

## 2022 RTEP Multi-Driver Proposal Window No. 1

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#### 2022 RTEP Multi-Driver Proposal Window 1

- Window opened on 6/7/2022
- Window closed on 8/8/2022
- For this Window, PJM seeks technical solutions, also called proposals, to resolve potential reliability criteria violations on multi-driver facilities identified below in accordance with all applicable planning criteria (PJM, NERC, SERC, RFC, and Local Transmission Owner criteria).
- 14 total proposals submitted from 3 different entities (includes 3 carry-over proposals from 2021 Proposal Window 2)
  - 8 Greenfields
  - 6 Upgrades
- Cost Estimates: Approximate range from \$215K 127M
- 4 Proposals identified with cost containment
- Redacted public proposals are available:

https://pjm.com/planning/competitive-planning-process/redacted-proposals



#### 2022 RTEP Multi-Driver Proposal Window 1 (1/2)

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Proposal ID#	Project Type	Project Description	Total Construction Cost (\$M)	Zone	kV Level	Analysis	Flowgate(s)
40		Swap 345kV transmission line at Green Acres, rebuild University Park to Olive 345kV lines and add a reactor along Crete- St John 345kV line.	83.4	AEP/ComEd	345	Winter Gen Deliv, Summer Gen Deliv, Market Efficiency	MDW1-GD-S1620,MDW1-ME-01,MDW1-ME-02,MDW1-GD-W392,MDW1-GD-W393,MDW1-GD-W309,MDW1-GD-W404,MDW1-GD-W419,MDW1-ME-04,MDW1-GD-W172,MDW1-GD-W171,MDW1-GD-W188,MDW1-GD-W190,MDW1-GD-W185,MDW1-GD-W332,MDW1-GD-W331,MDW1-ME-03
82	Greenfield	Add a new 345 kV double circuit to tap existing lines and connect to an existing sub, and reconfigure existing lines at the sub	61.5	AEP/ComEd	345	Winter Gen Deliv, Summer Gen Deliv, Market Efficiency	MDW1-GD-S1620,MDW1-ME-01,MDW1-ME-02,MDW1-GD-W392,MDW1-GD-W393,MDW1-GD-W309,MDW1-GD-W404,MDW1-GD-W419,MDW1-ME-04,MDW1-GD-W172,MDW1-GD-W171,MDW1-GD-W188,MDW1-GD-W190,MDW1-GD-W185,MDW1-GD-W332,MDW1-GD-W331,MDW1-ME-03
91	Greenfield	Goodenow-Lemon Lake 345kV Greenfield Line and Stations (Enhanced)	101.8	AEP/ComEd	345	Winter Gen Deliv, Summer Gen Deliv, Market Efficiency	MDW1-GD-S1620,MDW1-ME-01,MDW1-ME-02,MDW1-GD-W392,MDW1-GD-W393,MDW1-GD-W309,MDW1-GD-W404,MDW1-GD-W419,MDW1-ME-04,MDW1-GD-W172,MDW1-GD-W171,MDW1-GD-W188,MDW1-GD-W190,MDW1-GD-W185,MDW1-GD-W332,MDW1-GD-W331,MDW1-ME-03
165	Upgrade	Dumont-Stillwell Sag Study	0.2	AEP	345	Winter Gen Deliv	MDW1-GD-S1620
401	Greenfield	Add a new 345kV double circuit to reconfigure existing lines	51.2	AEP/ComEd	345	Winter Gen Deliv, Summer Gen Deliv, Market Efficiency	MDW1-GD-S1620,MDW1-ME-01,MDW1-ME-02,MDW1-GD-W392,MDW1-GD-W393,MDW1-GD-W309,MDW1-GD-W404,MDW1-GD-W419,MDW1-ME-04,MDW1-GD-W172,MDW1-GD-W171,MDW1-GD-W188,MDW1-GD-W190,MDW1-GD-W185,MDW1-GD-W332,MDW1-GD-W331,MDW1-ME-03
541	Greenfield	Peregrine Ditch	14.8	AEP/ComEd	345	Winter Gen Deliv	MDW1-GD-W392-MDW1-GD-W393



### 2022 RTEP Multi-Driver Proposal Window 1 (2/2)

Proposal ID#	Project Type	Project Description	Total Construction Cost (\$M)	Zone	kV Level	Analysis	Flowgate(s)
597	Greenfield	Goodenow-Lemon Lake 345kV Greenfield Line and Stations (Robust)	127.1	AEP/ComEd	345	Winter Gen Deliv, Summer Gen Deliv, Market Efficiency	MDW1-GD-S1620,MDW1-ME-01,MDW1-ME-02,MDW1-GD-W392,MDW1-GD-W393,MDW1-GD-W309,MDW1-GD-W404,MDW1-GD-W419,MDW1-ME-04,MDW1-GD-W172,MDW1-GD-W171,MDW1-GD-W188,MDW1-GD-W190,MDW1-GD-W185,MDW1-GD-W332,MDW1-GD-W331,MDW1-ME-03
612	Greenfield	Goodenow-Lemon Lake 345kV Greenfield Line and Stations (Basic)	98.1	AEP/ComEd	345	Winter Gen Deliv, Summer Gen Deliv, Market Efficiency	MDW1-GD-S1620,MDW1-ME-01,MDW1-ME-02,MDW1-GD-W392,MDW1-GD-W393,MDW1-GD-W309,MDW1-GD-W404,MDW1-GD-W419,MDW1-ME-04,MDW1-GD-W172,MDW1-GD-W171,MDW1-GD-W188,MDW1-GD-W190,MDW1-GD-W185,MDW1-GD-W332,MDW1-GD-W331,MDW1-ME-03
644	Upgrade	Swap 345kV transmission line at Green Acres, rebuild University Park to Olive 345kV lines	98.8	AEP/ComEd	345	Winter Gen Deliv, Summer Gen Deliv, Market Efficiency	MDW1-GD-S1620,MDW1-ME-01,MDW1-ME-02,MDW1-GD-W392,MDW1-GD-W393,MDW1-GD-W309,MDW1-GD-W404,MDW1-GD-W419,MDW1-ME-04,MDW1-GD-W172,MDW1-GD-W171,MDW1-GD-W188,MDW1-GD-W190,MDW1-GD-W185,MDW1-GD-W332,MDW1-GD-W331,MDW1-ME-03
664	Greenfield	Add a new 345 kV double circuit line looping the existing line into a new substation	74.0	AEP/ComEd	345	Winter Gen Deliv, Summer Gen Deliv, Market Efficiency	MDW1-GD-S1620,MDW1-ME-01,MDW1-ME-02,MDW1-GD-W392,MDW1-GD-W393,MDW1-GD-W309,MDW1-GD-W404,MDW1-GD-W419,MDW1-ME-04,MDW1-GD-W172,MDW1-GD-W171,MDW1-GD-W188,MDW1-GD-W190,MDW1-GD-W185,MDW1-GD-W332,MDW1-GD-W331,MDW1-ME-03
908	Upgrade	Olive-University Park Sag Study	1.5	AEP/ComEd	345	Winter Gen Deliv	MDW1-GD-W392-MDW1-GD-W393
253	Upgrade	Rebuild 345 kV Lines 6607/6608 East Frankfort - Crete and 94507/97008 Crete - St. John	62.6	ComEd	345	Winter Gen Deliv	GD-W2-W5, GD-W2-W6
977	Upgrade	Rebuild 345 kV double circuit Lines 94507 and 97008 Crete - Indiana	17.1	ComEd	345	Winter Gen Deliv	GD-W2-W5, GD-W2-W6
994	Upgrade	Install Series Inductor on Line 94507 Crete - St. John	12.0	ComEd	345	Winter Gen Deliv	GD-W2-W5, GD-W2-W6



# Reliability Analysis

### 2022 Multi-Driver Proposal Window 1

- PJM's reliability analysis showed that all 14 proposals solve the intended reliability criteria violations. However proposal #977 resulted in harm, and so was not considered further.
  - NOTE: Proposals are not required to resolve all of the posted flowgates. PJM can combine proposals for a more comprehensive solution.
- PJM conducted an independent review of the project components and costs, and made adjustments based on the following:
  - Where more accurate scope and costs were known from the incumbent TO
  - Where assumptions were documented in the proposal (which were also confirmed with proposing entity) as further described in the next slide.



### Independent Cost Review

*Proposal ID#	Туре	Proposing Entity	Original Cost (\$M)	Independent Cost (\$M)	Reason for Cost Adjustment
165	Upgrade	AEP	\$0.22	\$0.22	No cost adjustments made.
908	Upgrade	AEP	\$1.50	\$1.50	No cost adjustments made.
91	Greenfield	AEP	\$101.77	\$130.61	Inclusion of proposal #977, #165 and s2631 as documented in proposal assumptions.
541	Greenfield	AEP	\$14.79	\$89.19	Inclusion of proposal #253, #165 and s2631 as documented in proposal assumptions.
597	Greenfield	AEP	\$127.13	\$155.97	Inclusion of proposal #977, #165 and s2631 as documented in proposal assumptions.
612	Greenfield	AEP	\$98.12	\$126.97	Inclusion of proposal #977, #165 and s2631 as documented in proposal assumptions.
253	Upgrade	ComEd	\$62.68	\$64.67	Inclusion of NEET proposal #644.3 (Reconductor Crete - St. John-NEETMA 345 kV TL upgrade)
977	Upgrade	ComEd	\$17.13	\$19.12	Inclusion of NEET proposal #644.3 (Reconductor Crete - St. John-NEETMA 345 kV TL upgrade)
994	Upgrade	ComEd	\$12.01	\$12.01	No cost adjustments made.
644	Upgrade	NEET	\$98.77	\$72.37	Replacement of NEET's reconductor scope/cost of ComEd facilities (#644.4-7) with ComEd's proposal 253 rebuild. Cost adjustment for #644.8 component with estimate from incumbent TO. Removal of #644.2 component cost that will remain a supplemental project.
40	Greenfield	NEET	\$83.44	\$62.13	Replacement of NEET's reconductor scope/cost of ComEd facilities with ComEd's proposal #253 rebuild (using per mile estimate). Removal of #40.2 component cost that will remain a supplemental project.
82	Greenfield	NEET	\$61.52	\$68.93	Replacement of NEET's reconductor scope/cost of ComEd facilities with ComEd's proposal #977 rebuild. Cost adjustment for #82.9 component with estimate from incumbent TO.
401	Greenfield	NEET	\$51.23	\$48.44	Cost adjustment for #401.4 component with estimate from incumbent TO.
664	Greenfield	NEET	\$73.96	\$90.81	Replacement of NEET's reconductor scope/cost of ComEd facilities with ComEd's proposal #253 rebuild (using per mile estimate). Cost adjustment for #664.7 component with estimate from incumbent TO. Removal of #664.3 component cost that will remain a supplemental project.

\*Preferred solutions are identified in green.

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#### Additional Benefits: Aging Infrastructure

• Listed below are proposals which provide additional benefit by addressing aging infrastructure in the area not already addressed in the base case. Marked in green are proposals which provide the most benefit in this regard.

Proposal ID#	Additional Benefits
91	Addresses aging infrastructure on ComEd's section of Crete-St. John 345 kV double circuit (5 miles) and NEET's section of Crete-St. John 345 kV line (6.95 miles).
541	Addresses aging infrastructure on ComEd's section of Crete-St. John 345 kV double circuit (5 miles), NEET's section of Crete-St. John 345 kV line (6.95 miles) and ComEd's 345 kV double circuit extending from Crete to East Frankfort (12.7 miles).
597	Addresses aging infrastructure on ComEd's section of Crete-St. John 345 kV double circuit (5 miles) and NEET's section of Crete-St. John 345 kV line (6.95 miles).
612	Addresses aging infrastructure on ComEd's section of Crete-St. John 345 kV double circuit (5 miles) and NEET's section of Crete-St. John 345 kV line (6.95 miles).
253	Addresses aging infrastructure on ComEd's section of Crete-St. John 345 kV double circuit (5 miles), NEET's section of Crete-St. John 345 kV line (6.95 miles) and ComEd's 345 kV double circuit extending from Crete to East Frankfort (12.7 miles).
977	Addresses aging infrastructure on ComEd's section of Crete-St. John 345 kV double circuit (5 miles) and NEET's section of Crete-St. John 345 kV line (6.95 miles).
644	Addresses aging infrastructure on ComEd's section of Crete-St. John 345 kV double circuit (5 miles), NEET's section of Crete-St. John 345 kV line (6.95 miles) and ComEd's 345 kV double circuit extending from Crete to East Frankfort (12.7 miles).
40	Addresses aging infrastructure on a portion of ComEd's 345 kV double circuit extending from St. John to East Frankfort (12.21 miles), and NEET's section of Crete-St. John 345 kV line (6.95 miles).
82	Addresses aging infrastructure on ComEd's section of Crete-St. John 345 kV double circuit (5 miles) and NEET's section of Crete-St. John 345 kV line (6.95 miles).
664	Addresses aging infrastructure on a portion of ComEd's 345 kV double circuit extending from St. John to East Frankfort (12.21 miles), and NEET's section of Crete-St. John 345 kV line (6.95 miles).



### Reliability Analysis - Top 3 Solutions

 Based on reliability performance, adjusted cost and additional benefits, the below proposals are the top 3 preferred solutions from a reliability perspective.

Proposal ID#	Туре	Proposing Entity	Independent Cost (\$M)	Additional Benefits
253	Upgrade	ComEd	\$64.67	
644	Upgrade	NEET	\$72.37	Addresses all of Exelon's EOL facilities in the area, along with NEET EOL facilities not already addressed by s2509 (which will remain a supplemental
541	Greenfield	AEP	\$89.19	project).



## Market Efficiency Analysis



#### Market Efficiency Analysis - Individual Proposals

			2027	2027	
Proposal ID#	Proposal Description	Туре	Unsolved Cong.* (\$M)	% Cong. Solved	Comments
40	Swap 345kV line at Green Acres, rebuild University Park to Olive 345kV and add reactor to Crete- St John 345kV line.	Upgrade	2.71	85%	Proposal leaves some congestion on E. Frankfort-Univ. Park.
82	Add new 345 kV double circuit to tap existing lines and connect to an existing sub; reconfigure existing lines at the sub.	Greenfield	6.51	63%	Proposal leaves significant congestion on new line Olive-St John.
91	Goodenow-Lemon Lake 345kV Greenfield Line and Stations (Enhanced).	Greenfield	14.51	15%	Proposal leaves significant congestion on Dumont-Stillwell.
165	Dumont-Stillwell Sag Study.	Upgrade	13.07	24%	Proposal addresses Dumont-Stillwell congestion only.
253	Rebuild 345 kV Lines 6607/6608 East Frankfort - Crete and 94507/97008 Crete - St. John.	Upgrade	16.7	2%	Proposal leaves significant congestion on Dumont-Stillwell and Olive-University Park.
401	Add a new 345kV double circuit to reconfigure existing lines.	Greenfield	8.43	51%	Proposal leaves significant congestion on Olive-University Park and shifts congestion to St John-Green Acre NIPSCO line.
541	Tap Olive–Green Acres 345 kV and Olive-University Park 345 kV into new 4-breaker ring station (Peregrine Ditch 345 kV).	Greenfield	17.16	0%	Proposal leaves significant congestion on Dumont-Stillwell.

<sup>\*</sup>Congestion in the COMED-NIPSCO-AEP area left unsolved or shifted to nearby constraints.

Note: Base Case 2027 Total Congestion in the COMED-NIPSCO-AEP area is \$16.90M.



#### Market Efficiency Analysis - Individual Proposals (cont)

Proposal ID#	Proposal Description	Туре	2027 Unsolved Cong.* (\$M)	2027 % Cong. Solved	Comments
597	Goodenow-Lemon Lake 345kV Greenfield Line and Stations (Robust).	Greenfield	14.6	15%	Proposal leaves significant congestion on Dumont-Stillwell.
612	Goodenow-Lemon Lake 345kV Greenfield Line and Stations (Basic).	Greenfield	14.61	15%	Proposal leaves significant congestion on Dumont-Stillwell.
644	Swap 345kV transmission line at Green Acres, rebuild University Park to Olive 345kV lines.	Upgrade	2.42	87%	Proposal shifts some congestion to new line Olive-St John.
664	Add a new 345 kV double circuit line looping the existing line into a new substation.	Greenfield	8.04	54%	Proposal leaves significant congestion on new line Olive- Stateline.
908	Olive-University Park Sag Study.	Upgrade	15.95	7%	Proposal addresses Dumont-Stillwell congestion only.
994	Install Series Inductor on Line 94507 Crete - St. John.	Upgrade	18.37	0%	Proposal leaves significant congestion on Dumont-Stillwell. Increases flows and congestion on Olive-University Park.

<sup>\*</sup>Congestion in the COMED-NIPSCO-AEP area left unsolved or shifted to nearby constraints.

Most individual proposals leave significant congestion on Dumont-Stillwell and/or Olive-University Park and will benefit from combining with sag studies.



#### Market Efficiency Analysis – Top 5 Combination Solutions

*Proposal Combo ID#	Redacted Proposal Description	Туре	% Cong. Solved	Market Efficiency Benefits (15-Years Net Load Payment)	Independent Cost (In-Service \$M)	BC Ratio
82 + 908	Add a new 345 kV double circuit to tap existing lines and connect to an existing sub, and reconfigure existing lines at the sub. Olive-University Park Sag Study.	Greenfield	92%	\$155.59	\$75.32	1.99
h/L/L + UIIX	Swap 345kV transmission line at Green Acres, rebuild University Park to Olive 345kV lines. Olive-University Park Sag Study.	Upgrade	91%	\$167.15	\$82.30	1.96
40	Swap 345kV transmission line at Green Acres, rebuild University Park to Olive 345kV lines and add a reactor along Crete- St John 345kV line.	Upgrade	85%	\$120.03	\$65.02	1.78
541 + 908	Construct a greenfield 4-breaker ring station (Peregrine Ditch 345 kV) in Union Township, IN. Tap Olive–Green Acres 345 kV and Olive-University Park 345 kV at Tower #275 into the new station. Dumont-Stillwell Sag Study. Additional Dumont-Stillwell terminal upgrade. Olive-University Park Sag Study.	Greenfield	87%	\$163.96	\$94.72	1.67
B NN/I = UIIX	Add a new 345 kV double circuit line looping the existing line into a new substation. Olive-University Park Sag Study.	Greenfield	90%	\$137.69	\$96.38	1.38

<sup>\*</sup>Preferred solutions are identified in green.

#### Conclusions

- Proposal #253, which is the top candidate from reliability perspective, as a standalone project, does not resolve the congestion drivers Dumont-Stillwell and Olive-University Park 345 kV, therefore not addressing the market efficiency need.
- Proposal #82 and #908 combination, which is one of the top candidates from market efficiency perspective, is not preferred for the following reasons:
  - Addresses only a portion of EOL replacement needs in the area and introduces additional transmission costs in the area. Exelonhas an additional 12.7 miles of double circuit extending from Crete to East Frankfort 345 kV. Rebuilding this line and associated equipment has an estimated cost of \$45.55 million, which will result in greater overall future transmission costs as it proceeds through the M-3 process.
  - Includes a Greenfield component, which includes the construction of an approximately 12 mile 345 kV double circuit line from the existing Bloom-Davis Creek 345 kV line to the St. John substation (over 8 miles of which would require new ROW).
- PJM's preferred solution is the combination of modified proposal #644 as described below and proposal #908 to address both reliability and market efficiency drivers:
  - Proposal #644, modified to replace NEET's reconductor scope/cost of ComEd facilities (644.4-7) with ComEd's proposal 253 rebuild and removal of component 644.2 cost (which will remain a supplemental project), combined with proposal #908.
- PJM has shared the preferred solution with MISO for evaluation.



#### First Review

Baseline Reliability Projects

2022 RTEP Multi-Driver Window 1



Process Stage: First Read

**Criteria:** Summer & Winter Generator Deliverability **Assumption Reference**: 2027 RTEP assumption

Model Used for Analysis: 2027 RTEP Summer & Winter case

Proposal Window Exclusion: None

**Problem Statement:** 

MDW1-GD-S1620, MDW1-GD-W172, MDW1-GD-W171, MDW1-GD-W188, MDW1-GD-W190, MDW1-GD-W185, MDW1-GD-W332, MDW1-GD-W331, MDW1-GD-W309, MDW1-GD-W404, MDW1-GD-W419, MDW1-GD-W392, MDW1-GD-W393; MDW1-ME-01, MDW1-ME-02, MDW1-ME-03, MDW1-ME-04

In 2027 RTEP summer case, the Stillwell-Dumont 345 kV line is overload for an N-2 outage. In the 2027 RTEP winter case, the Crete-St. John 345 kV line is overloaded for N-1 and N-2 outages, and the Crete-E. Frankfort and University Park N-Olive 345 kV lines are overloaded for N-1 outages.

Additionally, in the 2027 RTEP cases there was congestion identified on the Dumont-Stillwell 345 kV line, the E. Frankfort-Crete-St. John 345 kV line and University Park N-Olive 345 kV line.





Proposed Solution: Proposal 664 (modified) and proposal 908

- Outside of the Green Acres substation, swap the NIPSCO Green Acre Tap towers from the St. John-Green Acres-Olive 345 kV line to the University Park N-Olive 345 kV line to create a University Park N-Green Acres-Olive and St. John-Olive 345 kV lines. – NEET (\$1.98 M)
- Reconductor NEET's section of Crete(IN/IL border)-St. John 345 kV line (6.95 miles). – NEET (\$1.99 M)
- Rebuild ComEd's section of 345 kV double circuit in IL from St.
  John to Crete (5 miles) with twin bundled 1277 ACAR conductor. –
  ComEd (\$16.64 M)
- Rebuild 12.7 miles of 345 kV double circuit extending from Crete to E. Frankfort with twin bundled 1277 ACAR conductor. – ComEd (\$42.28 M)
- Replace E. Frankfort 345 kV circuit breaker "9-14" with 3150A SF6 circuit breaker. ComEd (\$3.27 M)
- Perform sag study mitigation work on the Dumont-Stillwell 345 kV line (remove a center-pivot irrigation system from under the line, allowing for the normal and emergency ratings of the line to increase). – AEP (\$0.22 M)
- Upgrade the limiting element at Stillwell or Dumont substation to increase the rating of the Stillwell-Dumont 345 kV line to match conductor rating. – AEP (\$2 M)

(continued on next slide)





**Proposed Solution:** (continued from previous slide)

- Upgrade the existing terminal equipment (substation conductor) at St. John on the existing Crete to St. John 345 kV line with bundled 2x1590 ACSR Lapwing – NIPSCO (\$2 M)
- Upgrade the existing terminal equipment (substation conductor) at Green Acres on the existing St. John to Green Acres 345 kV line with bundled 2x1590 ACSR Lapwing – NIPSCO (\$2 M)
- Perform a sag study on the Olive University Park 345kV line to increase the operating temperature to 225 F. Remediation work includes two tower replacements on the line. – AEP (\$1.5 M)

**Ancillary Benefits:** Addresses aging infrastructure on ComEd's section of Crete-St. John 345 kV double circuit (5 miles), NEET's section of Crete-St. John 345 kV line (6.95 miles) and ComEd's 345 kV double circuit extending from Crete to East Frankfort (12.7 miles).

Total Estimated Cost: \$73.88 M Required IS Date: 12/1/2026 Projected IS Date: 12/1/2026





#### SN/SE/WN/WE (MVA) Ratings

Facility	Existing	Preliminary
Stillwell-Dumont 345 kV	1075/1075/1532/1532	1408/1887/1780/2143

#### SN/SE/SSTE/SLD WN/WE/WSTE/WLD (MVA) Ratings

Facility	Existing	Preliminary
Crete-St. John 345 kV	1091/1399/1483/1508 1310/1557/1658/1772	1679/2058/2107/2280 2091/2381/2390/2390
E. Frankfort-Crete 345 kV	1091/1399/1483/1674 1310/1557/1658/1873	1679/2058/2107/2280 2091/2381/2445/2648
E. Frankfort-University Park N 345 kV	1091/1399/1483/1674 1310/1557/1658/1873	1679/2058/2107/2280 2091/2381/2445/2648
University Park N-Olive 345 kV	971/971/1001 1234/1234/1272	N/A
St. John-Olive 345 kV	N/A	971/971/NP*/NP* 1234/1234/NP*/NP*
University Park N-St. John Tap 345 kV	N/A	1679/2004/NP*/NP* 1976/2142/NP*/NP*
St. John Tap-Green Acre 345 kV	N/A	1958/2390/NP*/NP* 2239/2239/NP*/NP*
Green Acre-Green Acre Tap 345 kV	N/A	1091/1091/NP*/1195 1195/1195/NP*/1195
Green Acre Tap -Olive 345 kV	N/A	971/971/971/1001 1234/1234/NP*/1272

NP\* = Not Provided; **Note**: Ratings in table are as provided in modeling files.