYBOX_8 (3371)	138	0.90	0.74
P7: N-1	TAYLOR_W2_8 (3376)	138	0.90	0.75
P7: N-1	KILL_SS__5 (3422)	345	0.90	0.87
P7: N-1	DBLCREEK_8 (3494)	138	0.90	0.74
P7: N-1	ANDICE_8 (3512)	138	0.90	0.81
P7: N-1	AVERY_8 (3517)	138	0.90	0.75
P7: N-1	JONAHT_8 (3539)	138	0.90	0.78
P7: N-1	JONAH_8 (3540)	138	0.90	0.77
P7: N-1	BRUSHYCRK_8 (3541)	138	0.90	0.80
P7: N-1	DONAHOE_9 (3549)	69	0.90	0.90
P7: N-1	SALADO1_8 (3640)	138	0.90	0.84
P7: N-1	GRANGER1_9 (3648)	69	0.90	0.89
P7: N-1	TAYLOR1_9 (3649)	69	0.90	0.87
P7: N-1	STARRANCH_8 (3653)	138	0.90	0.76
P7: N-1	RNDRCKSE1_8 (3654)	138	0.90	0.74
P7: N-1	HUTTO_SUB2_8 (3656)	138	0.90	0.77
P7: N-1	HUTTO_SUB1_8 (3657)	138	0.90	0.77
P7: N-1	TAYLOR1_8 (3658)	138	0.90	0.79
P7: N-1	THORNDLN1_8 (3659)	138	0.90	0.88
P7: N-1	BIRDNEST_8 (3661)	138	0.90	0.76
P7: N-1	RNDRCKWH_T_8 (3664)	138	0.90	0.78
P7: N-1	HUTTOSS1_8 (3666)	138	0.90	0.77
P7: N-1	RNDRCKNE2_8 (3667)	138	0.90	0.77
P7: N-1	RNDROCK1_8 (3668)	138	0.90	0.78
P7: N-1	RNDRCKWH1_8 (3669)	138	0.90	0.78
P7: N-1	RNDRCKNE1_8 (3670)	138	0.90	0.78
P7: N-1	RNDRCK_S1_8 (3672)	138	0.90	0.79
P7: N-1	TAYLOR_W1_8 (3673)	138	0.90	0.75
P7: N-1	ELGIN_SUB_8 (3674)	138	0.90	0.78
P7: N-1	RATTANCRK_8 (3676)	138	0.90	0.78

NERC Contingency Category	Monitored Element	Voltage Level (kV)	Base Loading (p.u.)	Min Loading (p.u.)
P7: N-1	MIDNIGHT_8 (3677)	138	0.90	0.78
P7: N-1	ASHWDS1_8 (3679)	138	0.90	0.79
P7: N-1	ASHWDS2_8 (3680)	138	0.90	0.79
P7: N-1	JARRELL_E_8 (3688)	138	0.90	0.80
P7: N-1	BATTLEGRND_8 (3690)	138	0.90	0.79
P7: N-1	PINTAIL_8 (3692)	138	0.90	0.75
P7: N-1	MALLARD_8 (3693)	138	0.90	0.75
P7: N-1	HUTTOSS__5 (3696)	345	0.90	0.74
P7: N-1	SALADOSS_5 (3699)	345	0.90	0.85
P7: N-1	TORTOISE_5 (3717)	345	0.90	0.86
P7: N-1	RNDRCKW_T2_8 (3764)	138	0.90	0.77
P7: N-1	MIDNIGHT2_8 (3777)	138	0.90	0.77
P7: N-1	L_ELGISW8_1Y (7321)	138	0.90	0.80
P7: N-1	L_LIMMER5_1Y (7341)	345	0.92	0.73
P7: N-1	L_GEORGE8_1Y (7343)	138	0.92	0.79
P7: N-1	L_GABRIE9_1Y (7345)	69	0.92	0.87
P7: N-1	L_GABRIE8_1Y (7346)	138	0.92	0.79
P7: N-1	L_RIVERY8_1Y (7347)	138	0.92	0.79
P7: N-1	L_BERRCR8_1Y (7361)	138	0.92	0.81
P7: N-1	L_CHIEBR8_1Y (7366)	138	0.92	0.79
P7: N-1	L_SPANOA8_1Y (7367)	138	0.92	0.79
P7: N-1	L_RIDGMA8_1Y (7368)	138	0.92	0.79
P7: N-1	L_FLOREN8_1Y (7521)	138	0.92	0.80
P7: N-1	L_GLASSC8_1Y (7523)	138	0.92	0.79
P7: N-1	L_GEOREA8_1Y (7528)	138	0.92	0.78
P7: N-1	L_KENTST8_1Y (7530)	138	0.92	0.80
P7: N-1	L_GEORSO8_1Y (7532)	138	0.92	0.78
P7: N-1	L_AVERRA8_1Y (7534)	138	0.92	0.80
P7: N-1	JV138_CAP (9009)	138	0.95	0.80
P7: N-1	JOLLYVIL (9223)	138	0.95	0.80
P7: N-1	NORTHWEST (9245)	138	0.95	0.80
P7: N-1	NORTHWES_MB2 (9246)	138	0.95	0.80

NERC Contingency Category	Monitored Element	Voltage Level (kV)	Base Loading (p.u.)	Min Loading (p.u.)
P7: N-1	TAYLORW_T2_8 (13376)	138	0.90	0.75
P7: N-1	SAND_TXU_5 (13429)	345	0.90	0.87
P7: N-1	SALADO_S1_8 (13640)	138	0.90	0.83
P7: N-1	SALADO_S2_8 (13641)	138	0.90	0.83
P7: N-1	STARRANCH1_8 (13656)	138	0.90	0.77
P7: N-1	STARRANCH2_8 (13657)	138	0.90	0.76
P7: N-1	PFLGRVILS2_8 (13664)	138	0.90	0.76
P7: N-1	TAYLORW_T1_8 (13673)	138	0.90	0.75
P7: N-1	P_PIPELI8_1_ (70390)	138	0.92	0.81
P7: N-1	P_ANDICE8_1_ (70522)	138	0.92	0.82
P7: N-1	P_SEWAJU8_1_ (70524)	138	0.92	0.81
P7: N-1	P_LEANDE8_1_ (70525)	138	0.92	0.80
P7: N-1	P_BLOCKH8_1_ (70527)	138	0.92	0.80
P7: N-1	P_WHITES8_1_ (70529)	138	0.92	0.80
P7: N-1	P_BUTTER8_1_ (70531)	138	0.92	0.80
P7: N-1	P_BALCON8_1_ (70533)	138	0.92	0.80
P7: N-1	P_HEROWA8_1_ (70536)	138	0.92	0.80
P7: N-1	SDSES_1_8 (170093)	138	0.97	0.93
P7: N-1	N_FORK_8 (170572)	138	0.90	0.82
P7: N-1	RVRVLYS_8 (170663)	138	0.90	0.80
P7: N-1	RVRVLY2_8 (170664)	138	0.90	0.80
P7: N-1	RVRVLYS3_8 (170665)	138	0.90	0.80
P7: N-1	SYPBRNCH_S1 (171161)	345	0.90	0.87
P7: N-1	NewBC (990132)	138	0.90	0.89
P3: (G-1+N-1)	TALBRTRIDG (120)	138	0.92	0.91
P3: (G-1+N-1)	TEMPTAYV1_9 (3636)	138	0.90	0.90
P3: (G-1+N-1)	ROOKIE_8 (3701)	138	0.90	0.89
P3: (G-1+N-1)	SLRPRTY_8 (3740)	138	0.90	0.89
P3: (G-1+N-1)	VOSSLAKE_8 (3750)	138	0.90	0.89
P3: (G-1+N-1)	GRANSLR1_S1 (171221)	138	0.90	0.89
P6-2: (X-1+N-1)	MILANO (64)	138	0.92	0.90
P6-2: (X-1+N-1)	SANDOW1_8 (3430)	138	0.90	0.86

NERC Contingency Category	Monitored Element	Voltage Level (kV)	Base Loading (p.u.)	Min Loading (p.u.)
P6-2: (X-1+N-1)	SDSES_2_8 (3431)	138	0.90	0.86
P6-2: (X-1+N-1)	WHINSTNE_8 (3445)	138	0.90	0.86
P6-2: (X-1+N-1)	ROCKDALE1_8 (3678)	138	0.90	0.85
P6-2: (X-1+N-1)	MINERVA1_8 (3683)	138	0.90	0.87
P6-2: (X-1+N-1)	TORTOISE_8 (3712)	138	0.90	0.87
P6-2: (X-1+N-1)	TOR_SR2_8 (3713)	138	0.90	0.87
P6-2: (X-1+N-1)	TOR_SR1_8 (3714)	138	0.90	0.87
P6-2: (X-1+N-1)	SAND_TXU_8 (13430)	138	0.90	0.86
P6-2: (X-1+N-1)	SANDOW_SW_8 (13431)	138	0.90	0.86
P6-2: (X-1+N-1)	SANDOW_SR1_8 (13441)	138	0.90	0.87
P6-2: (X-1+N-1)	SANDOW_SR2_8 (13442)	138	0.90	0.87

Table B.1.2: Unsolved Power Flows Observed in the Study Area Under NERC P1(N-1), P7(N-1), P3((G-1+N-1)), and/or P6-2(X-1+N-1) Conditions

No	Contingency
1	(REDACTED)
2	(REDACTED)
3	(REDACTED)

Table B.1.3: Voltage Violations Observed in the Study Area 2 and Not Addressed in this EIR

NERC Contingency Category	Monitored Element	Voltage Level (kV)	Base Loading (p.u.)	Min Loading (p.u.)
P0: N-0	L_COLTON8_1Y (7208)	138	0.95	0.88
P0: N-0	L_ELROY_8_1Y (7209)	138	0.95	0.86
P0: N-0	L_WYLDWO8_1Y (7210)	138	0.95	0.86
P0: N-0	L_WOLFLA8_1Y (7212)	138	0.95	0.83
P0: N-0	L_SETTLE8_1Y (7327)	138	0.95	0.94
P1: N-1	L_SETTLE8_2Y (7328)	138	0.95	0.94

NERC Contingency Category	Monitored Element	Voltage Level (kV)	Base Loading (p.u.)	Min Loading (p.u.)
P0: N-0	L_BASTWE8_1Y (7555)	138	0.95	0.92
P0: N-0	L_BLUEBO8_1Y (7556)	138	0.95	0.87
P0: N-0	BA138_CAP (9001)	138	0.98	0.97
P0: N-0	BC138_CAP (9002)	138	0.98	0.97
P0: N-0	CL138_CAP (9003)	138	0.98	0.97
P0: N-0	CA69_CAP (9004)	69	0.98	0.97
P0: N-0	CF138_CAP (9005)	138	0.98	0.97
P0: N-0	FV138_CAP (9006)	138	0.98	0.97
P0: N-0	HA69_CAP (9007)	69	0.98	0.98
P0: N-0	HV138_CAP (9008)	138	0.98	0.97
P0: N-0	MP138_CAP (9010)	138	0.98	0.97
P0: N-0	MC138_CAP (9011)	138	0.98	0.97
P0: N-0	OH138_CAP (9012)	138	0.98	0.97
P0: N-0	PE138MB1_CAP (9014)	138	0.98	0.97
P0: N-0	SW138_CAP (9016)	138	0.98	0.97
P0: N-0	BAL138_CAP (9017)	138	0.98	0.97
P0: N-0	WI138_CAP (9018)	138	0.98	0.97
P0: N-0	DUNLAP8 (9045)	138	0.98	0.98
P0: N-0	GILLE138 (9054)	138	0.98	0.96
P0: N-0	MCNEIL_DB1 (9076)	138	0.98	0.97
P0: N-0	MCNEIL_MB3 (9077)	138	0.98	0.97
P0: N-0	MCNEIL_MB1 (9079)	138	0.98	0.97
P0: N-0	MCNEIL (9080)	69	0.98	0.97
P0: N-0	MC1013BT (9082)	138	0.98	0.97
P0: N-0	PE_MB3 (9117)	138	0.98	0.97
P0: N-0	PE_MB1 (9118)	138	0.98	0.97
P0: N-0	PE_MB2 (9119)	69	0.98	0.97
P0: N-0	BURLSN_MB1 (9120)	138	0.98	0.97
P0: N-0	BURLSN_MB2 (9121)	138	0.98	0.97

NERC Contingency Category	Monitored Element	Voltage Level (kV)	Base Loading (p.u.)	Min Loading (p.u.)
P0: N-0	KINGSB_MB1 (9122)	138	0.98	0.97
P0: N-0	KINGSB_DB1 (9123)	138	0.98	0.97
P0: N-0	KINGSBERY (9125)	69	0.98	0.98
P0: N-0	NORTHL_MB3 (9127)	138	0.98	0.97
P0: N-0	NORTHL_MB1 (9128)	138	0.98	0.97
P0: N-0	NORTHL69 (9129)	69	0.98	0.97
P0: N-0	SEAHOLM (9132)	138	0.98	0.97
P0: N-0	AUSTNDAM (9139)	138	0.98	0.97
P0: N-0	EASTON PARK (9143)	138	0.98	0.98
P0: N-0	HICROS_DB1 (9147)	138	0.98	0.97
P0: N-0	HICROS_MB1 (9148)	138	0.98	0.97
P0: N-0	AMD (9151)	138	0.98	0.97
P0: N-0	ANGUSVAL (9155)	138	0.98	0.97
P0: N-0	BARTON (9158)	138	0.98	0.97
P0: N-0	BEECREEK_MB1 (9160)	138	0.98	0.97
P0: N-0	BULICK_LD1 (9161)	138	0.98	0.97
P0: N-0	BULICK_LD2 (9162)	138	0.98	0.97
P0: N-0	MTCNTR_MB1 (9164)	138	0.98	0.98
P0: N-0	BRACK (9166)	69	0.98	0.97
P0: N-0	MTCNTR_MB2 (9167)	138	0.98	0.98
P0: N-0	BRODIE (9169)	138	0.98	0.97
P0: N-0	CAMERON (9171)	138	0.98	0.97
P0: N-0	CARSON (9175)	138	0.98	0.98
P0: N-0	CARDINAL (9179)	138	0.98	0.97
P0: N-0	COMMONFD (9183)	138	0.98	0.97
P0: N-0	DAFFIN (9184)	138	0.98	0.97
P0: N-0	DECKER_MB1 (9187)	138	0.98	0.98
P0: N-0	DECKER_MB3 (9188)	138	0.98	0.98
P0: N-0	TRIDGE_MB1 (9190)	138	0.98	0.97

NERC Contingency Category	Monitored Element	Voltage Level (kV)	Base Loading (p.u.)	Min Loading (p.u.)
P0: N-0	TRIDGE_MB2 (9191)	138	0.98	0.97
P0: N-0	DESSAU (9193)	138	0.98	0.96
P0: N-0	EAST_VILLAGE (9195)	138	0.98	0.97
P0: N-0	EDBLUESTN (9196)	138	0.98	0.97
P0: N-0	ELROY_LD1 (9198)	138	0.98	0.86
P0: N-0	FISKVIL (9199)	138	0.98	0.97
P0: N-0	GROVE (9200)	138	0.98	0.97
P0: N-0	HAMLTN_MB2 (9202)	138	0.98	0.97
P0: N-0	HAMLTN_MB1 (9203)	138	0.98	0.97
P0: N-0	HARRIS (9204)	69	0.98	0.98
P0: N-0	HIDDENVL (9207)	138	0.98	0.97
P0: N-0	HOLLY_MB2 (9213)	69	0.98	0.97
P0: N-0	HOLLY_MB3 (9214)	69	0.98	0.97
P0: N-0	HOWARDLN (9217)	138	0.98	0.97
P0: N-0	JETT (9220)	138	0.98	0.97
P0: N-0	ASHTONW_MB2 (9224)	138	0.98	0.97
P0: N-0	JUSTINLN (9225)	69	0.98	0.97
P0: N-0	ASHTONW_MB1 (9226)	138	0.98	0.97
P0: N-0	KOENIG (9227)	69	0.98	0.97
P0: N-0	LAKESHORE (9228)	138	0.98	0.97
P0: N-0	LAKEWY_LD1 (9235)	138	0.98	0.97
P0: N-0	LAKEWY_LD2 (9236)	138	0.98	0.97
P0: N-0	MAGPLANT (9238)	138	0.98	0.97
P0: N-0	FIESTA_MB2 (9243)	69	0.98	0.97
P0: N-0	FIESTA_MB1 (9244)	69	0.98	0.97
P0: N-0	OAKHILL (9247)	138	0.98	0.97
P0: N-0	PATTON_MB1 (9253)	138	0.98	0.97
P0: N-0	PATTON_MB2 (9254)	138	0.98	0.97
P0: N-0	PEDERNAL (9257)	69	0.98	0.97

NERC Contingency Category	Monitored Element	Voltage Level (kV)	Base Loading (p.u.)	Min Loading (p.u.)
P0: N-0	RIVERPLACE (9260)	138	0.98	0.97
P0: N-0	RAINEYST (9261)	138	0.98	0.97
P0: N-0	BLUFFSPG (9262)	138	0.98	0.98
P0: N-0	SALEMWLK (9263)	138	0.98	0.97
P0: N-0	SLAUGHTR (9267)	138	0.98	0.97
P0: N-0	CENTAUS (9269)	69	0.98	0.97
P0: N-0	SPRNKL_MB2 (9271)	138	0.98	0.97
P0: N-0	SPRNKL_MB1 (9272)	138	0.98	0.97
P0: N-0	STECK (9275)	138	0.98	0.97
P0: N-0	KRAMER (9276)	138	0.98	0.97
P0: N-0	TPOST_LD1 (9278)	138	0.98	0.96
P0: N-0	SUMMIT_MB1 (9279)	138	0.98	0.97
P0: N-0	SUMMIT_MB2 (9280)	138	0.98	0.97
P0: N-0	TPOST_LD2 (9281)	138	0.98	0.96
P0: N-0	TPOST_LD3 (9282)	138	0.98	0.96
P0: N-0	UTBALC (9283)	138	0.98	0.97
P0: N-0	WALNUTCK (9284)	138	0.98	0.97
P0: N-0	VEGA (9285)	138	0.98	0.97
P0: N-0	WARREN (9286)	138	0.98	0.97
P0: N-0	WEBBERSOL (9287)	138	0.98	0.97
P0: N-0	WELLSB_LD1 (9288)	138	0.98	0.97
P0: N-0	WELLSB_LD2 (9289)	138	0.98	0.97
P0: N-0	WHELESS (9291)	138	0.98	0.97
P0: N-0	WILIAMSN (9295)	138	0.98	0.97
P0: N-0	AUSTROP8 (9328)	138	0.98	0.97
P0: N-0	MUELLER (9342)	138	0.98	0.97
P0: N-0	SODG_7208 (707208)	138	0.90	0.88
P7: N-1	LUND_8 (3569)	138	0.90	0.79
P7: N-1	PFLGRVIL1_8 (3665)	138	0.90	0.76

NERC Contingency Category	Monitored Element	Voltage Level (kV)	Base Loading (p.u.)	Min Loading (p.u.)
P7: N-1	NEWSWEDEN_8 (3710)	138	0.90	0.77
P7: N-1	L_AUSTRO5_1Y (7040)	345	0.92	0.82
P7: N-1	L_HORNSB5_1Y (7047)	345	0.92	0.71
P7: N-1	L_GARFIE5_1Y (7048)	345	0.92	0.83
P7: N-1	L_BASTEN5_1Y (7049)	345	0.92	0.83
P7: N-1	L_MISTY_5_1Y (7051)	345	0.90	0.87
P7: N-1	L_LACIMA8_1Y (7185)	138	0.92	0.92
P7: N-1	L_RARO128_1Y (7186)	138	0.92	0.92
P7: N-1	L_HILLTO8_1Y (7190)	138	0.92	0.91
P7: N-1	L_SANMAR8_1Y (7192)	138	0.92	0.91
P7: N-1	L_STRAHA8_1Y (7193)	138	0.92	0.91
P7: N-1	L_ROBRJR9_1Y (7194)	138	0.92	0.90
P7: N-1	L_CLEAFO9_1Y (7195)	138	0.92	0.89
P7: N-1	L_CAMPGA9_1Y (7196)	138	0.92	0.90
P7: N-1	L_CANYON8_1Y (7200)	138	0.92	0.90
P7: N-1	L_HICROS8_1Y (7202)	138	0.92	0.84
P7: N-1	L_LOCKHA8_1Y (7216)	138	0.92	0.88
P7: N-1	L_WELLBR8_1Y (7288)	138	0.92	0.79
P7: N-1	L_PAIGE_8_1Y (7308)	138	0.92	0.84
P7: N-1	L_SIMGID8_1Y (7310)	138	0.92	0.81
P7: N-1	L_SMITHV8_1Y (7314)	138	0.92	0.85
P7: N-1	L_ALUMCR8_1Y (7318)	138	0.92	0.83
P7: N-1	L_BASTCI8_2Y (7319)	138	0.92	0.80
P7: N-1	L_BASTCI8_1Y (7322)	138	0.92	0.77
P7: N-1	L_SHADGL8_1Y (7323)	138	0.92	0.78
P7: N-1	L_BUTLER8_1Y (7324)	138	0.92	0.80
P7: N-1	L_MENDOZ8_1Y (7325)	138	0.92	0.87
P7: N-1	L_SWIFTE8_1Y (7326)	138	0.92	0.80
P7: N-1	L_WEBBER8_1Y (7329)	138	0.92	0.84

NERC Contingency Category	Monitored Element	Voltage Level (kV)	Base Loading (p.u.)	Min Loading (p.u.)
P7: N-1	L_MANOR_8_1Y (7330)	138	0.92	0.78
P7: N-1	L_CEDAHI8_1Y (7331)	138	0.92	0.79
P7: N-1	L_HARRBR8_1Y (7333)	138	0.92	0.79
P7: N-1	L_MCNEIL8_1Y (7334)	138	0.92	0.80
P7: N-1	L_HOWALA8_1Y (7335)	138	0.92	0.79
P7: N-1	L_GILLCR8_1Y (7336)	138	0.92	0.76
P7: N-1	L_KIMBRO8_1Y (7337)	138	0.92	0.79
P7: N-1	L_CARLSO8_1Y (7338)	138	0.92	0.79
P7: N-1	L_STEGER8_1Y (7339)	138	0.92	0.77
P7: N-1	L_GILLCR5_1Y (7340)	345	0.92	0.73
P7: N-1	L_LAKEAE8_1Y (7349)	138	0.92	0.82
P7: N-1	L_MARSFO9_1Y (7354)	69	0.92	0.82
P7: N-1	L_MARSFO8_1Y (7356)	138	0.92	0.82
P7: N-1	L_PALEFA8_1Y (7476)	138	0.92	0.87
P7: N-1	L_TURNER8_1Y (7500)	138	0.92	0.85
P7: N-1	L_GOFORT8_1Y (7501)	138	0.92	0.87
P7: N-1	L_CROSSW8_1Y (7503)	138	0.92	0.86
P7: N-1	L_EUCLID5_1Y (7510)	345	0.92	0.71
P7: N-1	L_ROHR__8_1Y (7515)	138	0.92	0.88
P7: N-1	L_LAKEWA8_1Y (7538)	138	0.92	0.83
P7: N-1	L_BEECRE8_1Y (7540)	138	0.92	0.84
P7: N-1	L_SPICEW8_1Y (7542)	138	0.92	0.81
P7: N-1	L_NEWROS9_1Y (7558)	69	0.92	0.91
P7: N-1	L_REDROC8_1Y (7560)	138	0.92	0.85
P7: N-1	L_TAHIVI8_1Y (7575)	138	0.92	0.82
P7: N-1	L_HILBIG8_1Y (7576)	138	0.92	0.84
P7: N-1	L_ESCARP8_1Y (7672)	138	0.92	0.84
P7: N-1	L_WHISVA5_1Y (7738)	345	0.92	0.72
P7: N-1	PK138_CAP (9015)	138	0.95	0.84

NERC Contingency Category	Monitored Element	Voltage Level (kV)	Base Loading (p.u.)	Min Loading (p.u.)
P7: N-1	LOSTPINES (9041)	345	0.95	0.83
P7: N-1	WINCHES (9042)	345	0.95	0.84
P7: N-1	CISTERN (9043)	345	0.95	0.86
P7: N-1	DUNLAP5 (9044)	345	0.95	0.81
P7: N-1	GARFIELD5 (9048)	345	0.95	0.83
P7: N-1	GARFIELD8 (9071)	138	0.95	0.87
P7: N-1	LYTTON5 (9074)	345	0.95	0.84
P7: N-1	LYTTON8 (9075)	138	0.95	0.88
P7: N-1	BEECREEK_MB2 (9159)	138	0.90	0.81
P7: N-1	BRSTRM_MB2 (9163)	138	0.95	0.83
P7: N-1	BRSTRM_MB1 (9165)	138	0.95	0.83
P7: N-1	SANDHSYD (9216)	138	0.95	0.85
P7: N-1	STONEY (9237)	138	0.95	0.86
P7: N-1	SOUTHEAST (9240)	138	0.95	0.85
P7: N-1	ONIONCK (9251)	138	0.95	0.85
P7: N-1	PILOTKNOB (9259)	138	0.95	0.84
P7: N-1	PFLGRVILS_8 (13665)	138	0.90	0.76
P7: N-1	P_LEHIGH9_1_ (70197)	69	0.92	0.86
P7: N-1	P_LEHIGH8_1_ (70198)	138	0.92	0.86
P7: N-1	P_LAGOVI8_1_ (70352)	138	0.92	0.81
P7: N-1	P_PALEPE8_1_ (70477)	138	0.92	0.86
P7: N-1	P_WIMBER8_1_ (70496)	138	0.92	0.88
P7: N-1	P_BUDA__8_1_ (70498)	138	0.92	0.86
P7: N-1	P_BUDA__9_1_ (70499)	69	0.92	0.91
P7: N-1	P_KYLE__8_1_ (70502)	138	0.92	0.88
P7: N-1	P_MANCHA8_1_ (70504)	138	0.92	0.85
P7: N-1	P_TRADPO8_1_ (70505)	138	0.92	0.82
P7: N-1	P_CEDAVA8_1_ (70506)	138	0.92	0.83
P7: N-1	P_FRIEND8_1_ (70507)	138	0.92	0.84

NERC Contingency Category	Monitored Element	Voltage Level (kV)	Base Loading (p.u.)	Min Loading (p.u.)
P7: N-1	P_CENTEX9_1_ (70508)	69	0.92	0.91
P7: N-1	P_RUTHER8_1_ (70509)	138	0.92	0.85
P7: N-1	P_CEBOCR8_1_ (70511)	138	0.90	0.86
P7: N-1	P_DRIPSP8_1_ (70512)	138	0.92	0.86
P7: N-1	P_HENLY_8_1_ (70513)	138	0.92	0.87
P7: N-1	P_NAMELE8_1_ (70526)	138	0.92	0.80
P7: N-1	P_BULLHO8_1_ (70535)	138	0.92	0.81
P7: N-1	P_HIGH328_1_ (70546)	138	0.92	0.89
P7: N-1	L_HIDDVA8_1Y (78207)	138	0.92	0.82
P7: N-1	L_BARETA8_1Y (78220)	138	0.92	0.80
P7: N-1	L_BALCRE8_1Y (78221)	138	0.92	0.80
P7: N-1	AUSTDAM8 (170022)	138	0.90	0.81
P7: N-1	LOSTPINE5 (170174)	345	0.90	0.83
P7: N-1	E_BLACK_8 (170523)	138	0.90	0.79
P7: N-1	SLCNHLS_8 (170582)	138	0.90	0.76
P7: N-1	BIG_STAR_5 (170604)	345	0.90	0.86
P7: N-1	GIGABATT_5 (170872)	345	0.90	0.71
P7: N-1	SODG_3661 (703661)	138	0.90	0.76
P7: N-1	SODG_9121 (709121)	138	0.90	0.83
P7: N-1	SODG_9123 (709123)	138	0.90	0.82
P7: N-1	SODG_9271 (709271)	138	0.90	0.81
P7: N-1	SODG_9342 (709342)	138	0.90	0.81
P3: (G-1+N-1)	L_JOHNDU5_1Y (7041)	345	0.92	0.91
P3: (G-1+N-1)	L_REDWOO8_1Y (7188)	138	0.92	0.91
P3: (G-1+N-1)	L_SMITHV9_1Y (7315)	69	0.92	0.91
P3: (G-1+N-1)	L_HAYSEN5_1Y (7043)	345	0.92	0.92
P6-2: (X-1+N-1)	L_RATTLE8_1Y (7184)	138	0.92	0.91
P6-2: (X-1+N-1)	L_LULING8_1Y (7224)	138	0.92	0.92

NERC Contingency Category	Monitored Element	Voltage Level (kV)	Base Loading (p.u.)	Min Loading (p.u.)
P6-2: (X-1+N-1)	HAY_HAYSENG5 (170195)	345	0.90	0.90
P6-2: (X-1+N-1)	HAY_HAYSENG6 (170196)	345	0.90	0.90
P6-2: (X-1+N-1)	HAY_HAYSENG7 (170197)	345	0.90	0.90
P6-2: (X-1+N-1)	HAY_HAYSENG8 (170198)	345	0.90	0.90
P6-2: (X-1+N-1)	L_MCCALA8_1Y (7182)	138	0.92	0.90
P6-2: (X-1+N-1)	L_BEBACK8_1Y (7187)	138	0.92	0.91
P6-2: (X-1+N-1)	P_HUNTER8_1_ (70491)	138	0.92	0.90

Table B.1.4: Unsolved Power Flows Observed Under NERC P1(N-1), P7(N-1), P3((G-1+N-1)), and/or P6-2(X-1+N-1) Conditions in Study Area 2 Not Addressed in this EIR

No	Contingency
1	(REDACTED)
2	(REDACTED)
3	(REDACTED)
4	(REDACTED)
5	(REDACTED)
6	(REDACTED)
7	(REDACTED)
8	(REDACTED)
9	(REDACTED)
10	(REDACTED)
11	(REDACTED)

B: Attachments

Table B.1: Project Related Document

No	Document Name	Attachment
1	Oncor and LCRA TSC Muscovy and Voss Lake 345-kV Project	Muscovy_Voss_Lake_345-138_kV_RPG_O