# Permian Basin Reliability Plan Study – Status Update

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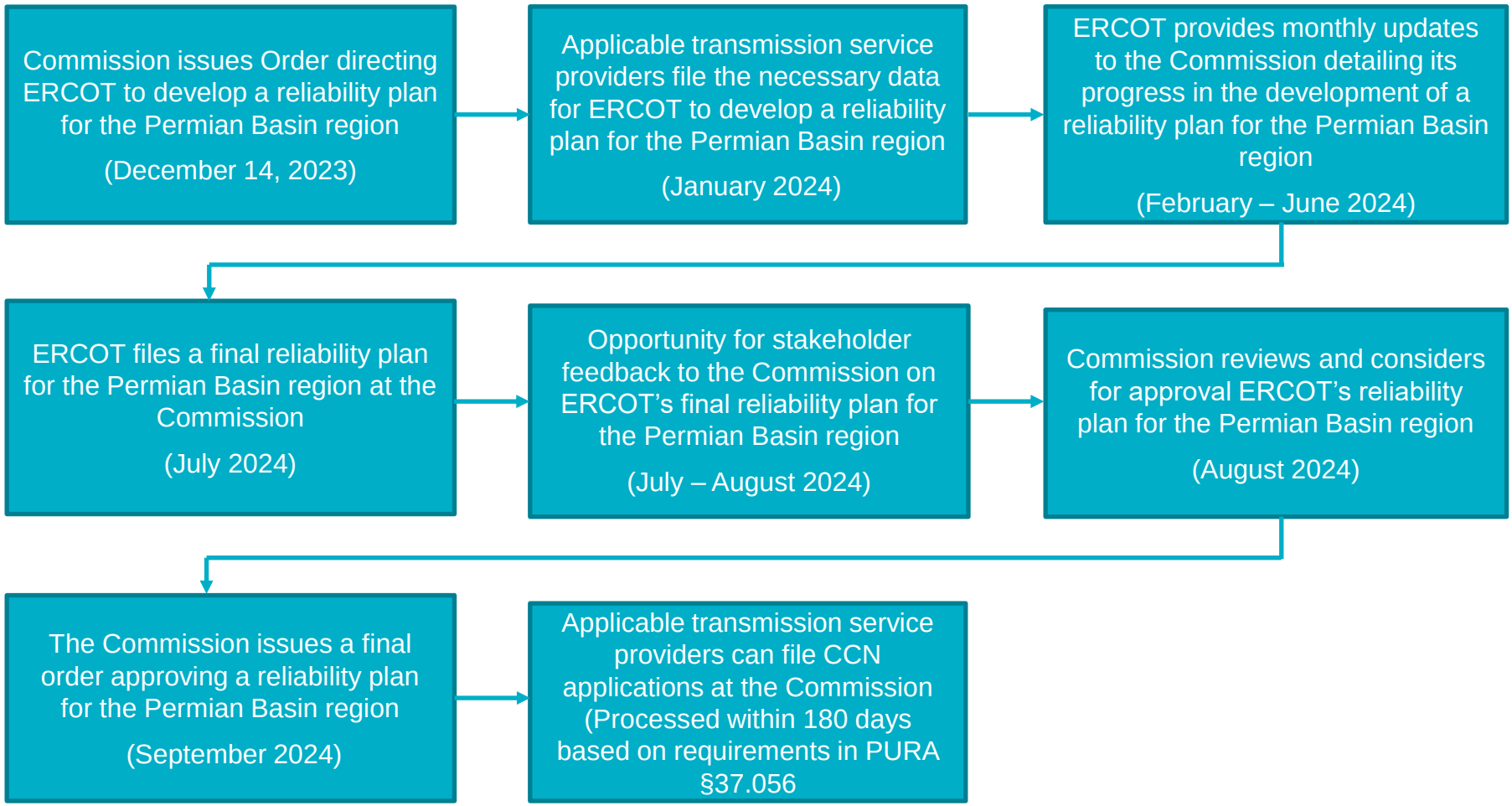
RPG Meeting
July 16, 2024

# Recap: Introduction

- H.B. 5066 (May 2023) requires the PUCT to direct ERCOT to develop a Reliability Plan for the Permian Basin region and that the plan must:
  - Address extending transmission service to areas where mineral resources have been found
  - Address increasing available capacity to meet forecasted load
  - Provide available infrastructure to reduce interconnection times in areas without access to transmission service
- PUCT Order Project No. 55718 (December 2023)
  - Procedural Process and Timeline
  - Not later than July 2024, ERCOT must file a final reliability plan at the Commission in this project, and after opportunity for stakeholder feedback, and Commission will review and approve a reliability plan for the Permian Basin region
  - The applicable transmission service providers (TSPs) responsible for constructing the transmission infrastructure in the Commission-approved reliability plan can then move forward with filing the necessary applications for certificate of convenience and necessity (CCN) at the Commission
- Significant progress has been made to address the high demand growth in the Permian Basin area
  - Delaware Basin Load Integration Study in 2019
  - Permian Basin Load Interconnection Study in 2021

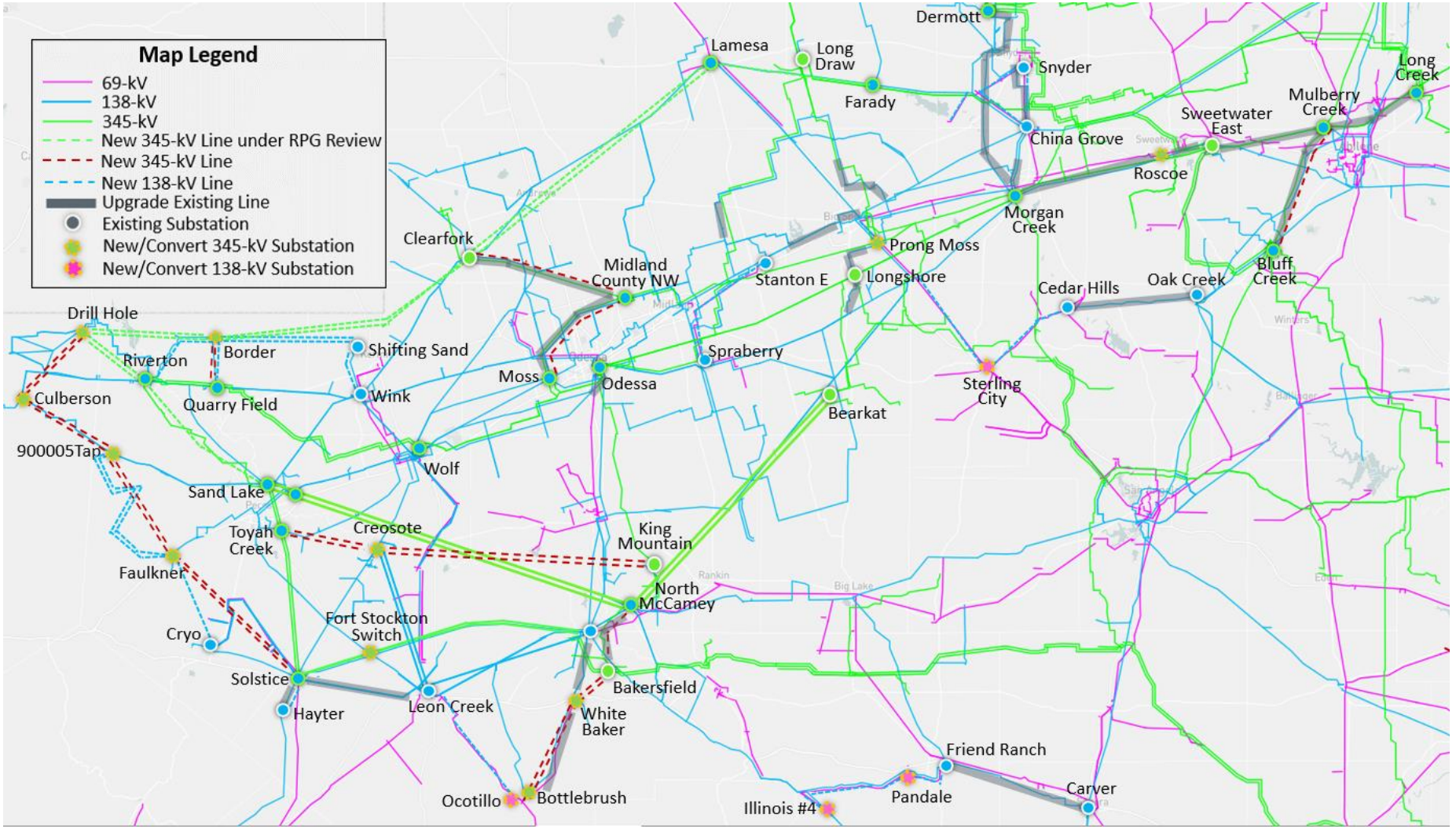
# Recap: Procedural Process and Timeline per PUCT Order Project No. 55718



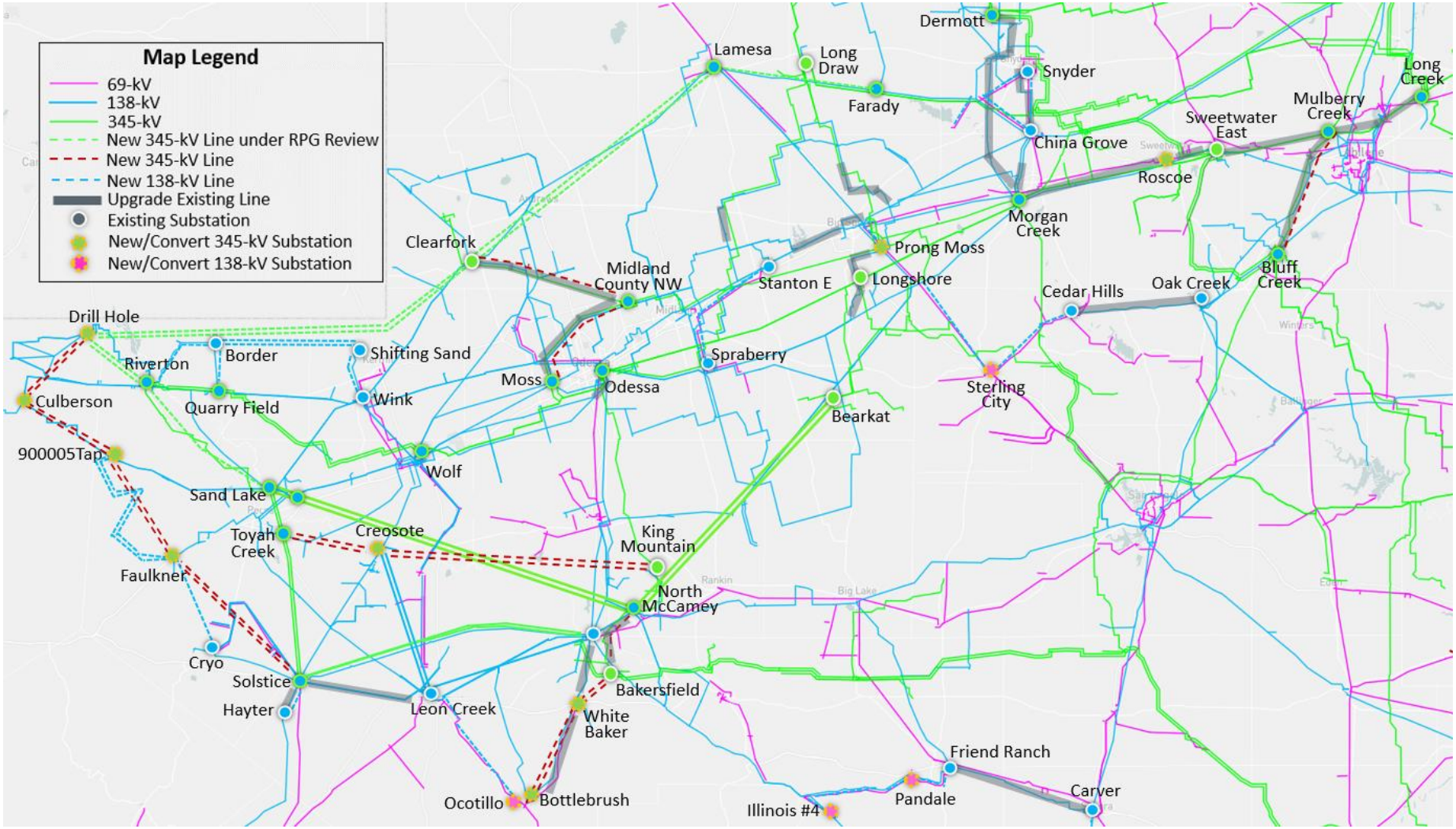
# ERCOT Status Update Notifications

- ERCOT presented the draft study scope at January RPG meeting
  - https://www.ercot.com/calendar/01172024-RPG-Meeting
- ERCOT presented the updated study scope at February RPG meeting
  - https://www.ercot.com/calendar/02122024-RPG-Meeting
- ERCOT presented the status update at March, April, May, and June RPG meetings
  - https://www.ercot.com/calendar/03182024-RPG-Meeting-_-Webex
  - https://www.ercot.com/calendar/04092024-RPG-Meeting
  - https://www.ercot.com/calendar/05142024-RPG-Meeting
  - https://www.ercot.com/calendar/06112024-RPG-Meeting
- ERCOT hosted a Permian Basin Reliability Plan Study workshop on June 28, 2024, for all stakeholders
  - https://www.ercot.com/calendar/06282024-Permian-Basin-Reliability-Plan
- ERCOT presented the local transmission upgrades and 345-kV import paths needed to serve all the Permian Basin load for 2030 and 2038
- ERCOT will present the extra high voltage (EHV) import paths options for 2038
- ERCOT will present the cost estimates

# Recap: Local Transmission Projects for 2038 to Serve All Loads in Permian Basin Region



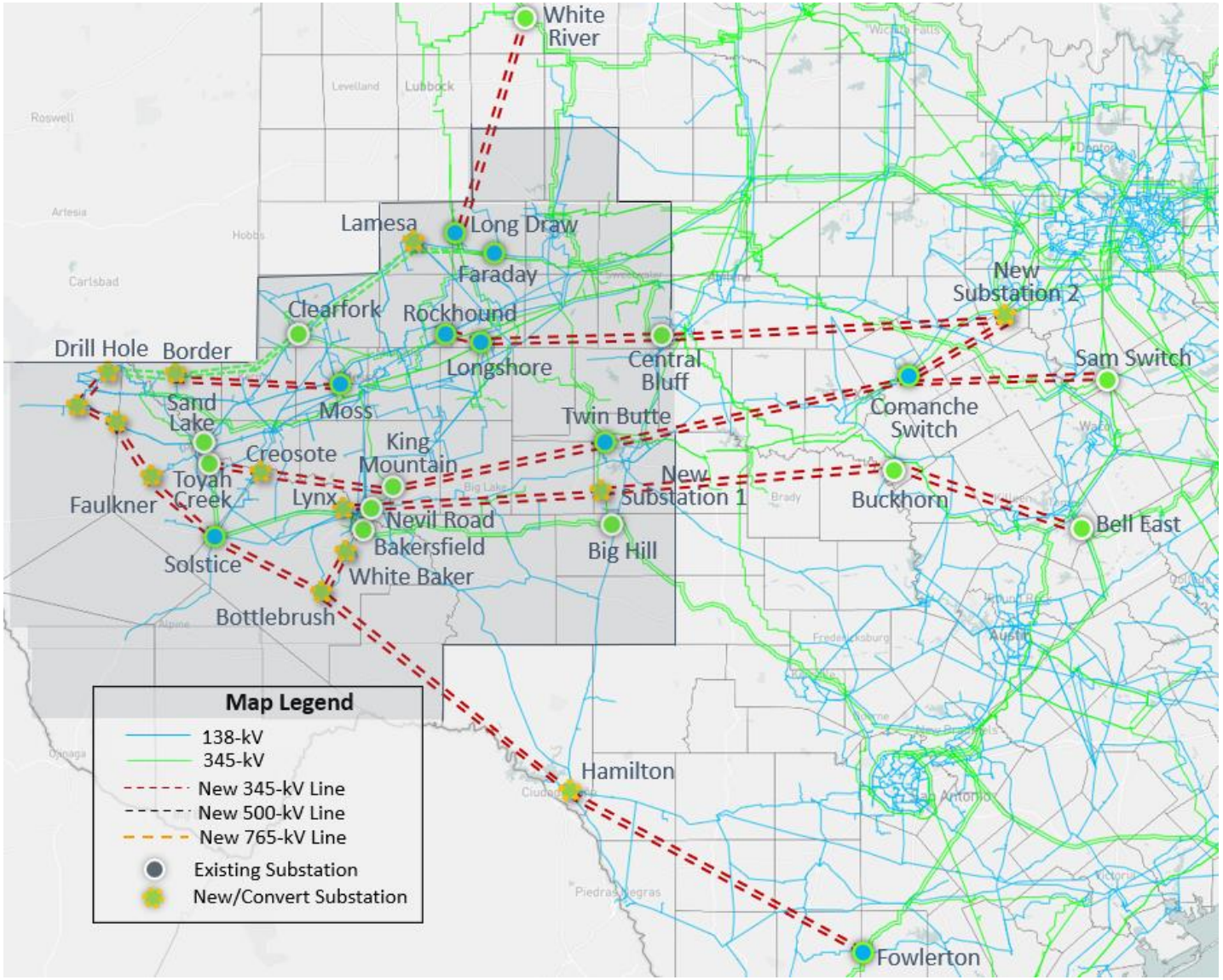
# Recap: Local Transmission Projects for 2030 to Serve All Loads in Permian Basin Region



# Recap: Import Paths – Major Consideration Factors

- Import paths could serve as dual-purpose
  - Import generation to Permian Basin region to serve the forecasted Permian Basin load
  - Export rich renewable generation in West Texas to the load centers
- Generation
  - Import from generation rich area
- CIP-014
  - Avoid voltage instability under the major 345-kV substation outage
- ERCOT Long-Term West Texas Export Study
  - Considered the West Texas export paths if applicable
- Cost effectiveness

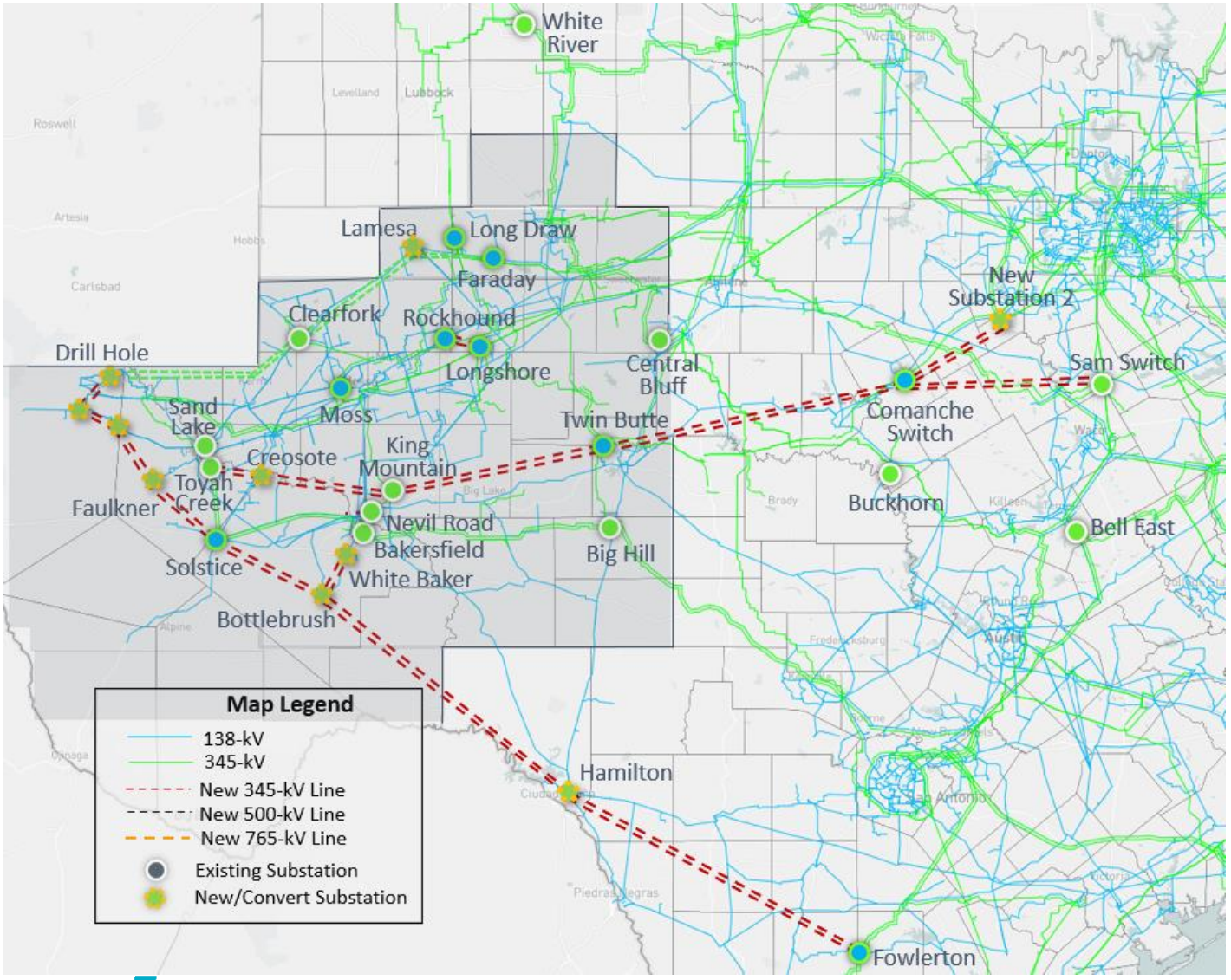
# Recap: 345-kV Import Paths to Permian Basin Region for 2038



# Recap: 345-kV Import Paths to Permian Basin Region for 2038 (cont.)

- Import Path 1
  - Construct a new 345-kV New Substation 2, about 2 miles southeast of the existing Comanche Peak Switch, cutting into the existing Comanche Peak – Wolf Hollow/Mitchell Bend 345-kV double-circuit line and Comanche Peak – Timberview/Johnson 345-kV double-circuit line
  - New New Substation 2 – Comanche Switch 345-kV double-circuit line
  - New New Substation 2 – Central Bluff – Longshore – Rockhound 345-kV double-circuit line
  - New Moss – Border 345-kV double-circuit line
- Import Path 2
  - New Sam Switch – Comanche Switch – Twin Butte – King Mountain 345-kV double-circuit line
- Import Path 3
  - New Bell East – Buckhorn – New Substation 1 – Nevil Road – Lynx 345-kV double-circuit line
  - New Substation 1 is cutting into the existing Big Hill – Twin Butte 345-kV line, about 16 miles away from the Big Hill substation
  - Lynx is cutting into the existing Bakersfield – Solstice 345-kV double-circuit line
- Import Path 4
  - New Fowlerton – Hamilton – Bottlebrush – Solstice 345-kV double-circuit line
  - No 345/138-kV transformers at Hamilton in this study
  - Add new dynamic reactive devices at Hamilton
- Additional Upgrades
  - New White River – Long Draw 345-kV double-circuit line
  - Bypass the series capacitors at Edison and add new dynamic reactive devices

# Recap: 345-kV Import Paths to Permian Basin Region for 2030



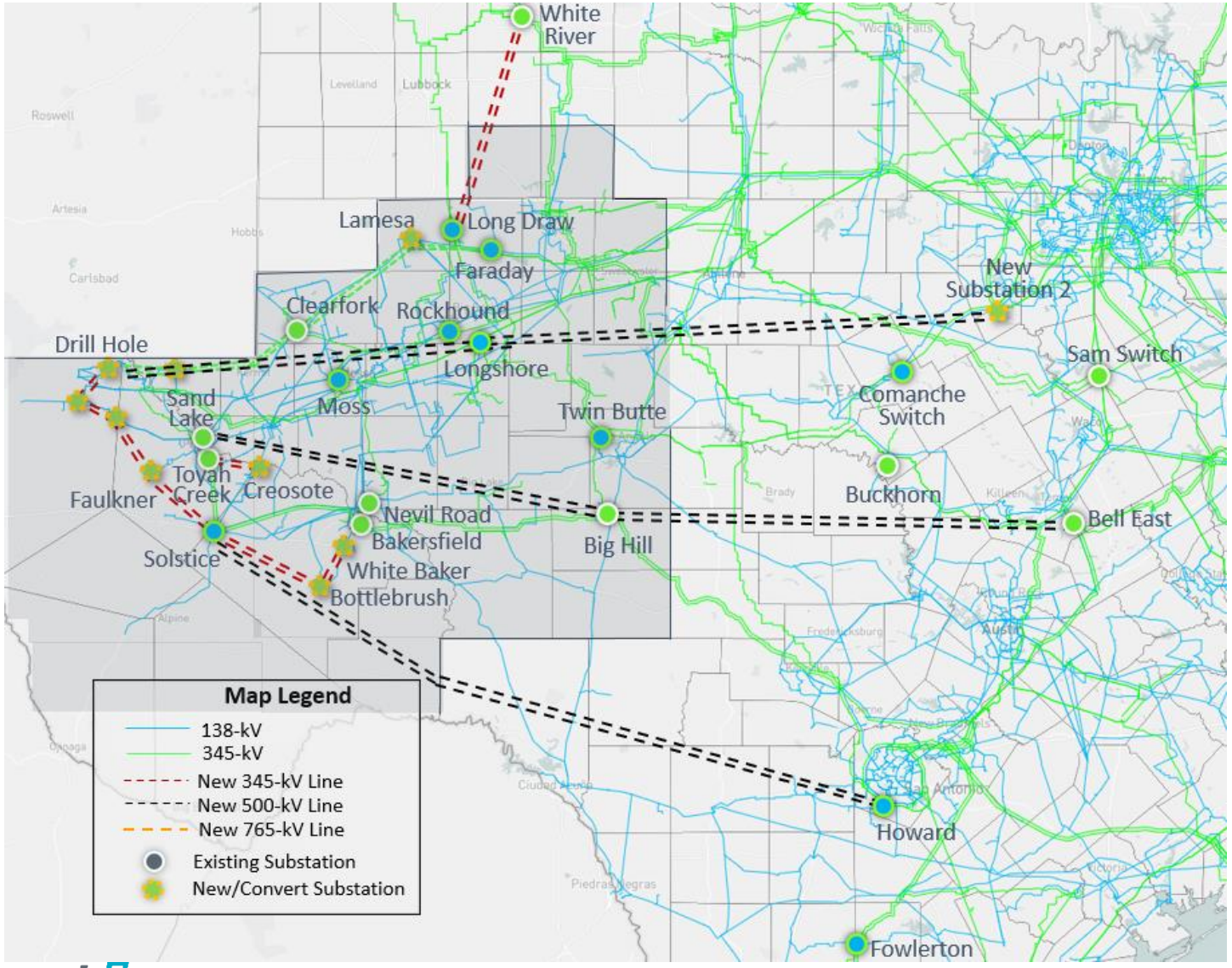
# Recap: 345-kV Import Paths to Permian Basin for 2030 (cont.)

- Portion of Import Path 1
  - Construct a new 345-kV New Substation 2, about 2 miles southeast of the existing Comanche Peak Switch, cutting into the existing Comanche Peak – Wolf Hollow/Mitchell Bend 345-kV double-circuit line and Comanche Peak – Timberview/Johnson 345-kV double-circuit line
  - New New Substation 2 – Comanche Switch 345-kV double-circuit line
  - New Longshore – Rockhound 345-kV double-circuit line
- Import Path 2
  - New Sam Switch – Comanche Switch – Twin Butte – King Mountain 345-kV double-circuit line
- Import Path 4
  - New Fowlerton – Hamilton – Bottlebrush – Solstice 345-kV double-circuit line
  - No 345/138-kV transformers at Hamilton in this study
  - Add new dynamic reactive devices at Hamilton
- Additional Upgrade
  - Bypass the series capacitors at Edison and add new dynamic reactive devices

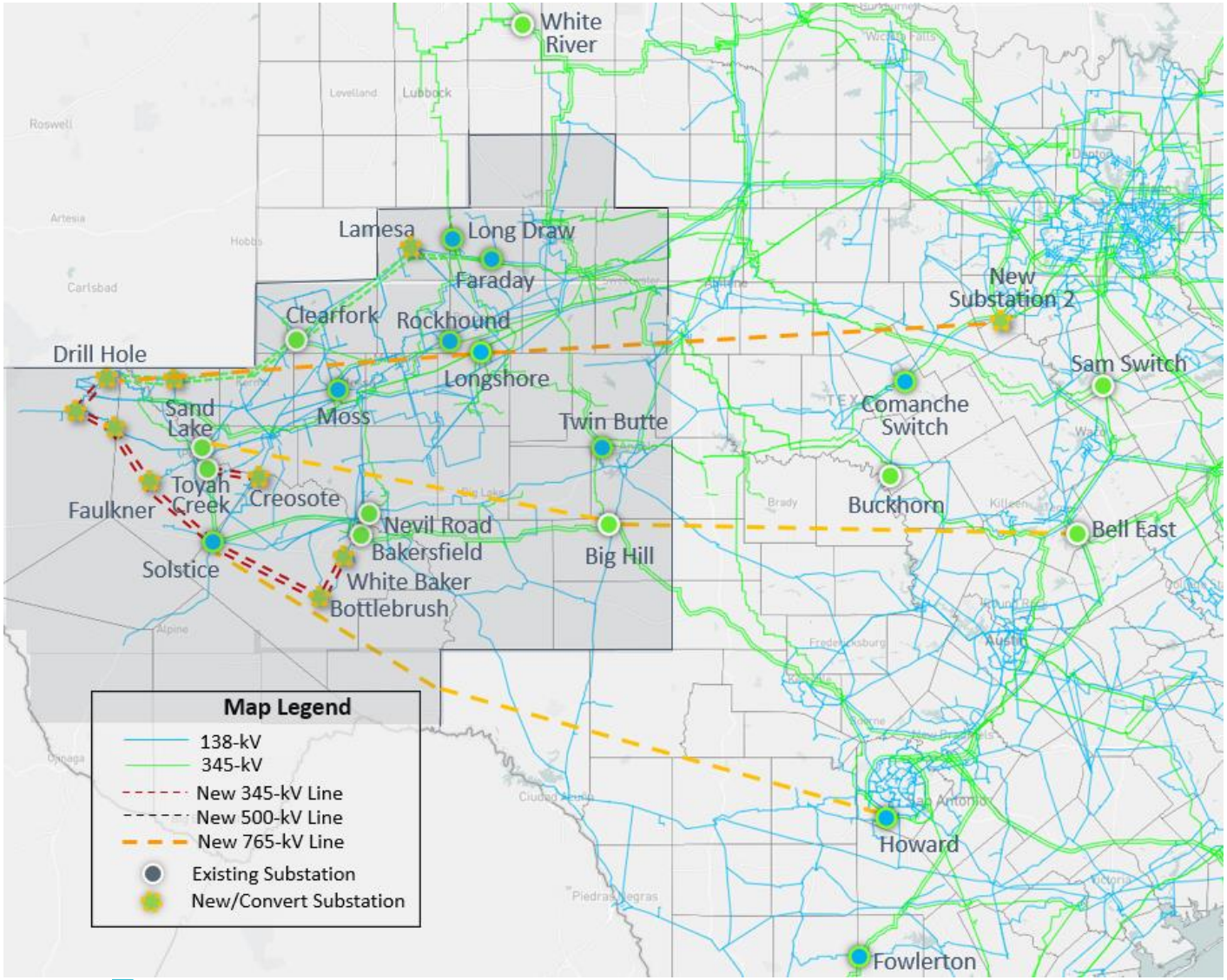
# EHV Import Paths to Permian Basin Region

- Size and locations of the load
- Multiple long 345-kV import paths will be needed to transfer power to Permian Basin region
- EHV import paths
  - Voltage level above 345-kV will make these needed transfers more efficient
  - More cost effective, and require less Right of Way, than 345-kV transmission lines of equal MW capacity
  - 500-kV and 765-kV transmission levels were evaluated for 2038
  - The design of the EHV paths considered the 2024 RTP needs

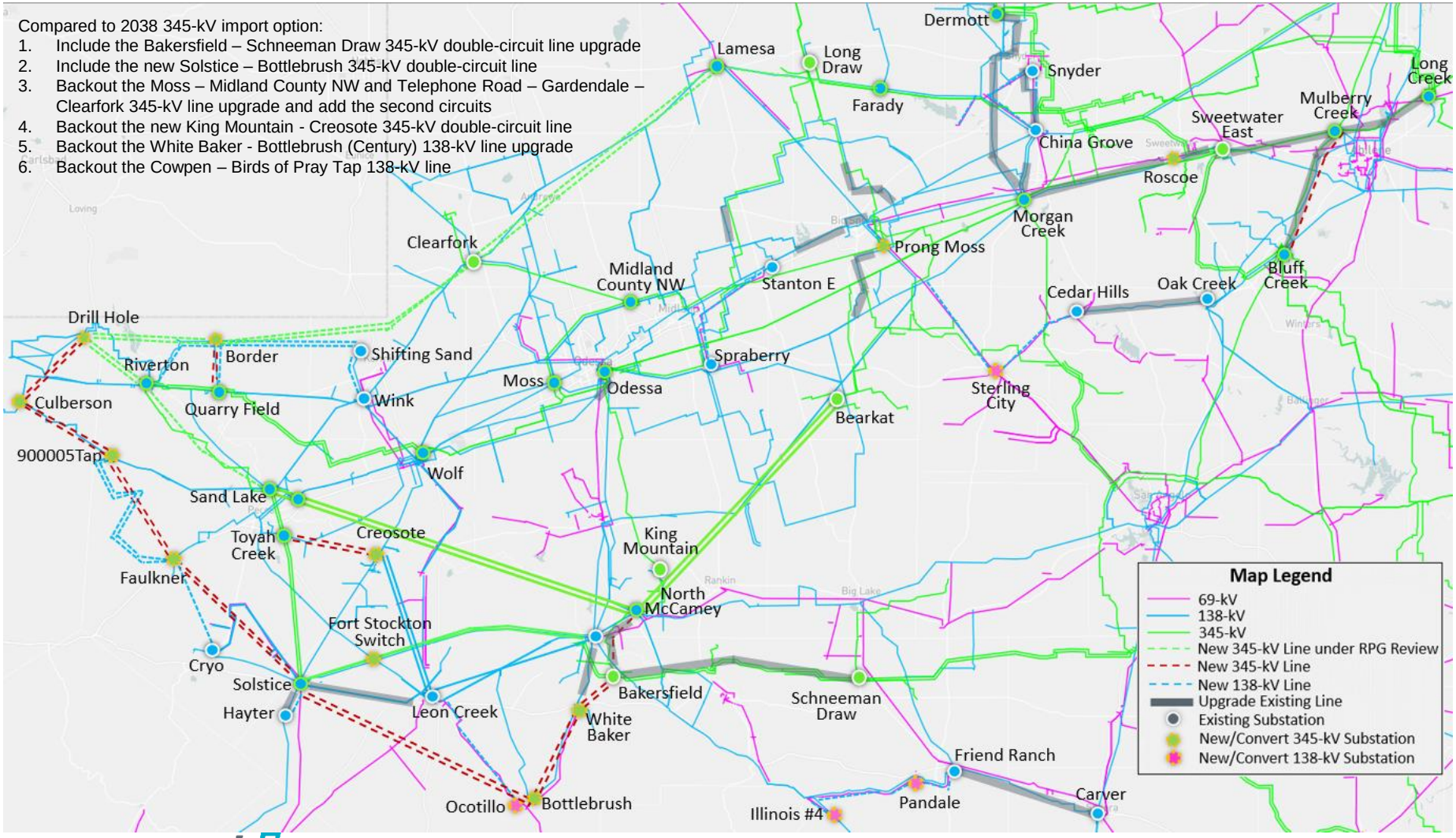
# 500-kV Import Paths Option for 2038



# 765-kV Import Paths Option for 2038



# Local Transmission Upgrades for EHV Options in 2038 to Serve All Loads in Permian Basin Region



# Study Assumption – Dynamic Studies

- As mentioned at the May 2024 RPG meeting, ERCOT conducted a limited dynamic stability analysis utilizing the case (year 2038) with all identified import path project modeled (345-kV option and 765-kV option)
- Key Assumptions:
  - Modeled dynamic data of all generation, except certain units (e.g., unit with no dynamic model available)
  - Included representative dynamic load model of the potential large load based on the review of existing load models in the study region
  - Modeled all transmission upgrades identified in the study region, including all dynamic reactive power devices (e.g., synchronous condensers) assumed in the 2038 case
  - Tested contingencies based on the planning criteria in ERCOT Planning Guide Section 4 and NERC TPL-001-5.1
    - 345-kV import paths option: All P1 and P7 345-kV and 138-kV contingencies in the study region
    - 765-kV import paths option: All P1 and P7 345-kV contingencies in the study region as well as the contingencies associated with the 765-kV import paths

# Dynamic Studies Findings

- The results of the dynamic stability analysis indicated no dynamic stability issue for the 2038 case with all transmission upgrades relevant to 345-kV import paths as well as 765-kV import paths

# Cost Estimates

- Capital costs estimates of each transmission upgrade at 345-kV level or lower were provided by the TSP(s) responsible for each upgrade
  - ERCOT used the cost estimates provided by the TSPs to calculate total project cost estimates for various transmission upgrades
- For EHV (500-kV and 765-kV) options, ERCOT used a general cost estimate to calculate the total project cost estimates
  - Referenced the MISO 2024 Transmission Cost Estimation Guide
    - Link: 20240131_PSC_Item_05_Transmission_Cost_Estimation_Guide_for_MTEP24_-_Redline631529.pdf (misoenergy.org)
  - General cost estimates for EHV options

| | T-Line $/mile | Substation | Transformer |
|---|---|---|---|
| 500-kV double-circuit | $6.9M* | $94.8M | $15.9M |
| 765-kV single-circuit | $6.1M | $97.3M | $27.2M |

*A ratio of 1.4 was used to estimate the cost for 500-kV double-circuit line based on 500-kV single-circuit line

# Cost Estimates Summary

- Cost estimates in $ Billion

| | 2030 | 2038 | | |
|---|---|---|---|---|
| | | 345-kV | 500-kV | 765-kV |
| Local Upgrades | 5.054 | 5.255 | 4.712 | 4.712 |
| Import Paths | 3.991 | 7.694 | 10.605 | 9.059 |
| Total | 9.045 | 12.949 | 15.317 | 13.771 |

- The cost estimates of the local upgrades include the 345-kV and 138-kV transmission upgrades, 69-kV transmission conversions, and placeholder reactive devices (capacitor banks)
- The difference of the cost estimates for the local upgrades between 345-kV and EHV import paths are due to certain transmission upgrades not needed in the EHV options
- The cost estimates of the import paths include the 345-kV and EHV transmission upgrades and dynamic reactive devices

# Comparison of 345-kV and EHV Import Paths in 2038

| | 345-kV | 500-kV | 765-kV |
|---|---|---|---|
| Meets ERCOT and NERC Reliability Criteria | Yes | Yes | Yes |
| Improves Long-Term Load Serving Capability | Yes | Yes | Yes (Best) |
| Improves Operational Flexibility | Yes | Yes | Yes |
| Reduces Transmission Losses | Yes (Least) | Yes | Yes (Best) |
| Long Distance Transmission Capability | Least | Better | Best |
| Number of Import Paths Required | 5 | 4 | 3 |
| Additional Transfer Capability* (MW) | 1,340 | 1,712 | 2,105 |
| Project Feasibility | Yes | Yes | Yes |
| New ROW** Required (miles) | 1,676 | 1,370 | 1,255 |
| Average Transmission Line Cost*** ($Million/mile) | 4.04 | 6.86 | 6.10 |
| Cost Estimate ($Billion) | 12.95 | 15.32 | 13.77 |

* Additional transfer capability under N-1 contingency conditions.

** A routing adder of 20% to the straight distance between two end points was assumed.

*** For 345-kV import paths option, the average cost based on the TSPs cost estimates for 345-kV import paths was used. MISO 2024 Transmission Cost Estimation Guide was referenced for the EHV options (500-kV or 765-kV).

# Next Step

- Complete the report in July 2024

# Deliverables and Timeline

- The study is expected to be completed in June 2024 and the final report is ready in July 2024
- Status updates at RPG meetings
- Tentative Timelines

| Deliverables | Tentative Timeline |
|---|---|
| Load Update by TSPs | January 2024 |
| Review the Data Provided by TSPs | January 2024 |
| Develop Study Base Case and Conduct Reliability Analysis | February 2024 |
| Study Potential Transmission Solutions and Propose Final Reliability Plan | March – June 2024 |
| Final Report | July 2024 |

# Thank you!


Stakeholder comments also welcomed through:

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# Appendix – Local Transmission Projects for 2030 and 2038 in Delaware Basin Area

- 345-kV
  - Update the Stage 3 upgrade: New 345-kV double-circuit transmission line from Riverton – Drill Hole (instead of new 345-kV single-circuit line from Riverton – Owl Hill)
  - Stage 4 upgrade: Convert the existing Sand Lake – Riverton 138-kV line into 345-kV and add a new 138-kV line from Sand Lake – Riverton
  - Update the Stage 5 upgrade: Faraday – Lamesa – Clearfork – Drill Hole (instead of Riverton)
  - Add a new Border 345/138-kV substation with two 345/138-kV transformers; Loop the Stage 5 upgrade of new Clearfork – Drill Hole 345-kV double-circuit transmission line into the new Border 345-kV station; Add a new Border – Quarry Field 345-kV double-circuit transmission line (2038)
  - Add new 345/138-kV substations with two 345/138-kV transformers each at Culberson, 900005Tap (between Culberson and Sand Lake), and Faulkner
  - Add new 345-kV double-circuit transmission lines to form a loop: Riverton – Drill Hole – Culberson – 900005Tap – Faulkner – Solstice
  - Add a new 345/138-kV Creosote substation with three 345/138-kV transformers and add new 345-kV double-circuit transmission lines from King Mountain to Creosote to Toyah Creek
  - Add a new Fort Stockton Switch 345/138-kV substation with three 345/138-kV transformers; Loop the existing Bakersfield – Solstice 345-kV double-circuit transmission lines into Fort Stockton Switch (2038)
  - Upgrade the existing Bakersfield – Nevill Road – North McCamey 345-kV transmission lines and add second circuits
  - Add new 345/138-kV substations with two 345/138-kV transformers each at White Baker and Century (Bottlebrush) and add new 345-kV double-circuit transmission lines from Bakersfield to White Baker to Bottlebrush

# Appendix – Local Transmission Projects for 2030 and 2038 in Delaware Basin Area (cont.)

- 138-kV
  - Add Quarry Field to Border 138-kV second circuit and Shifting Sand – Wink 138-kV second circuit, and add new 138-kV double-circuit transmissions line from Border – Shifting Sand to connect and serve the new loads and form a loop
  - Add Border – Riverton 138-kV second circuit
  - Add new 138-kV double-circuit transmission lines from 900005Tap to Faulkner to connect and serve the new loads and form a loop
  - Add new 138-kV transmission lines from Faulkner to Cryo to connect and serve the new loads and form a loop
  - Upgrade the existing Bottlebrush (Century) – White Baker – Girvin 138-kV transmission line
  - Bypass the Solstice phase shifter transformer and upgrade the existing Solstice – FT Stockton Plant 138-kV transmission line
  - Upgrade the existing Cowpen – Birds of Pray Tap 138-kV transmission line (2038)
  - Upgrade the existing Creosote - Trans Pecos Tap 138-kV transmission line
  - Rebuild the existing Solstice – Hayter Tap 138-kV transmission line to double-circuit; Move the large load as well as LCRA load at Hayter Tap to Hayter; Radially serve the loads at Hayter from Solstice
  - Convert the existing 16th Street – FT Stockton – Pinion – Ocotillo 69-kV transmission line to 138kV; Build a 138-kV tie between Ocotillo and Bottlebrush 138-kV substations; and Expand Ocotillo substation and move the 16th Street 138/69-kV transformer to Ocotillo

# Appendix – Local Transmission Projects for 2030 and 2038 in Midland Basin Area

- 345-kV
  - Add a new 345/138-kV Prong Moss substation with two new 345/138-kV transformers; Loop the existing Bulldog – Elbow 138-kV transmission line into Prong Moss; Loop the existing Hillcrest – McDonald 138-kV line into Prong Moss; Convert the existing Big Spring – Signal Mountain 69-kV line to 138-kV; and Connect Signal Mountain to Prong Moss
  - Add a new 345/138-kV Roscoe substation near the Sweetwater Tap with two new 345/138-kV transformers; Loop the existing Sweetwater East – Champion and Bitter Creek – Cattleman 345-kV double-circuit line into Roscoe; Convert the existing Plowboy – Escoka 69-kV line to 138-kV; Loop the converted Plowboy – Eskota 138-kV line into Roscoe near the Sweetwater; Move the Eskota 138/69-kV transformer #1 to Plowboy
  - Upgrade the existing 345-kV double-circuit transmission lines from Cattleman to Sweetwater East to Long Creek
  - Upgrade the existing Bluff Creek – Abilene Mulberry Creek 345-kV transmission line and add second circuit
  - Upgrade the existing Moss – Midland County NW and Telephone Road – Gardendale – Clearfork 345-kV transmission lines and add second circuits
  - Upgrade the existing Bakersfield – Cedar Caynon – Noelke – Schneeman Draw 345-kV double-circuit transmission lines (needed for EHV options)

# Appendix – Local Transmission Projects for 2030 and 2038 in Midland Basin Area (cont.)

- 138-kV
  - Add a new Ranger (Morgan Creek) – Frontier 138-kV transmission line
  - Upgrade the existing Ranger – Sun – Demott and Ranger – China Groove – Snyder 138-kV transmission lines
  - Upgrade the existing Eiland – Elbow 138-kV transmission line
  - Upgrade the existing Luther – Bulldog 138-kV transmission line
  - Upgrade the existing Natural Dam – Beals Creek 138-kV transmission line
  - Upgrade the existing Big Springs – Steer 138-kV transmission line
  - Upgrade the existing Friend Ranch – Carver 138-kV transmission line
  - Connect the new load bus 900052 to Big Lake to form a 138-kV loop
  - Upgrade the existing Grady – Coronado Midstream Tap – Sales Ranch 138-kV transmission line
  - Upgrade the existing Odessa – Reiter 138-kV double-circuit transmission line
  - Convert the existing Snyder – Scurry – China Grove and Snyder – Amoco Tap – China Grove 69-kV transmission lines to 138-kV
  - Convert the Stanton East – Midland Basin – Spraberry 69-kV transmission line to 138-kV
  - Convert the Illinois #4 – Pandale – Ozona – Friend Ranch 69-kV transmission line to 138-kV, expand Ozona substation and move the Illinois #4 138/69-kV transformer to Ozona
  - Expand the Pandale substation and build a 138-kV tie between Pandale and Stockman substations
  - Convert the Cedar Hill – Sterling City – Chalk 69-kV transmission line to 138-kV
  - Upgrade the existing Oak Creek – Cedar Hills 138-kV transmission line