

***Generation Interconnection  
Feasibility Study Report***

***For***

***PJM Generation Interconnection Request  
Queue Position AC2-087***

***Buckskin 69kV***

**October 2017**

## Preface

The intent of the feasibility study is to determine a plan, with ballpark cost and construction time estimates, to connect the subject generation to the PJM network at a location specified by the Interconnection Customer. The Interconnection Customer may request the interconnection of generation as a capacity resource or as an energy-only resource. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: (1) Direct Connections, which are new facilities and/or facilities upgrades needed to connect the generator to the PJM network, and (2) Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system.

In some instances a generator interconnection may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection, may also contribute to the need for the same network reinforcement. The possibility of sharing the reinforcement costs with other projects may be identified in the feasibility study, but the actual allocation will be deferred until the impact study is performed.

The Feasibility Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. The project developer is responsible for the right of way, real estate, and construction permit issues. For properties currently owned by Transmission Owners, the costs may be included in the study.

## General

The Interconnection Customer (IC) proposes to install PJM Project #AC2-087, an 85.0 MW (47.4 MW Capacity) solar generating facility in Ross County, Ohio (see Figure 2). The primary point of interconnection is a direct connection to AEP's Buckskin 69 kV substation (see Figure 1). The secondary point of interconnection is to tap the Buckskin – Greenfield 69 kV circuit in the DP&L area.

The requested in service date is May 31, 2019.

## Attachment Facilities

### Primary Point of Interconnection (Buckskin 69kV substation)

To accommodate the interconnection at the Buckskin 69 kV substation, the substation will have to be expanded requiring the installation of two (2) new 69 kV circuit breakers (see Figure 1). Installation of associated protection and control equipment, 69 kV line risers, SCADA, and 69 kV revenue metering will also be required.

#### Direct Connection at the Buckskin 69 kV Substation Work and Cost:

- Expand the substation requiring the installation of two (2) new 69 kV circuit breakers (see Figure 1). Installation of associated protection and control equipment, 69 kV line risers, SCADA, and 69 kV revenue metering will also be required.
- **Estimated Station Cost: \$1,000,000**

## Non-Direct Connection Cost Estimate

The total preliminary cost estimate for Non-Direct Connection work is given in the following table below:

For AEP building Non-Direct Connection cost estimates:

| Description                                                            | Estimated Cost   |
|------------------------------------------------------------------------|------------------|
| 69 kV Revenue Metering                                                 | <b>\$200,000</b> |
| Upgrade line protection and controls at the Buckskin 69 kV substation. | <b>\$200,000</b> |
| <b>Total</b>                                                           | <b>\$400,000</b> |

**Table 1**

## **Secondary Point of Interconnection (Buckskin – Greenfield (DP&L) 69 kV)**

DP&L to provide the attachment facilities.

## **Interconnection Customer Requirements**

It is understood that The IC is responsible for all costs associated with this interconnection. The cost of The IC's generating plant and the costs for the line connecting the generating plant to the Buckskin 69 kV substation are not included in this report; these are assumed to be The IC's responsibility.

The Generation Interconnection Agreement does not in or by itself establish a requirement for American Electric Power to provide power for consumption at the developer's facilities. A separate agreement may be reached with the local utility that provides service in the area to ensure that infrastructure is in place to meet this demand and proper metering equipment is installed. It is the responsibility of the developer to contact the local service provider to determine if a local service agreement is required.

Requirement from the PJM Open Access Transmission Tariff:

1. An Interconnection Customer entering the New Services Queue on or after October 1, 2012 with a proposed new Customer Facility that has a Maximum Facility Output equal to or greater than 100 MW shall install and maintain, at its expense, phasor measurement units (PMUs). See Section 8.5.3 of Appendix 2 to the Interconnection Service Agreement as well as section 4.3 of PJM Manual 14D for additional information.
2. The Interconnection Customer may be required to install and/or pay for metering as necessary to properly track real time output of the facility as well as installing metering which shall be used for billing purposes. See Section 8 of Appendix 2 to the Interconnection Service Agreement as well as Section 4 of PJM Manual 14D for additional information.

## **Revenue Metering and SCADA Requirements**

### **PJM Requirements**

The Interconnection Customer will be required to install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for IC's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Sections 24.1 and 24.2.

### **AEP Requirements**

The Interconnection Customer will be required to comply with all AEP Revenue Metering Requirements for Generation Interconnection Customers. The Revenue Metering Requirements may be found within the "Requirements for Connection of New Facilities or Changes to Existing Facilities Connected to the AEP Transmission System" document located at the following link:

<http://www.pjm.com/~media/planning/plan-standards/private-aep/aep-interconnection-requirements.ashx>

# Option 1

## Network Impacts

The Queue Project AC2-087 was evaluated as an 85.0 MW (Capacity 47.4 MW) injection at the Buckskin 69 kV substation in the AEP area. Project AC2-087 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC2-087 was studied with a commercial probability of 53%. Potential network impacts were as follows:

## Summer Peak Analysis – 2020

## Contingency Descriptions

The following contingencies resulted in overloads:

| Option 1                  |                                                                                                                                                                                                                                                                                                                                                 |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Contingency Name          | Description                                                                                                                                                                                                                                                                                                                                     |
| 8123                      | CONTINGENCY '8123'<br><br>OPEN BRANCH FROM BUS 243453 TO BUS 253110 CKT 1 / 243453 05BEATTY 345 253110 09ADKINS<br>345 1<br><br>OPEN BRANCH FROM BUS 243453 TO BUS 253248 CKT 1 / 243453 05BEATTY 345 253248 09SCHARL<br>345 1<br><br>OPEN BRANCH FROM BUS 243453 TO BUS 243469 CKT 3 / 243453 05BEATTY 345 243469 05BEATTY<br>138 3<br><br>END |
| 160_B3                    | CONTINGENCY '160_B3'<br><br>OPEN BRANCH FROM BUS 253110 TO BUS 253100 CKT 1 / 253110 09ADKINS 345 253100 09ATLNTA<br>345 1<br><br>OPEN BRANCH FROM BUS 253100 TO BUS 253099 CKT 1 / 253100 09ATLNTA 345 253099<br>09ATLNTA 69.0 1<br><br>END                                                                                                    |
| 2085_C2_05BEATTY 345-304C | CONTINGENCY '2085_C2_05BEATTY 345-304C'<br><br>OPEN BRANCH FROM BUS 243453 TO BUS 243454 CKT 1 / 243453 05BEATTY 345 243454 05BIXBY<br>345 1<br><br>OPEN BRANCH FROM BUS 243453 TO BUS 253110 CKT 1 / 243453 05BEATTY 345 253110 09ADKINS<br>345 1<br><br>END                                                                                   |
| 5891_B2_TOR607            | CONTINGENCY '5891_B2_TOR607'<br><br>OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB 138 253111 09MIDDLE<br>138 1<br><br>OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111 09MIDDLE 138 253057 09OHH 138<br>1<br><br>END                                                                                                |
| 6764_B2_TOR5300548        | CONTINGENCY '6764_B2_TOR5300548'<br><br>OPEN BRANCH FROM BUS 246888 TO BUS 242938 CKT 1 / 246888 05BIERSR 345 242938 05MARQUI<br>345 1<br><br>END                                                                                                                                                                                               |

| Option 1                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Contingency Name         | Description                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 6774_C2_05MARQUI 345-D   | CONTINGENCY '6774_C2_05MARQUI 345-D'<br><br>OPEN BRANCH FROM BUS 246888 TO BUS 242938 CKT 1 / 246888 05BIERSR 345 242938 05MARQUI<br>345 1<br><br>OPEN BRANCH FROM BUS 242938 TO BUS 253038 CKT 1 / 242938 05MARQUI 345 253038 09KILLEN<br>345 1<br><br>END                                                                                                                                                                                             |
| 6779_C2_05BIERSR 345-D   | CONTINGENCY '6779_C2_05BIERSR 345-D'<br><br>OPEN BRANCH FROM BUS 246888 TO BUS 243454 CKT 1 / 246888 05BIERSR 345 243454 05BIXBY<br>345 1<br><br>OPEN BRANCH FROM BUS 246888 TO BUS 246889 CKT 1 / 246888 05BIERSR 345 246889 05BIERSR<br>138 1<br><br>END                                                                                                                                                                                              |
| 6781_B3_05BIERSR 345-1   | CONTINGENCY '6781_B3_05BIERSR 345-1'<br><br>OPEN BRANCH FROM BUS 246888 TO BUS 246889 CKT 1 / 246888 05BIERSR 345 246889 05BIERSR<br>138 1<br><br>END                                                                                                                                                                                                                                                                                                   |
| 7353_B2_TOR12737         | CONTINGENCY '7353_B2_TOR12737'<br><br>OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 243019 05HILLSB 138 249995 08CLINCO<br>138 1<br><br>OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995 08CLINCO 138 250122<br>08WARRN1 138 1<br><br>END                                                                                                                                                                                                   |
| 762_B2_TOR8072           | CONTINGENCY '762_B2_TOR8072'<br><br>OPEN BRANCH FROM BUS 243453 TO BUS 253110 CKT 1 / 243453 05BEATTY 345 253110 09ADKINS<br>345 1<br><br>END                                                                                                                                                                                                                                                                                                           |
| 7954_C1_05MILLBR 138-2_A | CONTINGENCY '7954_C1_05MILLBR 138-2_A'<br><br>OPEN BRANCH FROM BUS 243042 TO BUS 243088 CKT 1 / 243042 05MILLBR 138 243088 05S POIN<br>138 1<br><br>OPEN BRANCH FROM BUS 243042 TO BUS 931350 CKT 1 / 243042 05MILLBR 138 931350 AC2-049<br>TAP 138 1<br><br>END                                                                                                                                                                                        |
| 7981_A                   | CONTINGENCY '7981_A'<br><br>OPEN BRANCH FROM BUS 243019 TO BUS 931430 CKT 1 / 243019 05HILLSB 138 931430 AC2-061<br>TAP 138 1<br><br>OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB 138 253111 09MIDDLE<br>138 1<br><br>OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995 08CLINCO 138 250122<br>08WARRN1 138 1<br><br>OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111 09MIDDLE 138 253057 09OHH 138<br>1<br><br>END |
| 7981_B                   | CONTINGENCY '7981_B'<br><br>OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061 TAP 138 249995<br>08CLINCO 138 1<br><br>OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB 138 253111 09MIDDLE<br>138 1                                                                                                                                                                                                                     |

| Option 1                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Contingency Name         | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |
|                          | OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995 08CLINCO 138 250122<br>08WARRN1 138 1<br><br>OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111 09MIDDLE 138 253057 09OHH 138<br>1<br><br>END                                                                                                                                                                                                                                                              |  |
| 8108_C2_05HILLSB 138-D_A | CONTINGENCY '8108_C2_05HILLSB 138-D_A'<br><br>OPEN BRANCH FROM BUS 243019 TO BUS 931430 CKT 1 / 243019 05HILLSB 138 931430 AC2-061<br>TAP 138 1<br><br>OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB 138 253111 09MIDDLE<br>138 1<br><br>OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995 08CLINCO 138 250122<br>08WARRN1 138 1<br><br>OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111 09MIDDLE 138 253057 09OHH 138<br>1<br><br>END |  |
| 8109_C2_05HILLSB 138-A_A | CONTINGENCY '8109_C2_05HILLSB 138-A_A'<br><br>OPEN BRANCH FROM BUS 243019 TO BUS 243102 CKT 1 / 243019 05HILLSB 138 243102 05SINKG8<br>138 1<br><br>OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB 138 253111 09MIDDLE<br>138 1<br><br>OPEN BRANCH FROM BUS 931350 TO BUS 243102 CKT 1 / 931350 AC2-049 TAP 138 243102<br>05SINKG8 138 1<br><br>OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111 09MIDDLE 138 253057 09OHH 138<br>1<br><br>END |  |
| 8111_C2_05HILLSB 138-_A  | CONTINGENCY '8111_C2_05HILLSB 138-_A'<br><br>OPEN BRANCH FROM BUS 243019 TO BUS 926100 CKT 1 / 243019 05HILLSB 138 926100 AC1-089<br>TAP 138 1<br><br>OPEN BRANCH FROM BUS 243019 TO BUS 931430 CKT 1 / 243019 05HILLSB 138 931430 AC2-060<br>TAP 138 1<br><br>END                                                                                                                                                                                                        |  |
| 8126_A                   | CONTINGENCY '8126_A'<br><br>OPEN BRANCH FROM BUS 246889 TO BUS 931410 CKT 1 / 246889 05BIERSR 138 931410 AC2-059<br>TAP 138 1<br><br>OPEN BRANCH FROM BUS 246889 TO BUS 246890 CKT 1 / 246889 05BIERSR 138 246890 05HOPETN<br>138 1<br><br>END                                                                                                                                                                                                                            |  |
| 8126_B                   | CONTINGENCY '8126_B'<br><br>OPEN BRANCH FROM BUS 931410 TO BUS 243483 CKT 1 / 931410 AC2-059 TAP 138 243483<br>05CRCLVS 138 1<br><br>OPEN BRANCH FROM BUS 246889 TO BUS 246890 CKT 1 / 246889 05BIERSR 138 246890 05HOPETN<br>138 1<br><br>END                                                                                                                                                                                                                            |  |
| 889_B2                   | CONTINGENCY '889_B2'<br><br>OPEN BRANCH FROM BUS 253100 TO BUS 253077 CKT 1 / 253100 09ATLNTA 345 253077 09STUART<br>345 1                                                                                                                                                                                                                                                                                                                                                |  |

| Option 1                                  |                                                                                                                                                                    |
|-------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Contingency Name                          | Description                                                                                                                                                        |
|                                           | END                                                                                                                                                                |
| DAY_L34552-2                              | CONTINGENCY 'DAY_L34552-2'<br>OPEN LINE FROM BUS 253077 TO BUS 253100 CKT 1 /* 09STUART 345 - 09ATLNTA 345<br>REMOVE UNIT 2 FROM BUS 253077 /* 09STUART 345<br>END |
| OUTAGE_02AB                               | CONTINGENCY 'OUTAGE_02AB'<br>DISCONNECT BRANCH FROM BUS 253111 TO BUS 253057 CKT 1<br>END                                                                          |
| P1-#..B2 WARREN-CLINTONCO-HILLSBORO 2381  | CONTINGENCY 'P1-#..B2 WARREN-CLINTONCO-HILLSBORO 2381'<br>OPEN BUS 249995<br>END                                                                                   |
| P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381 | CONTINGENCY 'P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381'<br>OPEN BRANCH FROM BUS 249995 TO BUS 931430 CKT 1<br>END                                                  |

**Table 2**

### **Generator Deliverability**

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

| Option 1                         |      |                         |               |                                  |        |        |      |    |         |        |        |     |         |         |
|----------------------------------|------|-------------------------|---------------|----------------------------------|--------|--------|------|----|---------|--------|--------|-----|---------|---------|
| AC2-087 Generator Deliverability |      |                         |               |                                  |        |        |      |    |         |        |        |     |         |         |
| Contingency                      |      |                         | Affected Area | Facility Description             | Bus    |        | Cir. | PF | Loading |        | Rating |     | MW Con. | FG App. |
| #                                | Type | Name                    |               |                                  | From   | To     |      |    | Initial | Final  | Type   | MVA |         |         |
| 1                                | Non  | Non                     | AEP - DEO&K   | 05HILLSB-AC2-061 TAP 138 kV line | 243019 | 931430 | 1    | DC | 99.55   | 101.13 | NR     | 159 | 2.52    |         |
| 2                                | N-1  | 6781_B3_05BIER SR 345-1 | AEP - AEP     | 05LATTAVL8-05BIERSRUN 69 kV line | 243608 | 246893 | 1    | DC | 82.34   | 113.18 | ER     | 50  | 15.42   |         |
| 3                                | N-1  | 6764_B2_TOR530 0548     | AEP - AEP     | 05LATTAVL8-05BIERSRUN 69 kV line | 243608 | 246893 | 1    | DC | 74.71   | 106.92 | ER     | 50  | 16.11   |         |
| 4                                | N-1  | 5891_B2_TOR607          | DEO&K - DEO&K | 08CLINCO-08WARRN1 138 kV line    | 249995 | 250122 | 1    | DC | 99.61   | 101.1  | ER     | 198 | 2.94    |         |
| 5                                | N-1  | OUTAGE_02AB             | DEO&K - DEO&K | 08CLINCO-08WARRN1 138 kV line    | 249995 | 250122 | 1    | DC | 99.01   | 100.49 | ER     | 198 | 2.94    |         |

**Table 3**

### **Multiple Facility Contingency**

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

| AC2-087 Multiple Facility Contingency |             |      |               |                      |      |    |      |    |         |       |        |     |         |         |
|---------------------------------------|-------------|------|---------------|----------------------|------|----|------|----|---------|-------|--------|-----|---------|---------|
| #                                     | Contingency |      | Affected Area | Facility Description | Bus  |    | Cir. | PF | Loading |       | Rating |     | MW Con. | FG App. |
|                                       | Type        | Name |               |                      | From | To |      |    | Initial | Final | Type   | MVA |         |         |

| AC2-087 Multiple Facility Contingency |             |                            |               |                                 |        |        |      |    |         |        |             |     |         |         |
|---------------------------------------|-------------|----------------------------|---------------|---------------------------------|--------|--------|------|----|---------|--------|-------------|-----|---------|---------|
| #                                     | Contingency |                            | Affected Area | Facility Description            | Bus    |        | Cir. | PF | Loading |        | Rating Type | MVA | MW Con. | FG App. |
|                                       | Type        | Name                       |               |                                 | From   | To     |      |    | Initial | Final  |             |     |         |         |
| 1                                     | DCTL        | 8123                       | AEP - AEP     | 05BCKSKI-05LATTAVL8 69 kV line  | 243598 | 243608 | 1    | DC | 82.09   | 111.49 | ER          | 100 | 29.39   | 1       |
| 2                                     | LFFB        | 6774_C2_05MAR QUI 345-D    | AEP - AEP     | 05BCKSKI-05LATTAVL8 69 kV line  | 243598 | 243608 | 1    | DC | 76.51   | 105.41 | ER          | 100 | 28.91   |         |
| 3                                     | LFFB        | 6779_C2_05BIER SR 345-D    | AEP - AEP     | 05BCKSKI-05LATTAVL8 69 kV line  | 243598 | 243608 | 1    | DC | 76.7    | 104.36 | ER          | 100 | 27.65   |         |
| 4                                     | LFFB        | 2085_C2_05BEA TTY 345-304C | AEP - AEP     | 05BCKSKI-AC2-055 TAP 69 kV line | 243598 | 931380 | 1    | DC | 92.07   | 146.79 | ER          | 50  | 27.36   | 2       |
| 5                                     | DCTL        | 7981_B                     | AEP - AEP     | 05NMARSS-05SEAMAN 138 kV line   | 247035 | 243571 | 1    | DC | 99.92   | 100.87 | ER          | 310 | 6.56    | 3       |

**Table 4**

### **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)*

| AC2-087 Contribution to Previously Identified Overloads |             |                           |               |                                  |        |        |      |    |         |        |             |     |         |         |
|---------------------------------------------------------|-------------|---------------------------|---------------|----------------------------------|--------|--------|------|----|---------|--------|-------------|-----|---------|---------|
| #                                                       | Contingency |                           | Affected Area | Facility Description             | Bus    |        | Cir. | PF | Loading |        | Rating Type | MVA | MW Con. | FG App. |
|                                                         | Type        | Name                      |               |                                  | From   | To     |      |    | Initial | Final  |             |     |         |         |
| 1                                                       | DCTL        | 7981_B                    | AEP - AEP     | 05HILLSB-05SINKG8 138 kV line    | 243019 | 243102 | 1    | DC | 242.84  | 244.57 | ER          | 185 | 7.12    | 4       |
| 2                                                       | LFFB        | 8108_C2_05HILLSB 138-D_A  | AEP - AEP     | 05HILLSB-05SINKG8 138 kV line    | 243019 | 243102 | 1    | DC | 220.77  | 222.51 | ER          | 185 | 7.12    |         |
| 3                                                       | DCTL        | 7981_A                    | AEP - AEP     | 05HILLSB-05SINKG8 138 kV line    | 243019 | 243102 | 1    | DC | 220.77  | 222.51 | ER          | 185 | 7.12    |         |
| 4                                                       | LFFB        | 8111_C2_05HILLSB 138- A_A | AEP - DAY     | 05HILLSB-09MIDDLE 138 kV line    | 243019 | 253111 | 1    | DC | 169.6   | 170.77 | ER          | 185 | 4.81    | 5       |
| 5                                                       | DCTL        | 7981_B                    | AEP - AEP     | 05HILLSB-AC1-089 TAP 138 kV line | 243019 | 926100 | 1    | DC | 153.15  | 154.53 | ER          | 185 | 5.67    | 6       |
| 6                                                       | LFFB        | 8108_C2_05HILLSB 138-D_A  | AEP - AEP     | 05HILLSB-AC1-089 TAP 138 kV line | 243019 | 926100 | 1    | DC | 135.23  | 136.61 | ER          | 185 | 5.67    |         |
| 7                                                       | DCTL        | 7981_A                    | AEP - AEP     | 05HILLSB-AC1-089 TAP 138 kV line | 243019 | 926100 | 1    | DC | 135.23  | 136.61 | ER          | 185 | 5.67    |         |
| 8                                                       | LFFB        | 8109_C2_05HILLSB 138-A_A  | AEP - DEO&K   | 05HILLSB-AC2-061 TAP 138 kV line | 243019 | 931430 | 1    | DC | 244.23  | 245.98 | ER          | 184 | 7.14    | 7       |
| 9                                                       | BUS         | 7954_C1_05MILLBR 138-2_A  | AEP - DEO&K   | 05HILLSB-AC2-061 TAP 138 kV line | 243019 | 931430 | 1    | DC | 214.12  | 215.55 | ER          | 184 | 5.84    |         |
| 10                                                      | N-1         | 5891_B2_TOR607            | AEP - DEO&K   | 05HILLSB-AC2-061 TAP 138 kV line | 243019 | 931430 | 1    | DC | 109.21  | 110.81 | ER          | 184 | 2.94    |         |
| 11                                                      | N-1         | OUTAGE_02AB               | AEP - DEO&K   | 05HILLSB-AC2-061 TAP 138 kV line | 243019 | 931430 | 1    | DC | 108.61  | 110.21 | ER          | 184 | 2.94    |         |
| 12                                                      | DCTL        | 7981_B                    | AEP - AEP     | 05SINKG8-AC2-049 TAP 138 kV line | 243102 | 931350 | 1    | DC | 249.02  | 250.81 | ER          | 179 | 7.12    | 8       |
| 13                                                      | LFFB        | 8108_C2_05HILLSB 138-D_A  | AEP - AEP     | 05SINKG8-AC2-049 TAP 138 kV line | 243102 | 931350 | 1    | DC | 226.22  | 228.01 | ER          | 179 | 7.12    |         |

**AC2-087 Contribution to Previously Identified Overloads**

| #  | Contingency |                           | Affected Area | Facility Description             | Bus    |        | Cir. | PF | Loading |        | Rating |     | MW Con. | FG App. |
|----|-------------|---------------------------|---------------|----------------------------------|--------|--------|------|----|---------|--------|--------|-----|---------|---------|
|    | Type        | Name                      |               |                                  | From   | To     |      |    | Initial | Final  | Type   | MVA |         |         |
| 14 | DCTL        | 7981_A                    | AEP - AEP     | 05SINKG8-AC2-049 TAP 138 kV line | 243102 | 931350 | 1    | DC | 226.22  | 228.01 | ER     | 179 | 7.12    |         |
| 15 | DCTL        | 7981_B                    | AEP - AEP     | 05ADAMS-05WARERD 138 kV line     | 243464 | 246942 | 1    | DC | 173.25  | 174.73 | ER     | 150 | 4.92    | 9       |
| 16 | LFFB        | 8109_C2_05HILLSB 138-A_A  | AEP - AEP     | 05ADAMS-05WARERD 138 kV line     | 243464 | 246942 | 1    | DC | 166.2   | 167.72 | ER     | 150 | 5.06    |         |
| 17 | LFFB        | 8108_C2_05HILLSB 138-D_A  | AEP - AEP     | 05ADAMS-05WARERD 138 kV line     | 243464 | 246942 | 1    | DC | 160.28  | 161.76 | ER     | 150 | 4.92    |         |
| 18 | DCTL        | 7981_A                    | AEP - AEP     | 05ADAMS-05WARERD 138 kV line     | 243464 | 246942 | 1    | DC | 160.28  | 161.76 | ER     | 150 | 4.92    |         |
| 19 | BUS         | 7954_C1_05MILLBR 138-2_A  | AEP - AEP     | 05ADAMS-05WARERD 138 kV line     | 243464 | 246942 | 1    | DC | 149.44  | 150.78 | ER     | 150 | 4.46    |         |
| 20 | DCTL        | 7981_B                    | AEP - AEP     | 05SEAMAN-05ADAMS 138 kV line     | 243571 | 243464 | 1    | DC | 159.6   | 161.06 | ER     | 150 | 4.88    | 10      |
| 21 | LFFB        | 8109_C2_05HILLSB 138-A_A  | AEP - AEP     | 05SEAMAN-05ADAMS 138 kV line     | 243571 | 243464 | 1    | DC | 151.54  | 153.04 | ER     | 150 | 4.99    |         |
| 22 | LFFB        | 8108_C2_05HILLSB 138-D_A  | AEP - AEP     | 05SEAMAN-05ADAMS 138 kV line     | 243571 | 243464 | 1    | DC | 146.77  | 148.23 | ER     | 150 | 4.88    |         |
| 23 | DCTL        | 7981_A                    | AEP - AEP     | 05SEAMAN-05ADAMS 138 kV line     | 243571 | 243464 | 1    | DC | 146.77  | 148.23 | ER     | 150 | 4.88    |         |
| 24 | BUS         | 7954_C1_05MILLBR 138-2_A  | AEP - AEP     | 05SEAMAN-05ADAMS 138 kV line     | 243571 | 243464 | 1    | DC | 135.71  | 137.03 | ER     | 150 | 4.41    |         |
| 25 | LFFB        | DAY_L34552-2              | AEP - AEP     | 05BCKSKI-AC2-020 TAP 69 kV line  | 243598 | 931130 | 1    | DC | 108.24  | 147.86 | ER     | 72  | 28.53   | 11      |
| 26 | DCTL        | 7981_B                    | AEP - DAY     | 05HIGHLA-09MRTNSV 69 kV line     | 243606 | 253043 | 1    | DC | 126.73  | 131.47 | ER     | 71  | 7.47    | 12      |
| 27 | LFFB        | 8108_C2_05HILLSB 138-D_A  | AEP - DAY     | 05HIGHLA-09MRTNSV 69 kV line     | 243606 | 253043 | 1    | DC | 120.48  | 125.22 | ER     | 71  | 7.47    |         |
| 28 | DCTL        | 7981_A                    | AEP - DAY     | 05HIGHLA-09MRTNSV 69 kV line     | 243606 | 253043 | 1    | DC | 120.48  | 125.22 | ER     | 71  | 7.47    |         |
| 29 | DCTL        | 8123                      | AEP - AEP     | 05LATTAVL8-05BIERSRUN 69 kV line | 243608 | 246893 | 1    | DC | 154.98  | 213.77 | ER     | 50  | 29.39   | 13      |
| 30 | LFFB        | 6774_C2_05MARQUI 345-D    | AEP - AEP     | 05LATTAVL8-05BIERSRUN 69 kV line | 243608 | 246893 | 1    | DC | 143.61  | 201.42 | ER     | 50  | 28.91   |         |
| 31 | LFFB        | 6779_C2_05BIERSR 345-D    | AEP - AEP     | 05LATTAVL8-05BIERSRUN 69 kV line | 243608 | 246893 | 1    | DC | 144.21  | 199.51 | ER     | 50  | 27.65   |         |
| 32 | LFFB        | 2085_C2_05BEATTY 345-304C | AEP - AEP     | 05PETERSB8-05HIGHLA 69 kV line   | 243612 | 243606 | 1    | DC | 114.46  | 161.44 | ER     | 50  | 27.36   | 14      |
| 33 | DCTL        | 8126_B                    | AEP - AEP     | 05BIERSRUN-05SLATE 69 kV line    | 246893 | 243617 | 1    | DC | 133.07  | 139.7  | ER     | 50  | 7.35    | 15      |
| 34 | DCTL        | 8126_A                    | AEP - AEP     | 05BIERSRUN-05SLATE 69 kV line    | 246893 | 243617 | 1    | DC | 125.6   | 132.22 | ER     | 50  | 7.35    |         |
| 35 | DCTL        | 7981_B                    | AEP - AEP     | 05HIGHLA-05NMARSS 138 kV line    | 246911 | 247035 | 1    | DC | 103.3   | 104.26 | ER     | 310 | 6.56    | 16      |

**AC2-087 Contribution to Previously Identified Overloads**

| #  | Contingency |                          | Affected Area | Facility Description             | Bus    |        | Cir. | PF | Loading |        | Rating |     | MW Con. | FG App. |
|----|-------------|--------------------------|---------------|----------------------------------|--------|--------|------|----|---------|--------|--------|-----|---------|---------|
|    | Type        | Name                     |               |                                  | From   | To     |      |    | Initial | Final  | Type   | MVA |         |         |
| 36 | DCTL        | 7981_B                   | AEP - AEP     | 05WARERD-05WAVERL 138 kV line    | 246942 | 243585 | 1    | DC | 163.05  | 164.53 | ER     | 150 | 4.92    | 17      |
| 37 | LFFB        | 8109_C2_05HILLSB 138-A_A | AEP - AEP     | 05WARERD-05WAVERL 138 kV line    | 246942 | 243585 | 1    | DC | 156     | 157.52 | ER     | 150 | 5.06    |         |
| 38 | LFFB        | 8108_C2_05HILLSB 138-D_A | AEP - AEP     | 05WARERD-05WAVERL 138 kV line    | 246942 | 243585 | 1    | DC | 150.08  | 151.56 | ER     | 150 | 4.92    |         |
| 39 | DCTL        | 7981_A                   | AEP - AEP     | 05WARERD-05WAVERL 138 kV line    | 246942 | 243585 | 1    | DC | 150.08  | 151.56 | ER     | 150 | 4.92    |         |
| 40 | BUS         | 7954_C1_05MILLBR 138-2_A | AEP - AEP     | 05WARERD-05WAVERL 138 kV line    | 246942 | 243585 | 1    | DC | 139.24  | 140.58 | ER     | 150 | 4.46    |         |
| 41 | DCTL        | 7981_B                   | AEP - AEP     | 05WLDCA-05EMERSS 138 kV line     | 246946 | 247034 | 1    | DC | 180.77  | 182.15 | ER     | 185 | 5.67    | 18      |
| 42 | LFFB        | 8108_C2_05HILLSB 138-D_A | AEP - AEP     | 05WLDCA-05EMERSS 138 kV line     | 246946 | 247034 | 1    | DC | 162.85  | 164.23 | ER     | 185 | 5.67    |         |
| 43 | DCTL        | 7981_A                   | AEP - AEP     | 05WLDCA-05EMERSS 138 kV line     | 246946 | 247034 | 1    | DC | 162.85  | 164.23 | ER     | 185 | 5.67    |         |
| 44 | DCTL        | 7981_B                   | AEP - AEP     | 05EMERSS-AC2-062 TAP 138 kV line | 247034 | 931440 | 1    | DC | 178.77  | 180.15 | ER     | 185 | 5.67    | 19      |
| 45 | LFFB        | 8108_C2_05HILLSB 138-D_A | AEP - AEP     | 05EMERSS-AC2-062 TAP 138 kV line | 247034 | 931440 | 1    | DC | 160.85  | 162.23 | ER     | 185 | 5.67    |         |
| 46 | DCTL        | 7981_A                   | AEP - AEP     | 05EMERSS-AC2-062 TAP 138 kV line | 247034 | 931440 | 1    | DC | 160.85  | 162.23 | ER     | 185 | 5.67    |         |
| 47 | LFFB        | 8109_C2_05HILLSB 138-A_A | DEO&K - DEO&K | 08CLINCO-08WARRN1 138 kV line    | 249995 | 250122 | 1    | DC | 242.78  | 244.4  | ER     | 198 | 7.14    | 20      |
| 48 | BUS         | 7954_C1_05MILLBR 138-2_A | DEO&K - DEO&K | 08CLINCO-08WARRN1 138 kV line    | 249995 | 250122 | 1    | DC | 211.32  | 212.65 | ER     | 198 | 5.84    |         |
| 49 | LFFB        | 8111_C2_05HILLSB 138-A_A | DAY - DAY     | 09MIDDLE-09OHH 138 kV line       | 253111 | 253057 | 1    | DC | 167.33  | 168.5  | ER     | 185 | 4.81    | 21      |
| 50 | DCTL        | 7981_B                   | AEP - AEP     | AC1-089 TAP-05WLDCA 138 kV line  | 926100 | 246946 | 1    | DC | 181.85  | 183.23 | ER     | 185 | 5.67    | 22      |
| 51 | LFFB        | 8108_C2_05HILLSB 138-D_A | AEP - AEP     | AC1-089 TAP-05WLDCA 138 kV line  | 926100 | 246946 | 1    | DC | 163.93  | 165.31 | ER     | 185 | 5.67    |         |
| 52 | DCTL        | 7981_A                   | AEP - AEP     | AC1-089 TAP-05WLDCA 138 kV line  | 926100 | 246946 | 1    | DC | 163.93  | 165.31 | ER     | 185 | 5.67    |         |
| 53 | LFFB        | DAY_L34552-2             | AEP - DAY     | AC2-020 TAP-09GRNFLD 69 kV line  | 931130 | 253030 | 1    | DC | 106.53  | 146.16 | ER     | 72  | 28.53   | 23      |
| 54 | DCTL        | 7981_B                   | AEP - AEP     | AC2-049 TAP-05MILLBR 138 kV line | 931350 | 243042 | 1    | DC | 311.7   | 313.5  | ER     | 179 | 7.12    | 24      |
| 55 | LFFB        | 8108_C2_05HILLSB 138-D_A | AEP - AEP     | AC2-049 TAP-05MILLBR 138 kV line | 931350 | 243042 | 1    | DC | 288.9   | 290.7  | ER     | 179 | 7.12    |         |
| 56 | DCTL        | 7981_A                   | AEP - AEP     | AC2-049 TAP-05MILLBR 138 kV line | 931350 | 243042 | 1    | DC | 288.9   | 290.7  | ER     | 179 | 7.12    |         |
| 57 | N-1         | 7353_B2_TOR12737         | AEP - AEP     | AC2-049 TAP-05MILLBR 138 kV line | 931350 | 243042 | 1    | DC | 122.15  | 123.99 | ER     | 179 | 3.29    |         |

AC2-087 Contribution to Previously Identified Overloads

| #  | Contingency |                                          | Affected Area | Facility Description              | Bus    |        | Cir. | PF | Loading |        | Rating |     | MW Con. | FG App. |
|----|-------------|------------------------------------------|---------------|-----------------------------------|--------|--------|------|----|---------|--------|--------|-----|---------|---------|
|    | Type        | Name                                     |               |                                   | From   | To     |      |    | Initial | Final  | Type   | MVA |         |         |
| 58 | N-1         | P1-#..B2 WARREN-CLINTONCO-HILLSBORO 2381 | AEP - AEP     | AC2-049 TAP-05MILLBR 138 kV line  | 931350 | 243042 | 1    | DC | 122.15  | 123.99 | ER     | 179 | 3.29    |         |
| 59 | LFFB        | 2085_C2_05BEATTY 345-304C                | AEP - AEP     | AC2-055 TAP-05PETERSB8 69 kV line | 931380 | 243612 | 1    | DC | 130.52  | 185.24 | ER     | 50  | 27.36   | 25      |
| 60 | LFFB        | 8109_C2_05HILLSB 138-A_A                 | DEO&K - DEO&K | AC2-061 TAP-08CLINCO 138 kV line  | 931430 | 249995 | 1    | DC | 275.8   | 277.54 | ER     | 184 | 7.14    | 26      |
| 61 | BUS         | 7954_C1_05MILLBR 138-2_A                 | DEO&K - DEO&K | AC2-061 TAP-08CLINCO 138 kV line  | 931430 | 249995 | 1    | DC | 242.25  | 243.68 | ER     | 184 | 5.84    |         |
| 62 | N-1         | 5891_B2_TOR607                           | DEO&K - DEO&K | AC2-061 TAP-08CLINCO 138 kV line  | 931430 | 249995 | 1    | DC | 122.63  | 124.22 | ER     | 184 | 2.94    |         |
| 63 | N-1         | OUTAGE_02AB                              | DEO&K - DEO&K | AC2-061 TAP-08CLINCO 138 kV line  | 931430 | 249995 | 1    | DC | 122.03  | 123.62 | ER     | 184 | 2.94    |         |
| 64 | Non         | Non                                      | DEO&K - DEO&K | AC2-061 TAP-08CLINCO 138 kV line  | 931430 | 249995 | 1    | DC | 113.84  | 115.43 | NR     | 159 | 2.52    |         |
| 65 | DCTL        | 7981_B                                   | AEP - LGEE    | AC2-062 TAP-4KENTON 138 kV line   | 931440 | 324267 | 1    | DC | 197.28  | 198.66 | ER     | 185 | 5.67    | 27      |
| 66 | LFFB        | 8108_C2_05HILLSB 138-D_A                 | AEP - LGEE    | AC2-062 TAP-4KENTON 138 kV line   | 931440 | 324267 | 1    | DC | 179.35  | 180.73 | ER     | 185 | 5.67    |         |
| 67 | DCTL        | 7981_A                                   | AEP - LGEE    | AC2-062 TAP-4KENTON 138 kV line   | 931440 | 324267 | 1    | DC | 179.35  | 180.73 | ER     | 185 | 5.67    |         |

Table 5

**Steady-State Voltage Requirements**

None

**Short Circuit***(Summary of impacted circuit breakers)*

New circuit breakers found to be over-duty:

None

**Affected System Analysis & Mitigation****LGEE Impacts:**

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

**MISO Impacts:**

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

**Duke, Progress & TVA Impacts:**

Duke Carolina, Progress, & TVA Impacts to be determined during later study phases (as applicable).

### **OVEC Impacts:**

OVEC 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.

| AC2-087 Delivery of Energy Portion of Interconnection Request |      |                                         |               |                                  |        |        |         |    |         |        |        |     |         |         |
|---------------------------------------------------------------|------|-----------------------------------------|---------------|----------------------------------|--------|--------|---------|----|---------|--------|--------|-----|---------|---------|
| Contingency                                                   |      |                                         | Affected Area | Facility Description             | Bus    |        | Loading |    |         |        | Rating |     | MW Con. | FG App. |
| #                                                             | Type | Name                                    |               |                                  | From   | To     | Cir.    | PF | Initial | Final  | Type   | MVA |         |         |
| 1                                                             | N-1  | 7353_B2_TOR12737                        | AEP - AEP     | 05HILLSB-05SINKG8 138 kV line    | 243019 | 243102 | 1       | DC | 184.53  | 185.97 | ER     | 185 | 5.89    |         |
| 2                                                             | N-1  | 5891_B2_TOR607                          | AEP - DEO&K   | 05HILLSB-AC2-061 TAP 138 kV line | 243019 | 931430 | 1       | DC | 199.75  | 201.04 | ER     | 184 | 5.27    |         |
| 3                                                             | Non  | Non                                     | AEP - DEO&K   | 05HILLSB-AC2-061 TAP 138 kV line | 243019 | 931430 | 1       | DC | 188.9   | 190.18 | NR     | 159 | 4.52    |         |
| 4                                                             | N-1  | 7353_B2_TOR12737                        | AEP - AEP     | 05SINKG8-AC2-049 TAP 138 kV line | 243102 | 931350 | 1       | DC | 188.71  | 190.19 | ER     | 179 | 5.89    |         |
| 5                                                             | N-1  | P1-#.B2 WARREN-CLINTONCO-HILLSBORO 2381 | AEP - AEP     | 05ADAMS-05WARERD 138 kV line     | 243464 | 246942 | 1       | DC | 138.88  | 140.18 | ER     | 150 | 4.33    |         |
| 6                                                             | N-1  | 7353_B2_TOR12737                        | AEP - AEP     | 05SEAMAN-05ADAMS 138 kV line     | 243571 | 243464 | 1       | DC | 126.33  | 127.62 | ER     | 150 | 4.3     |         |
| 7                                                             | N-1  | 6781_B3_05BIERSR 345-1                  | AEP - AEP     | 05BCKSKI-05LATTAVL8 69 kV line   | 243598 | 243608 | 1       | DC | 76.2    | 103.86 | ER     | 100 | 27.65   |         |
| 8                                                             | N-1  | 889_B2                                  | AEP - AEP     | 05BCKSKI-AC2-020 TAP 69 kV line  | 243598 | 931130 | 1       | DC | 107.96  | 147.58 | ER     | 72  | 28.53   |         |
| 9                                                             | N-1  | 762_B2_TOR8072                          | AEP - AEP     | 05BCKSKI-AC2-055 TAP 69 kV line  | 243598 | 931380 | 1       | DC | 91.68   | 146.4  | ER     | 50  | 27.36   |         |
| 10                                                            | N-1  | 7353_B2_TOR12737                        | AEP - DAY     | 05HIGHLA-09MRTNSV 69 kV line     | 243606 | 253043 | 1       | DC | 97.68   | 102.21 | ER     | 71  | 7.14    |         |
| 11                                                            | N-1  | 6781_B3_05BIERSR 345-1                  | AEP - AEP     | 05LATTAVL8-05BIERSRUN 69 kV line | 243608 | 246893 | 1       | DC | 143.21  | 198.51 | ER     | 50  | 27.65   |         |
| 12                                                            | N-1  | 762_B2_TOR8072                          | AEP - AEP     | 05PETERSB8-05HIGHLA 69 kV line   | 243612 | 243606 | 1       | DC | 114.32  | 161.05 | ER     | 50  | 27.36   |         |
| 13                                                            | N-1  | P1-#.B2 WARREN-CLINTONCO-HILLSBORO 2381 | AEP - AEP     | 05WARERD-05WAVERL 138 kV line    | 246942 | 243585 | 1       | DC | 128.68  | 129.98 | ER     | 150 | 4.33    |         |

| AC2-087 Delivery of Energy Portion of Interconnection Request |      |                                           |               |                                   |        |        |         |    |         |        |        |     |         |         |
|---------------------------------------------------------------|------|-------------------------------------------|---------------|-----------------------------------|--------|--------|---------|----|---------|--------|--------|-----|---------|---------|
| Contingency                                                   |      |                                           | Affected Area | Facility Description              | Bus    |        | Loading |    |         |        | Rating |     | MW Con. | FG App. |
| #                                                             | Type | Name                                      |               |                                   | From   | To     | Cir.    | PF | Initial | Final  | Type   | MVA |         |         |
|                                                               |      |                                           |               | 05WLDCAT-05EMERSS 138 kV line     |        |        |         |    |         |        |        |     |         |         |
| 14                                                            | N-1  | 7353_B2_TOR12737                          | AEP - AEP     |                                   | 246946 | 247034 | 1       | DC | 131.35  | 132.47 | ER     | 185 | 4.63    |         |
| 15                                                            | N-1  | 7353_B2_TOR12737                          | AEP - AEP     | 05EMERSS-AC2-062 TAP 138 kV line  | 247034 | 931440 | 1       | DC | 129.35  | 130.47 | ER     | 185 | 4.63    |         |
| 16                                                            | N-1  | 5891_B2_TOR607                            | DEO&K - DEO&K | 08CLINCO-08WARRN1 138 kV line     | 249995 | 250122 | 1       | DC | 196.89  | 198.09 | ER     | 198 | 5.27    |         |
| 17                                                            | Non  | Non                                       | DAY - DAY     | 09GRNFLD-09WASHCH 69 kV line      | 253030 | 253091 | 1       | DC | 74.06   | 109.73 | NR     | 80  | 28.58   |         |
| 18                                                            | N-1  | 160_B3                                    | DAY - DAY     | 09TEXTAP-09JFFRTP 69 kV line      | 253081 | 253163 | 1       | DC | 104.72  | 119.49 | ER     | 96  | 14.18   |         |
| 19                                                            | N-1  | 160_B3                                    | DAY - DAY     | 09WASHCH-09TEXTAP 69 kV line      | 253091 | 253081 | 1       | DC | 102.58  | 117.05 | ER     | 98  | 14.18   |         |
| 20                                                            | N-1  | P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381 | AEP - AEP     | AC1-089 TAP-05WLDCAT 138 kV line  | 926100 | 246946 | 1       | DC | 132.67  | 133.79 | ER     | 185 | 4.63    |         |
| 21                                                            | N-1  | 889_B2                                    | AEP - DAY     | AC2-020 TAP-09GRNFLD 69 kV line   | 931130 | 253030 | 1       | DC | 106.25  | 145.88 | ER     | 72  | 28.53   |         |
| 22                                                            | N-1  | 7353_B2_TOR12737                          | AEP - AEP     | AC2-049 TAP-05MILLBR 138 kV line  | 931350 | 243042 | 1       | DC | 247.85  | 249.33 | ER     | 179 | 5.89    |         |
| 23                                                            | N-1  | 762_B2_TOR8072                            | AEP - AEP     | AC2-055 TAP-05PETERSB8 69 kV line | 931380 | 243612 | 1       | DC | 130.13  | 184.85 | ER     | 50  | 27.36   |         |
| 24                                                            | N-1  | 5891_B2_TOR607                            | DEO&K - DEO&K | AC2-061 TAP-08CLINCO 138 kV line  | 931430 | 249995 | 1       | DC | 226.76  | 228.05 | ER     | 184 | 5.27    |         |
| 25                                                            | Non  | Non                                       | DEO&K - DEO&K | AC2-061 TAP-08CLINCO 138 kV line  | 931430 | 249995 | 1       | DC | 217.74  | 219.03 | NR     | 159 | 4.52    |         |
| 26                                                            | N-1  | P1-#.B2 WARREN-CLINTONCO-HILLSBORO 2381   | AEP - LGEE    | AC2-062 TAP-4KENTON 138 kV line   | 931440 | 324267 | 1       | DC | 146.66  | 147.79 | ER     | 185 | 4.63    |         |

**Table 6**

### New System Reinforcements

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

None

The System Reinforcements listed below is not part of the Bulk Electric System (BES), but was identified by AEP and will be required for the interconnection of AC2-087.

| #  | Overloaded Facility            | Upgrade Description                                                        | Schedule                                                                                              | Estimated Cost |
|----|--------------------------------|----------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|----------------|
| #1 | 05BCKSKI-05LATTAVL8 69 kV line | Rebuild/reconductor 12.0 miles of the ACSR 556.5 18/1 conductor section 1. | An approximate construction time would be 24 to 36 months after signing an interconnection agreement. | \$14,400,000   |
|    | 05BCKSKI-AC2-055 69            | 3.0 miles of ACSR 211.6.4 6/1 conductor section 4 will need to be          | An approximate construction time would be                                                             | \$3,600,000    |

| #  | Overloaded Facility             | Upgrade Description                                                                                                                                              | Schedule                                                   | Estimated Cost         |
|----|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|------------------------|
| #2 | kV line                         | rebuilt/reconductored.                                                                                                                                           | 24 to 36 months after signing an interconnection agreement |                        |
| #3 | AC2-020 TAP-09GRNFLD 69 kV line | Non AEP conductor is the limiting this line. This is an AEP- Dayton Power & Light tie line therefore; PJM is going to have to coordinate this upgrade with DP&L. | To be provided by DP&L                                     | To be provided by DP&L |
|    |                                 |                                                                                                                                                                  | <b>Total Network Upgrades</b>                              | <b>\$18,00,000</b>     |

**Table 7**

**Previous System Reinforcements**

*(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, identified for earlier generation or transmission interconnection projects in the PJM Queue)*

| Violation # | Overloaded Facility              | Upgrade Description                                                                                                                                                                                                                                                                                                                                                                                     | Schedule                                                                                              | Estimated Cost |
|-------------|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|----------------|
| #1          | 05HILLSB-05SINKG8 138 kV line    | Rebuild/Reconductor 4.36 miles of ACSR 477 26/7 conductor section 1.<br><br>An engineering study will need to be conducted to determine if the Relay Compliance Trip limits settings can be adjusted to mitigate the overload.<br><br>Replace the Sinking Springs jumpers.<br><br>Replace the Sinking Spring Switch (1200A)<br><br>Rebuild/Reconductor 8.93 miles of ACSR 477 26/7 conductor section 2. | An approximate construction time would be 24 to 36 months after signing an interconnection agreement. | \$20,500,000   |
| #2          | 05HILLSB-09MIDDLE 138 kV line    | 22.3 miles of the ACSR 477 26/7 conductor section 1 will need to be rebuilt/reconductored.<br><br>An engineering study will need to be conducted to determine if the Relay Compliance Trip limits settings at Hillsboro can be adjusted to mitigate the overload.                                                                                                                                       | An approximate construction time would be 24 to 36 months after signing an interconnection agreement  | \$33,450,000   |
| #3          | 05HILLSB-AC1-089 TAP 138 kV line | Rebuild/reconductor 8.0 miles of the ACSR 477 26/7 conductor section 1.                                                                                                                                                                                                                                                                                                                                 | An approximate construction time would be 24 to 36 months after signing an interconnection agreement. | \$12,000,000   |
| #4          | 05HILLSB-AC2-061 TAP 138 kV line | Rebuild/reconductor 5.0 miles of the ACSR 477 26/7 conductor section 1.<br><br>Conduct an engineering study will to determine if the Relay Compliance Trip limits settings at Hillsboro can be adjusted.                                                                                                                                                                                                | An approximate construction time would be 24 to 36 months after signing an interconnection agreement. | \$7,500,000    |
| #5          | 05SINKG8-AC2-049 TAP 138 kV line | Conduct an engineering study will to determine if the Relay Compliance Trip limits settings at Millbrook Park can be adjusted.                                                                                                                                                                                                                                                                          | An approximate construction time would be 24 to 36 months after signing an interconnection agreement. | \$31,800,000   |

| Violation # | Overloaded Facility                | Upgrade Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Schedule                                                                                              | Estimated Cost |
|-------------|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|----------------|
|             |                                    | Rebuild/reconductor 20.37 miles of the ACSR 477 26/7 conductor section 3.<br><br>Replace the Millbrook Park line riser.<br><br>Replace the Millbrook Park Bus and Risers.<br><br>Replace the Millbrook Park Trap Riser.<br><br>Replace the Sinking Spring switch (1200A).<br><br>A Sag Study will be required on the 20.37 mile ACSR 477 26/7 conduction section 2.<br><br>A Sag Study will be required on the 20.37 mile ACSR 477 26/7 conduction section 1.<br><br>Conduct an engineering study will to determine if the Thermal limit settings at Millbrook Park can be adjusted. |                                                                                                       |                |
| #6          | 05ADAMS-05WARERD 138 kV line       | Rebuild/reconductor 20.50 miles of the ACSR 336.4 30/7 conductor section 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | An approximate construction time would be 24 to 36 months after signing an interconnection agreement. | \$30,780,000   |
| #7          | 05SEAMAN-05ADAMS 138 kV line       | Rebuild/reconductor 20.50 miles of the ACSR 336.4 30/7 conductor section 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | An approximate construction time would be 24 to 36 months after signing an interconnection agreement. | \$12,000,000   |
| #8          | 05WARERD-05WAVERL 138 kV line      | Rebuild/reconductor 3.12 miles of the ACSR 336.4 30/7 conductor section 1.<br><br>Rebuild/reconductor 4.37 miles of the ACSR 336.4 30/7 conductor section 2.                                                                                                                                                                                                                                                                                                                                                                                                                         | An approximate construction time would be 24 to 36 months after signing an interconnection agreement. | \$11,240,000   |
| #9          | 05WLDCAT-05EMERSS 138 kV line      | Rebuild/reconductor 1.3 miles of the ACSR 477 26/7 conductor section 1.<br><br>Conduct an engineering study will to determine if the Relay Compliance Trip limits settings at Hillsboro can be adjusted.                                                                                                                                                                                                                                                                                                                                                                             | An approximate construction time would be 24 to 36 months after signing an interconnection agreement. | \$2,025,000    |
| #10         | 05EMERSS-AC2-062 TAP 138 kV line   | Rebuild/reconductor 6.4 miles of the ACSR 477 26/7 conductor section 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | An approximate construction time would be 24 to 36 months after signing an interconnection agreement. | \$9,600,000    |
| #11         | AC1-089 TAP-05WLDCAT 138 kV line   | Rebuild/reconductor 10.0 miles of the ACSR 477 26/7 conductor section 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | An approximate construction time would be 24 to 36 months after signing an interconnection agreement. | \$15,000,000   |
| #12         | 05AC2-049 Tap-05MILLBR 138 kV line | An engineering study will need to be conducted to determine if the Relay Compliance Trip limit settings can be adjusted at Millbrook Park to mitigate the overload.<br><br>8.50 miles of ACSR 477 26/7 conductor                                                                                                                                                                                                                                                                                                                                                                     | An approximate construction time would be 24 to 36 months after signing an interconnection agreement  | \$59,100,000   |

| Violation #                            | Overloaded Facility              | Upgrade Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Schedule                                                                                              | Estimated Cost       |
|----------------------------------------|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|----------------------|
|                                        |                                  | section 3 will need to be rebuilt/reconductored.<br><br>Replace the Millbrook Park line risers<br><br>Replace the Millbrook Park bus and risers<br><br>Replace the Millbrook Park trap riser<br><br>Replace the Sinking Spring switch (1200A)<br><br>20.4 miles of ACSR 477 26/7 conductor section 2 will need to be rebuilt/reconductored.<br><br>9.8 miles of ACSR 477 26/7 conductor section 1 will need to be rebuilt/reconductored.<br><br>An engineering study will need to be conducted to determine if the Relay Thermal limits settings can be adjusted at Millbrook Park to mitigate the overload.<br><br>Replace the Hillsboro Wavetrap (2000A) |                                                                                                       |                      |
| #13                                    | AC2-061 TAP-08CLINCO 138 kV line | Rebuild/reconductor 5.0 miles of the ACSR 477 26/7 conductor section 1.<br><br>Conduct an engineering study will to determine if the Relay Compliance Trip limits settings at Hillsboro can be adjusted.                                                                                                                                                                                                                                                                                                                                                                                                                                                   | An approximate construction time would be 24 to 36 months after signing an interconnection agreement. | \$7,525,000          |
| #14                                    | AC2-062 TAP-4KENTON 138 kV line  | Rebuild/reconductor 18.0 miles of the ACSR 477 26/7 conductor section 1.<br><br>Replace the Emerald SS Jumpers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | An approximate construction time would be 24 to 36 months after signing an interconnection agreement. | \$27,050,000         |
| #15                                    | 05HIGHLA-05NMARSS 138 kV line    | Rebuild/reconductor 3.10 miles of the ACSR 636 26/7 conductor section 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | An approximate construction time would be 24 to 36 months after signing an interconnection agreement. | \$4,700,000          |
| #6                                     | 05NMARSS-05SEAMAN 138 kV line    | Rebuild/reconductor 13.20 miles of the ACSR 636 26/7 conductor section 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | An approximate construction time would be 24 to 36 months after signing an interconnection agreement. | \$19,800,000         |
| <b>Total Previous Network Upgrades</b> |                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                       | <b>\$304,070,000</b> |

**Table 8**

The System Reinforcements listed below is not part of the Bulk Electric System (BES), but was identified by AEP and will be required for the interconnection of AC2-087.

| #  | Overloaded Facility          | Upgrade Description                                                                                       | Schedule                                                        | Estimated Cost |
|----|------------------------------|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|----------------|
| #1 | 05HIGHLA-09MRTNSV 69 kV line | Conduct an engineering study will to determine if the Thermal limit settings at Highland can be adjusted. | An approximate construction time would be 24 to 36 months after | \$250,000      |

| #  | Overloaded Facility                  | Upgrade Description                                                                                                                                                                                         | Schedule                                                                                              | Estimated Cost         |
|----|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|------------------------|
|    |                                      | Replace the Highland switch (1200A).<br><br>Conduct an engineering study will to determine if the Relay Compliance Trip limits settings at Highland can be adjusted.                                        | signing an interconnection agreement.                                                                 |                        |
| #2 | 05BIERSRUN-05SLATE<br>69 kV line     | Rebuild/reconductor 5.0 miles of the ACSR 211.6 6/1 Penguin (4/0) conductor section 1.                                                                                                                      | An approximate construction time would be 24 to 36 months after signing an interconnection agreement. | \$6,000,000            |
| #3 | 05BCKSKI-AC2-020<br>TAP 69 kV line   | Non AEP conductor is the limiting this line. This is an AEP- Dayton Power & Light tie line therefore; PJM is going to have to coordinate this upgrade with DP&L.                                            | To be provided by DP&L                                                                                | To be provided by DP&L |
| #4 | 05LATTAVL8-<br>05BIERSRUN 69 kV line | Rebuild/reconductor 12.3 miles of the ACSR 211.6 6/1 Penguin (4/0) conductor section 1.<br><br>Conduct an engineering study will to determine if the Relay Compliance Trip limits settings can be adjusted. | An approximate construction time would be 24 to 36 months after signing an interconnection agreement. | \$14,800,000           |
| #5 | 05HIGHLA-<br>05PETERSB8 69 kV line   | 10.0 miles of ACSR 336.4 30/7 conductor section 1 will need to be rebuilt/reconducted.                                                                                                                      | An approximate construction time would be 24 to 36 months after signing an interconnection agreement  | \$12,000,000           |
| #6 | 05PETERSB8-AC2-055<br>69 kV line     | 16.4 miles of ACSR 211.6.4 6/1 conductor section 1 will need to be rebuilt/reconducted.                                                                                                                     | An approximate construction time would be 24 to 36 months after signing an interconnection agreement  | \$7,680,000            |
|    |                                      |                                                                                                                                                                                                             | <b>Total Network Upgrades</b>                                                                         | <b>\$40,730,000</b>    |

**Table 9**

### **Schedule**

It is anticipated that the time between receipt of executed agreements and Commercial Operation may range from 12 to 18 months if no line work is required. If line work is required, construction time would be between 24 to 36 months after signing an interconnection agreement.

**Note:** The time provided between anticipated normal completion of System Impact, Facilities Studies, subsequent execution of ISA and ICSA documents, and the proposed In-Service Date is shorter than usual and may be difficult to achieve.

### **Conclusion**

Based upon the results of this Feasibility Study, the construction of the 85.0 MW (47.4 MW Capacity) solar generating facility of THE IC (PJM Project #AC2-087) will require the following additional interconnection charges. This plan of service will interconnect the proposed generating facility in a manner that will provide operational reliability and flexibility to both the AEP system and the THE IC generating facility.

| <b>Cost Breakdown for the Primary Point of Interconnection (Buckskin 69 kV )</b> |                                                                                                                                                                                                                                                    |                      |
|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| <b>Attachment Cost</b>                                                           | Expand Buckskin 69 kV Substation                                                                                                                                                                                                                   | <b>\$1,000,000</b>   |
| <b>Non-Direct Connection Cost Estimate</b>                                       | 69 kV Revenue Metering                                                                                                                                                                                                                             | <b>\$200,000</b>     |
|                                                                                  | Upgrade line protection and controls at the Buckskin 69 kV substation.                                                                                                                                                                             | <b>\$200,000</b>     |
|                                                                                  | <b>Previous System Reinforcements</b><br><i>(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, identified for earlier generation or transmission interconnection projects in the PJM Queue)</i>                 | <b>\$304,070,000</b> |
|                                                                                  | <b>New System Reinforcements – Not part of BES</b><br><i>(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)</i>                                    | <b>\$18,00,000</b>   |
|                                                                                  | <b>Previous System Reinforcements-Not part of BES</b><br><i>(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, identified for earlier generation or transmission interconnection projects in the PJM Queue)</i> | <b>\$40,730,000</b>  |
| <b>Total Estimated Cost for Project AC2-087</b>                                  |                                                                                                                                                                                                                                                    | <b>\$364,200,000</b> |

**Table 10**

The estimates are preliminary in nature, as they were determined without the benefit of detailed engineering studies. The cost of remediation for sag limited conductors is not included in this estimate. Final estimates will require an on-site review and coordination to determine final construction requirements.

## Option 2

### Network Impacts

The Queue Project AC2-087 was evaluated as a 85.0 MW (Capacity 47.4 MW) injection tapping the Buckskin – Greenfield 69 kV line in the Dayton area. Project AC2-087 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC2-087 was studied with a commercial probability of 53%. Potential network impacts were as follows:

### Summer Peak Analysis – 2020

### Contingency Descriptions

The following contingencies resulted in overloads:

| Option 2                  |                                                                                                                                                                                                                                                                                                                                                 |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Contingency Name          | Description                                                                                                                                                                                                                                                                                                                                     |
| 8123                      | CONTINGENCY '8123'<br><br>OPEN BRANCH FROM BUS 243453 TO BUS 253110 CKT 1 / 243453 05BEATTY 345 253110 09ADKINS<br>345 1<br><br>OPEN BRANCH FROM BUS 243453 TO BUS 253248 CKT 1 / 243453 05BEATTY 345 253248 09SCHARL<br>345 1<br><br>OPEN BRANCH FROM BUS 243453 TO BUS 243469 CKT 3 / 243453 05BEATTY 345 243469 05BEATTY<br>138 3<br><br>END |
| 160_B3                    | CONTINGENCY '160_B3'<br><br>OPEN BRANCH FROM BUS 253110 TO BUS 253100 CKT 1 / 253110 09ADKINS 345 253100 09ATLNTA<br>345 1<br><br>OPEN BRANCH FROM BUS 253100 TO BUS 253099 CKT 1 / 253100 09ATLNTA 345 253099 09ATLNTA<br>69.0 1<br><br>END                                                                                                    |
| 2085_C2_05BEATTY 345-304C | CONTINGENCY '2085_C2_05BEATTY 345-304C'<br><br>OPEN BRANCH FROM BUS 243453 TO BUS 243454 CKT 1 / 243453 05BEATTY 345 243454 05BIXBY<br>345 1<br><br>OPEN BRANCH FROM BUS 243453 TO BUS 253110 CKT 1 / 243453 05BEATTY 345 253110 09ADKINS<br>345 1<br><br>END                                                                                   |
| 5891_B2_TOR607            | CONTINGENCY '5891_B2_TOR607'<br><br>OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB 138 253111 09MIDDLE<br>138 1<br><br>OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111 09MIDDLE 138 253057 09OHH 138<br>1<br><br>END                                                                                                |

| Option 2                 |                                                                                                                                                                                                                                                |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Contingency Name         | Description                                                                                                                                                                                                                                    |
| 6764_B2_TOR5300548       | CONTINGENCY '6764_B2_TOR5300548'<br>OPEN BRANCH FROM BUS 246888 TO BUS 242938 CKT 1 / 246888 05BIERSR 345 242938 05MARQUI 345 1<br>END                                                                                                         |
| 6774_C2_05MARQUI 345-D   | CONTINGENCY '6774_C2_05MARQUI 345-D'<br>OPEN BRANCH FROM BUS 246888 TO BUS 242938 CKT 1 / 246888 05BIERSR 345 242938 05MARQUI 345 1<br>OPEN BRANCH FROM BUS 242938 TO BUS 253038 CKT 1 / 242938 05MARQUI 345 253038 09KILLEN 345 1<br>END      |
| 6779_C2_05BIERSR 345-D   | CONTINGENCY '6779_C2_05BIERSR 345-D'<br>OPEN BRANCH FROM BUS 246888 TO BUS 243454 CKT 1 / 246888 05BIERSR 345 243454 05BIXBY 345 1<br>OPEN BRANCH FROM BUS 246888 TO BUS 246889 CKT 1 / 246888 05BIERSR 345 246889 05BIERSR 138 1<br>END       |
| 6781_B3_05BIERSR 345-1   | CONTINGENCY '6781_B3_05BIERSR 345-1'<br>OPEN BRANCH FROM BUS 246888 TO BUS 246889 CKT 1 / 246888 05BIERSR 345 246889 05BIERSR 138 1<br>END                                                                                                     |
| 6786_B2_A                | CONTINGENCY '6786_B2_A'<br>OPEN BRANCH FROM BUS 246889 TO BUS 931410 CKT 1 / 246889 05BIERSR 138 931410 AC2-059 TAP 138 1<br>END                                                                                                               |
| 6786_B2_B                | CONTINGENCY '6786_B2_B'<br>OPEN BRANCH FROM BUS 931410 TO BUS 246890 CKT 1 / 931410 AC2-059 TAP 138 246890 05HOPETN 138 1<br>END                                                                                                               |
| 7353_B2_TOR12737         | CONTINGENCY '7353_B2_TOR12737'<br>OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 243019 05HILLSB 138 249995 08CLINCO 138 1<br>OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995 08CLINCO 138 250122 08WARRN1 138 1<br>END            |
| 762_B2_TOR8072           | CONTINGENCY '762_B2_TOR8072'<br>OPEN BRANCH FROM BUS 243453 TO BUS 253110 CKT 1 / 243453 05BEATTY 345 253110 09ADKINS 345 1<br>END                                                                                                             |
| 7954_C1_05MILLBR 138-2_A | CONTINGENCY '7954_C1_05MILLBR 138-2_A'<br>OPEN BRANCH FROM BUS 243042 TO BUS 243088 CKT 1 / 243042 05MILLBR 138 243088 05S POIN 138 1<br>OPEN BRANCH FROM BUS 243042 TO BUS 931350 CKT 1 / 243042 05MILLBR 138 931350 AC2-049 TAP 138 1<br>END |

| Option 2                 |                                                                |                                        |
|--------------------------|----------------------------------------------------------------|----------------------------------------|
| Contingency Name         | Description                                                    |                                        |
| 7981_A                   | CONTINGENCY '7981_A'                                           |                                        |
|                          | OPEN BRANCH FROM BUS 243019 TO BUS 931430 CKT 1 TAP 138 1      | / 243019 05HILLSB 138 931430 AC2-061   |
|                          | OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 138 1          | / 243019 05HILLSB 138 253111 09MIDDLE  |
|                          | OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 138 1          | / 249995 08CLINCO 138 250122 08WARRN1  |
|                          | OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 1              | / 253111 09MIDDLE 138 253057 09OHH 138 |
|                          | END                                                            |                                        |
| 7981_B                   | CONTINGENCY '7981_B'                                           |                                        |
|                          | OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 08CLINCO 138 1 | / 931430 AC2-061 TAP 138 249995        |
|                          | OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 138 1          | / 243019 05HILLSB 138 253111 09MIDDLE  |
|                          | OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 138 1          | / 249995 08CLINCO 138 250122 08WARRN1  |
|                          | OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 1              | / 253111 09MIDDLE 138 253057 09OHH 138 |
|                          | END                                                            |                                        |
| 8108_C2_05HILLSB 138-D_A | CONTINGENCY '8108_C2_05HILLSB 138-D_A'                         |                                        |
|                          | OPEN BRANCH FROM BUS 243019 TO BUS 931430 CKT 1 TAP 138 1      | / 243019 05HILLSB 138 931430 AC2-061   |
|                          | OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 138 1          | / 243019 05HILLSB 138 253111 09MIDDLE  |
|                          | OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 138 1          | / 249995 08CLINCO 138 250122 08WARRN1  |
|                          | OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 1              | / 253111 09MIDDLE 138 253057 09OHH 138 |
|                          | END                                                            |                                        |
| 8109_C2_05HILLSB 138-A_A | CONTINGENCY '8109_C2_05HILLSB 138-A_A'                         |                                        |
|                          | OPEN BRANCH FROM BUS 243019 TO BUS 243102 CKT 1 138 1          | / 243019 05HILLSB 138 243102 05SINKG8  |
|                          | OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 138 1          | / 243019 05HILLSB 138 253111 09MIDDLE  |
|                          | OPEN BRANCH FROM BUS 931350 TO BUS 243102 CKT 1 05SINKG8 138 1 | / 931350 AC2-049 TAP 138 243102        |
|                          | OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 1              | / 253111 09MIDDLE 138 253057 09OHH 138 |
|                          | END                                                            |                                        |
| 8110_C2_05HILLSB 138-B_A | CONTINGENCY '8110_C2_05HILLSB 138-B_A'                         |                                        |
|                          | OPEN BRANCH FROM BUS 243019 TO BUS 243102 CKT 1 138 1          | / 243019 05HILLSB 138 243102 05SINKG8  |
|                          | OPEN BRANCH FROM BUS 243019 TO BUS 926100 CKT 1 TAP 138 1      | / 243019 05HILLSB 138 926100 AC1-089   |
|                          | OPEN BRANCH FROM BUS 931350 TO BUS 243102 CKT 1 05SINKG8 138 1 | / 931350 AC2-049 TAP 138 243102        |

| Option 2                                  |                                                                                                                                                                                                                                                                     |
|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Contingency Name                          | Description                                                                                                                                                                                                                                                         |
|                                           | END                                                                                                                                                                                                                                                                 |
| 8111_C2_05HILLSB 138-_A                   | CONTINGENCY '8111_C2_05HILLSB 138-_A'<br><br>OPEN BRANCH FROM BUS 243019 TO BUS 926100 CKT 1 / 243019 05HILLSB 138 926100 AC1-089<br>TAP 138 1<br><br>OPEN BRANCH FROM BUS 243019 TO BUS 931430 CKT 1 / 243019 05HILLSB 138 931430 AC2-060<br>TAP 138 1<br><br>END  |
| 8124_C2_05BIERSR 138-F_A                  | CONTINGENCY '8124_C2_05BIERSR 138-F_A'<br><br>OPEN BRANCH FROM BUS 246889 TO BUS 931410 CKT 1 / 246889 05BIERSR 138 931410 AC2-059<br>TAP 138 1<br><br>OPEN BRANCH FROM BUS 246889 TO BUS 246893 CKT 1 / 246889 05BIERSR 138 246893<br>05BIERSRUN 69.0 1<br><br>END |
| 8126_A                                    | CONTINGENCY '8126_A'<br><br>OPEN BRANCH FROM BUS 246889 TO BUS 243483 CKT 1 / 246889 05BIERSR 138 243483 05CRCLVS<br>138 1<br><br>OPEN BRANCH FROM BUS 246889 TO BUS 931410 CKT 1 / 246889 05BIERSR 138 931410 AC2-059<br>TAP 138 1<br><br>END                      |
| 8126_B                                    | CONTINGENCY '8126_B'<br><br>OPEN BRANCH FROM BUS 246889 TO BUS 243483 CKT 1 / 246889 05BIERSR 138 243483 05CRCLVS<br>138 1<br><br>OPEN BRANCH FROM BUS 931410 TO BUS 246890 CKT 1 / 931410 AC2-059 TAP 138 246890<br>05HOPETN 138 1<br><br>END                      |
| 889_B2                                    | CONTINGENCY '889_B2'<br><br>OPEN BRANCH FROM BUS 253100 TO BUS 253077 CKT 1 / 253100 09ATLNTA 345 253077 09STUART<br>345 1<br><br>END                                                                                                                               |
| DAY_L34552-2                              | CONTINGENCY 'DAY_L34552-2'<br><br>OPEN LINE FROM BUS 253077 TO BUS 253100 CKT 1 /* 09STUART 345 - 09ATLNTA 345<br>REMOVE UNIT 2 FROM BUS 253077 /* 09STUART 345<br><br>END                                                                                          |
| OUTAGE_02AB                               | CONTINGENCY 'OUTAGE_02AB'<br><br>DISCONNECT BRANCH FROM BUS 253111 TO BUS 253057 CKT 1<br><br>END                                                                                                                                                                   |
| P1-#..B2 WARREN-CLINTONCO-HILLSBORO 2381  | CONTINGENCY 'P1-#..B2 WARREN-CLINTONCO-HILLSBORO 2381'<br><br>OPEN BUS 249995<br><br>END                                                                                                                                                                            |
| P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381 | CONTINGENCY 'P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381'<br><br>OPEN BRANCH FROM BUS 249995 TO BUS 931430 CKT 1<br><br>END                                                                                                                                           |

**Table 11**

**Generator Deliverability**

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

| Option 2<br>AC2-087 Generator Deliverability |      |                         |               |                                  |        |        |      |    |         |        |        |     |         |         |
|----------------------------------------------|------|-------------------------|---------------|----------------------------------|--------|--------|------|----|---------|--------|--------|-----|---------|---------|
| #                                            | Type | Contingency Name        | Affected Area | Facility Description             | Bus    |        |      | PF | Loading |        | Rating |     | MW Con. | FG App. |
|                                              |      |                         |               |                                  | From   | To     | Cir. |    | Initial | Final  | Type   | MVA |         |         |
| 1                                            | N-1  | 6781_B3_05BIER SR 345-1 | AEP - AEP     | 05LATTAVL8-05BIERSRUN 69 kV line | 243608 | 246893 | 1    | DC | 84.19   | 114.68 | ER     | 50  | 15.24   |         |
| 2                                            | N-1  | 6764_B2_TOR530 0548     | AEP - AEP     | 05LATTAVL8-05BIERSRUN 69 kV line | 243608 | 246893 | 1    | DC | 76.63   | 108.47 | ER     | 50  | 15.92   |         |
| 3                                            | N-1  | 6786_B2_B               | AEP - AEP     | 05BIERSRUN-05SLATE 69 kV line    | 246893 | 243617 | 1    | DC | 91      | 98.73  | ER     | 50  | 3.87    |         |
| 4                                            | N-1  | 6786_B2_A               | AEP - AEP     | 05BIERSRUN-05SLATE 69 kV line    | 246893 | 243617 | 1    | DC | 91      | 98.73  | ER     | 50  | 3.87    |         |
| 5                                            | N-1  | OUTAGE_02AB             | DEO&K - DEO&K | 08CLINCO-08WARRN1 138 kV line    | 249995 | 250122 | 1    | DC | 99.9    | 101.36 | ER     | 198 | 2.9     |         |

**Table 12**

**Multiple Facility Contingency**

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

| AC2-087 Multiple Facility Contingency |      |                           |               |                                 |        |        |      |    |         |        |        |     |         |         |
|---------------------------------------|------|---------------------------|---------------|---------------------------------|--------|--------|------|----|---------|--------|--------|-----|---------|---------|
| #                                     | Type | Contingency Name          | Affected Area | Facility Description            | Bus    |        |      | PF | Loading |        | Rating |     | MW Con. | FG App. |
|                                       |      |                           |               |                                 | From   | To     | Cir. |    | Initial | Final  | Type   | MVA |         |         |
| 1                                     | DCTL | 8123                      | AEP - AEP     | 05BCKSKI-05LATTAVL8 69 kV line  | 243598 | 243608 | 1    | DC | 84.87   | 113.93 | ER     | 100 | 29.06   | 1       |
| 2                                     | LFFB | 6774_C2_05MAR QUI 345-D   | AEP - AEP     | 05BCKSKI-05LATTAVL8 69 kV line  | 243598 | 243608 | 1    | DC | 79.27   | 107.83 | ER     | 100 | 28.57   |         |
| 3                                     | LFFB | 6779_C2_05BIER SR 345-D   | AEP - AEP     | 05BCKSKI-05LATTAVL8 69 kV line  | 243598 | 243608 | 1    | DC | 79.35   | 106.68 | ER     | 100 | 27.33   |         |
| 4                                     | LFFB | 8124_C2_05BIER SR 138-F_A | AEP - AEP     | 05SLATE-05ADENA 69 kV line      | 243617 | 243839 | 1    | DC | 52.47   | 66.82  | ER     | 100 | 21.5    | 2       |
| 5                                     | LFFB | 8124_C2_05BIER SR 138-F_A | AEP - AEP     | 05ADENA-05ROSS 69 kV line       | 243839 | 243615 | 1    | DC | 77.71   | 91.45  | ER     | 73  | 21.5    | 3       |
| 6                                     | LFFB | 8124_C2_05BIER SR 138-F_A | AEP - AEP     | 05BIERSRUN-05SLATE 69 kV line   | 246893 | 243617 | 1    | DC | 99.15   | 133.74 | ER     | 50  | 21.5    | 4       |
| 7                                     | LFFB | DAY_L34552-2              | DAY - DAY     | 09GRNFLD-09WASHCH 69 kV line    | 253030 | 253091 | 1    | DC | 70.47   | 100.26 | ER     | 98  | 29.2    | 5       |
| 8                                     | DCTL | 8123                      | DAY - AEP     | AC2-087 TAP-05BCKSKI 69 kV line | 931650 | 243598 | 1    | DC | 67.1    | 145    | ER     | 72  | 56.08   | 6       |

Table 13

**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)*

| AC2-087 Contribution to Previously Identified Overloads |      |                          |               |                                  |        |        |         |    |         |        |        |     |         |         |
|---------------------------------------------------------|------|--------------------------|---------------|----------------------------------|--------|--------|---------|----|---------|--------|--------|-----|---------|---------|
| Contingency                                             |      |                          | Affected Area | Facility Description             | Bus    |        | Loading |    |         |        | Rating |     | MW Con. | FG App. |
| #                                                       | Type | Name                     |               |                                  | From   | To     | Cir.    | PF | Initial | Final  | Type   | MVA |         |         |
| 1                                                       | DCTL | 7981_B                   | AEP - AEP     | 05HILLSB-05SINKG8 138 kV line    | 243019 | 243102 | 1       | DC | 240.71  | 242.43 | ER     | 185 | 7.05    | 7       |
| 2                                                       | LFFB | 8108_C2_05HILLSB 138-D_A | AEP - AEP     | 05HILLSB-05SINKG8 138 kV line    | 243019 | 243102 | 1       | DC | 218.7   | 220.42 | ER     | 185 | 7.05    |         |
| 3                                                       | DCTL | 7981_A                   | AEP - AEP     | 05HILLSB-05SINKG8 138 kV line    | 243019 | 243102 | 1       | DC | 218.7   | 220.42 | ER     | 185 | 7.05    |         |
| 4                                                       | LFFB | 8111_C2_05HILLSB 138-_A  | AEP - DAY     | 05HILLSB-09MIDDLE 138 kV line    | 243019 | 253111 | 1       | DC | 172.96  | 174.12 | ER     | 185 | 4.74    | 8       |
| 5                                                       | DCTL | 7981_B                   | AEP - AEP     | 05HILLSB-AC1-089 TAP 138 kV line | 243019 | 926100 | 1       | DC | 156.88  | 158.24 | ER     | 185 | 5.6     | 9       |
| 6                                                       | LFFB | 8108_C2_05HILLSB 138-D_A | AEP - AEP     | 05HILLSB-AC1-089 TAP 138 kV line | 243019 | 926100 | 1       | DC | 138.96  | 140.32 | ER     | 185 | 5.6     |         |
| 7                                                       | DCTL | 7981_A                   | AEP - AEP     | 05HILLSB-AC1-089 TAP 138 kV line | 243019 | 926100 | 1       | DC | 138.96  | 140.32 | ER     | 185 | 5.6     |         |
| 8                                                       | LFFB | 8109_C2_05HILLSB 138-A_A | AEP - DEO&K   | 05HILLSB-AC2-061 TAP 138 kV line | 243019 | 931430 | 1       | DC | 242.27  | 244    | ER     | 184 | 7.06    | 10      |
| 9                                                       | BUS  | 7954_C1_05MILLBR 138-2_A | AEP - DEO&K   | 05HILLSB-AC2-061 TAP 138 kV line | 243019 | 931430 | 1       | DC | 213.73  | 215.15 | ER     | 184 | 5.78    |         |
| 10                                                      | N-1  | 5891_B2_TOR607           | AEP - DEO&K   | 05HILLSB-AC2-061 TAP 138 kV line | 243019 | 931430 | 1       | DC | 110.17  | 111.75 | ER     | 184 | 2.9     |         |
| 11                                                      | N-1  | OUTAGE_02AB              | AEP - DEO&K   | 05HILLSB-AC2-061 TAP 138 kV line | 243019 | 931430 | 1       | DC | 109.57  | 111.15 | ER     | 184 | 2.9     |         |
| 12                                                      | Non  | Non                      | AEP - DEO&K   | 05HILLSB-AC2-061 TAP 138 kV line | 243019 | 931430 | 1       | DC | 100.72  | 102.29 | NR     | 159 | 2.49    |         |
| 13                                                      | DCTL | 7981_B                   | AEP - AEP     | 05SINKG8-AC2-049 TAP 138 kV line | 243102 | 931350 | 1       | DC | 246.83  | 248.6  | ER     | 179 | 7.05    | 11      |
| 14                                                      | LFFB | 8108_C2_05HILLSB 138-D_A | AEP - AEP     | 05SINKG8-AC2-049 TAP 138 kV line | 243102 | 931350 | 1       | DC | 224.02  | 225.8  | ER     | 179 | 7.05    |         |
| 15                                                      | DCTL | 7981_A                   | AEP - AEP     | 05SINKG8-AC2-049 TAP 138 kV line | 243102 | 931350 | 1       | DC | 224.02  | 225.8  | ER     | 179 | 7.05    |         |
| 16                                                      | DCTL | 7981_B                   | AEP - AEP     | 05ADAMS-05WARERD 138 kV line     | 243464 | 246942 | 1       | DC | 185.75  | 187.22 | ER     | 150 | 4.87    | 12      |
| 17                                                      | LFFB | 8109_C2_05HILLSB 138-A_A | AEP - AEP     | 05ADAMS-05WARERD 138 kV line     | 243464 | 246942 | 1       | DC | 178.64  | 180.14 | ER     | 150 | 5.01    |         |
| 18                                                      | LFFB | 8108_C2_05HILLSB 138-D_A | AEP - AEP     | 05ADAMS-05WARERD 138 kV line     | 243464 | 246942 | 1       | DC | 172.72  | 174.18 | ER     | 150 | 4.87    |         |
| 19                                                      | DCTL | 7981_A                   | AEP - AEP     | 05ADAMS-05WARERD 138 kV line     | 243464 | 246942 | 1       | DC | 172.72  | 174.18 | ER     | 150 | 4.87    |         |

| AC2-087 Contribution to Previously Identified Overloads |             |                           |               |                                  |        |        |      |    |         |        |        |     |         |         |
|---------------------------------------------------------|-------------|---------------------------|---------------|----------------------------------|--------|--------|------|----|---------|--------|--------|-----|---------|---------|
| #                                                       | Contingency |                           | Affected Area | Facility Description             | Bus    |        | Cir. | PF | Loading |        | Rating |     | MW Con. | FG App. |
|                                                         | Type        | Name                      |               |                                  | From   | To     |      |    | Initial | Final  | Type   | MVA |         |         |
| 20                                                      | BUS         | 7954_C1_05MILLBR 138-2_A  | AEP - AEP     | 05ADAMS-05WARERD 138 kV line     | 243464 | 246942 | 1    | DC | 162.07  | 163.4  | ER     | 150 | 4.42    |         |
| 21                                                      | DCTL        | 7981_B                    | AEP - AEP     | 05SEAMAN-05ADAMS 138 kV line     | 243571 | 243464 | 1    | DC | 162.99  | 164.44 | ER     | 150 | 4.83    | 13      |
| 22                                                      | LFFB        | 8109_C2_05HILLSB 138-A_A  | AEP - AEP     | 05SEAMAN-05ADAMS 138 kV line     | 243571 | 243464 | 1    | DC | 154.92  | 156.41 | ER     | 150 | 4.94    |         |
| 23                                                      | LFFB        | 8108_C2_05HILLSB 138-D_A  | AEP - AEP     | 05SEAMAN-05ADAMS 138 kV line     | 243571 | 243464 | 1    | DC | 150.16  | 151.61 | ER     | 150 | 4.83    |         |
| 24                                                      | DCTL        | 7981_A                    | AEP - AEP     | 05SEAMAN-05ADAMS 138 kV line     | 243571 | 243464 | 1    | DC | 150.16  | 151.61 | ER     | 150 | 4.83    |         |
| 25                                                      | BUS         | 7954_C1_05MILLBR 138-2_A  | AEP - AEP     | 05SEAMAN-05ADAMS 138 kV line     | 243571 | 243464 | 1    | DC | 139.29  | 140.6  | ER     | 150 | 4.37    |         |
| 26                                                      | LFFB        | 2085_C2_05BEATTY 345-304C | AEP - AEP     | 05BCKSKI-05PETERSB8 69 kV line   | 243598 | 243612 | 1    | DC | 124.24  | 178.3  | ER     | 50  | 27.03   | 14      |
| 27                                                      | DCTL        | 7981_B                    | AEP - DAY     | 05HIGHLA-09MRTNSV 69 kV line     | 243606 | 253043 | 1    | DC | 124     | 128.67 | ER     | 71  | 7.36    | 15      |
| 28                                                      | LFFB        | 8108_C2_05HILLSB 138-D_A  | AEP - DAY     | 05HIGHLA-09MRTNSV 69 kV line     | 243606 | 253043 | 1    | DC | 117.89  | 122.56 | ER     | 71  | 7.36    |         |
| 29                                                      | DCTL        | 7981_A                    | AEP - DAY     | 05HIGHLA-09MRTNSV 69 kV line     | 243606 | 253043 | 1    | DC | 117.89  | 122.56 | ER     | 71  | 7.36    |         |
| 30                                                      | DCTL        | 8123                      | AEP - AEP     | 05LATTAVL8-05BIERSRUN 69 kV line | 243608 | 246893 | 1    | DC | 160.53  | 218.65 | ER     | 50  | 29.06   | 16      |
| 31                                                      | LFFB        | 6774_C2_05MARQUI 345-D    | AEP - AEP     | 05LATTAVL8-05BIERSRUN 69 kV line | 243608 | 246893 | 1    | DC | 149.13  | 206.27 | ER     | 50  | 28.57   |         |
| 32                                                      | LFFB        | 6779_C2_05BIERSR 345-D    | AEP - AEP     | 05LATTAVL8-05BIERSRUN 69 kV line | 243608 | 246893 | 1    | DC | 149.51  | 204.17 | ER     | 50  | 27.33   |         |
| 33                                                      | LFFB        | 2085_C2_05BEATTY 345-304C | AEP - AEP     | 05PETERSB8-05HIGHLA 69 kV line   | 243612 | 243606 | 1    | DC | 108.88  | 155.21 | ER     | 50  | 27.03   | 17      |
| 34                                                      | DCTL        | 8126_B                    | AEP - AEP     | 05BIERSRUN-05SLATE 69 kV line    | 246893 | 243617 | 1    | DC | 133.56  | 140.11 | ER     | 50  | 7.27    |         |
| 35                                                      | DCTL        | 8126_A                    | AEP - AEP     | 05BIERSRUN-05SLATE 69 kV line    | 246893 | 243617 | 1    | DC | 126.08  | 132.63 | ER     | 50  | 7.27    |         |
| 36                                                      | DCTL        | 7981_B                    | AEP - AEP     | 05HIGHLA-05NMARSS 138 kV line    | 246911 | 247035 | 1    | DC | 101.29  | 102.23 | ER     | 310 | 6.49    | 18      |
| 37                                                      | DCTL        | 7981_B                    | AEP - AEP     | 05WARERD-05WAVERL 138 kV line    | 246942 | 243585 | 1    | DC | 175.55  | 177.02 | ER     | 150 | 4.87    | 19      |
| 38                                                      | LFFB        | 8109_C2_05HILLSB 138-A_A  | AEP - AEP     | 05WARERD-05WAVERL 138 kV line    | 246942 | 243585 | 1    | DC | 168.44  | 169.94 | ER     | 150 | 5.01    |         |
| 39                                                      | LFFB        | 8108_C2_05HILLSB 138-D_A  | AEP - AEP     | 05WARERD-05WAVERL 138 kV line    | 246942 | 243585 | 1    | DC | 162.52  | 163.98 | ER     | 150 | 4.87    |         |
| 40                                                      | DCTL        | 7981_A                    | AEP - AEP     | 05WARERD-05WAVERL 138 kV line    | 246942 | 243585 | 1    | DC | 162.52  | 163.98 | ER     | 150 | 4.87    |         |
| 41                                                      | BUS         | 7954_C1_05MILLBR 138-2_A  | AEP - AEP     | 05WARERD-05WAVERL 138 kV line    | 246942 | 243585 | 1    | DC | 151.87  | 153.2  | ER     | 150 | 4.42    |         |

| AC2-087 Contribution to Previously Identified Overloads |             |                                         |               |                                  |        |        |      |    |         |        |        |     |         |         |
|---------------------------------------------------------|-------------|-----------------------------------------|---------------|----------------------------------|--------|--------|------|----|---------|--------|--------|-----|---------|---------|
| #                                                       | Contingency |                                         | Affected Area | Facility Description             | Bus    |        | Cir. | PF | Loading |        | Rating |     | MW Con. | FG App. |
|                                                         | Type        | Name                                    |               |                                  | From   | To     |      |    | Initial | Final  | Type   | MVA |         |         |
| 42                                                      | DCTL        | 7981_B                                  | AEP - AEP     | 05WLDCAT-05EMERSS 138 kV line    | 246946 | 247034 | 1    | DC | 184.5   | 185.87 | ER     | 185 | 5.6     | 20      |
| 43                                                      | LFFB        | 8108_C2_05HILLSB 138-D_A                | AEP - AEP     | 05WLDCAT-05EMERSS 138 kV line    | 246946 | 247034 | 1    | DC | 166.58  | 167.94 | ER     | 185 | 5.6     |         |
| 44                                                      | DCTL        | 7981_A                                  | AEP - AEP     | 05WLDCAT-05EMERSS 138 kV line    | 246946 | 247034 | 1    | DC | 166.58  | 167.94 | ER     | 185 | 5.6     |         |
| 45                                                      | DCTL        | 7981_B                                  | AEP - LGEE    | 05EMERSS-4KENTON 138 kV line     | 247034 | 324267 | 1    | DC | 183.2   | 184.57 | ER     | 185 | 5.6     | 21      |
| 46                                                      | LFFB        | 8108_C2_05HILLSB 138-D_A                | AEP - LGEE    | 05EMERSS-4KENTON 138 kV line     | 247034 | 324267 | 1    | DC | 165.28  | 166.65 | ER     | 185 | 5.6     |         |
| 47                                                      | DCTL        | 7981_A                                  | AEP - LGEE    | 05EMERSS-4KENTON 138 kV line     | 247034 | 324267 | 1    | DC | 165.28  | 166.65 | ER     | 185 | 5.6     |         |
| 48                                                      | LFFB        | 8109_C2_05HILLSB 138-A_A                | DEO&K - DEO&K | 08CLINCO-08WARRN1 138 kV line    | 249995 | 250122 | 1    | DC | 240.96  | 242.56 | ER     | 198 | 7.06    | 22      |
| 49                                                      | BUS         | 7954_C1_05MILLBR 138-2_A                | DEO&K - DEO&K | 08CLINCO-08WARRN1 138 kV line    | 249995 | 250122 | 1    | DC | 210.97  | 212.28 | ER     | 198 | 5.78    |         |
| 50                                                      | LFFB        | 8110_C2_05HILLSB 138-B_A                | DEO&K - DEO&K | 08CLINCO-08WARRN1 138 kV line    | 249995 | 250122 | 1    | DC | 199.08  | 200.78 | ER     | 198 | 7.5     |         |
| 51                                                      | N-1         | 5891_B2_TOR607                          | DEO&K - DEO&K | 08CLINCO-08WARRN1 138 kV line    | 249995 | 250122 | 1    | DC | 100.45  | 101.92 | ER     | 198 | 2.9     |         |
| 52                                                      | LFFB        | 8111_C2_05HILLSB 138-A                  | DAY - DAY     | 09MIDDLE-09OHH 138 kV line       | 253111 | 253057 | 1    | DC | 170.69  | 171.85 | ER     | 185 | 4.74    | 23      |
| 53                                                      | DCTL        | 7981_B                                  | AEP - AEP     | AC1-089 TAP-05WLDCAT 138 kV line | 926100 | 246946 | 1    | DC | 185.58  | 186.95 | ER     | 185 | 5.6     | 24      |
| 54                                                      | LFFB        | 8108_C2_05HILLSB 138-D_A                | AEP - AEP     | AC1-089 TAP-05WLDCAT 138 kV line | 926100 | 246946 | 1    | DC | 167.66  | 169.02 | ER     | 185 | 5.6     |         |
| 55                                                      | DCTL        | 7981_A                                  | AEP - AEP     | AC1-089 TAP-05WLDCAT 138 kV line | 926100 | 246946 | 1    | DC | 167.66  | 169.02 | ER     | 185 | 5.6     |         |
| 56                                                      | DCTL        | 7981_B                                  | AEP - AEP     | AC2-049 TAP-05MILLBR 138 kV line | 931350 | 243042 | 1    | DC | 309.51  | 311.29 | ER     | 179 | 7.05    | 25      |
| 57                                                      | LFFB        | 8108_C2_05HILLSB 138-D_A                | AEP - AEP     | AC2-049 TAP-05MILLBR 138 kV line | 931350 | 243042 | 1    | DC | 286.71  | 288.48 | ER     | 179 | 7.05    |         |
| 58                                                      | DCTL        | 7981_A                                  | AEP - AEP     | AC2-049 TAP-05MILLBR 138 kV line | 931350 | 243042 | 1    | DC | 286.71  | 288.48 | ER     | 179 | 7.05    |         |
| 59                                                      | N-1         | 7353_B2_TOR12737                        | AEP - AEP     | AC2-049 TAP-05MILLBR 138 kV line | 931350 | 243042 | 1    | DC | 123.11  | 124.93 | ER     | 179 | 3.26    |         |
| 60                                                      | N-1         | P1-#.B2 WARREN-CLINTONCO-HILLSBORO 2381 | AEP - AEP     | AC2-049 TAP-05MILLBR 138 kV line | 931350 | 243042 | 1    | DC | 123.06  | 124.88 | ER     | 179 | 3.26    |         |
| 61                                                      | LFFB        | 8109_C2_05HILLSB 138-A_A                | DEO&K - DEO&K | AC2-061 TAP-08CLINCO 138 kV line | 931430 | 249995 | 1    | DC | 273.84  | 275.57 | ER     | 184 | 7.06    | 26      |
| 62                                                      | BUS         | 7954_C1_05MILLBR 138-2_A                | DEO&K - DEO&K | AC2-061 TAP-08CLINCO 138 kV line | 931430 | 249995 | 1    | DC | 241.82  | 243.23 | ER     | 184 | 5.78    |         |
| 63                                                      | N-1         | 5891_B2_TOR607                          | DEO&K - DEO&K | AC2-061 TAP-08CLINCO 138 kV line | 931430 | 249995 | 1    | DC | 123.58  | 125.16 | ER     | 184 | 2.9     |         |

| AC2-087 Contribution to Previously Identified Overloads |             |              |               |                                  |        |        |      |    |         |        |        |     |         |         |
|---------------------------------------------------------|-------------|--------------|---------------|----------------------------------|--------|--------|------|----|---------|--------|--------|-----|---------|---------|
| #                                                       | Contingency |              | Affected Area | Facility Description             | Bus    |        | Cir. | PF | Loading |        | Rating |     | MW Con. | FG App. |
|                                                         | Type        | Name         |               |                                  | From   | To     |      |    | Initial | Final  | Type   | MVA |         |         |
| 64                                                      | N-1         | OUTAGE_02AB  | DEO&K - DEO&K | AC2-061 TAP-08CLINCO 138 kV line | 931430 | 249995 | 1    | DC | 122.99  | 124.56 | ER     | 184 | 2.9     |         |
| 65                                                      | Non         | Non          | DEO&K - DEO&K | AC2-061 TAP-08CLINCO 138 kV line | 931430 | 249995 | 1    | DC | 115.01  | 116.58 | NR     | 159 | 2.49    |         |
| 66                                                      | LFFB        | DAY_L34552-2 | DAY - DAY     | AC2-087 TAP-09GRNFLD 69 kV line  | 931650 | 253030 | 1    | DC | 107.03  | 147.58 | ER     | 72  | 29.2    | 27      |

**Table 14**

## **Steady-State Voltage Requirements**

None

## **Short Circuit**

*(Summary of impacted circuit breakers)*

New circuit breakers found to be over-duty:

None

## **Affected System Analysis & Mitigation**

### **LGEE Impacts:**

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

### **MISO Impacts:**

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

### **Duke, Progress & TVA Impacts:**

Duke Carolina, Progress, & TVA Impacts to be determined during later study phases (as applicable).

### **OVEC Impacts:**

OVEC 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.

| AC2-087 Delivery of Energy Portion of Interconnection Request |      |                                           |               |                                  |        |        |      |    |         |        |        |     |         |         |
|---------------------------------------------------------------|------|-------------------------------------------|---------------|----------------------------------|--------|--------|------|----|---------|--------|--------|-----|---------|---------|
| Contingency                                                   |      |                                           | Affected Area | Facility Description             | Bus    |        |      |    | Loading |        | Rating |     | MW Con. | FG App. |
| #                                                             | Type | Name                                      |               |                                  | From   | To     | Cir. | PF | Initial | Final  | Type   | MVA |         |         |
| 1                                                             | N-1  | 7353_B2_TOR12737                          | AEP - AEP     | 05HILLSB-05SINKG8 138 kV line    | 243019 | 243102 | 1    | DC | 183.95  | 185.37 | ER     | 185 | 5.84    |         |
| 2                                                             | N-1  | 7353_B2_TOR12737                          | AEP - AEP     | 05HILLSB-AC1-089 TAP 138 kV line | 243019 | 926100 | 1    | DC | 111.01  | 112.12 | ER     | 185 | 4.58    |         |
| 3                                                             | N-1  | 5891_B2_TOR607                            | AEP - DEO&K   | 05HILLSB-AC2-061 TAP 138 kV line | 243019 | 931430 | 1    | DC | 199.46  | 200.74 | ER     | 184 | 5.21    |         |
| 4                                                             | Non  | Non                                       | AEP - DEO&K   | 05HILLSB-AC2-061 TAP 138 kV line | 243019 | 931430 | 1    | DC | 189.06  | 190.32 | NR     | 159 | 4.47    |         |
| 5                                                             | N-1  | 7353_B2_TOR12737                          | AEP - AEP     | 05SINKG8-AC2-049 TAP 138 kV line | 243102 | 931350 | 1    | DC | 188.1   | 189.57 | ER     | 179 | 5.84    |         |
| 6                                                             | N-1  | P1-#.B2 WARREN-CLINTONCO-HILLSBORO 2381   | AEP - AEP     | 05ADAMS-05WARERD 138 kV line     | 243464 | 246942 | 1    | DC | 151.49  | 152.78 | ER     | 150 | 4.29    |         |
| 7                                                             | N-1  | 7353_B2_TOR12737                          | AEP - AEP     | 05SEAMAN-05ADAMS 138 kV line     | 243571 | 243464 | 1    | DC | 129.91  | 131.18 | ER     | 150 | 4.25    |         |
| 8                                                             | N-1  | 6781_B3_05BIERSR 345-1                    | AEP - AEP     | 05BCKSKI-05LATTAVL8 69 kV line   | 243598 | 243608 | 1    | DC | 78.85   | 106.19 | ER     | 100 | 27.33   |         |
| 9                                                             | N-1  | 762_B2_TOR8072                            | AEP - AEP     | 05BCKSKI-05PETERSB8 69 kV line   | 243598 | 243612 | 1    | DC | 123.85  | 177.91 | ER     | 50  | 27.03   |         |
| 10                                                            | N-1  | 6781_B3_05BIERSR 345-1                    | AEP - AEP     | 05LATTAVL8-05BIERSRUN 69 kV line | 243608 | 246893 | 1    | DC | 148.51  | 203.17 | ER     | 50  | 27.33   |         |
| 11                                                            | N-1  | 762_B2_TOR8072                            | AEP - AEP     | 05PETERSB8-05HIGHLA 69 kV line   | 243612 | 243606 | 1    | DC | 108.76  | 154.85 | ER     | 50  | 27.03   |         |
| 12                                                            | N-1  | 6786_B2_B                                 | AEP - AEP     | 05BIERSRUN-05SLATE 69 kV line    | 246893 | 243617 | 1    | DC | 91.17   | 97.41  | ER     | 50  | 6.93    |         |
| 13                                                            | N-1  | P1-#.B2 WARREN-CLINTONCO-HILLSBORO 2381   | AEP - AEP     | 05WARERD-05WAVERL 138 kV line    | 246942 | 243585 | 1    | DC | 141.29  | 142.58 | ER     | 150 | 4.29    |         |
| 14                                                            | N-1  | 7353_B2_TOR12737                          | AEP - AEP     | 05WLDCAT-05EMERSS 138 kV line    | 246946 | 247034 | 1    | DC | 134.33  | 135.44 | ER     | 185 | 4.58    |         |
| 15                                                            | N-1  | P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381 | AEP - LGEE    | 05EMERSS-4KENTON 138 kV line     | 247034 | 324267 | 1    | DC | 133.03  | 134.15 | ER     | 185 | 4.58    |         |
| 16                                                            | N-1  | 5891_B2_TOR607                            | DEO&K - DEO&K | 08CLINCO-08WARRN1 138 kV line    | 249995 | 250122 | 1    | DC | 196.58  | 197.76 | ER     | 198 | 5.21    |         |
| 17                                                            | Non  | Non                                       | DAY - DAY     | 09GRNFLD-09WASHCH 69 kV line     | 253030 | 253091 | 1    | DC | 74.51   | 111.02 | NR     | 80  | 29.25   |         |
| 18                                                            | N-1  | 889_B2                                    | DAY - DAY     | 09GRNFLD-09WASHCH 69 kV line     | 253030 | 253091 | 1    | DC | 70.26   | 100.06 | ER     | 98  | 29.2    |         |
| 19                                                            | N-1  | 160_B3                                    | DAY - DAY     | 09TEXTAP-09JFFRTP 69 kV line     | 253081 | 253163 | 1    | DC | 104.85  | 119.95 | ER     | 96  | 14.49   |         |
| 20                                                            | N-1  | 160_B3                                    | DAY - DAY     | 09WASHCH-09TEXTAP 69 kV line     | 253091 | 253081 | 1    | DC | 102.71  | 117.5  | ER     | 98  | 14.49   |         |

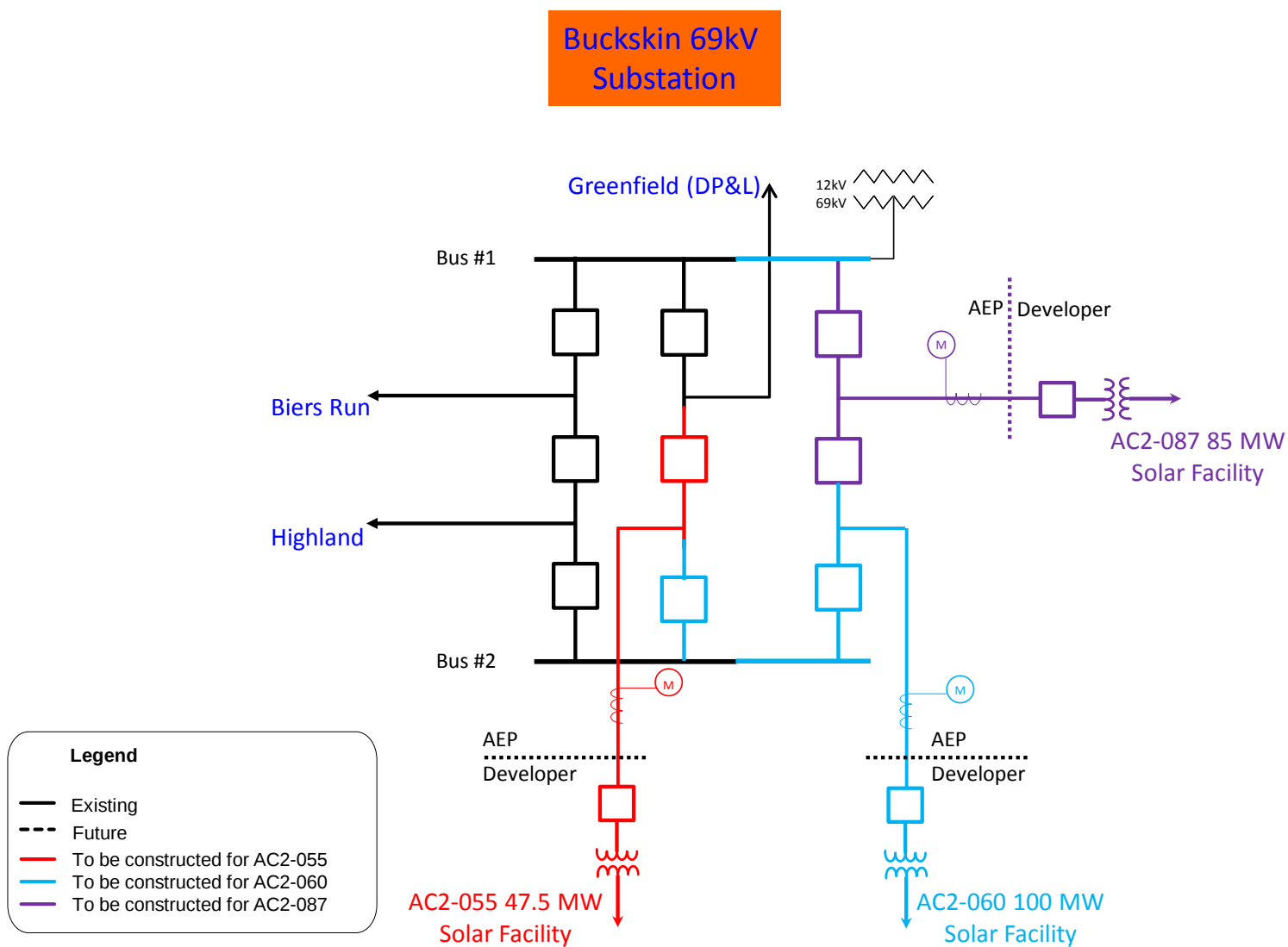
**AC2-087 Delivery of Energy Portion of Interconnection Request**

| #  | Type | Contingency                             | Affected Area | Facility Description             | Bus    |        | Cir. | PF | Loading |        | Rating |     | MW Con. | FG App. |
|----|------|-----------------------------------------|---------------|----------------------------------|--------|--------|------|----|---------|--------|--------|-----|---------|---------|
|    |      | Name                                    |               |                                  | From   | To     |      |    | Initial | Final  | Type   | MVA |         |         |
|    |      |                                         |               | kV line                          |        |        |      |    |         |        |        |     |         |         |
| 21 | N-1  | P1-#.B2 WARREN-CLINTONCO-HILLSBORO 2381 | AEP - AEP     | AC1-089 TAP-05WLDCA138 kV line   | 926100 | 246946 | 1    | DC | 135.65  | 136.76 | ER     | 185 | 4.58    |         |
| 22 | N-1  | 7353_B2_TOR12737                        | AEP - AEP     | AC2-049 TAP-05MILLBR 138 kV line | 931350 | 243042 | 1    | DC | 247.8   | 249.27 | ER     | 179 | 5.84    |         |
| 23 | N-1  | 5891_B2_TOR607                          | DEO&K - DEO&K | AC2-061 TAP-08CLINCO 138 kV line | 931430 | 249995 | 1    | DC | 226.48  | 227.75 | ER     | 184 | 5.21    |         |
| 24 | Non  | Non                                     | DEO&K - DEO&K | AC2-061 TAP-08CLINCO 138 kV line | 931430 | 249995 | 1    | DC | 217.9   | 219.17 | NR     | 159 | 4.47    |         |
| 25 | N-1  | 160_B3                                  | DAY - AEP     | AC2-087 TAP-05BCKSKI 69 kV line  | 931650 | 243598 | 1    | DC | 55.25   | 136.99 | ER     | 72  | 58.85   |         |
| 26 | N-1  | 889_B2                                  | DAY - DAY     | AC2-087 TAP-09GRNFLD 69 kV line  | 931650 | 253030 | 1    | DC | 106.75  | 147.3  | ER     | 72  | 29.2    |         |

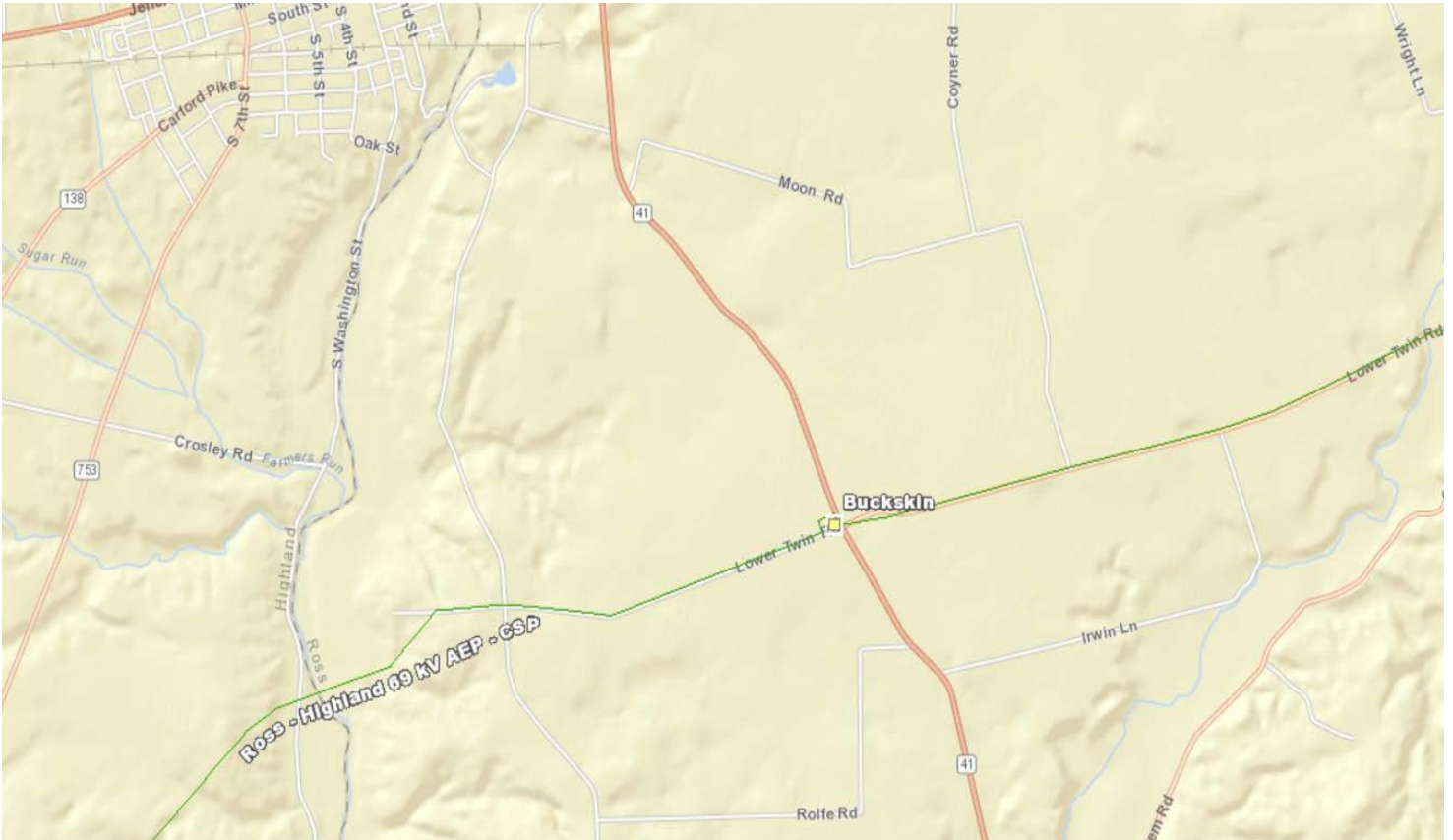
**Table 15**

**Figure 1: Primary Point of Interconnection (Buckskin 69 kV Substation)**

**Single Line Diagram**



**Figure 2: Primary Point of Interconnection (Buckskin 69 kV Substation)**



## **Appendices – Primary POI**

The following appendices contain additional information about each flowgate presented in the body of the report. For each appendix, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gage other generators impact.

It should be noted the generator contributions presented in the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

## Appendix 1

(AEP - AEP) The 05NMARSS-05SEAMAN 138 kV line (from bus 247035 to bus 243571 ckt 1) loads from 99.92% to 100.87% (**DC power flow**) of its emergency rating (310 MVA) for the tower line contingency outage of '7981\_B'. This project contributes approximately 6.56 MW to the thermal violation.

CONTINGENCY '7981\_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061

TAP 138 249995 08CLINCO 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB

138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995

08CLINCO 138 250122 08WARRN1 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111

09MIDDLE 138 253057 09OHH 138 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931022            | AC2-008 E       | 1.73                     |
| 931121            | AC2-019 C       | 0.77                     |
| 931122            | AC2-019 E       | 1.25                     |
| 931131            | AC2-020 C OP    | 0.54                     |
| 931132            | AC2-020 E OP    | 1.42                     |
| 931192            | AC2-027 E       | 2.02                     |
| 931221            | AC2-031 C       | 14.63                    |
| 931222            | AC2-031 E       | 7.2                      |
| 931281            | AC2-042 C       | 45.72                    |
| 931282            | AC2-042 E       | 30.48                    |
| 931351            | AC2-049 C       | 2.96                     |
| 931352            | AC2-049 E       | 1.97                     |
| 931381            | AC2-055 C OP    | 1.77                     |
| 931382            | AC2-055 E OP    | 2.88                     |
| 931421            | AC2-060 C       | 4.94                     |
| 931422            | AC2-060 E       | 2.78                     |
| 931431            | AC2-061 C       | 12.68                    |
| 931432            | AC2-061 E       | 12.86                    |
| 931441            | AC2-062 C OP    | 4.07                     |
| 931442            | AC2-062 E OP    | 1.82                     |
| 931451            | AC2-064 C       | 6.95                     |
| 931452            | AC2-064 E       | 4.63                     |
| 931651            | AC2-087 C OP    | 3.66                     |
| 931652            | AC2-087 E OP    | 2.9                      |
| 247592            | W4-036          | 0.93                     |
| 926061            | AC1-085 C       | 33.18                    |
| 926062            | AC1-085 E       | 54.14                    |
| 926101            | AC1-089 C       | 11.16                    |
| 926102            | AC1-089 E       | 18.22                    |

|        |           |       |
|--------|-----------|-------|
| 926631 | AC1-144 C | 14.69 |
| 926632 | AC1-144 E | 7.14  |

## Appendix 2

(AEP - AEP) The 05HILLSB-05SINKG8 138 kV line (from bus 243019 to bus 243102 ckt 1) loads from 242.84% to 244.57% (**DC power flow**) of its emergency rating (185 MVA) for the tower line contingency outage of '7981\_B'. This project contributes approximately 7.12 MW to the thermal violation.

CONTINGENCY '7981\_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061

TAP 138 249995 08CLINCO 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB  
138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995

08CLINCO 138 250122 08WARRN1 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111

09MIDDLE 138 253057 09OHH 138 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931022            | AC2-008 E       | 2.78                     |
| 931121            | AC2-019 C       | 0.76                     |
| 931122            | AC2-019 E       | 1.25                     |
| 931131            | AC2-020 C OP    | 0.59                     |
| 931132            | AC2-020 E OP    | 1.55                     |
| 931192            | AC2-027 E       | 2.01                     |
| 931221            | AC2-031 C       | 23.37                    |
| 931222            | AC2-031 E       | 11.51                    |
| 931281            | AC2-042 C       | 73.05                    |
| 931282            | AC2-042 E       | 48.7                     |
| 931381            | AC2-055 C OP    | 1.86                     |
| 931382            | AC2-055 E OP    | 3.04                     |
| 931421            | AC2-060 C       | 5.36                     |
| 931422            | AC2-060 E       | 3.02                     |
| 931431            | AC2-061 C       | 20.27                    |
| 931432            | AC2-061 E       | 20.55                    |
| 931441            | AC2-062 C OP    | 6.62                     |
| 931442            | AC2-062 E OP    | 2.96                     |
| 931651            | AC2-087 C OP    | 3.97                     |
| 931652            | AC2-087 E OP    | 3.15                     |
| 247592            | W4-036          | 1.01                     |
| 924371            | AB2-085 C OP    | 8.23                     |
| 924372            | AB2-085 E OP    | 3.87                     |
| 924541            | AB2-103 C OP    | 5.1                      |
| 924542            | AB2-103 E OP    | 2.4                      |
| 926061            | AC1-085 C       | 53.03                    |
| 926062            | AC1-085 E       | 86.52                    |
| 926101            | AC1-089 C       | 17.87                    |
| 926102            | AC1-089 E       | 29.16                    |

|        |           |       |
|--------|-----------|-------|
| 926631 | AC1-144 C | 23.48 |
| 926632 | AC1-144 E | 11.41 |

## Appendix 3

(AEP - DAY) The 05HILLSB-09MIDDLE 138 kV line (from bus 243019 to bus 253111 ckt 1) loads from 169.6% to 170.77% (**DC power flow**) of its emergency rating (185 MVA) for the line fault with failed breaker contingency outage of '8111\_C2\_05HILLSB 138-\_A'. This project contributes approximately 4.81 MW to the thermal violation.

CONTINGENCY '8111\_C2\_05HILLSB 138-\_A'

OPEN BRANCH FROM BUS 243019 TO BUS 926100 CKT 1 / 243019 05HILLSB  
138 926100 AC1-089 TAP 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 931430 CKT 1 / 243019 05HILLSB  
138 931430 AC2-060 TAP 138 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931121            | AC2-019 C       | 0.54                     |
| 931122            | AC2-019 E       | 0.88                     |
| 931131            | AC2-020 C OP    | 0.39                     |
| 931132            | AC2-020 E OP    | 1.02                     |
| 931192            | AC2-027 E       | 1.42                     |
| 931221            | AC2-031 C       | 16.99                    |
| 931222            | AC2-031 E       | 8.37                     |
| 931281            | AC2-042 C       | 53.11                    |
| 931282            | AC2-042 E       | 35.41                    |
| 931351            | AC2-049 C       | 3.7                      |
| 931352            | AC2-049 E       | 2.47                     |
| 931381            | AC2-055 C OP    | 1.28                     |
| 931382            | AC2-055 E OP    | 2.08                     |
| 931421            | AC2-060 C       | 3.62                     |
| 931422            | AC2-060 E       | 2.04                     |
| 931451            | AC2-064 C       | 8.69                     |
| 931452            | AC2-064 E       | 5.8                      |
| 931651            | AC2-087 C OP    | 2.68                     |
| 931652            | AC2-087 E OP    | 2.13                     |
| 247592            | W4-036          | 0.68                     |
| 924371            | AB2-085 C OP    | 6.32                     |
| 924372            | AB2-085 E OP    | 2.97                     |
| 924541            | AB2-103 C OP    | 3.81                     |
| 924542            | AB2-103 E OP    | 1.79                     |
| 926061            | AC1-085 C       | 38.55                    |
| 926062            | AC1-085 E       | 62.9                     |
| 926631            | AC1-144 C       | 17.07                    |
| 926632            | AC1-144 E       | 8.29                     |

## Appendix 4

(AEP - AEP) The 05HILLSB-AC1-089 TAP 138 kV line (from bus 243019 to bus 926100 ckt 1) loads from 153.15% to 154.53% (**DC power flow**) of its emergency rating (185 MVA) for the tower line contingency outage of '7981\_B'. This project contributes approximately 5.67 MW to the thermal violation.

CONTINGENCY '7981\_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061

TAP 138 249995 08CLINCO 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB  
138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995

08CLINCO 138 250122 08WARRN1 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111

09MIDDLE 138 253057 09OHH 138 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931121            | AC2-019 C       | 0.61                     |
| 931122            | AC2-019 E       | 1.                       |
| 931131            | AC2-020 C OP    | 0.46                     |
| 931132            | AC2-020 E OP    | 1.22                     |
| 931192            | AC2-027 E       | 1.62                     |
| 931221            | AC2-031 C       | 18.99                    |
| 931222            | AC2-031 E       | 9.35                     |
| 931281            | AC2-042 C       | 59.34                    |
| 931282            | AC2-042 E       | 39.56                    |
| 931351            | AC2-049 C       | 4.11                     |
| 931352            | AC2-049 E       | 2.74                     |
| 931381            | AC2-055 C OP    | 1.49                     |
| 931382            | AC2-055 E OP    | 2.42                     |
| 931421            | AC2-060 C       | 4.27                     |
| 931422            | AC2-060 E       | 2.4                      |
| 931431            | AC2-061 C       | 16.47                    |
| 931432            | AC2-061 E       | 16.69                    |
| 931451            | AC2-064 C       | 9.64                     |
| 931452            | AC2-064 E       | 6.43                     |
| 931651            | AC2-087 C OP    | 3.16                     |
| 931652            | AC2-087 E OP    | 2.51                     |
| 247592            | W4-036          | 0.8                      |
| 924371            | AB2-085 C OP    | 7.03                     |
| 924372            | AB2-085 E OP    | 3.31                     |
| 924541            | AB2-103 C OP    | 4.25                     |
| 924542            | AB2-103 E OP    | 2.                       |
| 926061            | AC1-085 C       | 43.08                    |
| 926062            | AC1-085 E       | 70.28                    |
| 926631            | AC1-144 C       | 19.07                    |

|        |                  |      |
|--------|------------------|------|
| 926632 | <i>AC1-144 E</i> | 9.27 |
|--------|------------------|------|

## Appendix 5

(AEP - DEO&K) The 05HILLSB-AC2-061 TAP 138 kV line (from bus 243019 to bus 931430 ckt 1) loads from 244.23% to 245.98% (**DC power flow**) of its emergency rating (184 MVA) for the line fault with failed breaker contingency outage of '8109\_C2\_05HILLSB 138-A\_A'. This project contributes approximately 7.14 MW to the thermal violation.

CONTINGENCY '8109\_C2\_05HILLSB 138-A\_A'

OPEN BRANCH FROM BUS 243019 TO BUS 243102 CKT 1 / 243019 05HILLSB  
138 243102 05SINKG8 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB  
138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 931350 TO BUS 243102 CKT 1 / 931350 AC2-049  
TAP 138 243102 05SINKG8 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111  
09MIDDLE 138 253057 09OHH 138 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931022            | AC2-008 E       | 2.83                     |
| 931121            | AC2-019 C       | 0.77                     |
| 931122            | AC2-019 E       | 1.26                     |
| 931131            | AC2-020 C OP    | 0.59                     |
| 931132            | AC2-020 E OP    | 1.54                     |
| 931192            | AC2-027 E       | 2.04                     |
| 931221            | AC2-031 C       | 23.89                    |
| 931222            | AC2-031 E       | 11.77                    |
| 931281            | AC2-042 C       | 74.67                    |
| 931282            | AC2-042 E       | 49.78                    |
| 931381            | AC2-055 C OP    | 1.87                     |
| 931382            | AC2-055 E OP    | 3.06                     |
| 931421            | AC2-060 C       | 5.37                     |
| 931422            | AC2-060 E       | 3.02                     |
| 931441            | AC2-062 C OP    | 6.6                      |
| 931442            | AC2-062 E OP    | 2.95                     |
| 931651            | AC2-087 C OP    | 3.98                     |
| 931652            | AC2-087 E OP    | 3.16                     |
| 247592            | W4-036          | 1.01                     |
| 916272            | Z1-080 E        | 2.18                     |
| 924371            | AB2-085 C OP    | 8.72                     |
| 924372            | AB2-085 E OP    | 4.1                      |
| 924541            | AB2-103 C OP    | 5.31                     |
| 924542            | AB2-103 E OP    | 2.5                      |
| 926061            | AC1-085 C       | 54.2                     |
| 926062            | AC1-085 E       | 88.44                    |
| 926101            | AC1-089 C       | 18.22                    |
| 926102            | AC1-089 E       | 29.73                    |
| 926631            | AC1-144 C       | 24.                      |

|        |                  |       |
|--------|------------------|-------|
| 926632 | <i>AC1-144 E</i> | 11.66 |
|--------|------------------|-------|

## Appendix 6

(AEP - AEP) The 05SINKG8-AC2-049 TAP 138 kV line (from bus 243102 to bus 931350 ckt 1) loads from 249.02% to 250.81% (**DC power flow**) of its emergency rating (179 MVA) for the tower line contingency outage of '7981\_B'. This project contributes approximately 7.12 MW to the thermal violation.

CONTINGENCY '7981\_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061

TAP 138 249995 08CLINCO 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB

138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995

08CLINCO 138 250122 08WARRN1 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111

09MIDDLE 138 253057 09OHH 138 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931022            | AC2-008 E       | 2.78                     |
| 931121            | AC2-019 C       | 0.76                     |
| 931122            | AC2-019 E       | 1.25                     |
| 931131            | AC2-020 C OP    | 0.59                     |
| 931132            | AC2-020 E OP    | 1.55                     |
| 931192            | AC2-027 E       | 2.01                     |
| 931221            | AC2-031 C       | 23.37                    |
| 931222            | AC2-031 E       | 11.51                    |
| 931281            | AC2-042 C       | 73.05                    |
| 931282            | AC2-042 E       | 48.7                     |
| 931381            | AC2-055 C OP    | 1.86                     |
| 931382            | AC2-055 E OP    | 3.04                     |
| 931421            | AC2-060 C       | 5.36                     |
| 931422            | AC2-060 E       | 3.02                     |
| 931431            | AC2-061 C       | 20.27                    |
| 931432            | AC2-061 E       | 20.55                    |
| 931441            | AC2-062 C OP    | 6.62                     |
| 931442            | AC2-062 E OP    | 2.96                     |
| 931651            | AC2-087 C OP    | 3.97                     |
| 931652            | AC2-087 E OP    | 3.15                     |
| 247592            | W4-036          | 1.01                     |
| 924371            | AB2-085 C OP    | 8.23                     |
| 924372            | AB2-085 E OP    | 3.87                     |
| 924541            | AB2-103 C OP    | 5.1                      |
| 924542            | AB2-103 E OP    | 2.4                      |
| 926061            | AC1-085 C       | 53.03                    |
| 926062            | AC1-085 E       | 86.52                    |
| 926101            | AC1-089 C       | 17.87                    |
| 926102            | AC1-089 E       | 29.16                    |

|               |                  |              |
|---------------|------------------|--------------|
| <i>926631</i> | <i>AC1-144 C</i> | <i>23.48</i> |
| <i>926632</i> | <i>AC1-144 E</i> | <i>11.41</i> |

## Appendix 7

(AEP - AEP) The 05ADAMS-05WARERD 138 kV line (from bus 243464 to bus 246942 ckt 1) loads from 173.32% to 174.79% (**DC power flow**) of its emergency rating (150 MVA) for the tower line contingency outage of '7981\_B'. This project contributes approximately 4.92 MW to the thermal violation.

CONTINGENCY '7981\_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061

TAP 138 249995 08CLINCO 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB  
138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995

08CLINCO 138 250122 08WARRN1 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111

09MIDDLE 138 253057 09OHH 138 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931022            | AC2-008 E       | 1.34                     |
| 931121            | AC2-019 C       | 0.59                     |
| 931122            | AC2-019 E       | 0.96                     |
| 931131            | AC2-020 C OP    | 0.41                     |
| 931132            | AC2-020 E OP    | 1.07                     |
| 931192            | AC2-027 E       | 1.55                     |
| 931221            | AC2-031 C       | 11.2                     |
| 931222            | AC2-031 E       | 5.51                     |
| 931281            | AC2-042 C       | 34.99                    |
| 931282            | AC2-042 E       | 23.33                    |
| 931351            | AC2-049 C       | 2.18                     |
| 931352            | AC2-049 E       | 1.45                     |
| 931381            | AC2-055 C OP    | 1.33                     |
| 931382            | AC2-055 E OP    | 2.18                     |
| 931421            | AC2-060 C       | 3.7                      |
| 931422            | AC2-060 E       | 2.08                     |
| 931431            | AC2-061 C       | 9.71                     |
| 931432            | AC2-061 E       | 9.84                     |
| 931441            | AC2-062 C OP    | 3.21                     |
| 931442            | AC2-062 E OP    | 1.44                     |
| 931451            | AC2-064 C       | 5.11                     |
| 931452            | AC2-064 E       | 3.41                     |
| 931651            | AC2-087 C OP    | 2.74                     |
| 931652            | AC2-087 E OP    | 2.18                     |
| 247592            | W4-036          | 0.69                     |
| 924371            | AB2-085 C OP    | 27.11                    |
| 924372            | AB2-085 E OP    | 12.76                    |
| 924541            | AB2-103 C OP    | 10.95                    |
| 924542            | AB2-103 E OP    | 5.15                     |

|        |           |       |
|--------|-----------|-------|
| 926061 | AC1-085 C | 25.4  |
| 926062 | AC1-085 E | 41.44 |
| 926101 | AC1-089 C | 8.57  |
| 926102 | AC1-089 E | 13.99 |
| 926631 | AC1-144 C | 11.25 |
| 926632 | AC1-144 E | 5.46  |

## Appendix 8

(AEP - AEP) The 05SEAMAN-05ADAMS 138 kV line (from bus 243571 to bus 243464 ckt 1) loads from 159.6% to 161.06% (**DC power flow**) of its emergency rating (150 MVA) for the tower line contingency outage of '7981\_B'. This project contributes approximately 4.88 MW to the thermal violation.

CONTINGENCY '7981\_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061

TAP 138 249995 08CLINCO 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB  
138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995

08CLINCO 138 250122 08WARRN1 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111

09MIDDLE 138 253057 09OHH 138 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931022            | AC2-008 E       | 1.31                     |
| 931121            | AC2-019 C       | 0.58                     |
| 931122            | AC2-019 E       | 0.95                     |
| 931131            | AC2-020 C OP    | 0.4                      |
| 931132            | AC2-020 E OP    | 1.06                     |
| 931192            | AC2-027 E       | 1.53                     |
| 931221            | AC2-031 C       | 11.02                    |
| 931222            | AC2-031 E       | 5.43                     |
| 931281            | AC2-042 C       | 34.44                    |
| 931282            | AC2-042 E       | 22.96                    |
| 931351            | AC2-049 C       | 2.17                     |
| 931352            | AC2-049 E       | 1.45                     |
| 931381            | AC2-055 C OP    | 1.32                     |
| 931382            | AC2-055 E OP    | 2.15                     |
| 931421            | AC2-060 C       | 3.67                     |
| 931422            | AC2-060 E       | 2.07                     |
| 931431            | AC2-061 C       | 9.56                     |
| 931432            | AC2-061 E       | 9.69                     |
| 931441            | AC2-062 C OP    | 3.13                     |
| 931442            | AC2-062 E OP    | 1.4                      |
| 931451            | AC2-064 C       | 5.1                      |
| 931452            | AC2-064 E       | 3.4                      |
| 931651            | AC2-087 C OP    | 2.72                     |
| 931652            | AC2-087 E OP    | 2.16                     |
| 247592            | W4-036          | 0.69                     |
| 924541            | AB2-103 C OP    | 10.77                    |
| 924542            | AB2-103 E OP    | 5.07                     |
| 926061            | AC1-085 C       | 25.                      |
| 926062            | AC1-085 E       | 40.79                    |

|               |                  |              |
|---------------|------------------|--------------|
| <i>926101</i> | <i>AC1-089 C</i> | <i>8.43</i>  |
| <i>926102</i> | <i>AC1-089 E</i> | <i>13.75</i> |
| <i>926631</i> | <i>AC1-144 C</i> | <i>11.07</i> |
| <i>926632</i> | <i>AC1-144 E</i> | <i>5.38</i>  |

## Appendix 9

(AEP - AEP) The 05HIGHLA-05NMARSS 138 kV line (from bus 246911 to bus 247035 ckt 1) loads from 103.3% to 104.26% (**DC power flow**) of its emergency rating (310 MVA) for the tower line contingency outage of '7981\_B'. This project contributes approximately 6.56 MW to the thermal violation.

CONTINGENCY '7981\_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061  
TAP 138 249995 08CLINCO 138 1  
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB  
138 253111 09MIDDLE 138 1  
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995  
08CLINCO 138 250122 08WARRN1 138 1  
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111  
09MIDDLE 138 253057 09OHH 138 1  
END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931022            | AC2-008 E       | 1.73                     |
| 931121            | AC2-019 C       | 0.77                     |
| 931122            | AC2-019 E       | 1.25                     |
| 931131            | AC2-020 C OP    | 0.54                     |
| 931132            | AC2-020 E OP    | 1.42                     |
| 931192            | AC2-027 E       | 2.02                     |
| 931221            | AC2-031 C       | 14.63                    |
| 931222            | AC2-031 E       | 7.2                      |
| 931281            | AC2-042 C       | 45.72                    |
| 931282            | AC2-042 E       | 30.48                    |
| 931351            | AC2-049 C       | 2.96                     |
| 931352            | AC2-049 E       | 1.97                     |
| 931381            | AC2-055 C OP    | 1.77                     |
| 931382            | AC2-055 E OP    | 2.88                     |
| 931421            | AC2-060 C       | 4.94                     |
| 931422            | AC2-060 E       | 2.78                     |
| 931431            | AC2-061 C       | 12.68                    |
| 931432            | AC2-061 E       | 12.86                    |
| 931441            | AC2-062 C OP    | 4.07                     |
| 931442            | AC2-062 E OP    | 1.82                     |
| 931451            | AC2-064 C       | 6.95                     |
| 931452            | AC2-064 E       | 4.63                     |
| 931651            | AC2-087 C OP    | 3.66                     |
| 931652            | AC2-087 E OP    | 2.9                      |
| 247592            | W4-036          | 0.93                     |
| 926061            | AC1-085 C       | 33.18                    |
| 926062            | AC1-085 E       | 54.14                    |
| 926101            | AC1-089 C       | 11.16                    |
| 926102            | AC1-089 E       | 18.22                    |

|        |                  |       |
|--------|------------------|-------|
| 926631 | <i>AC1-144 C</i> | 14.69 |
| 926632 | <i>AC1-144 E</i> | 7.14  |

## Appendix 10

(AEP - AEP) The 05WARERD-05WAVERL 138 kV line (from bus 246942 to bus 243585 ckt 1) loads from 163.12% to 164.59% (**DC power flow**) of its emergency rating (150 MVA) for the tower line contingency outage of '7981\_B'. This project contributes approximately 4.92 MW to the thermal violation.

CONTINGENCY '7981\_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061  
TAP 138 249995 08CLINCO 138 1  
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB  
138 253111 09MIDDLE 138 1  
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995  
08CLINCO 138 250122 08WARRN1 138 1  
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111  
09MIDDLE 138 253057 09OHH 138 1  
END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931022            | AC2-008 E       | 1.34                     |
| 931121            | AC2-019 C       | 0.59                     |
| 931122            | AC2-019 E       | 0.96                     |
| 931131            | AC2-020 C OP    | 0.41                     |
| 931132            | AC2-020 E OP    | 1.07                     |
| 931192            | AC2-027 E       | 1.55                     |
| 931221            | AC2-031 C       | 11.2                     |
| 931222            | AC2-031 E       | 5.51                     |
| 931281            | AC2-042 C       | 34.99                    |
| 931282            | AC2-042 E       | 23.33                    |
| 931351            | AC2-049 C       | 2.18                     |
| 931352            | AC2-049 E       | 1.45                     |
| 931381            | AC2-055 C OP    | 1.33                     |
| 931382            | AC2-055 E OP    | 2.18                     |
| 931421            | AC2-060 C       | 3.7                      |
| 931422            | AC2-060 E       | 2.08                     |
| 931431            | AC2-061 C       | 9.71                     |
| 931432            | AC2-061 E       | 9.84                     |
| 931441            | AC2-062 C OP    | 3.21                     |
| 931442            | AC2-062 E OP    | 1.44                     |
| 931451            | AC2-064 C       | 5.11                     |
| 931452            | AC2-064 E       | 3.41                     |
| 931651            | AC2-087 C OP    | 2.74                     |
| 931652            | AC2-087 E OP    | 2.18                     |
| 247592            | W4-036          | 0.69                     |
| 924371            | AB2-085 C OP    | 27.11                    |
| 924372            | AB2-085 E OP    | 12.76                    |
| 924541            | AB2-103 C OP    | 10.95                    |
| 924542            | AB2-103 E OP    | 5.15                     |

|        |           |       |
|--------|-----------|-------|
| 926061 | AC1-085 C | 25.4  |
| 926062 | AC1-085 E | 41.44 |
| 926101 | AC1-089 C | 8.57  |
| 926102 | AC1-089 E | 13.99 |
| 926631 | AC1-144 C | 11.25 |
| 926632 | AC1-144 E | 5.46  |

## Appendix 11

(AEP - AEP) The 05WLDCAT-05EMERSS 138 kV line (from bus 246946 to bus 247034 ckt 1) loads from 180.77% to 182.15% (**DC power flow**) of its emergency rating (185 MVA) for the tower line contingency outage of '7981\_B'. This project contributes approximately 5.67 MW to the thermal violation.

CONTINGENCY '7981\_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061

TAP 138 249995 08CLINCO 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB

138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995

08CLINCO 138 250122 08WARRN1 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111

09MIDDLE 138 253057 09OHH 138 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931022            | AC2-008 E       | 4.3                      |
| 931121            | AC2-019 C       | 0.61                     |
| 931122            | AC2-019 E       | 1.                       |
| 931131            | AC2-020 C OP    | 0.46                     |
| 931132            | AC2-020 E OP    | 1.22                     |
| 931192            | AC2-027 E       | 1.62                     |
| 931221            | AC2-031 C       | 18.99                    |
| 931222            | AC2-031 E       | 9.35                     |
| 931281            | AC2-042 C       | 59.34                    |
| 931282            | AC2-042 E       | 39.56                    |
| 931351            | AC2-049 C       | 4.11                     |
| 931352            | AC2-049 E       | 2.74                     |
| 931381            | AC2-055 C OP    | 1.49                     |
| 931382            | AC2-055 E OP    | 2.42                     |
| 931421            | AC2-060 C       | 4.27                     |
| 931422            | AC2-060 E       | 2.4                      |
| 931431            | AC2-061 C       | 16.47                    |
| 931432            | AC2-061 E       | 16.69                    |
| 931451            | AC2-064 C       | 9.64                     |
| 931452            | AC2-064 E       | 6.43                     |
| 931651            | AC2-087 C OP    | 3.16                     |
| 931652            | AC2-087 E OP    | 2.51                     |
| 247592            | W4-036          | 0.8                      |
| 924371            | AB2-085 C OP    | 7.03                     |
| 924372            | AB2-085 E OP    | 3.31                     |
| 924541            | AB2-103 C OP    | 4.25                     |
| 924542            | AB2-103 E OP    | 2.                       |
| 926061            | AC1-085 C       | 43.08                    |
| 926062            | AC1-085 E       | 70.28                    |

|               |                  |              |
|---------------|------------------|--------------|
| <i>926101</i> | <i>AC1-089 C</i> | <i>20.33</i> |
| <i>926102</i> | <i>AC1-089 E</i> | <i>33.17</i> |
| <i>926631</i> | <i>AC1-144 C</i> | <i>19.07</i> |
| <i>926632</i> | <i>AC1-144 E</i> | <i>9.27</i>  |

## Appendix 12

(AEP - AEP) The 05EMERSS-AC2-062 TAP 138 kV line (from bus 247034 to bus 931440 ckt 1) loads from 178.77% to 180.15% (**DC power flow**) of its emergency rating (185 MVA) for the tower line contingency outage of '7981\_B'. This project contributes approximately 5.67 MW to the thermal violation.

CONTINGENCY '7981\_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061

TAP 138 249995 08CLINCO 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB

138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995

08CLINCO 138 250122 08WARRN1 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111

09MIDDLE 138 253057 09OHH 138 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931022            | AC2-008 E       | 4.3                      |
| 931121            | AC2-019 C       | 0.61                     |
| 931122            | AC2-019 E       | 1.                       |
| 931131            | AC2-020 C OP    | 0.46                     |
| 931132            | AC2-020 E OP    | 1.22                     |
| 931192            | AC2-027 E       | 1.62                     |
| 931221            | AC2-031 C       | 18.99                    |
| 931222            | AC2-031 E       | 9.35                     |
| 931281            | AC2-042 C       | 59.34                    |
| 931282            | AC2-042 E       | 39.56                    |
| 931351            | AC2-049 C       | 4.11                     |
| 931352            | AC2-049 E       | 2.74                     |
| 931381            | AC2-055 C OP    | 1.49                     |
| 931382            | AC2-055 E OP    | 2.42                     |
| 931421            | AC2-060 C       | 4.27                     |
| 931422            | AC2-060 E       | 2.4                      |
| 931431            | AC2-061 C       | 16.47                    |
| 931432            | AC2-061 E       | 16.69                    |
| 931451            | AC2-064 C       | 9.64                     |
| 931452            | AC2-064 E       | 6.43                     |
| 931651            | AC2-087 C OP    | 3.16                     |
| 931652            | AC2-087 E OP    | 2.51                     |
| 247592            | W4-036          | 0.8                      |
| 924371            | AB2-085 C OP    | 7.03                     |
| 924372            | AB2-085 E OP    | 3.31                     |
| 924541            | AB2-103 C OP    | 4.25                     |
| 924542            | AB2-103 E OP    | 2.                       |
| 926061            | AC1-085 C       | 43.08                    |
| 926062            | AC1-085 E       | 70.28                    |

|               |                  |              |
|---------------|------------------|--------------|
| <i>926101</i> | <i>AC1-089 C</i> | <i>20.33</i> |
| <i>926102</i> | <i>AC1-089 E</i> | <i>33.17</i> |
| <i>926631</i> | <i>AC1-144 C</i> | <i>19.07</i> |
| <i>926632</i> | <i>AC1-144 E</i> | <i>9.27</i>  |

## Appendix 13

(DEO&K - DEO&K) The 08CLINCO-08WARRN1 138 kV line (from bus 249995 to bus 250122 ckt 1) loads from 242.78% to 244.4% (**DC power flow**) of its emergency rating (198 MVA) for the line fault with failed breaker contingency outage of '8109\_C2\_05HILLSB 138-A\_A'. This project contributes approximately 7.14 MW to the thermal violation.

CONTINGENCY '8109\_C2\_05HILLSB 138-A\_A'

OPEN BRANCH FROM BUS 243019 TO BUS 243102 CKT 1 / 243019 05HILLSB  
138 243102 05SINKG8 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB  
138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 931350 TO BUS 243102 CKT 1 / 931350 AC2-049  
TAP 138 243102 05SINKG8 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111  
09MIDDLE 138 253057 09OHH 138 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931022            | AC2-008 E       | 2.83                     |
| 931121            | AC2-019 C       | 0.77                     |
| 931122            | AC2-019 E       | 1.26                     |
| 931131            | AC2-020 C OP    | 0.59                     |
| 931132            | AC2-020 E OP    | 1.54                     |
| 931192            | AC2-027 E       | 2.04                     |
| 931221            | AC2-031 C       | 23.89                    |
| 931222            | AC2-031 E       | 11.77                    |
| 931281            | AC2-042 C       | 74.67                    |
| 931282            | AC2-042 E       | 49.78                    |
| 931381            | AC2-055 C OP    | 1.87                     |
| 931382            | AC2-055 E OP    | 3.06                     |
| 931421            | AC2-060 C       | 5.37                     |
| 931422            | AC2-060 E       | 3.02                     |
| 931431            | AC2-061 C       | 28.84                    |
| 931432            | AC2-061 E       | 29.24                    |
| 931441            | AC2-062 C OP    | 6.6                      |
| 931442            | AC2-062 E OP    | 2.95                     |
| 931651            | AC2-087 C OP    | 3.98                     |
| 931652            | AC2-087 E OP    | 3.16                     |
| 247592            | W4-036          | 1.01                     |
| 916272            | Z1-080 E        | 3.82                     |
| 924371            | AB2-085 C OP    | 8.72                     |
| 924372            | AB2-085 E OP    | 4.1                      |
| 924541            | AB2-103 C OP    | 5.31                     |
| 924542            | AB2-103 E OP    | 2.5                      |
| 926061            | AC1-085 C       | 54.2                     |
| 926062            | AC1-085 E       | 88.44                    |
| 926101            | AC1-089 C       | 18.22                    |

|        |           |       |
|--------|-----------|-------|
| 926102 | AC1-089 E | 29.73 |
| 926631 | AC1-144 C | 24.   |
| 926632 | AC1-144 E | 11.66 |

## Appendix 14

(DAY - DAY) The 09MIDDLE-09OHH 138 kV line (from bus 253111 to bus 253057 ckt 1) loads from 167.33% to 168.5% (**DC power flow**) of its emergency rating (185 MVA) for the line fault with failed breaker contingency outage of '8111\_C2\_05HILLSB 138-\_A'. This project contributes approximately 4.81 MW to the thermal violation.

CONTINGENCY '8111\_C2\_05HILLSB 138-\_A'

OPEN BRANCH FROM BUS 243019 TO BUS 926100 CKT 1 / 243019 05HILLSB  
138 926100 AC1-089 TAP 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 931430 CKT 1 / 243019 05HILLSB  
138 931430 AC2-060 TAP 138 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931121            | AC2-019 C       | 0.54                     |
| 931122            | AC2-019 E       | 0.88                     |
| 931131            | AC2-020 C OP    | 0.39                     |
| 931132            | AC2-020 E OP    | 1.02                     |
| 931192            | AC2-027 E       | 1.42                     |
| 931221            | AC2-031 C       | 16.99                    |
| 931222            | AC2-031 E       | 8.37                     |
| 931281            | AC2-042 C       | 53.11                    |
| 931282            | AC2-042 E       | 35.41                    |
| 931351            | AC2-049 C       | 3.7                      |
| 931352            | AC2-049 E       | 2.47                     |
| 931381            | AC2-055 C OP    | 1.28                     |
| 931382            | AC2-055 E OP    | 2.08                     |
| 931421            | AC2-060 C       | 3.62                     |
| 931422            | AC2-060 E       | 2.04                     |
| 931451            | AC2-064 C       | 8.69                     |
| 931452            | AC2-064 E       | 5.8                      |
| 931651            | AC2-087 C OP    | 2.68                     |
| 931652            | AC2-087 E OP    | 2.13                     |
| 247592            | W4-036          | 0.68                     |
| 924371            | AB2-085 C OP    | 6.32                     |
| 924372            | AB2-085 E OP    | 2.97                     |
| 924541            | AB2-103 C OP    | 3.81                     |
| 924542            | AB2-103 E OP    | 1.79                     |
| 926061            | AC1-085 C       | 38.55                    |
| 926062            | AC1-085 E       | 62.9                     |
| 926631            | AC1-144 C       | 17.07                    |
| 926632            | AC1-144 E       | 8.29                     |

## Appendix 15

(AEP - AEP) The AC1-089 TAP-05WLDCAT 138 kV line (from bus 926100 to bus 246946 ckt 1) loads from 181.85% to 183.23% (**DC power flow**) of its emergency rating (185 MVA) for the tower line contingency outage of '7981\_B'. This project contributes approximately 5.67 MW to the thermal violation.

CONTINGENCY '7981\_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061  
TAP 138 249995 08CLINCO 138 1  
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB  
138 253111 09MIDDLE 138 1  
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995  
08CLINCO 138 250122 08WARRN1 138 1  
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111  
09MIDDLE 138 253057 09OHH 138 1  
END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931121            | AC2-019 C       | 0.61                     |
| 931122            | AC2-019 E       | 1.                       |
| 931131            | AC2-020 C OP    | 0.46                     |
| 931132            | AC2-020 E OP    | 1.22                     |
| 931192            | AC2-027 E       | 1.62                     |
| 931221            | AC2-031 C       | 18.99                    |
| 931222            | AC2-031 E       | 9.35                     |
| 931281            | AC2-042 C       | 59.34                    |
| 931282            | AC2-042 E       | 39.56                    |
| 931351            | AC2-049 C       | 4.11                     |
| 931352            | AC2-049 E       | 2.74                     |
| 931381            | AC2-055 C OP    | 1.49                     |
| 931382            | AC2-055 E OP    | 2.42                     |
| 931421            | AC2-060 C       | 4.27                     |
| 931422            | AC2-060 E       | 2.4                      |
| 931431            | AC2-061 C       | 16.47                    |
| 931432            | AC2-061 E       | 16.69                    |
| 931451            | AC2-064 C       | 9.64                     |
| 931452            | AC2-064 E       | 6.43                     |
| 931651            | AC2-087 C OP    | 3.16                     |
| 931652            | AC2-087 E OP    | 2.51                     |
| 247592            | W4-036          | 0.8                      |
| 924371            | AB2-085 C OP    | 7.03                     |
| 924372            | AB2-085 E OP    | 3.31                     |
| 924541            | AB2-103 C OP    | 4.25                     |
| 924542            | AB2-103 E OP    | 2.                       |
| 926061            | AC1-085 C       | 43.08                    |
| 926062            | AC1-085 E       | 70.28                    |
| 926101            | AC1-089 C       | 20.33                    |

|               |                  |              |
|---------------|------------------|--------------|
| <i>926102</i> | <i>AC1-089 E</i> | <i>33.17</i> |
| <i>926631</i> | <i>AC1-144 C</i> | <i>19.07</i> |
| <i>926632</i> | <i>AC1-144 E</i> | <i>9.27</i>  |

## Appendix 16

(AEP - AEP) The AC2-049 TAP-05MILLBR 138 kV line (from bus 931350 to bus 243042 ckt 1) loads from 311.7% to 313.5% (**DC power flow**) of its emergency rating (179 MVA) for the tower line contingency outage of '7981\_B'. This project contributes approximately 7.12 MW to the thermal violation.

CONTINGENCY '7981\_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061

TAP 138 249995 08CLINCO 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB

138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995

08CLINCO 138 250122 08WARRN1 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111

09MIDDLE 138 253057 09OHH 138 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931022            | AC2-008 E       | 2.78                     |
| 931121            | AC2-019 C       | 0.76                     |
| 931122            | AC2-019 E       | 1.25                     |
| 931131            | AC2-020 C OP    | 0.59                     |
| 931132            | AC2-020 E OP    | 1.55                     |
| 931192            | AC2-027 E       | 2.01                     |
| 931221            | AC2-031 C       | 23.37                    |
| 931222            | AC2-031 E       | 11.51                    |
| 931281            | AC2-042 C       | 73.05                    |
| 931282            | AC2-042 E       | 48.7                     |
| 931351            | AC2-049 C       | 20.15                    |
| 931352            | AC2-049 E       | 13.43                    |
| 931381            | AC2-055 C OP    | 1.86                     |
| 931382            | AC2-055 E OP    | 3.04                     |
| 931421            | AC2-060 C       | 5.36                     |
| 931422            | AC2-060 E       | 3.02                     |
| 931431            | AC2-061 C       | 20.27                    |
| 931432            | AC2-061 E       | 20.55                    |
| 931441            | AC2-062 C OP    | 6.62                     |
| 931442            | AC2-062 E OP    | 2.96                     |
| 931451            | AC2-064 C       | 47.29                    |
| 931452            | AC2-064 E       | 31.53                    |
| 931651            | AC2-087 C OP    | 3.97                     |
| 931652            | AC2-087 E OP    | 3.15                     |
| 247592            | W4-036          | 1.01                     |
| 924371            | AB2-085 C OP    | 8.23                     |
| 924372            | AB2-085 E OP    | 3.87                     |
| 924541            | AB2-103 C OP    | 5.1                      |
| 924542            | AB2-103 E OP    | 2.4                      |

|        |           |       |
|--------|-----------|-------|
| 926061 | AC1-085 C | 53.03 |
| 926062 | AC1-085 E | 86.52 |
| 926101 | AC1-089 C | 17.87 |
| 926102 | AC1-089 E | 29.16 |
| 926631 | AC1-144 C | 23.48 |
| 926632 | AC1-144 E | 11.41 |

## Appendix 17

(DEO&K - DEO&K) The AC2-061 TAP-08CLINCO 138 kV line (from bus 931430 to bus 249995 ckt 1) loads from 275.8% to 277.54% (**DC power flow**) of its emergency rating (184 MVA) for the line fault with failed breaker contingency outage of '8109\_C2\_05HILLSB 138-A\_A'. This project contributes approximately 7.14 MW to the thermal violation.

CONTINGENCY '8109\_C2\_05HILLSB 138-A\_A'

OPEN BRANCH FROM BUS 243019 TO BUS 243102 CKT 1 / 243019 05HILLSB  
138 243102 05SINKG8 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB  
138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 931350 TO BUS 243102 CKT 1 / 931350 AC2-049  
TAP 138 243102 05SINKG8 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111  
09MIDDLE 138 253057 09OHH 138 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931022            | AC2-008 E       | 2.83                     |
| 931121            | AC2-019 C       | 0.77                     |
| 931122            | AC2-019 E       | 1.26                     |
| 931131            | AC2-020 C OP    | 0.59                     |
| 931132            | AC2-020 E OP    | 1.54                     |
| 931192            | AC2-027 E       | 2.04                     |
| 931221            | AC2-031 C       | 23.89                    |
| 931222            | AC2-031 E       | 11.77                    |
| 931281            | AC2-042 C       | 74.67                    |
| 931282            | AC2-042 E       | 49.78                    |
| 931381            | AC2-055 C OP    | 1.87                     |
| 931382            | AC2-055 E OP    | 3.06                     |
| 931421            | AC2-060 C       | 5.37                     |
| 931422            | AC2-060 E       | 3.02                     |
| 931431            | AC2-061 C       | 28.84                    |
| 931432            | AC2-061 E       | 29.24                    |
| 931441            | AC2-062 C OP    | 6.6                      |
| 931442            | AC2-062 E OP    | 2.95                     |
| 931651            | AC2-087 C OP    | 3.98                     |
| 931652            | AC2-087 E OP    | 3.16                     |
| 247592            | W4-036          | 1.01                     |
| 916272            | Z1-080 E        | 2.18                     |
| 924371            | AB2-085 C OP    | 8.72                     |
| 924372            | AB2-085 E OP    | 4.1                      |
| 924541            | AB2-103 C OP    | 5.31                     |
| 924542            | AB2-103 E OP    | 2.5                      |
| 926061            | AC1-085 C       | 54.2                     |
| 926062            | AC1-085 E       | 88.44                    |
| 926101            | AC1-089 C       | 18.22                    |

|        |           |       |
|--------|-----------|-------|
| 926102 | AC1-089 E | 29.73 |
| 926631 | AC1-144 C | 24.   |
| 926632 | AC1-144 E | 11.66 |

## Appendix 18

(AEP - LGEE) The AC2-062 TAP-4KENTON 138 kV line (from bus 931440 to bus 324267 ckt 1) loads from 197.28% to 198.66% (**DC power flow**) of its emergency rating (185 MVA) for the tower line contingency outage of '7981\_B'. This project contributes approximately 5.67 MW to the thermal violation.

CONTINGENCY '7981\_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061

TAP 138 249995 08CLINCO 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB

138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995

08CLINCO 138 250122 08WARRN1 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111

09MIDDLE 138 253057 09OHH 138 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931022            | AC2-008 E       | 4.3                      |
| 931121            | AC2-019 C       | 0.61                     |
| 931122            | AC2-019 E       | 1.                       |
| 931131            | AC2-020 C OP    | 0.46                     |
| 931132            | AC2-020 E OP    | 1.22                     |
| 931192            | AC2-027 E       | 1.62                     |
| 931221            | AC2-031 C       | 18.99                    |
| 931222            | AC2-031 E       | 9.35                     |
| 931281            | AC2-042 C       | 59.34                    |
| 931282            | AC2-042 E       | 39.56                    |
| 931351            | AC2-049 C       | 4.11                     |
| 931352            | AC2-049 E       | 2.74                     |
| 931381            | AC2-055 C OP    | 1.49                     |
| 931382            | AC2-055 E OP    | 2.42                     |
| 931421            | AC2-060 C       | 4.27                     |
| 931422            | AC2-060 E       | 2.4                      |
| 931431            | AC2-061 C       | 16.47                    |
| 931432            | AC2-061 E       | 16.69                    |
| 931441            | AC2-062 C OP    | 24.55                    |
| 931442            | AC2-062 E OP    | 10.98                    |
| 931451            | AC2-064 C       | 9.64                     |
| 931452            | AC2-064 E       | 6.43                     |
| 931651            | AC2-087 C OP    | 3.16                     |
| 931652            | AC2-087 E OP    | 2.51                     |
| 247592            | W4-036          | 0.8                      |
| 924371            | AB2-085 C OP    | 7.03                     |
| 924372            | AB2-085 E OP    | 3.31                     |
| 924541            | AB2-103 C OP    | 4.25                     |
| 924542            | AB2-103 E OP    | 2.                       |

|        |           |       |
|--------|-----------|-------|
| 926061 | AC1-085 C | 43.08 |
| 926062 | AC1-085 E | 70.28 |
| 926101 | AC1-089 C | 20.33 |
| 926102 | AC1-089 E | 33.17 |
| 926631 | AC1-144 C | 19.07 |
| 926632 | AC1-144 E | 9.27  |

## **Appendices Secondary POI**

The following appendices contain additional information about each flowgate presented in the body of the report. For each appendix, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gage other generators impact.

It should be noted the generator contributions presented in the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

## Appendix 1

(AEP - AEP) The 05HILLSB-05SINKG8 138 kV line (from bus 243019 to bus 243102 ckt 1) loads from 240.71% to 242.43% (**DC power flow**) of its emergency rating (185 MVA) for the tower line contingency outage of '7981\_B'. This project contributes approximately 7.05 MW to the thermal violation.

CONTINGENCY '7981\_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061

TAP 138 249995 08CLINCO 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB  
138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995

08CLINCO 138 250122 08WARRN1 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111

09MIDDLE 138 253057 09OHH 138 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931022            | AC2-008 E       | 2.78                     |
| 931121            | AC2-019 C       | 0.76                     |
| 931122            | AC2-019 E       | 1.25                     |
| 931131            | AC2-020 C OP    | 0.64                     |
| 931132            | AC2-020 E OP    | 1.68                     |
| 931192            | AC2-027 E       | 2.01                     |
| 931221            | AC2-031 C       | 23.37                    |
| 931222            | AC2-031 E       | 11.51                    |
| 931281            | AC2-042 C       | 73.05                    |
| 931282            | AC2-042 E       | 48.7                     |
| 931381            | AC2-055 C OP    | 1.51                     |
| 931382            | AC2-055 E OP    | 2.47                     |
| 931421            | AC2-060 C       | 5.36                     |
| 931422            | AC2-060 E       | 3.02                     |
| 931431            | AC2-061 C       | 20.27                    |
| 931432            | AC2-061 E       | 20.55                    |
| 931441            | AC2-062 C OP    | 6.                       |
| 931442            | AC2-062 E OP    | 2.68                     |
| 931651            | AC2-087 C OP    | 3.93                     |
| 931652            | AC2-087 E OP    | 3.12                     |
| 247592            | W4-036          | 1.01                     |
| 924371            | AB2-085 C OP    | 8.23                     |
| 924372            | AB2-085 E OP    | 3.87                     |
| 924541            | AB2-103 C OP    | 5.1                      |
| 924542            | AB2-103 E OP    | 2.4                      |
| 926061            | AC1-085 C       | 53.03                    |
| 926062            | AC1-085 E       | 86.52                    |
| 926101            | AC1-089 C       | 17.87                    |
| 926102            | AC1-089 E       | 29.16                    |

|               |                  |              |
|---------------|------------------|--------------|
| <i>926631</i> | <i>AC1-144 C</i> | <i>23.48</i> |
| <i>926632</i> | <i>AC1-144 E</i> | <i>11.41</i> |

## Appendix 2

(AEP - DAY) The 05HILLSB-09MIDDLE 138 kV line (from bus 243019 to bus 253111 ckt 1) loads from 172.96% to 174.12% (**DC power flow**) of its emergency rating (185 MVA) for the line fault with failed breaker contingency outage of '8111\_C2\_05HILLSB 138-\_A'. This project contributes approximately 4.74 MW to the thermal violation.

CONTINGENCY '8111\_C2\_05HILLSB 138-\_A'

OPEN BRANCH FROM BUS 243019 TO BUS 926100 CKT 1 / 243019 05HILLSB  
138 926100 AC1-089 TAP 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 931430 CKT 1 / 243019 05HILLSB  
138 931430 AC2-060 TAP 138 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931121            | AC2-019 C       | 0.54                     |
| 931122            | AC2-019 E       | 0.88                     |
| 931131            | AC2-020 C OP    | 0.43                     |
| 931132            | AC2-020 E OP    | 1.13                     |
| 931192            | AC2-027 E       | 1.42                     |
| 931221            | AC2-031 C       | 16.99                    |
| 931222            | AC2-031 E       | 8.37                     |
| 931281            | AC2-042 C       | 53.11                    |
| 931282            | AC2-042 E       | 35.41                    |
| 931351            | AC2-049 C       | 3.7                      |
| 931352            | AC2-049 E       | 2.47                     |
| 931381            | AC2-055 C OP    | 1.02                     |
| 931382            | AC2-055 E OP    | 1.66                     |
| 931421            | AC2-060 C       | 3.62                     |
| 931422            | AC2-060 E       | 2.04                     |
| 931441            | AC2-062 C OP    | 4.46                     |
| 931442            | AC2-062 E OP    | 2.                       |
| 931451            | AC2-064 C       | 8.69                     |
| 931452            | AC2-064 E       | 5.8                      |
| 931651            | AC2-087 C OP    | 2.65                     |
| 931652            | AC2-087 E OP    | 2.1                      |
| 247592            | W4-036          | 0.68                     |
| 924371            | AB2-085 C OP    | 6.32                     |
| 924372            | AB2-085 E OP    | 2.97                     |
| 924541            | AB2-103 C OP    | 3.81                     |
| 924542            | AB2-103 E OP    | 1.79                     |
| 926061            | AC1-085 C       | 38.55                    |
| 926062            | AC1-085 E       | 62.9                     |
| 926631            | AC1-144 C       | 17.07                    |
| 926632            | AC1-144 E       | 8.29                     |

## Appendix 3

(AEP - AEP) The 05HILLSB-AC1-089 TAP 138 kV line (from bus 243019 to bus 926100 ckt 1) loads from 156.88% to 158.24% (**DC power flow**) of its emergency rating (185 MVA) for the tower line contingency outage of '7981\_B'. This project contributes approximately 5.6 MW to the thermal violation.

CONTINGENCY '7981\_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061

TAP 138 249995 08CLINCO 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB  
138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995

08CLINCO 138 250122 08WARRN1 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111

09MIDDLE 138 253057 09OHH 138 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931121            | AC2-019 C       | 0.61                     |
| 931122            | AC2-019 E       | 1.                       |
| 931131            | AC2-020 C OP    | 0.51                     |
| 931132            | AC2-020 E OP    | 1.33                     |
| 931192            | AC2-027 E       | 1.62                     |
| 931221            | AC2-031 C       | 18.99                    |
| 931222            | AC2-031 E       | 9.35                     |
| 931281            | AC2-042 C       | 59.34                    |
| 931282            | AC2-042 E       | 39.56                    |
| 931351            | AC2-049 C       | 4.11                     |
| 931352            | AC2-049 E       | 2.74                     |
| 931381            | AC2-055 C OP    | 1.2                      |
| 931382            | AC2-055 E OP    | 1.96                     |
| 931421            | AC2-060 C       | 4.27                     |
| 931422            | AC2-060 E       | 2.4                      |
| 931431            | AC2-061 C       | 16.47                    |
| 931432            | AC2-061 E       | 16.69                    |
| 931441            | AC2-062 C OP    | 4.94                     |
| 931442            | AC2-062 E OP    | 2.21                     |
| 931451            | AC2-064 C       | 9.64                     |
| 931452            | AC2-064 E       | 6.43                     |
| 931651            | AC2-087 C OP    | 3.12                     |
| 931652            | AC2-087 E OP    | 2.48                     |
| 247592            | W4-036          | 0.8                      |
| 924371            | AB2-085 C OP    | 7.03                     |
| 924372            | AB2-085 E OP    | 3.31                     |
| 924541            | AB2-103 C OP    | 4.25                     |
| 924542            | AB2-103 E OP    | 2.                       |
| 926061            | AC1-085 C       | 43.08                    |

|        |           |       |
|--------|-----------|-------|
| 926062 | AC1-085 E | 70.28 |
| 926631 | AC1-144 C | 19.07 |
| 926632 | AC1-144 E | 9.27  |

## Appendix 4

(AEP - DEO&K) The 05HILLSB-AC2-061 TAP 138 kV line (from bus 243019 to bus 931430 ckt 1) loads from 242.27% to 244.0% (**DC power flow**) of its emergency rating (184 MVA) for the line fault with failed breaker contingency outage of '8109\_C2\_05HILLSB 138-A\_A'. This project contributes approximately 7.06 MW to the thermal violation.

CONTINGENCY '8109\_C2\_05HILLSB 138-A\_A'

OPEN BRANCH FROM BUS 243019 TO BUS 243102 CKT 1 / 243019 05HILLSB  
138 243102 05SINKG8 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB  
138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 931350 TO BUS 243102 CKT 1 / 931350 AC2-049  
TAP 138 243102 05SINKG8 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111  
09MIDDLE 138 253057 09OHH 138 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931022            | AC2-008 E       | 2.83                     |
| 931121            | AC2-019 C       | 0.77                     |
| 931122            | AC2-019 E       | 1.26                     |
| 931131            | AC2-020 C OP    | 0.64                     |
| 931132            | AC2-020 E OP    | 1.68                     |
| 931192            | AC2-027 E       | 2.04                     |
| 931221            | AC2-031 C       | 23.89                    |
| 931222            | AC2-031 E       | 11.77                    |
| 931281            | AC2-042 C       | 74.67                    |
| 931282            | AC2-042 E       | 49.78                    |
| 931381            | AC2-055 C OP    | 1.52                     |
| 931382            | AC2-055 E OP    | 2.47                     |
| 931421            | AC2-060 C       | 5.37                     |
| 931422            | AC2-060 E       | 3.02                     |
| 931441            | AC2-062 C OP    | 6.21                     |
| 931442            | AC2-062 E OP    | 2.78                     |
| 931651            | AC2-087 C OP    | 3.94                     |
| 931652            | AC2-087 E OP    | 3.12                     |
| 247592            | W4-036          | 1.01                     |
| 916272            | Z1-080 E        | 2.18                     |
| 924371            | AB2-085 C OP    | 8.72                     |
| 924372            | AB2-085 E OP    | 4.1                      |
| 924541            | AB2-103 C OP    | 5.31                     |
| 924542            | AB2-103 E OP    | 2.5                      |
| 926061            | AC1-085 C       | 54.2                     |
| 926062            | AC1-085 E       | 88.44                    |
| 926101            | AC1-089 C       | 18.22                    |
| 926102            | AC1-089 E       | 29.73                    |
| 926631            | AC1-144 C       | 24.                      |

|        |                  |       |
|--------|------------------|-------|
| 926632 | <i>AC1-144 E</i> | 11.66 |
|--------|------------------|-------|

## Appendix 5

(AEP - AEP) The 05SINKG8-AC2-049 TAP 138 kV line (from bus 243102 to bus 931350 ckt 1) loads from 246.83% to 248.6% (**DC power flow**) of its emergency rating (179 MVA) for the tower line contingency outage of '7981\_B'. This project contributes approximately 7.05 MW to the thermal violation.

CONTINGENCY '7981\_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061

TAP 138 249995 08CLINCO 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB

138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995

08CLINCO 138 250122 08WARRN1 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111

09MIDDLE 138 253057 09OHH 138 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931022            | AC2-008 E       | 2.78                     |
| 931121            | AC2-019 C       | 0.76                     |
| 931122            | AC2-019 E       | 1.25                     |
| 931131            | AC2-020 C OP    | 0.64                     |
| 931132            | AC2-020 E OP    | 1.68                     |
| 931192            | AC2-027 E       | 2.01                     |
| 931221            | AC2-031 C       | 23.37                    |
| 931222            | AC2-031 E       | 11.51                    |
| 931281            | AC2-042 C       | 73.05                    |
| 931282            | AC2-042 E       | 48.7                     |
| 931381            | AC2-055 C OP    | 1.51                     |
| 931382            | AC2-055 E OP    | 2.47                     |
| 931421            | AC2-060 C       | 5.36                     |
| 931422            | AC2-060 E       | 3.02                     |
| 931431            | AC2-061 C       | 20.27                    |
| 931432            | AC2-061 E       | 20.55                    |
| 931441            | AC2-062 C OP    | 6.                       |
| 931442            | AC2-062 E OP    | 2.68                     |
| 931651            | AC2-087 C OP    | 3.93                     |
| 931652            | AC2-087 E OP    | 3.12                     |
| 247592            | W4-036          | 1.01                     |
| 924371            | AB2-085 C OP    | 8.23                     |
| 924372            | AB2-085 E OP    | 3.87                     |
| 924541            | AB2-103 C OP    | 5.1                      |
| 924542            | AB2-103 E OP    | 2.4                      |
| 926061            | AC1-085 C       | 53.03                    |
| 926062            | AC1-085 E       | 86.52                    |
| 926101            | AC1-089 C       | 17.87                    |
| 926102            | AC1-089 E       | 29.16                    |

|               |                  |              |
|---------------|------------------|--------------|
| <i>926631</i> | <i>AC1-144 C</i> | <i>23.48</i> |
| <i>926632</i> | <i>AC1-144 E</i> | <i>11.41</i> |

## Appendix 6

(AEP - AEP) The 05ADAMS-05WARERD 138 kV line (from bus 243464 to bus 246942 ckt 1) loads from 185.75% to 187.22% (**DC power flow**) of its emergency rating (150 MVA) for the tower line contingency outage of '7981\_B'. This project contributes approximately 4.87 MW to the thermal violation.

CONTINGENCY '7981\_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061

TAP 138 249995 08CLINCO 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB  
138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995

08CLINCO 138 250122 08WARRN1 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111

09MIDDLE 138 253057 09OHH 138 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931022            | AC2-008 E       | 1.34                     |
| 931121            | AC2-019 C       | 0.59                     |
| 931122            | AC2-019 E       | 0.96                     |
| 931131            | AC2-020 C OP    | 0.44                     |
| 931132            | AC2-020 E OP    | 1.16                     |
| 931192            | AC2-027 E       | 1.55                     |
| 931221            | AC2-031 C       | 11.2                     |
| 931222            | AC2-031 E       | 5.51                     |
| 931281            | AC2-042 C       | 34.99                    |
| 931282            | AC2-042 E       | 23.33                    |
| 931351            | AC2-049 C       | 2.18                     |
| 931352            | AC2-049 E       | 1.45                     |
| 931381            | AC2-055 C OP    | 1.04                     |
| 931382            | AC2-055 E OP    | 1.7                      |
| 931421            | AC2-060 C       | 3.7                      |
| 931422            | AC2-060 E       | 2.08                     |
| 931431            | AC2-061 C       | 9.71                     |
| 931432            | AC2-061 E       | 9.84                     |
| 931441            | AC2-062 C OP    | 14.53                    |
| 931442            | AC2-062 E OP    | 6.5                      |
| 931451            | AC2-064 C       | 5.11                     |
| 931452            | AC2-064 E       | 3.41                     |
| 931651            | AC2-087 C OP    | 2.71                     |
| 931652            | AC2-087 E OP    | 2.15                     |
| 247592            | W4-036          | 0.69                     |
| 924371            | AB2-085 C OP    | 27.11                    |
| 924372            | AB2-085 E OP    | 12.76                    |
| 924541            | AB2-103 C OP    | 10.95                    |
| 924542            | AB2-103 E OP    | 5.15                     |

|        |           |       |
|--------|-----------|-------|
| 926061 | AC1-085 C | 25.4  |
| 926062 | AC1-085 E | 41.44 |
| 926101 | AC1-089 C | 8.57  |
| 926102 | AC1-089 E | 13.99 |
| 926631 | AC1-144 C | 11.25 |
| 926632 | AC1-144 E | 5.46  |

## Appendix 7

(AEP - AEP) The 05SEAMAN-05ADAMS 138 kV line (from bus 243571 to bus 243464 ckt 1) loads from 162.99% to 164.44% (**DC power flow**) of its emergency rating (150 MVA) for the tower line contingency outage of '7981\_B'. This project contributes approximately 4.83 MW to the thermal violation.

CONTINGENCY '7981\_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061

TAP 138 249995 08CLINCO 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB

138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995

08CLINCO 138 250122 08WARRN1 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111

09MIDDLE 138 253057 09OHH 138 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931022            | AC2-008 E       | 1.31                     |
| 931121            | AC2-019 C       | 0.58                     |
| 931122            | AC2-019 E       | 0.95                     |
| 931131            | AC2-020 C OP    | 0.44                     |
| 931132            | AC2-020 E OP    | 1.15                     |
| 931192            | AC2-027 E       | 1.53                     |
| 931221            | AC2-031 C       | 11.02                    |
| 931222            | AC2-031 E       | 5.43                     |
| 931281            | AC2-042 C       | 34.44                    |
| 931282            | AC2-042 E       | 22.96                    |
| 931351            | AC2-049 C       | 2.17                     |
| 931352            | AC2-049 E       | 1.45                     |
| 931381            | AC2-055 C OP    | 1.04                     |
| 931382            | AC2-055 E OP    | 1.69                     |
| 931421            | AC2-060 C       | 3.67                     |
| 931422            | AC2-060 E       | 2.07                     |
| 931431            | AC2-061 C       | 9.56                     |
| 931432            | AC2-061 E       | 9.69                     |
| 931441            | AC2-062 C OP    | 5.12                     |
| 931442            | AC2-062 E OP    | 2.29                     |
| 931451            | AC2-064 C       | 5.1                      |
| 931452            | AC2-064 E       | 3.4                      |
| 931651            | AC2-087 C OP    | 2.69                     |
| 931652            | AC2-087 E OP    | 2.14                     |
| 247592            | W4-036          | 0.69                     |
| 924541            | AB2-103 C OP    | 10.77                    |
| 924542            | AB2-103 E OP    | 5.07                     |
| 926061            | AC1-085 C       | 25.                      |
| 926062            | AC1-085 E       | 40.79                    |

|               |                  |              |
|---------------|------------------|--------------|
| <i>926101</i> | <i>AC1-089 C</i> | <i>8.43</i>  |
| <i>926102</i> | <i>AC1-089 E</i> | <i>13.75</i> |
| <i>926631</i> | <i>AC1-144 C</i> | <i>11.07</i> |
| <i>926632</i> | <i>AC1-144 E</i> | <i>5.38</i>  |

## Appendix 8

(AEP - AEP) The 05HIGHLA-05NMARSS 138 kV line (from bus 246911 to bus 247035 ckt 1) loads from 101.29% to 102.23% (**DC power flow**) of its emergency rating (310 MVA) for the tower line contingency outage of '7981\_B'. This project contributes approximately 6.49 MW to the thermal violation.

CONTINGENCY '7981\_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061

TAP 138 249995 08CLINCO 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB

138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995

08CLINCO 138 250122 08WARRN1 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111

09MIDDLE 138 253057 09OHH 138 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931022            | AC2-008 E       | 1.73                     |
| 931121            | AC2-019 C       | 0.77                     |
| 931122            | AC2-019 E       | 1.25                     |
| 931131            | AC2-020 C OP    | 0.59                     |
| 931132            | AC2-020 E OP    | 1.54                     |
| 931192            | AC2-027 E       | 2.02                     |
| 931221            | AC2-031 C       | 14.63                    |
| 931222            | AC2-031 E       | 7.2                      |
| 931281            | AC2-042 C       | 45.72                    |
| 931282            | AC2-042 E       | 30.48                    |
| 931351            | AC2-049 C       | 2.96                     |
| 931352            | AC2-049 E       | 1.97                     |
| 931381            | AC2-055 C OP    | 1.39                     |
| 931382            | AC2-055 E OP    | 2.27                     |
| 931421            | AC2-060 C       | 4.94                     |
| 931422            | AC2-060 E       | 2.78                     |
| 931431            | AC2-061 C       | 12.68                    |
| 931432            | AC2-061 E       | 12.86                    |
| 931451            | AC2-064 C       | 6.95                     |
| 931452            | AC2-064 E       | 4.63                     |
| 931651            | AC2-087 C OP    | 3.62                     |
| 931652            | AC2-087 E OP    | 2.87                     |
| 247592            | W4-036          | 0.93                     |
| 926061            | AC1-085 C       | 33.18                    |
| 926062            | AC1-085 E       | 54.14                    |
| 926101            | AC1-089 C       | 11.16                    |
| 926102            | AC1-089 E       | 18.22                    |
| 926631            | AC1-144 C       | 14.69                    |
| 926632            | AC1-144 E       | 7.14                     |



## Appendix 9

(AEP - AEP) The 05WARERD-05WAVERL 138 kV line (from bus 246942 to bus 243585 ckt 1) loads from 175.55% to 177.02% (**DC power flow**) of its emergency rating (150 MVA) for the tower line contingency outage of '7981\_B'. This project contributes approximately 4.87 MW to the thermal violation.

CONTINGENCY '7981\_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061

TAP 138 249995 08CLINCO 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB

138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995

08CLINCO 138 250122 08WARRN1 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111

09MIDDLE 138 253057 09OHH 138 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931022            | AC2-008 E       | 1.34                     |
| 931121            | AC2-019 C       | 0.59                     |
| 931122            | AC2-019 E       | 0.96                     |
| 931131            | AC2-020 C OP    | 0.44                     |
| 931132            | AC2-020 E OP    | 1.16                     |
| 931192            | AC2-027 E       | 1.55                     |
| 931221            | AC2-031 C       | 11.2                     |
| 931222            | AC2-031 E       | 5.51                     |
| 931281            | AC2-042 C       | 34.99                    |
| 931282            | AC2-042 E       | 23.33                    |
| 931351            | AC2-049 C       | 2.18                     |
| 931352            | AC2-049 E       | 1.45                     |
| 931381            | AC2-055 C OP    | 1.04                     |
| 931382            | AC2-055 E OP    | 1.7                      |
| 931421            | AC2-060 C       | 3.7                      |
| 931422            | AC2-060 E       | 2.08                     |
| 931431            | AC2-061 C       | 9.71                     |
| 931432            | AC2-061 E       | 9.84                     |
| 931441            | AC2-062 C OP    | 14.53                    |
| 931442            | AC2-062 E OP    | 6.5                      |
| 931451            | AC2-064 C       | 5.11                     |
| 931452            | AC2-064 E       | 3.41                     |
| 931651            | AC2-087 C OP    | 2.71                     |
| 931652            | AC2-087 E OP    | 2.15                     |
| 247592            | W4-036          | 0.69                     |
| 924371            | AB2-085 C OP    | 27.11                    |
| 924372            | AB2-085 E OP    | 12.76                    |
| 924541            | AB2-103 C OP    | 10.95                    |
| 924542            | AB2-103 E OP    | 5.15                     |

|        |           |       |
|--------|-----------|-------|
| 926061 | AC1-085 C | 25.4  |
| 926062 | AC1-085 E | 41.44 |
| 926101 | AC1-089 C | 8.57  |
| 926102 | AC1-089 E | 13.99 |
| 926631 | AC1-144 C | 11.25 |
| 926632 | AC1-144 E | 5.46  |

## Appendix 10

(AEP - AEP) The 05WLDCAT-05EMERSS 138 kV line (from bus 246946 to bus 247034 ckt 1) loads from 184.5% to 185.87% (**DC power flow**) of its emergency rating (185 MVA) for the tower line contingency outage of '7981\_B'. This project contributes approximately 5.6 MW to the thermal violation.

CONTINGENCY '7981\_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061

TAP 138 249995 08CLINCO 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB

138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995

08CLINCO 138 250122 08WARRN1 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111

09MIDDLE 138 253057 09OHH 138 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931022            | AC2-008 E       | 4.3                      |
| 931121            | AC2-019 C       | 0.61                     |
| 931122            | AC2-019 E       | 1.                       |
| 931131            | AC2-020 C OP    | 0.51                     |
| 931132            | AC2-020 E OP    | 1.33                     |
| 931192            | AC2-027 E       | 1.62                     |
| 931221            | AC2-031 C       | 18.99                    |
| 931222            | AC2-031 E       | 9.35                     |
| 931281            | AC2-042 C       | 59.34                    |
| 931282            | AC2-042 E       | 39.56                    |
| 931351            | AC2-049 C       | 4.11                     |
| 931352            | AC2-049 E       | 2.74                     |
| 931381            | AC2-055 C OP    | 1.2                      |
| 931382            | AC2-055 E OP    | 1.96                     |
| 931421            | AC2-060 C       | 4.27                     |
| 931422            | AC2-060 E       | 2.4                      |
| 931431            | AC2-061 C       | 16.47                    |
| 931432            | AC2-061 E       | 16.69                    |
| 931441            | AC2-062 C OP    | 4.94                     |
| 931442            | AC2-062 E OP    | 2.21                     |
| 931451            | AC2-064 C       | 9.64                     |
| 931452            | AC2-064 E       | 6.43                     |
| 931651            | AC2-087 C OP    | 3.12                     |
| 931652            | AC2-087 E OP    | 2.48                     |
| 247592            | W4-036          | 0.8                      |
| 924371            | AB2-085 C OP    | 7.03                     |
| 924372            | AB2-085 E OP    | 3.31                     |
| 924541            | AB2-103 C OP    | 4.25                     |
| 924542            | AB2-103 E OP    | 2.                       |

|        |           |       |
|--------|-----------|-------|
| 926061 | AC1-085 C | 43.08 |
| 926062 | AC1-085 E | 70.28 |
| 926101 | AC1-089 C | 20.33 |
| 926102 | AC1-089 E | 33.17 |
| 926631 | AC1-144 C | 19.07 |
| 926632 | AC1-144 E | 9.27  |

## Appendix 11

(AEP - LGEE) The 05EMERSS-4KENTON 138 kV line (from bus 247034 to bus 324267 ckt 1) loads from 183.2% to 184.57% (**DC power flow**) of its emergency rating (185 MVA) for the tower line contingency outage of '7981\_B'. This project contributes approximately 5.6 MW to the thermal violation.

CONTINGENCY '7981\_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061

TAP 138 249995 08CLINCO 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB  
138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995

08CLINCO 138 250122 08WARRN1 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111

09MIDDLE 138 253057 09OHH 138 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931022            | AC2-008 E       | 4.3                      |
| 931121            | AC2-019 C       | 0.61                     |
| 931122            | AC2-019 E       | 1.                       |
| 931131            | AC2-020 C OP    | 0.51                     |
| 931132            | AC2-020 E OP    | 1.33                     |
| 931192            | AC2-027 E       | 1.62                     |
| 931221            | AC2-031 C       | 18.99                    |
| 931222            | AC2-031 E       | 9.35                     |
| 931281            | AC2-042 C       | 59.34                    |
| 931282            | AC2-042 E       | 39.56                    |
| 931351            | AC2-049 C       | 4.11                     |
| 931352            | AC2-049 E       | 2.74                     |
| 931381            | AC2-055 C OP    | 1.2                      |
| 931382            | AC2-055 E OP    | 1.96                     |
| 931421            | AC2-060 C       | 4.27                     |
| 931422            | AC2-060 E       | 2.4                      |
| 931431            | AC2-061 C       | 16.47                    |
| 931432            | AC2-061 E       | 16.69                    |
| 931441            | AC2-062 C OP    | 4.94                     |
| 931442            | AC2-062 E OP    | 2.21                     |
| 931451            | AC2-064 C       | 9.64                     |
| 931452            | AC2-064 E       | 6.43                     |
| 931651            | AC2-087 C OP    | 3.12                     |
| 931652            | AC2-087 E OP    | 2.48                     |
| 247592            | W4-036          | 0.8                      |
| 924371            | AB2-085 C OP    | 7.03                     |
| 924372            | AB2-085 E OP    | 3.31                     |
| 924541            | AB2-103 C OP    | 4.25                     |
| 924542            | AB2-103 E OP    | 2.                       |

|        |           |       |
|--------|-----------|-------|
| 926061 | AC1-085 C | 43.08 |
| 926062 | AC1-085 E | 70.28 |
| 926101 | AC1-089 C | 20.33 |
| 926102 | AC1-089 E | 33.17 |
| 926631 | AC1-144 C | 19.07 |
| 926632 | AC1-144 E | 9.27  |

## Appendix 12

(DEO&K - DEO&K) The 08CLINCO-08WARRN1 138 kV line (from bus 249995 to bus 250122 ckt 1) loads from 240.96% to 242.56% (**DC power flow**) of its emergency rating (198 MVA) for the line fault with failed breaker contingency outage of '8109\_C2\_05HILLSB 138-A\_A'. This project contributes approximately 7.06 MW to the thermal violation.

CONTINGENCY '8109\_C2\_05HILLSB 138-A\_A'

OPEN BRANCH FROM BUS 243019 TO BUS 243102 CKT 1 / 243019 05HILLSB  
138 243102 05SINKG8 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB  
138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 931350 TO BUS 243102 CKT 1 / 931350 AC2-049  
TAP 138 243102 05SINKG8 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111  
09MIDDLE 138 253057 09OHH 138 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931022            | AC2-008 E       | 2.83                     |
| 931121            | AC2-019 C       | 0.77                     |
| 931122            | AC2-019 E       | 1.26                     |
| 931131            | AC2-020 C OP    | 0.64                     |
| 931132            | AC2-020 E OP    | 1.68                     |
| 931192            | AC2-027 E       | 2.04                     |
| 931221            | AC2-031 C       | 23.89                    |
| 931222            | AC2-031 E       | 11.77                    |
| 931281            | AC2-042 C       | 74.67                    |
| 931282            | AC2-042 E       | 49.78                    |
| 931381            | AC2-055 C OP    | 1.52                     |
| 931382            | AC2-055 E OP    | 2.47                     |
| 931421            | AC2-060 C       | 5.37                     |
| 931422            | AC2-060 E       | 3.02                     |
| 931431            | AC2-061 C       | 28.84                    |
| 931432            | AC2-061 E       | 29.24                    |
| 931441            | AC2-062 C OP    | 6.21                     |
| 931442            | AC2-062 E OP    | 2.78                     |
| 931651            | AC2-087 C OP    | 3.94                     |
| 931652            | AC2-087 E OP    | 3.12                     |
| 247592            | W4-036          | 1.01                     |
| 916272            | Z1-080 E        | 3.82                     |
| 924371            | AB2-085 C OP    | 8.72                     |
| 924372            | AB2-085 E OP    | 4.1                      |
| 924541            | AB2-103 C OP    | 5.31                     |
| 924542            | AB2-103 E OP    | 2.5                      |
| 926061            | AC1-085 C       | 54.2                     |
| 926062            | AC1-085 E       | 88.44                    |
| 926101            | AC1-089 C       | 18.22                    |

|        |           |       |
|--------|-----------|-------|
| 926102 | AC1-089 E | 29.73 |
| 926631 | AC1-144 C | 24.   |
| 926632 | AC1-144 E | 11.66 |

## Appendix 13

(DAY - DAY) The 09MIDDLE-09OHH 138 kV line (from bus 253111 to bus 253057 ckt 1) loads from 170.69% to 171.85% (**DC power flow**) of its emergency rating (185 MVA) for the line fault with failed breaker contingency outage of '8111\_C2\_05HILLSB 138-\_A'. This project contributes approximately 4.74 MW to the thermal violation.

CONTINGENCY '8111\_C2\_05HILLSB 138-\_A'

OPEN BRANCH FROM BUS 243019 TO BUS 926100 CKT 1 / 243019 05HILLSB  
138 926100 AC1-089 TAP 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 931430 CKT 1 / 243019 05HILLSB  
138 931430 AC2-060 TAP 138 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931121            | AC2-019 C       | 0.54                     |
| 931122            | AC2-019 E       | 0.88                     |
| 931131            | AC2-020 C OP    | 0.43                     |
| 931132            | AC2-020 E OP    | 1.13                     |
| 931192            | AC2-027 E       | 1.42                     |
| 931221            | AC2-031 C       | 16.99                    |
| 931222            | AC2-031 E       | 8.37                     |
| 931281            | AC2-042 C       | 53.11                    |
| 931282            | AC2-042 E       | 35.41                    |
| 931351            | AC2-049 C       | 3.7                      |
| 931352            | AC2-049 E       | 2.47                     |
| 931381            | AC2-055 C OP    | 1.02                     |
| 931382            | AC2-055 E OP    | 1.66                     |
| 931421            | AC2-060 C       | 3.62                     |
| 931422            | AC2-060 E       | 2.04                     |
| 931441            | AC2-062 C OP    | 4.46                     |
| 931442            | AC2-062 E OP    | 2.                       |
| 931451            | AC2-064 C       | 8.69                     |
| 931452            | AC2-064 E       | 5.8                      |
| 931651            | AC2-087 C OP    | 2.65                     |
| 931652            | AC2-087 E OP    | 2.1                      |
| 247592            | W4-036          | 0.68                     |
| 924371            | AB2-085 C OP    | 6.32                     |
| 924372            | AB2-085 E OP    | 2.97                     |
| 924541            | AB2-103 C OP    | 3.81                     |
| 924542            | AB2-103 E OP    | 1.79                     |
| 926061            | AC1-085 C       | 38.55                    |
| 926062            | AC1-085 E       | 62.9                     |
| 926631            | AC1-144 C       | 17.07                    |
| 926632            | AC1-144 E       | 8.29                     |

## Appendix 14

(AEP - AEP) The AC1-089 TAP-05WLDCAT 138 kV line (from bus 926100 to bus 246946 ckt 1) loads from 185.58% to 186.95% (**DC power flow**) of its emergency rating (185 MVA) for the tower line contingency outage of '7981\_B'. This project contributes approximately 5.6 MW to the thermal violation.

CONTINGENCY '7981\_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061

TAP 138 249995 08CLINCO 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB

138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995

08CLINCO 138 250122 08WARRN1 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111

09MIDDLE 138 253057 09OHH 138 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931121            | AC2-019 C       | 0.61                     |
| 931122            | AC2-019 E       | 1.                       |
| 931131            | AC2-020 C OP    | 0.51                     |
| 931132            | AC2-020 E OP    | 1.33                     |
| 931192            | AC2-027 E       | 1.62                     |
| 931221            | AC2-031 C       | 18.99                    |
| 931222            | AC2-031 E       | 9.35                     |
| 931281            | AC2-042 C       | 59.34                    |
| 931282            | AC2-042 E       | 39.56                    |
| 931351            | AC2-049 C       | 4.11                     |
| 931352            | AC2-049 E       | 2.74                     |
| 931381            | AC2-055 C OP    | 1.2                      |
| 931382            | AC2-055 E OP    | 1.96                     |
| 931421            | AC2-060 C       | 4.27                     |
| 931422            | AC2-060 E       | 2.4                      |
| 931431            | AC2-061 C       | 16.47                    |
| 931432            | AC2-061 E       | 16.69                    |
| 931441            | AC2-062 C OP    | 4.94                     |
| 931442            | AC2-062 E OP    | 2.21                     |
| 931451            | AC2-064 C       | 9.64                     |
| 931452            | AC2-064 E       | 6.43                     |
| 931651            | AC2-087 C OP    | 3.12                     |
| 931652            | AC2-087 E OP    | 2.48                     |
| 247592            | W4-036          | 0.8                      |
| 924371            | AB2-085 C OP    | 7.03                     |
| 924372            | AB2-085 E OP    | 3.31                     |
| 924541            | AB2-103 C OP    | 4.25                     |
| 924542            | AB2-103 E OP    | 2.                       |
| 926061            | AC1-085 C       | 43.08                    |

|        |           |       |
|--------|-----------|-------|
| 926062 | AC1-085 E | 70.28 |
| 926101 | AC1-089 C | 20.33 |
| 926102 | AC1-089 E | 33.17 |
| 926631 | AC1-144 C | 19.07 |
| 926632 | AC1-144 E | 9.27  |

## Appendix 15

(AEP - AEP) The AC2-049 TAP-05MILLBR 138 kV line (from bus 931350 to bus 243042 ckt 1) loads from 309.51% to 311.29% (**DC power flow**) of its emergency rating (179 MVA) for the tower line contingency outage of '7981\_B'. This project contributes approximately 7.05 MW to the thermal violation.

CONTINGENCY '7981\_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061  
TAP 138 249995 08CLINCO 138 1  
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB  
138 253111 09MIDDLE 138 1  
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995  
08CLINCO 138 250122 08WARRN1 138 1  
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111  
09MIDDLE 138 253057 09OHH 138 1  
END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931022            | AC2-008 E       | 2.78                     |
| 931121            | AC2-019 C       | 0.76                     |
| 931122            | AC2-019 E       | 1.25                     |
| 931131            | AC2-020 C OP    | 0.64                     |
| 931132            | AC2-020 E OP    | 1.68                     |
| 931192            | AC2-027 E       | 2.01                     |
| 931221            | AC2-031 C       | 23.37                    |
| 931222            | AC2-031 E       | 11.51                    |
| 931281            | AC2-042 C       | 73.05                    |
| 931282            | AC2-042 E       | 48.7                     |
| 931351            | AC2-049 C       | 20.15                    |
| 931352            | AC2-049 E       | 13.43                    |
| 931381            | AC2-055 C OP    | 1.51                     |
| 931382            | AC2-055 E OP    | 2.47                     |
| 931421            | AC2-060 C       | 5.36                     |
| 931422            | AC2-060 E       | 3.02                     |
| 931431            | AC2-061 C       | 20.27                    |
| 931432            | AC2-061 E       | 20.55                    |
| 931441            | AC2-062 C OP    | 6.                       |
| 931442            | AC2-062 E OP    | 2.68                     |
| 931451            | AC2-064 C       | 47.29                    |
| 931452            | AC2-064 E       | 31.53                    |
| 931651            | AC2-087 C OP    | 3.93                     |
| 931652            | AC2-087 E OP    | 3.12                     |
| 247592            | W4-036          | 1.01                     |
| 924371            | AB2-085 C OP    | 8.23                     |
| 924372            | AB2-085 E OP    | 3.87                     |
| 924541            | AB2-103 C OP    | 5.1                      |
| 924542            | AB2-103 E OP    | 2.4                      |

|        |           |       |
|--------|-----------|-------|
| 926061 | AC1-085 C | 53.03 |
| 926062 | AC1-085 E | 86.52 |
| 926101 | AC1-089 C | 17.87 |
| 926102 | AC1-089 E | 29.16 |
| 926631 | AC1-144 C | 23.48 |
| 926632 | AC1-144 E | 11.41 |

## Appendix 16

(DEO&K - DEO&K) The AC2-061 TAP-08CLINCO 138 kV line (from bus 931430 to bus 249995 ckt 1) loads from 273.84% to 275.57% (**DC power flow**) of its emergency rating (184 MVA) for the line fault with failed breaker contingency outage of '8109\_C2\_05HILLSB 138-A\_A'. This project contributes approximately 7.06 MW to the thermal violation.

CONTINGENCY '8109\_C2\_05HILLSB 138-A\_A'

OPEN BRANCH FROM BUS 243019 TO BUS 243102 CKT 1 / 243019 05HILLSB  
138 243102 05SINKG8 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB  
138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 931350 TO BUS 243102 CKT 1 / 931350 AC2-049  
TAP 138 243102 05SINKG8 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111  
09MIDDLE 138 253057 09OHH 138 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931022            | AC2-008 E       | 2.83                     |
| 931121            | AC2-019 C       | 0.77                     |
| 931122            | AC2-019 E       | 1.26                     |
| 931131            | AC2-020 C OP    | 0.64                     |
| 931132            | AC2-020 E OP    | 1.68                     |
| 931192            | AC2-027 E       | 2.04                     |
| 931221            | AC2-031 C       | 23.89                    |
| 931222            | AC2-031 E       | 11.77                    |
| 931281            | AC2-042 C       | 74.67                    |
| 931282            | AC2-042 E       | 49.78                    |
| 931381            | AC2-055 C OP    | 1.52                     |
| 931382            | AC2-055 E OP    | 2.47                     |
| 931421            | AC2-060 C       | 5.37                     |
| 931422            | AC2-060 E       | 3.02                     |
| 931431            | AC2-061 C       | 28.84                    |
| 931432            | AC2-061 E       | 29.24                    |
| 931441            | AC2-062 C OP    | 6.21                     |
| 931442            | AC2-062 E OP    | 2.78                     |
| 931651            | AC2-087 C OP    | 3.94                     |
| 931652            | AC2-087 E OP    | 3.12                     |
| 247592            | W4-036          | 1.01                     |
| 916272            | Z1-080 E        | 2.18                     |
| 924371            | AB2-085 C OP    | 8.72                     |
| 924372            | AB2-085 E OP    | 4.1                      |
| 924541            | AB2-103 C OP    | 5.31                     |
| 924542            | AB2-103 E OP    | 2.5                      |
| 926061            | AC1-085 C       | 54.2                     |
| 926062            | AC1-085 E       | 88.44                    |
| 926101            | AC1-089 C       | 18.22                    |

|        |           |       |
|--------|-----------|-------|
| 926102 | AC1-089 E | 29.73 |
| 926631 | AC1-144 C | 24.   |
| 926632 | AC1-144 E | 11.66 |