Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AC1-067

Davis Creek—Burnham

February 2017

Network Impacts

The Queue Project AC1-067 was evaluated as a 1254.0 MW (Capacity 1092.0 MW) injection tapping the Davis Creek-Burnham 345kV line substation in the ComEd area. Project AC1-067 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC1-067 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis - 2020

Generator Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

1. (CE - MISO NIPS) The BURNHAM ;0R-17MUNSTER 345 kV line (from bus 270677 to bus 255109 ckt 1) loads from 67.3% to 89.43% (**DC power flow**) of its emergency rating (1195 MVA) for the single line contingency outage of '695_B2'. This project contributes approximately 269.04 MW to the thermal violation.

```
CONTINGENCY '695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1              / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

2. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 93.57% to 98.61% (**DC power flow**) of its normal rating (971 MVA) for the single line contingency outage of '695_B2'. This project contributes approximately 108.61 MW to the thermal violation.

```
CONTINGENCY '695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1              / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

Multiple Facility Contingency

(Double Circuit Tower Line, Fault with a Stuck Breaker, and Bus Fault contingencies for the full energy output)

None

Contribution to Previously Identified Overloads

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

1. (AEP - AEP) The X2-052 TAP-05DUMONT 345 kV line (from bus 247610 to bus 243219 ckt 2) loads from 105.16% to 105.41% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of '112-65-BT4-5__'. This project contributes approximately 97.19 MW to the thermal violation.

```
CONTINGENCY '112-65-BT4-5__'
 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1          / WILTO; 765 05DUMONT 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1          / WILTO;4M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1          / WILTO;4M 345 WILTO; R 345
 TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1          / WILTO;4M 345 WILTO;4C 33
 END
```

Please refer to Appendix 1 for a table containing the generators having contribution to this flowgate.

2. (AEP - AEP) The X2-052 TAP-05DUMONT 345 kV line (from bus 247610 to bus 243219 ckt 2) loads from 105.15% to 105.41% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of '112-65-BT3-4__'. This project contributes approximately 97.19 MW to the thermal violation.

```
CONTINGENCY '112-65-BT3-4__'
 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1          / WILTO; 765 05DUMONT 765
 TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1          / WILTO;3M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1          / WILTO;3M 345 WILTO; B 345
 TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1          / WILTO;3M 345 WILTO;3C 33
 END
```

3. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 151.89% to 153.7% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of '2978_C2_05DUMONT 765-B_A'. This project contributes approximately 224.58 MW to the thermal violation.

```
CONTINGENCY '2978_C2_05DUMONT 765-B_A'
 OPEN BRANCH FROM BUS 243206 TO BUS 920251 CKT 1          / 243206 05DUMONT 765 920251 X1-020 TAP 765 1
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Please refer to Appendix 2 for a table containing the generators having contribution to this flowgate.

4. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 101.76% to 116.07% (**DC power flow**) of its normal rating (1409 MVA) for the single line contingency outage of '695_B2'. This project contributes approximately 201.64 MW to the thermal violation.

```
CONTINGENCY '695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

5. (CE - MISO NIPS) The BURNHAM ;0R-17MUNSTER 345 kV line (from bus 270677 to bus 255109 ckt 1) loads from 113.09% to 123.35% (**DC power flow**) of its emergency rating (1195 MVA) for the line fault with failed breaker contingency outage of '2978_C2_05DUMONT 765-B_A'. This project contributes approximately 307.58 MW to the thermal violation.

```
CONTINGENCY '2978_C2_05DUMONT 765-B_A'
 OPEN BRANCH FROM BUS 243206 TO BUS 920251 CKT 1          / 243206 05DUMONT 765 920251 X1-020 TAP 765 1
```

```
OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
END
```

Please refer to Appendix 3 for a table containing the generators having contribution to this flowgate.

6. (CE - CE) The WILTON ; B-WILTON ;3M 345 kV line (from bus 270926 to bus 275232 ckt 1) loads from 122.59% to 123.41% (**DC power flow**) of its emergency rating (1601 MVA) for the line fault with failed breaker contingency outage of '112-65-BT5-6__'. This project contributes approximately 181.77 MW to the thermal violation.

```
CONTINGENCY '112-65-BT5-6__'
 TRIP BRANCH FROM BUS 270644 TO BUS 270607 CKT 1          / WILTO; 765 COLLI; 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1          / WILTO;4M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1          / WILTO;4M 345 WILTO; R 345
 TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1          / WILTO;4M 345 WILTO;4C 33
 END
```

Please refer to Appendix 4 for a table containing the generators having contribution to this flowgate.

7. (CE - CE) The WILTON ; R-WILTON ;4M 345 kV line (from bus 270927 to bus 275233 ckt 1) loads from 126.65% to 127.49% (**DC power flow**) of its emergency rating (1601 MVA) for the line fault with failed breaker contingency outage of '112-65-BT2-3__'. This project contributes approximately 185.81 MW to the thermal violation.

```
CONTINGENCY '112-65-BT2-3__'
 TRIP BRANCH FROM BUS 270644 TO BUS 270607 CKT 1          / WILTO; 765 COLLI; 765
 TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1          / WILTO;3M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1          / WILTO;3M 345 WILTO; B 345
 TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1          / WILTO;3M 345 WILTO;3C 33
 END
```

Please refer to Appendix 5 for a table containing the generators having contribution to this flowgate.

8. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 124.88% to 125.68% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of '2978_C2_05DUMONT 765-B_A'. This project contributes approximately 123.36 MW to the thermal violation.

```
CONTINGENCY '2978_C2_05DUMONT 765-B_A'
 OPEN BRANCH FROM BUS 243206 TO BUS 920251 CKT 1          / 243206 05DUMONT 765 920251 X1-020 TAP 765 1
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Please refer to Appendix 6 for a table containing the generators having contribution to this flowgate.

9. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 124.25% to 125.07% (**DC power flow**) of its emergency rating (971 MVA) for the

line fault with failed breaker contingency outage of '112-65-BT4-5__'. This project contributes approximately 124.71 MW to the thermal violation.

```
CONTINGENCY '112-65-BT4-5__'
 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1          / WILTO; 765 05DUMONT 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1          / WILTO;4M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1          / WILTO;4M 345 WILTO; R 345
 TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1          / WILTO;4M 345 WILTO;4C 33
 END
```

10. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 124.22% to 125.04% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of '112-65-BT3-4__'. This project contributes approximately 124.71 MW to the thermal violation.

```
CONTINGENCY '112-65-BT3-4__'
 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1          / WILTO; 765 05DUMONT 765
 TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1          / WILTO;3M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1          / WILTO;3M 345 WILTO; B 345
 TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1          / WILTO;3M 345 WILTO;3C 33
 END
```

Steady-State Voltage Requirements

(Results of the steady-state voltage studies should be inserted here)

To be determined

Short Circuit

(Summary of impacted circuit breakers)

Two breakers were identified as overloaded due to this project:

Bus Number	Bus Name	BREAKER	Rating Type	Breaker Capacity (Amps)	Duty Percent With AC1-067	Duty Percent Without AC1-067	Duty Percent Difference	Duty Amps With AC1-067	Duty Amps Without AC1-067
0	DaviCrk B3 138.kV	86 8604	S	49858.2	101.24%	96.33%	4.91%	50475.3	48028.2
0	DaviCrk B4 138.kV	86 8605	S	49858.2	100.55%	95.66%	4.89%	50131.6	47695.1

Affected System Analysis & Mitigation

MISO Impacts:

MISO Impacts to be determined during later study phases (as applicable).

Delivery of Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.
Only the most severely overloaded conditions are listed. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed, which will study all overload conditions associated with the overloaded element(s) identified.

1. (AEP - AEP) The X2-052 TAP-05DUMONT 345 kV line (from bus 247610 to bus 243219 ckt 2) loads from 105.02% to 105.28% (**DC power flow**) of its normal rating (1409 MVA) for the single line contingency outage of '695_B2'. This project contributes approximately 97.2 MW to the thermal violation.

```
CONTINGENCY '695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

2. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 147.93% to 149.34% (**DC power flow**) of its normal rating (1409 MVA) for the single line contingency outage of '695_B2'. This project contributes approximately 231.55 MW to the thermal violation.

```
CONTINGENCY '695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

3. (CE - MISO NIPS) The BURNHAM ;0R-17MUNSTER 345 kV line (from bus 270677 to bus 255109 ckt 1) loads from 112.23% to 122.54% (**DC power flow**) of its emergency rating (1195 MVA) for the single line contingency outage of '695_B2'. This project contributes approximately 308.95 MW to the thermal violation.

```
CONTINGENCY '695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

4. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 123.82% to 124.65% (**DC power flow**) of its normal rating (971 MVA) for the single line contingency outage of '695_B2'. This project contributes approximately 124.72 MW to the thermal violation.

```
CONTINGENCY '695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

5. (AEP - AEP) The AC1-225 TAP-05MARYSV 765 kV line (from bus 927280 to bus 242928 ckt 1) loads from 96.87% to 97.84% (**DC power flow**) of its normal rating (4249 MVA) for the single line contingency outage of '8649_B2_TOR546'. This project contributes approximately 335.28 MW to the thermal violation.

```
CONTINGENCY '8649_B2_TOR546'
 OPEN BRANCH FROM BUS 242924 TO BUS 243208 CKT 1          / 242924 05HANG R 765 243208 05JEFRSO 765 1
 END
```

Light Load Analysis - 2020

Light Load Studies to be conducted during later study phases (as required by PJM Manual 14B).

System Reinforcements

Short Circuit

(Summary form of Cost allocation for breakers will be inserted here if any)

A preliminary cost estimate to upgrade the two 138kV circuit breakers (L8604 & L8605) is $4M with a construction timeline of 24-30 months.

Stability and Reactive Power Requirement

(Results of the dynamic studies should be inserted here)

To be determined

Summer Peak Load Flow Analysis Reinforcements

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)

Generator Deliverability

1. (CE - MISO NIPS) The BURNHAM ;0R-17MUNSTER 345 kV line (from bus 270677 to bus 255109 ckt 1) loads from 67.3% to 89.43% (**DC power flow**) of its emergency rating (1195 MVA) for the single line contingency outage of '695_B2'. This project contributes approximately 269.04 MW to the thermal violation.

ComEd: ComEd 345kV L17703 SSTE rating is 1251 MVA. No upgrade is required.

NIPSCO (MISO) will have to evaluate this violation during the SIS phase.

2. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 93.57% to 98.61% (**DC power flow**) of its normal rating (971 MVA) for the single line contingency outage of '695_B2'. This project contributes approximately 108.61 MW to the thermal violation.

Comed: ComEd 345kV L97008 SLD is 1237 MVA and the ALDR is 1423 MVA. No upgrade required.

AEP
Reinforcement: A sag check will be required for the AEP owned section of the Olive - University Park (CE) 345 kV line to determine if the line section can be operated above its emergency rating of 971 MVA. The result could prove that no additional upgrades are necessary, that some upgrades on the circuit are necessary, or that the entire 40.61 mile section of line would need to be rebuilt. Estimated Cost for the Sag Study: $162,440. Estimated Cost to reconductor/rebuild AEP section of line: $81,220,000. S/N: 971 MVA S/E: 1318 MVA
Cost: $81,382,440
Time: 6-12 months, sag study. 36-48 months, reconductor/rebuild

Contribution to Previously Identified System Reinforcements
(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)
(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)

1. (AEP - AEP) The X2-052 TAP-05DUMONT 345 kV line (from bus 247610 to bus 243219 ckt 2) loads from 105.16% to 105.41% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of '112-65-BT4-5__'. This project contributes approximately 97.19 MW to the thermal violation.

Reinforcement: A sag check will be required for the ACSR ~ 954 ~ 45/7 ~ RAIL Conductor Section 1 to determine if the line section can be operated above its emergency rating of 1409 MVA. The result could prove that no additional upgrades are necessary, that some upgrades on the circuit are necessary, or that the entire 14 mile section of line would need to be rebuilt. Estimated Cost for the Sag Study: $56,000. If deemed necessary to rebuild section of line, Estimated Cost: $28,000,000. S/N: 1409 MVA S/E: 1868 MVA
Cost: $28,056,000
Time: 6-12 months, sag study. 24-36 months, rebuild.

Please refer to Appendix 1 for a table containing the generators having contribution to this flowgate.

2. (AEP - AEP) The X2-052 TAP-05DUMONT 345 kV line (from bus 247610 to bus 243219 ckt 2) loads from 105.15% to 105.41% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of '112-65-BT3-4__'. This project contributes approximately 97.19 MW to the thermal violation.

Same as Contribution to Previously Identified Overload #1

3. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 151.89% to 153.7% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of '2978_C2_05DUMONT 765-B_A'. This project contributes approximately 224.58 MW to the thermal violation.

NIPSCO (MISO) will have to evaluate this violation during the SIS phase.

AEP
Reinforcement: Reconductor/Rebuild 9 mile section of line. Estimated Cost: $18,000,000. Replace the Dumont Wavetrap (2500 A): Estimated cost: $500,000. Replace the Dumont Line Riser (2500 A): Estimated cost: $100,000. S/N: 2387 MVA S/E: 2387 MVA
Cost: $18,600,000
Time: 24-36 months

Please refer to Appendix 2 for a table containing the generators having contribution to this flowgate.

4. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 101.76% to 116.07% (**DC power flow**) of its normal rating (1409 MVA) for the single line contingency outage of '695_B2'. This project contributes approximately 201.64 MW to the thermal violation.

Same as Contribution to Previously Identified Overload #3

5. (CE - MISO NIPS) The BURNHAM ;0R-17MUNSTER 345 kV line (from bus 270677 to bus 255109 ckt 1) loads from 113.09% to 123.35% (**DC power flow**) of its emergency rating (1195 MVA) for the line fault with failed breaker contingency outage of '2978_C2_05DUMONT 765-B_A'. This project contributes approximately 307.58 MW to the thermal violation.

Comed: ComEd Transmission Planning Comments-ComEd 345kV L7703 SLD rating is 1367 MVA and the ALDR is 1572 MVA. No upgrade is required.

NIPSCO (MISO) will have to evaluate this violation during the SIS phase.

Please refer to Appendix 3 for a table containing the generators having contribution to this flowgate.

6. (CE - CE) The WILTON ; B-WILTON ;3M 345 kV line (from bus 270926 to bus 275232 ckt 1) loads from 122.59% to 123.41% (**DC power flow**) of its emergency rating (1601 MVA) for the line fault with failed breaker contingency outage of '112-65-BT5-6__'. This project contributes approximately 181.77 MW to the thermal violation.

Reinforcement: ComEd Tr. 93 SLD is 1601 MVA with an ALDR rating of 1841 MVA. The post contingency flow for this event is exceeds the ALDR rating. The proposed upgrade will be to construct the 765kV bus at Wilton Center to the ultimate layout. Install 2-345kV Bus Tie Circuit Breakers (BT7-8 & 1-8). Relocate 765kV L11216 from 765kV Bus 6 to Bus 8.
Cost: $15.5M
Time: 30 months

Please refer to Appendix 4 for a table containing the generators having contribution to this flowgate.

7. (CE - CE) The WILTON ; R-WILTON ;4M 345 kV line (from bus 270927 to bus 275233 ckt 1) loads from 126.65% to 127.49% (**DC power flow**) of its emergency rating (1601 MVA) for the line fault with failed breaker contingency outage of '112-65-BT2-3__'. This project contributes approximately 185.81 MW to the thermal violation.

Same as Contribution to Previously Identified Overload #6

Please refer to Appendix 5 for a table containing the generators having contribution to this flowgate.

8. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 124.88% to 125.68% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of '2978_C2_05DUMONT 765-B_A'. This project contributes approximately 123.36 MW to the thermal violation.

Comed: ComEd 345kV L97008 SLD is 1237 MVA and the ALDR is 1423 MVA. No upgrade required.

AEP
Reinforcement: A sag check will be required for the AEP owned section of the Olive - University Park (CE) 345 kV line to determine if the line section can be operated above its emergency rating of 971 MVA. The result could prove that no additional upgrades are necessary, that some upgrades on the circuit are necessary, or that the entire 40.61 mile section of line would need to be rebuilt. Estimated Cost for the Sag Study: $162,440. Estimated Cost to reconductor/rebuild AEP section of line: $81,220,000. S/N: 971 MVA S/E: 1318 MVA
Cost: $81,382,440
Time: 6-12 months, sag study. 36-48 months, reconductor/rebuild

Please refer to Appendix 6 for a table containing the generators having contribution to this flowgate.

9. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 124.25% to 125.07% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of '112-65-BT4-5__'. This project contributes approximately 124.71 MW to the thermal violation.

Same as Contribution to Previously Identified Overload #8

10. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 124.22% to 125.04% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of '112-65-BT3-4__'. This project contributes approximately 124.71 MW to the thermal violation.

Same as Contribution to Previously Identified Overload #8

Light Load Load Flow Analysis Reinforcements

New System Reinforcements
(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)

To be determined in System Impact Study phase

Contribution to Previously Identified System Reinforcements
(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)
(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)

To be determined in System Impact Study phase

Network Impacts for Option 2

The Queue Project AC1-067 was evaluated as a 1254.0 MW (Capacity 1092.0 MW) injection tapping the Bloom-Burnham 345kV line in the ComEd area. Project AC1-067 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC1-067 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis - 2020

Generator Deliverability
(Single or N-1 contingencies for the Capacity portion only of the interconnection)

1. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 93.38% to 98.18% (**DC power flow**) of its normal rating (971 MVA) for the single line contingency outage of '695_B2'. This project contributes approximately 103.51 MW to the thermal violation.

```
CONTINGENCY '695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

Multiple Facility Contingency
(Double Circuit Tower Line, Fault with a Stuck Breaker, and Bus Fault contingencies for the full energy output)

1. (CE - MISO NIPS) The BURNHAM ; B-17SHEFFIELD 345 kV line (from bus 270674 to bus 255111 ckt 1) loads from 90.14% to 101.94% (**DC power flow**) of its emergency rating (1441 MVA) for the line fault with failed breaker contingency outage of '2978_C2_05DUMONT 765-B_A'. This project contributes approximately 335.56 MW to the thermal violation.

```
CONTINGENCY '2978_C2_05DUMONT 765-B_A'
 OPEN BRANCH FROM BUS 243206 TO BUS 920251 CKT 1          / 243206 05DUMONT 765 920251 X1-020 TAP 765 1
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Contribution to Previously Identified Overloads
(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

1. (AEP - AEP) The X2-052 TAP-05DUMONT 345 kV line (from bus 247610 to bus 243219 ckt 2) loads from 105.11% to 105.32% (**DC power flow**) of its emergency rating (1409 MVA)

for the line fault with failed breaker contingency outage of '112-65-BT4-5__'. This project contributes approximately 93.47 MW to the thermal violation.

```
CONTINGENCY '112-65-BT4-5__'
 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1          / WILTO; 765 05DUMONT 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1          / WILTO;4M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1          / WILTO;4M 345 WILTO; R 345
 TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1          / WILTO;4M 345 WILTO;4C 33
 END
```

2. (AEP - AEP) The X2-052 TAP-05DUMONT 345 kV line (from bus 247610 to bus 243219 ckt 2) loads from 105.1% to 105.31% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of '112-65-BT3-4__'. This project contributes approximately 93.47 MW to the thermal violation.

```
CONTINGENCY '112-65-BT3-4__'
 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1          / WILTO; 765 05DUMONT 765
 TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1          / WILTO;3M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1          / WILTO;3M 345 WILTO; B 345
 TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1          / WILTO;3M 345 WILTO;3C 33
 END
```

3. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 152.19% to 154.07% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of '2978_C2_05DUMONT 765-B_A'. This project contributes approximately 230.9 MW to the thermal violation.

```
CONTINGENCY '2978_C2_05DUMONT 765-B_A'
 OPEN BRANCH FROM BUS 243206 TO BUS 920251 CKT 1          / 243206 05DUMONT 765 920251 X1-020 TAP 765 1
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

4. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 102.97% to 117.68% (**DC power flow**) of its normal rating (1409 MVA) for the single line contingency outage of '695_B2'. This project contributes approximately 207.23 MW to the thermal violation.

```
CONTINGENCY '695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

5. (CE - CE) The WILTON ; B-WILTON ;3M 345 kV line (from bus 270926 to bus 275232 ckt 1) loads from 122.68% to 123.55% (**DC power flow**) of its emergency rating (1601 MVA) for the line fault with failed breaker contingency outage of '112-65-BT5-6__'. This project contributes approximately 186.68 MW to the thermal violation.

```
CONTINGENCY '112-65-BT5-6__'
 TRIP BRANCH FROM BUS 270644 TO BUS 270607 CKT 1          / WILTO; 765 COLLI; 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1          / WILTO;4M 345 WILTO; 765
```

```
 TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1          / WILTO;4M 345 WILTO; R 345
 TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1          / WILTO;4M 345 WILTO;4C 33
 END
```

6. (CE - CE) The WILTON ; R-WILTON ;4M 345 kV line (from bus 270927 to bus 275233 ckt 1) loads from 126.74% to 127.62% (**DC power flow**) of its emergency rating (1601 MVA) for the line fault with failed breaker contingency outage of '112-65-BT2-3__'. This project contributes approximately 190.62 MW to the thermal violation.

```
CONTINGENCY '112-65-BT2-3__'
 TRIP BRANCH FROM BUS 270644 TO BUS 270607 CKT 1          / WILTO; 765 COLLI; 765
 TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1          / WILTO;3M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1          / WILTO;3M 345 WILTO; B 345
 TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1          / WILTO;3M 345 WILTO;3C 33
 END
```

7. (CE - MISO NIPS) The CRETE EC ;BP-17STJOHN 345 kV line (from bus 274750 to bus 255112 ckt 1) loads from 101.31% to 104.15% (**DC power flow**) of its emergency rating (1399 MVA) for the single line contingency outage of '695_B2'. This project contributes approximately 109.15 MW to the thermal violation.

```
CONTINGENCY '695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

8. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 124.77% to 125.09% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of '2978_C2_05DUMONT 765-B_A'. This project contributes approximately 117.49 MW to the thermal violation.

```
CONTINGENCY '2978_C2_05DUMONT 765-B_A'
 OPEN BRANCH FROM BUS 243206 TO BUS 920251 CKT 1          / 243206 05DUMONT 765 920251 X1-020 TAP 765 1
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

9. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 124.12% to 124.66% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of '112-65-BT4-5__'. This project contributes approximately 118.83 MW to the thermal violation.

```
CONTINGENCY '112-65-BT4-5__'
 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1          / WILTO; 765 05DUMONT 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1          / WILTO;4M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1          / WILTO;4M 345 WILTO; R 345
 TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1          / WILTO;4M 345 WILTO;4C 33
 END
```

10. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 124.09% to 124.63% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of '112-65-BT3-4__'. This project contributes approximately 118.83 MW to the thermal violation.

```
CONTINGENCY '112-65-BT3-4__'
 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1          / WILTO; 765 05DUMONT 765
 TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1          / WILTO;3M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1          / WILTO;3M 345 WILTO; B 345
 TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1          / WILTO;3M 345 WILTO;3C 33
 END
```

11. (LGEE - OVEC) The 7TRIMBLE-06CLIFTY 345 kV line (from bus 324114 to bus 248000 ckt 1) loads from 173.85% to 173.85% (**DC power flow**) of its emergency rating (1370 MVA) for the single line contingency outage of '363_B2_TOR1682'. This project contributes approximately 0.0 MW to the thermal violation.

```
CONTINGENCY '363_B2_TOR1682'
 OPEN BRANCH FROM BUS 243208 TO BUS 243209 CKT 1          / 243208 05JEFRSO 765 243209 05ROCKPT 765 1
 END
```

12. (LGEE - OVEC) The 7TRIMBLE-06CLIFTY 345 kV line (from bus 324114 to bus 248000 ckt 1) loads from 120.12% to 120.12% (**DC power flow**) of its normal rating (1134 MVA) for non-contingency condition. This project contributes approximately 0.0 MW to the thermal violation.

13. (LGEE - OVEC) The 7TRIMBLE-06CLIFTY 345 kV line (from bus 324114 to bus 248000 ckt 1) loads from 106.12% to 106.12% (**DC power flow**) of its emergency rating (1370 MVA) for the single line contingency outage of '4812_B2_TOR8931'. This project contributes approximately 0.0 MW to the thermal violation.

```
CONTINGENCY '4812_B2_TOR8931'
 OPEN BRANCH FROM BUS 242921 TO BUS 242924 CKT 1          / 242921 05CORNU
765 242924 05HANG R 765 1
 END
```

14. (MISO AMIL - MISO AMIL) The 7NEWTON-7CASEY 345 kV line (from bus 347830 to bus 346809 ckt 1) loads from 110.7% to 110.7% (**DC power flow**) of its normal rating (1200 MVA) for non-contingency condition. This project contributes approximately 0.0 MW to the thermal violation.

15. (MISO AMIL - MISO AMIL) The 7NEWTON-7CASEY 345 kV line (from bus 347830 to bus 346809 ckt 1) loads from 106.4% to 106.4% (**DC power flow**) of its emergency rating (1319

MVA) for the line fault with failed breaker contingency outage of 'H1TH3'. This project contributes approximately 0.0 MW to the thermal violation.

```
CONTINGENCY 'H1TH3'                    /* BATH CO.
 REMOVE MACHINE 5 FROM BUS 315205              /*BATH UNIT #5
 REMOVE MACHINE 6 FROM BUS 315206              /*BATH UNIT #6
 REMOVE MACHINE 1 FROM BUS 315201              /*BATH UNIT #1
 REMOVE MACHINE 2 FROM BUS 315202              /*BATH UNIT #2
 END
```

16. (MISO AMIL - MISO AMIL) The 7NEWTON-7CASEY 345 kV line (from bus 347830 to bus 346809 ckt 1) loads from 106.23% to 106.23% (**DC power flow**) of its emergency rating (1319 MVA) for the single line contingency outage of 'P04'. This project contributes approximately 0.0 MW to the thermal violation.

```
CONTINGENCY 'P04'
 DISCONNECT BUS 200122                 /*
 DISCONNECT BUS 200192                 /*
 DISCONNECT BUS 200193                 /*
 DISCONNECT BUS 200194                 /*
 DISCONNECT BUS 200195                 /*
 END
```

17. (MISO AMIL - MISO AMIL) The 7NEWTON-7CASEY 345 kV line (from bus 347830 to bus 346809 ckt 1) loads from 106.05% to 106.05% (**DC power flow**) of its emergency rating (1319 MVA) for the single line contingency outage of 'SPS-2105&U1___'. This project contributes approximately 0.0 MW to the thermal violation.

```
CONTINGENCY 'SPS-2105&U1___'
 TRIP BRANCH FROM BUS 270797 TO BUS 347945 CKT 1          / KINCA; R 345 7PANA 345
 TRIP BRANCH FROM BUS 347945 TO BUS 346895 CKT 1          / 7PANA 345 7COFFEEN 345
 REMOVE UNIT 1 FROM BUS 274650                  / KINCA;1U 20
 END
```

Steady-State Voltage Requirements

(Results of the steady-state voltage studies should be inserted here)

To be determined

Short Circuit

(Summary of impacted circuit breakers)

To be determined

Affected System Analysis & Mitigation

MISO Impacts:

MISO Impacts to be determined during later study phases (as applicable).

Delivery of Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.
Only the most severely overloaded conditions are listed. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed, which will study all overload conditions associated with the overloaded element(s) identified.

1. (AEP - AEP) The X2-052 TAP-05DUMONT 345 kV line (from bus 247610 to bus 243219 ckt 2) loads from 104.98% to 105.19% (**DC power flow**) of its normal rating (1409 MVA) for the single line contingency outage of '695_B2'. This project contributes approximately 93.5 MW to the thermal violation.

```
CONTINGENCY '695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

2. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 148.23% to 149.7% (**DC power flow**) of its normal rating (1409 MVA) for the single line contingency outage of '695_B2'. This project contributes approximately 237.97 MW to the thermal violation.

```
CONTINGENCY '695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

3. (CE - MISO NIPS) The BURNHAM ; B-17SHEFFIELD 345 kV line (from bus 270674 to bus 255111 ckt 1) loads from 89.49% to 101.34% (**DC power flow**) of its emergency rating (1441 MVA) for the single line contingency outage of '695_B2'. This project contributes approximately 336.82 MW to the thermal violation.

```
CONTINGENCY '695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

4. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 123.71% to 124.25% (**DC power flow**) of its normal rating (971 MVA) for the single line contingency outage of '695_B2'. This project contributes approximately 118.87 MW to the thermal violation.

```
CONTINGENCY '695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

5. (LGEE - OVEC) The 7TRIMBLE-06CLIFTY 345 kV line (from bus 324114 to bus 248000 ckt 1) loads from 184.81% to 184.81% (**DC power flow**) of its emergency rating (1370 MVA) for the single line contingency outage of '363_B2_TOR1682'. This project contributes approximately 0.0 MW to the thermal violation.

```
CONTINGENCY '363_B2_TOR1682'
 OPEN BRANCH FROM BUS 243208 TO BUS 243209 CKT 1              / 243208 05JEFRSO 765 243209 05ROCKPT 765 1
 END
```

6. (LGEE - OVEC) The 7TRIMBLE-06CLIFTY 345 kV line (from bus 324114 to bus 248000 ckt 1) loads from 117.01% to 117.01% (**DC power flow**) of its normal rating (1134 MVA) for non-contingency condition. This project contributes approximately 0.0 MW to the thermal violation.

7. (MISO AMIL - MISO AMIL) The 7NEWTON-7CASEY 345 kV line (from bus 347830 to bus 346809 ckt 1) loads from 110.7% to 110.7% (**DC power flow**) of its normal rating (1200 MVA) for non-contingency condition. This project contributes approximately 0.0 MW to the thermal violation.

8. (MISO AMIL - MISO AMIL) The 7NEWTON-7CASEY 345 kV line (from bus 347830 to bus 346809 ckt 1) loads from 106.05% to 106.05% (**DC power flow**) of its emergency rating (1319 MVA) for the single line contingency outage of 'SPS-2105&U1___'. This project contributes approximately 0.0 MW to the thermal violation.

```
CONTINGENCY 'SPS-2105&U1___'
 TRIP BRANCH FROM BUS 270797 TO BUS 347945 CKT 1              / KINCA; R 345 7PANA 345
 TRIP BRANCH FROM BUS 347945 TO BUS 346895 CKT 1              / 7PANA 345 7COFFEEN 345
 REMOVE UNIT 1 FROM BUS 274650                        / KINCA;1U 20
 END
```

9. (AEP - AEP) The AC1-225 TAP-05MARYSV 765 kV line (from bus 927280 to bus 242928 ckt 1) loads from 96.9% to 97.86% (**DC power flow**) of its normal rating (4249 MVA) for the single line contingency outage of '8649_B2_TOR546'. This project contributes approximately 335.24 MW to the thermal violation.

```
CONTINGENCY '8649_B2_TOR546'
 OPEN BRANCH FROM BUS 242924 TO BUS 243208 CKT 1              / 242924 05HANG R 765 243208 05JEFRSO 765 1
 END
```

Light Load Analysis - 2020

Light Load Studies to be conducted during later study phases (as required by PJM Manual 14B).

System Reinforcements

Short Circuit

(Summary form of Cost allocation for breakers will be inserted here if any)

To be determined

Stability and Reactive Power Requirement

(Results of the dynamic studies should be inserted here)

To be determined