# DPA-2024-OCTOBER-2044

## Delivery Point Network Study

Published on 1/13/2025

By SPP Engineering, Transmission Services

# REVISION HISTORY

| DATE OR VERSION NUMBER | AUTHOR | CHANGE DESCRIPTION | COMMENTS |
|---|---|---|---|
| 1/13/2025 | SPP | Original | |
| | | | |
| | | | |

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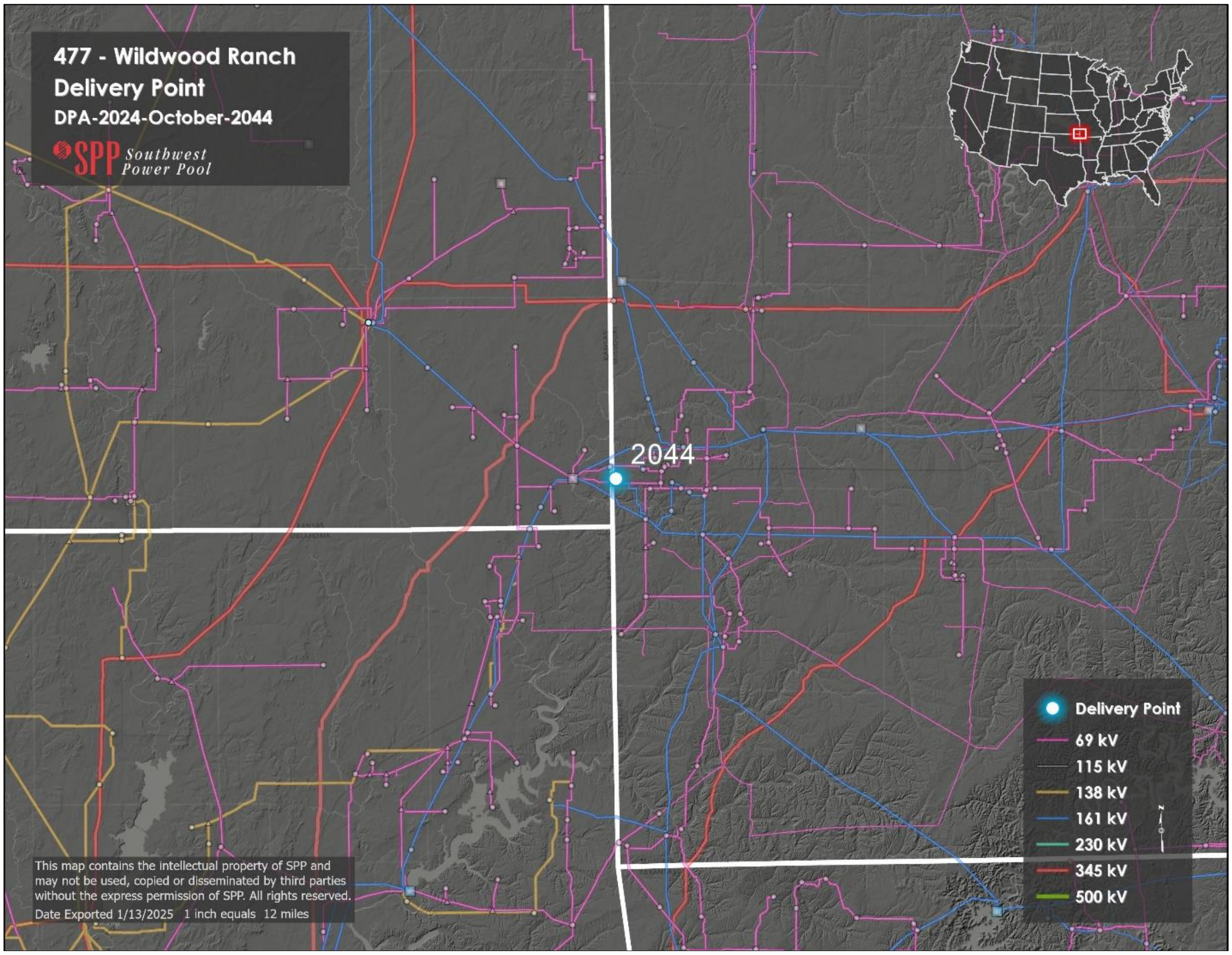
# SECTION 1: INTRODUCTION

This report outlines the results of an evaluation of regional transmission impacts from delivery point request DPA-2024-October-2044. The requesting entity plans to add new load to the existing delivery point called 477 - Wildwood Ranch (WWR477) with an in-service date of 7/1/2027. The WWR477 delivery point is in the Liberty Utilities (EMDE) Transmission System.




The load flow models used for the evaluation were 2024 Integrated Transmission Planning (ITP) base reliability models. Southwest Power Pool (SPP) performed an Alternating Current (AC) contingency analysis on these models using PSS®E.

# SECTION 2: STUDY METHODOLOGY

## *OBJECTIVE*

The purpose of this study was to determine the regional Transmission System impacts within the SPP footprint due to the new load served by EMDE. SPP performed a Delivery Point Network Study (DPNS) with the configurations shown in Table 2-1 below.

## *STUDY PROCESS*

- Model Assumptions
  - 2024 ITP Base Reliability Model Series
    - Model years 2028 and 2033
    - Summer Peak (2028S and 2033S), Winter Peak (2028W and 2033W), and Light Load (2028L and 2033L)
  - 2024 ITP Short Circuit Model Series
    - 2028 Summer Max Fault
  - 2024 Transmission System Planning (TPL) Dynamic Model Series
    - 2033 Summer Peak Base and Change Cases

| Case Name | Study Year | Season | Scenario | Load (MW/MVAR) |
|---|---|---|---|---|
| 2024ITPPF-28L.sav | 2028 | Light Load | Base Reliability | Base Case |
| 2024ITPPF-28S.sav | 2028 | Summer Peak | Base Reliability | Base Case |
| 2024ITPPF-28W.sav | 2028 | Winter Peak | Base Reliability | Base Case |
| 2024ITPPF-33L.sav | 2033 | Light Load | Base Reliability | Base Case |
| 2024ITPPF-33S.sav | 2033 | Summer Peak | Base Reliability | Base Case |
| 2024ITPPF-33W.sav | 2033 | Winter Peak | Base Reliability | Base Case |
| 2024ITPPF-28L_2044.sav | 2028 | Light Load | Base Reliability | WWR477 = 100/32.9 |
| 2024ITPPF-28S_2044.sav | 2028 | Summer Peak | Base Reliability | WWR477 = 200/65.74 |
| 2024ITPPF-28W_2044.sav | 2028 | Winter Peak | Base Reliability | WWR477 = 200/65.74 |
| 2024ITPPF-33L_2044.sav | 2033 | Light Load | Base Reliability | WWR477 = 200/65.74 |
| 2024ITPPF-33S_2044.sav | 2033 | Summer Peak | Base Reliability | WWR477 = 200/65.74 |
| 2024ITPPF-33W_2044.sav | 2033 | Winter Peak | Base Reliability | WWR477 = 200/65.74 |

**Table 2-1: Study Cases**

- Steady State Analysis
  - Assumptions (consistent with the ITP analysis)
    - AC contingency analysis on all load flow models using PSS®E
    - Monitored Elements
      - SPP facilities 69 kV and above
      - First-tier companies 100 kV and above
    - Contingencies (consistent with the ITP analysis)
      - Provided for the ITP by SPP members and first-tier companies
    - Apply SPP Criteria and National American Electric Reliability Corporation (NERC) reliability standards
  - Compare thermal and voltage violations that occur with and without the WWR477 delivery point change to determine thermal and voltage violations resulting from the load addition to the Transmission System.
- Dynamics Analysis
  - Assumptions
    - 2024 TPL Dynamics Model Series
      - 2033 Summer Peak Base and Change Cases
  - Analyses
    - Fast Fault Screening using Physical and Operational Margins Studio
- Short Circuit Analysis
  - Assumptions
    - Used 2024 Final ITP Short Circuit models (Max Fault)
      - Placed all available facilities in service
        - Generation
        - Transmission lines
        - Transformers
        - Buses
      - Short Circuit Output
        - Physical
      - Short Circuit Coordinates
        - Polar
      - Short Circuit Parameters
        - 3 Phase
      - FLAT – classical fault analysis conditions
  - Analyses
    - Three-phase fault

# SECTION 3: RESULTS OF ANALYSIS

## *POTENTIAL THERMAL AND VOLTAGE VIOLATIONS*

The analysis identified potential thermal violations resulting from the new load at the WWR477 delivery point. Table 3-1 details the potential thermal violations resulting from the load addition.

| Model | Bus kV | Facility Name | Contingency Name | Rate A, Rate B (MVA) | Max Flow (MVA) | Base Case Max Loading (%) |
|---|---|---|---|---|---|---|
| 28L | 161 | WWR477 - STL439 5 - 1 | BASE CASE | 223/223 | 265.15 | 118.9 |
| 28S | 161 | WWR477 - STL439 5 - 1 | BASE CASE | 223/223 | 375.76 | 168.5 |
| 28W | 161 | WWR477 - STL439 5 - 1 | BASE CASE | 257/257 | 375.99 | 146.3 |
| 33L | 161 | WWR477 - STL439 5 - 1 | BASE CASE | 223/223 | 370.85 | 166.3 |
| 33S | 161 | WWR477 - STL439 5 - 1 | BASE CASE | 223/223 | 375.76 | 168.5 |
| 33W | 161 | WWR477 - STL439 5 - 1 | BASE CASE | 257/257 | 375.99 | 146.3 |

**Table 3-1: Potential Thermal Violations**

## *SHORT CIRCUIT*

SPP performed short circuit analysis for the 2028 Summer Peak with the new load addition. The analysis identified the currents as listed in Table 3-2.

| Season | Model | Fault | Bus | Current (Amps) |
|---|---|---|---|---|
| 28S | Max Fault | Three Phase | 2VERONA 69.000 | 6,454 |
| 28S | Max Fault | Three Phase | 7BLACKBERRY 345.00 | 15,440 |
| 28S | Max Fault | Three Phase | 1NEOSHTR 13.200 | 13,944 |
| 28S | Max Fault | Three Phase | 2NEOSAC 69.000 | 20,454 |
| 28S | Max Fault | Three Phase | 2WASHBRN 69.000 | 6,651 |
| 28S | Max Fault | Three Phase | BEAVER 5 161.00 | 12,403 |
| 28S | Max Fault | Three Phase | WASHBURN5 161.00 | 8,482 |
| 28S | Max Fault | Three Phase | NEO SPA5 161.00 | 15,592 |
| 28S | Max Fault | Three Phase | CRG X1 1 13.800 | 10,096 |
| 28S | Max Fault | Three Phase | CARTHAG5 161.00 | 16,870 |
| 28S | Max Fault | Three Phase | CRG X2 1 13.800 | 9,454 |
| 28S | Max Fault | Three Phase | CARTHG 2 69.000 | 13,565 |
| 28S | Max Fault | Three Phase | SPRGFLD5 161.00 | 26,844 |
| 28S | Max Fault | Three Phase | DELWARE7 345.00 | 11,196 |
| 28S | Max Fault | Three Phase | VINTAJC4 138.00 | 5,044 |
| 28S | Max Fault | Three Phase | MIAMI 2 69.000 | 12,125 |
| 28S | Max Fault | Three Phase | MIAMI 5 161.00 | 9,424 |
| 28S | Max Fault | Three Phase | AFTON 5 161.00 | 8,366 |
| 28S | Max Fault | Three Phase | MIAMI1 1 13.800 | 4,731 |
| 28S | Max Fault | Three Phase | MIAMI2 1 13.800 | 13,939 |
| 28S | Max Fault | Three Phase | NSES 2X1 13.200 | 40,595 |

| Season | Model | Fault | Bus | Current (Amps) |
|---|---|---|---|---|
| 28S | Max Fault | Three Phase | NEC U3 12.000 | 21,787 |
| 28S | Max Fault | Three Phase | NRSS7 345.00 | 11,752 |
| 28S | Max Fault | Three Phase | NEOSHO 7 345.00 | 17,573 |
| 28S | Max Fault | Three Phase | N345 1 1 13.800 | 40,578 |
| 28S | Max Fault | Three Phase | N345 2 1 13.800 | 40,475 |
| 28S | Max Fault | Three Phase | ERIE5 161.00 | 7,054 |
| 28S | Max Fault | Three Phase | BAKER 2 69.000 | 6,084 |
| 28S | Max Fault | Three Phase | MARMTNE5 161.00 | 8,096 |
| 28S | Max Fault | Three Phase | MARMTNW5 161.00 | 8,091 |
| 28S | Max Fault | Three Phase | NEOSHO 5 161.00 | 22,840 |
| 28S | Max Fault | Three Phase | N345 4 5 161.00 | 22,666 |
| 28S | Max Fault | Three Phase | ERIEN1 13.200 | 11,026 |
| 28S | Max Fault | Three Phase | MARMATN1 13.200 | 10,897 |
| 28S | Max Fault | Three Phase | NEOSH4 1 13.200 | 9,272 |
| 28S | Max Fault | Three Phase | NEOSH5 1 13.200 | 11,224 |
| 28S | Max Fault | Three Phase | LIBERTY4 138.00 | 7,675 |
| 28S | Max Fault | Three Phase | NEPARSN4 138.00 | 12,899 |
| 28S | Max Fault | Three Phase | TV1MNDV4 138.00 | 7,145 |
| 28S | Max Fault | Three Phase | NEOSHOS4 138.00 | 24,533 |
| 28S | Max Fault | Three Phase | NEOSHO 4 138.00 | 24,576 |
| 28S | Max Fault | Three Phase | NEOSHON4 138.00 | 24,462 |
| 28S | Max Fault | Three Phase | N345 3 4 138.00 | 24,151 |
| 28S | Max Fault | Three Phase | ERIE2 69.000 | 9,199 |
| 28S | Max Fault | Three Phase | MARMATN2 69.000 | 8,905 |
| 28S | Max Fault | Three Phase | ORDNJCT2 69.000 | 8,455 |
| 28S | Max Fault | Three Phase | CRAWFOR2 69.000 | 7,204 |
| 28S | Max Fault | Three Phase | ERIE 2 69.000 | 9,080 |
| 28S | Max Fault | Three Phase | NEOSHON2 69.000 | 23,275 |
| 28S | Max Fault | Three Phase | NEOSHOS2 69.000 | 23,300 |
| 28S | Max Fault | Three Phase | LACYGNE7 345.00 | 28,275 |
| 28S | Max Fault | Three Phase | MON376J2 69.000 | 3,958 |
| 28S | Max Fault | Three Phase | MON352J2 69.000 | 7,636 |
| 28S | Max Fault | Three Phase | SCAM66 2 69.000 | 3,052 |
| 28S | Max Fault | Three Phase | COL282 2 69.000 | 6,683 |
| 28S | Max Fault | Three Phase | SEK225T2 69.000 | 3,964 |
| 28S | Max Fault | Three Phase | SEK225 2 69.000 | 3,948 |
| 28S | Max Fault | Three Phase | SMN425 2 69.000 | 2,629 |
| 28S | Max Fault | Three Phase | SHR444 2 69.000 | 3,058 |
| 28S | Max Fault | Three Phase | CHE491T2 69.000 | 1,869 |
| 28S | Max Fault | Three Phase | SEN375 2 69.000 | 3,111 |
| 28S | Max Fault | Three Phase | WEB105 2 69.000 | 8,002 |
| 28S | Max Fault | Three Phase | EXP449T2 69.000 | 9,598 |
| 28S | Max Fault | Three Phase | EXP4492 69.000 | 7,840 |
| 28S | Max Fault | Three Phase | PRC460 2 69.000 | 5,986 |
| 28S | Max Fault | Three Phase | COL473 2 69.000 | 6,600 |
| 28S | Max Fault | Three Phase | WWR477 161.00 | 22,706 |
| 28S | Max Fault | Three Phase | SVRCK469 5 161.00 | 13,918 |

| Season | Model | Fault | Bus | Current (Amps) |
|---|---|---|---|---|
| 28S | Max Fault | Three Phase | KOD471 2 69.000 | 14,810 |
| 28S | Max Fault | Three Phase | ATL109 5 161.00 | 16,650 |
| 28S | Max Fault | Three Phase | ORO110 5 161.00 | 20,017 |
| 28S | Max Fault | Three Phase | AUR124 5 161.00 | 10,388 |
| 28S | Max Fault | Three Phase | RIV4525 161.00 | 24,786 |
| 28S | Max Fault | Three Phase | JOP145 5 161.00 | 19,199 |
| 28S | Max Fault | Three Phase | NEO184 5 161.00 | 14,396 |
| 28S | Max Fault | Three Phase | TIP292 5 161.00 | 17,329 |
| 28S | Max Fault | Three Phase | RDS295 5 161.00 | 8,011 |
| 28S | Max Fault | Three Phase | ASB349 5 161.00 | 10,873 |
| 28S | Max Fault | Three Phase | CJ 366 5 161.00 | 12,379 |
| 28S | Max Fault | Three Phase | LAR382 5 161.00 | 16,585 |
| 28S | Max Fault | Three Phase | MON383 5 161.00 | 12,012 |
| 28S | Max Fault | Three Phase | JOP389 5 161.00 | 19,510 |
| 28S | Max Fault | Three Phase | CAR395 5 161.00 | 12,304 |
| 28S | Max Fault | Three Phase | HOC404 4 138.00 | 6,523 |
| 28S | Max Fault | Three Phase | HOC404 5 161.00 | 13,337 |
| 28S | Max Fault | Three Phase | FIR417 5 161.00 | 14,358 |
| 28S | Max Fault | Three Phase | OAK432 5 161.00 | 18,559 |
| 28S | Max Fault | Three Phase | NOL435 5 161.00 | 9,869 |
| 28S | Max Fault | Three Phase | STL439 5 161.00 | 25,158 |
| 28S | Max Fault | Three Phase | CPK446 5 161.00 | 8,309 |
| 28S | Max Fault | Three Phase | RNM393 5 161.00 | 14,121 |
| 28S | Max Fault | Three Phase | RIV453 5 161.00 | 23,398 |
| 28S | Max Fault | Three Phase | RIV167 5 161.00 | 23,019 |
| 28S | Max Fault | Three Phase | RIV452T 5 161.00 | 24,404 |
| 28S | Max Fault | Three Phase | NEO 56 2 69.000 | 9,922 |
| 28S | Max Fault | Three Phase | JOP 59 2 69.000 | 19,753 |
| 28S | Max Fault | Three Phase | JOP 64 2 69.000 | 19,556 |
| 28S | Max Fault | Three Phase | WEB436 2 69.000 | 8,974 |
| 28S | Max Fault | Three Phase | COL 94 2 69.000 | 7,702 |
| 28S | Max Fault | Three Phase | COL476 2 69.000 | 6,740 |
| 28S | Max Fault | Three Phase | CAR108 2 69.000 | 7,180 |
| 28S | Max Fault | Three Phase | ATL109 2 69.000 | 22,042 |
| 28S | Max Fault | Three Phase | ORO110 2 69.000 | 18,554 |
| 28S | Max Fault | Three Phase | AUR124 2 69.000 | 12,165 |
| 28S | Max Fault | Three Phase | JOP145 2 69.000 | 20,676 |
| 28S | Max Fault | Three Phase | MON152 2 69.000 | 10,631 |
| 28S | Max Fault | Three Phase | RIV167 2 69.000 | 17,644 |
| 28S | Max Fault | Three Phase | NEO184 2 69.000 | 20,454 |
| 28S | Max Fault | Three Phase | GAT490 2 69.000 | 14,500 |
| 28S | Max Fault | Three Phase | BAX492 2 69.000 | 10,660 |
| 28S | Max Fault | Three Phase | GAL278 2 69.000 | 12,887 |
| 28S | Max Fault | Three Phase | OAK280 2 69.000 | 16,372 |
| 28S | Max Fault | Three Phase | JOP284 2 69.000 | 16,848 |
| 28S | Max Fault | Three Phase | TIP292 2 69.000 | 10,268 |
| 28S | Max Fault | Three Phase | JOP341 2 69.000 | 15,421 |

| Season | Model | Fault | Bus | Current (Amps) |
|---|---|---|---|---|
| 28S | Max Fault | Three Phase | JOP372 2 69.000 | 15,388 |
| 28S | Max Fault | Three Phase | RAC375 2 69.000 | 6,746 |
| 28S | Max Fault | Three Phase | QUA377 2 69.000 | 7,940 |
| 28S | Max Fault | Three Phase | MON383 2 69.000 | 12,271 |
| 28S | Max Fault | Three Phase | JOP389 2 69.000 | 15,197 |
| 28S | Max Fault | Three Phase | JOP391 5 161.00 | 13,207 |
| 28S | Max Fault | Three Phase | RNM393 2 69.000 | 20,399 |
| 28S | Max Fault | Three Phase | HOC404 2 69.000 | 11,406 |
| 28S | Max Fault | Three Phase | RIV406 2 69.000 | 15,648 |
| 28S | Max Fault | Three Phase | JOP422 5 161.00 | 12,999 |
| 28S | Max Fault | Three Phase | JOP430 2 69.000 | 15,764 |
| 28S | Max Fault | Three Phase | R12G4531 13.800 | 20,103 |
| 28S | Max Fault | Three Phase | R13G167 13.800 | 53,887 |
| 28S | Max Fault | Three Phase | R10G1671 13.200 | 28,312 |
| 28S | Max Fault | Three Phase | L1G382 1 13.200 | 72,182 |
| 28S | Max Fault | Three Phase | L2G382 1 13.200 | 72,491 |
| 28S | Max Fault | Three Phase | L3G3821 18.000 | 31,857 |
| 28S | Max Fault | Three Phase | L4G3821 18.000 | 31,881 |
| 28S | Max Fault | Three Phase | S1G439 1 13.200 | 63,713 |
| 28S | Max Fault | Three Phase | S2G439 1 18.000 | 66,347 |
| 28S | Max Fault | Three Phase | S3G439 1 18.000 | 74,728 |
| 28S | Max Fault | Three Phase | S4G439 1 18.000 | 81,872 |
| 28S | Max Fault | Three Phase | PLB447 2 69.000 | 14,497 |
| 28S | Max Fault | Three Phase | GLF339 2 69.000 | 11,732 |
| 28S | Max Fault | Three Phase | ATL109 1 12.500 | 16,922 |
| 28S | Max Fault | Three Phase | ORO110 1 12.500 | 16,925 |
| 28S | Max Fault | Three Phase | AUR1241 12.500 | 13,515 |
| 28S | Max Fault | Three Phase | JOP145 1 12.500 | 15,638 |
| 28S | Max Fault | Three Phase | NEO184B1 12.500 | 12,700 |
| 28S | Max Fault | Three Phase | MON383 1 12.500 | 15,681 |
| 28S | Max Fault | Three Phase | JOP389 1 12.500 | 16,129 |
| 28S | Max Fault | Three Phase | HOC404A1 12.500 | 4,338 |
| 28S | Max Fault | Three Phase | HOC404B1 12.500 | 16,132 |
| 28S | Max Fault | Three Phase | RNM393 1 12.500 | 19,419 |
| 28S | Max Fault | Three Phase | RIV452 1 12.500 | 10,772 |
| 28S | Max Fault | Three Phase | GAL278T 69.000 | 13,177 |
| 28S | Max Fault | Three Phase | BAX488 5 161.00 | 14,992 |
| 28S | Max Fault | Three Phase | KINGSPT WF 161.00 | 7,485 |

**Table 3-2: Short Circuit Results**

## *STABILITY*

SPP performed a Fast Fault Screening (FFS) using the 2033 Summer Peak for the base case and change case models. The change case models include the WWR477 delivery point changes. SPP determined no significant differences in the critical clearing times between the base and change cases. Therefore, a transient stability analysis is not required.

## *TRANSMISSION SOLUTIONS*

The addition of the load at the existing WWR477 delivery point caused potential thermal overloads on the radial 161 kV line serving the WWR477 delivery point. SPP's solution is to rebuild the overloaded transmission line that serves multiple customers. The solution is listed below.

**Solution:** Rebuild WWR477 to STL439 5 Circuit 1 (Total cost $628,972)

The solution solves all issues identified in Table 3-1 in the most cost-effective manner.

| New Upgrade Description* | Mileage | MVA (Rate B) | Date Needed** | Host Transmission Owner | Estimated Cost*** |
|---|---|---|---|---|---|
| Rebuild WWR477 to STL439 5 Circuit 1 | 0.5 | 376 | 7/1/2027 | EMDE | $628,972 |
| **TOTAL NEW UPGRADE COST** | | | | | **$628,972** |

**Table 3-3: Recommended Upgrade Solution**

*All requests with a Network Upgrade(s) identified in the DPNS will be subject to further evaluation in the soonest available Integrated Transmission Planning Assessment that is able to include the load changes, if it is determined that the Network Upgrade(s) will be able to meet the study timeframe requirements pursuant to the standardized project timelines in SPP Business Practices, based on the SPP determined Network Upgrade(s) need date. If it is determined that a Network Upgrade(s) identified from a DPNS is unable to be further evaluated pursuant to the Integrated Transmission Planning Assessment, the DPNS report will be posted on the SPP website once SPP is notified by the Transmission Customer to update the applicable Network Integration Transmission Service Agreement to reflect the changes in delivery points and the Network Upgrade(s).

Pursuant to Attachment AQ of the Tariff, the Transmission provider is responsible for assessing the impacts on the Transmission System caused by modifying an existing delivery point or establishing the new delivery point through the Delivery Point Network Study ("DPNS"). The DPNS may determine the need for a Network Upgrade(s) necessary for the modification of an existing delivery point or the establishment of a new delivery point. A Network Upgrade(s) that the Transmission Customer or Host Transmission Owner desires that exceeds the needed Network Upgrade(s) identified in the DPNS will need to be studied through the Transmission Provider's Sponsored Upgrade study process to evaluate the impacts of the desired changes on the Transmission System.

**If the project need date specified in this study cannot be met, the Transmission Owner will be required to submit mitigations pursuant to the SPP Project Tracking process. All upgrades or mitigations must be in place prior to the dates shown in Table 3-3.

***Note that the estimated new upgrade cost provided in this report is an SPP Conceptual Cost Estimate only; this is preliminary, and a more refined Study Cost Estimate will be developed after issuance of this report through a Standardized Cost Estimate Reporting Template (SCERT).

# SECTION 4: CONCLUSION

The AC analysis revealed potential thermal violations associated with the WWR477 load addition. The study shows that the following upgrade is required to reliably serve the load addition:

- Rebuild WWR477 to STL439 5 Circuit 1

The transmission upgrade in Table 3-3 is recommended to mitigate the potential thermal violations.