Generation Interconnection Feasibility Study Report Queue Position AC1-009

The Interconnection Customer (IC) has proposed a 20 MW energy (7.6 MW Capacity) solar generating facility to be located in Accomack County, Virginia. PJM studied AC1-009 as a 20 MW injection into the Old Dominion Electric Cooperative (ODEC) system at a tap of the Tasley-Parksley 69 kV circuit and evaluated it for compliance with reliability criteria for summer peak conditions in 2020. The planned in-service date, as requested by the IC during the project kick-off call, is March 31, 2019. This in-service date cannot be accomplished due to construction schedules.

Point of Interconnection

The Interconnection Customer requested a transmission level interconnection. As a result, AC1-009 will interconnect with the ODEC system at Oak Hall – Tasley circuit 6790 (West) 69 kV line.

Transmission Owner (ODEC) Scope of Direct Connection Work

The total estimated cost of Direct Connection Facilities needed to connect Queue AC1-009 to the ODEC 69 kV system are **$ 3,130,000** without a statcom, and **4,060,000** if a statcom is required. Both estimates exclude any applicable state or federal taxes.
A further breakdown of the direct connection cost are as follows:

$160,000.00	Grading and Site Preparation
$600,000.00	Substation Package (steel, switches, buswork)
$200,000.00	69 kV Circuit Breakers
$260,000.00	Relaying and SCADA (includes relay settings and local SCADA programming and Changes at Tasley)
$20,000.00	Operations Center Programming (DPL)
$300,000.00	Project Management (includes ordering materials, scheduling deliveries, work coordination)
$800,000.00	Substation Construction Labor and Contractor Supplied Materials (includes Ground Mat)
$200,000.00	Substation Engineering
$70,000.00	Control Building
$200,000.00	69 kV A-frame Structures

$150,000.00	Communications to Tasley Substation
$50,000.00	Power Quality Metering
$20,000.00	Screening (beautification fence)
$100,000.00	Contingency
$3,130,000.00	Total Estimated Direct Connection Cost (**without Statcom**)

$160,000.00	Grading and Site Preparation
$600,000.00	Substation Package (steel, switches, buswork)
$200,000.00	69 kV Circuit Breakers
$260,000.00	Relaying and SCADA
$300,000.00	Project Management
$800,000.00	Substation Construction Labor and Contractor Supplied Materials
$200,000.00	Engineering
$70,000.00	Control Building
$200,000.00	69 kV A-frame Structures
$150,000.00	Communications to Tasley Substation
$300,000.00	Transformer(s) for Statcom
$700,000.00	4 MVA Statcom
$20,000.00	Screening (beautification fence)
$100,000.00	Contingency
$4,060,000.00	Total Estimated Direct Connection Cost (**with Statcom**)

The total estimated construction time for the Direct Connection facilities is **24 months.**

These transmission costs exclude any applicable state or federal taxes. If at a future date Federal CIAC taxes are deemed necessary by the IRS for this project, PJM, ANEC, and ODEC shall be reimbursed by the Interconnection Customer for such taxes.

Costs for extraordinary Threatened and Endangered Species, Archaeological, Cultural, or other as yet unidentified mitigation strategies are not estimated nor included in the above estimate. No environmental, real estate, or permitting issues were reviewed for this AC1-009 Feasibility Study.

Transmission Owner Interconnection Requirements

AC1-009 Inverter and GSU modeling

The AC1-009 Interconnection Customer must provide ODEC and PJM with the transformer test reports and a model of the inverters once they are available in order to perform more detailed analyses.

AC1-009 Generator Harmonic Requirements @ Point of Interconnection

Harmonic Voltage Requirements:

On the 69 kV system, the total harmonic distortion to the fundamental voltage wave from a single customer is limited to 1.5% of nominal. In addition, no individual harmonic component can exceed 1.0% of the fundamental system voltage.

Maximum Allowable Harmonic Voltage Distortion Table (Tariff Rule 32)		
Voltage Level	**Distortion Factor (% System Voltage)**	**Individual Harmonic (% System Voltage)**
69 kV through 138 kV	1.5	1

Harmonic current limits must comply with IEEE standard 519 (see table 10.2 and 10.3 limits for power generation). Harmonic filtering sufficient to limit harmonic current to the limits proscribed by these tables may need to be installed. AC1-009 will be responsible for installing such filtering and may be disconnected until remedies are taken if these standards are violated.

Current Distortion Limits in % of 60~ Current (from IEEE 519 tables 10.2 and 10.3)						
Voltage Level	<11	11<h<17	17<h<23	23<h<35	35<h	TDD
69 kV	2.0	1.0	0.75	0.3	0.15	2.5
25 kV	4.0	2.0	1.5	0.6	0.3	5.0

AC1-009 Inverter Regulation or Reactive Support Requirements

As specified in Interconnection Service Agreement, Appendix 2, Section 4.7.1.1 of the PJM OATT (Open Access Transmission Tariff), the AC1-009 generator may need to design its Facility to meet the following power factor requirement, depending on the outcome of the system impact study:

"For all new wind-powered and other non-synchronous generation facilities, if determined in the system impact study to be required for the safety or reliability of the Transmission System, the Generation Interconnection Customer shall design its Customer Facility with the ability to maintain a composite power delivery at continuous rated power output at a power factor of at least 0.95 leading to 0.95 lagging."

Preliminary Schedule and Notes / Assumptions

ODEC will begin the project only after the PJM 3-party Interconnection Service Agreement (ISA) and Interconnection Construction Service Agreement (ICSA) are fully executed and ODEC receives a written authorization by PJM to commence activities. The estimated time to complete the direct

connection work is approximately **24 months** after the execution of an ICSA. The schedule for the 69 kV transmission and substation work to accommodate AC1-009 would depend on the project start date. The work to accommodate AC1-009 will require transmission line outages. ODEC's outage windows for construction are only in the spring and fall of the year. Missing an outage window could result in significant project delays.

Notes / Assumptions:
During construction, if extreme weather conditions or other system safety concerns arise, field construction may need to be rescheduled, which could possibly impact the schedule plan.
Excepting any operational, governmental and/or environmental regulatory delays, the use of additional resources, such as overtime, premiums for expedited material, and/or contractor labor, may enable ODEC to decrease this construction period. It is also assumed that all right-of-way and easements are secured without impact on anticipated construction start dates.

Interconnection Customer Scope of Direct Connection Work
Queue AC1-009 Interconnection Customer will be responsible for the construction of all generating station facilities on the AC1-009 side of the POI (Point of Interconnection) as shown on Attachment 1. AC1-009 Interconnection Customer is required to design, construct, and own the 69 kV line from the POI to the Customer Facility. This line must be built in accordance RUS standards or an accepted national standard, be effectively grounded, and appropriately shielded from lightning. (Refer to RUS bulletins 1728f-810 and 1724E-200.) The customer's transformer shall be connected wye-ground on the 69 kV side and have a delta winding (either low-side or tertiary) to provide a source for system grounding.

Protection equipment --
The Interconnection Customer is responsible for the design and implementation of all protection equipment on the AC1-009 side of the POI (Point of Interconnection) as shown on the one line diagram of the previous page and will do so in accordance with good utility practice.
ODEC will provide a four-breaker substation and protection for all 69 kV faults on the line from Tasley to Oak Hall. AC1-009 will provide a 69 kV breaker near the POI beyond which ODEC protection will no longer be a primary means of interrupting fault current. The breaker **shall not** reclose after tripping. AC1-009 is required to provide ODEC with any information necessary to set ODEC line relaying. The conductor between the ODEC breakers and the AC1-009 breaker will be protected by differential relaying.

Statcom --
AC1-009 will need to operate absorbing VARS from the system, so that when real power output decrease due to intermittent cloud cover, the resulting decrease in VAR withdrawal will maintain system voltage. To put it another way, the VARS needed for the step transformer will need to come from the system side of the interconnection. Also, due to the close proximity to the 80 MW of solar generation at Oak Hall, intermittent sunshine may cause voltage flicker, as there may be little diversity in the amount of solar energy supplied to these panels. Dynamic VAR support may be required to alleviate this problem. Further studies in during the Impact Study phase will be needed to determine the necessity of the Statcom and the size.

Metering Equipment --

Installation of revenue grade Metering Equipment will be required at the Queue AC1-009 Point of Interconnection (POI). At the Interconnection Customer's discretion, ODEC will design and supply the required metering equipment but all of the installation cost would be borne by the customer. ODEC will install power quality metering to monitor compliance with industry standards for harmonics and other power quality requirements.

The Interconnection Customer is also required to provide revenue metering and real-time telemetry data to PJM in compliance with the requirements listed in PJM Manuals M-01 and M-14. At the customer's discretion, ODEC will design and supply the required telemetering equipment but all the installation cost and on-going costs will be borne by AC1-009. In the event that that AC1-009 provides the metering, AC1-009 will provide ODEC read only access to its PJM metering account for this site for verification of billing for ODEC.

Distribution Service Requirements--
The Interconnection Customer must submit a request for electric service through the A&N Electric Cooperative (ANEC) if back up electric service or station service power at less than 69 kV is desired.

Summer Peak Analysis - 2020

Transmission Network Impacts

Potential network impacts are as follows:

Generator Deliverability

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

None

Multiple Facility Contingency

(Double Circuit Tower Line contingencies only with full energy output. Stuck Breaker and Bus Fault contingencies will be applied during the Impact Study)

1. (DP&L - DP&L) The TOWNSEND-MIDLTNTP 138 kV line (from bus 232107 to bus 232106 ckt 1) loads from 99.95% to 100.5% (DC power flow) of its emergency rating (348 MVA) for the tower line contingency outage of 'DBL_1NCB_A'. This project contributes approximately 4.22 MW to the thermal violation.

   CONTINGENCY 'DBL_1NCB_A'/* #1 & #2 KEENEY-STEELE 230
   OPEN LINE FROM BUS 231003 TO BUS 232000 CKT 1
   OPEN LINE FROM BUS 231003 TO BUS 923960 CKT 2
   END

2. (DP&L - DP&L) The NMEREDTH-AB2-135 TAP 69 kV line (from bus 232812 to bus 924820 ckt 1) loads from 84.15% to 84.8% (DC power flow) of its emergency rating (93

MVA) for the tower line contingency outage of 'DBL_4NC'. This project contributes approximately 1.33 MW to the thermal violation.

CONTINGENCY 'DBL_4NC'/* RED LION-CEDAR CREEK 230;RED LION-CARTANZA 230
OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1
OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1
END

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

Contribution to Previously Identified Overloads

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

1. (DP&L - DP&L) The MILF_230-STEELE 230 kV line (from bus 232004 to bus 232000 ckt 1) loads from 157.75% to 158.55% (DC power flow) of its emergency rating (551 MVA) for the tower line contingency outage of 'DBL_4NC'. This project contributes approximately 9.82 MW to the thermal violation.

   CONTINGENCY 'DBL_4NC'/* RED LION-CEDAR CREEK 230;RED LION-CARTANZA 230
   OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1
   OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1
   END

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

2. (DP&L - DP&L) The MIDLTNTP-MT PLSNT 138 kV line (from bus 232106 to bus 232104 ckt 1) loads from 108.91% to 109.42% (DC power flow) of its emergency rating (348 MVA) for the tower line contingency outage of 'DBL_4NC'. This project contributes approximately 3.94 MW to the thermal violation.

   CONTINGENCY 'DBL_4NC'/* RED LION-CEDAR CREEK 230;RED LION-CARTANZA 230
   OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1
   OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1
   END

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

3. (DP&L - DP&L) The TOWNSEND-MIDLTNTP 138 kV line (from bus 232107 to bus 232106 ckt 1) loads from 119.63% to 120.14% (DC power flow) of its emergency rating (348 MVA) for the tower line contingency outage of 'DBL_4NC'. This project contributes approximately 3.94 MW to the thermal violation.

   CONTINGENCY 'DBL_4NC'/* RED LION-CEDAR CREEK 230;RED LION-CARTANZA 230
   OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1
   OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1
   END

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

4. (DP&L - DP&L) The LORETTO 138/69 kV transformer (from bus 232127 to bus 232275 ckt 1) loads from 105.09% to 106.25% (DC power flow) of its emergency rating (71 MVA) for the line fault with failed breaker contingency outage of 'DP56'. This project contributes approximately 1.83 MW to the thermal violation.

   CONTINGENCY 'DP56'/*LORETTO BUS BREAKER
   DISCONNECT BRANCH FROM BUS 232127 TO BUS 232117 CKT 1/*LORETTO VIENNA 138 1380
   DISCONNECT BRANCH FROM BUS 232127 TO BUS 232128 CKT 1/*LORETTO PINEY GROVE 138 138
   END

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

5. (DP&L - DP&L) The KENT-NMEREDTH 69 kV line (from bus 232215 to bus 232812 ckt 1) loads from 109.21% to 109.85% (DC power flow) of its emergency rating (93 MVA) for the tower line contingency outage of 'DBL_4NC'. This project contributes approximately 1.61 MW to the thermal violation.

   CONTINGENCY 'DBL_4NC'/* RED LION-CEDAR CREEK 230;RED LION-CARTANZA 230
   OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1
   OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1
   END

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

6. (DP&L - DP&L) The PRESTON-TANYARD 69 kV line (from bus 232233 to bus 232821 ckt 1) loads from 123.81% to 124.92% (DC power flow) of its emergency rating (93 MVA)

for the line fault with failed breaker contingency outage of 'DP11'. This project contributes approximately 2.29 MW to the thermal violation.

CONTINGENCY 'DP11'/*STEELE BUS BREAKER TO MILFORD
DISCONNECT BRANCH FROM BUS 232004 TO BUS 232000 CKT 1/*MILFORD STEELE 230 230
DISCONNECT BRANCH FROM BUS 232000 TO BUS 232005 CKT 1/*STEELE VIENNA 230 230
END

Please refer to Appendix 7 for a table containing the generators having contribution to this flowgate.

7. (DP&L - DP&L) The TODD-PRESTON 69 kV line (from bus 232234 to bus 232233 ckt 1) loads from 129.83% to 130.94% (DC power flow) of its emergency rating (93 MVA) for the line fault with failed breaker contingency outage of 'DP11'. This project contributes approximately 2.29 MW to the thermal violation.

   CONTINGENCY 'DP11'/*STEELE BUS BREAKER TO MILFORD
   DISCONNECT BRANCH FROM BUS 232004 TO BUS 232000 CKT 1/*MILFORD STEELE 230 230
   DISCONNECT BRANCH FROM BUS 232000 TO BUS 232005 CKT 1/*STEELE VIENNA 230 230
   END

   Please refer to Appendix 8 for a table containing the generators having contribution to this flowgate.

8. (DP&L - DP&L) The PINEY_69-M HERMON 69 kV line (from bus 232274 to bus 232272 ckt 1) loads from 108.18% to 110.95% (DC power flow) of its emergency rating (174 MVA) for the line fault with failed breaker contingency outage of 'DP15'. This project contributes approximately 4.83 MW to the thermal violation.

   CONTINGENCY 'DP15'/*INDIAN RIVER BUS BREAKER TO PINEY GROVE
   DISCONNECT BRANCH FROM BUS 232007 TO BUS 232006 CKT 1/*PINEY GR INDRIV 4 230 230
   DISCONNECT BRANCH FROM BUS 232007 TO BUS 232128 CKT 1/*PINEY GR PINEY GR 230 138
   DISCONNECT BRANCH FROM BUS 232006 TO BUS 232004 CKT 1/*MILFORD INDIAN RIVER 230 230
   END

   Please refer to Appendix 9 for a table containing the generators having contribution to this flowgate.

9. (DP&L - DP&L) The LORET_69-FRUITLND 69 kV line (from bus 232275 to bus 232288 ckt 1) loads from 107.33% to 109.86% (DC power flow) of its emergency rating (137 MVA) for the line fault with failed breaker contingency outage of 'DP56'. This project contributes approximately 3.47 MW to the thermal violation.

   CONTINGENCY 'DP56'/*LORETTO BUS BREAKER
   DISCONNECT BRANCH FROM BUS 232127 TO BUS 232117 CKT 1/*LORETTO VIENNA 138 1380
   DISCONNECT BRANCH FROM BUS 232127 TO BUS 232128 CKT 1/*LORETTO PINEY GROVE 138 138
   END

   Please refer to Appendix 10 for a table containing the generators having contribution to this flowgate.

10. (DP&L - DP&L) The FRUITLND-PEMBERTN 69 kV line (from bus 232288 to bus 232273 ckt 1) loads from 116.09% to 119.9% (DC power flow) of its emergency rating (91 MVA) for the line fault with failed breaker contingency outage of 'DP56'. This project contributes approximately 3.47 MW to the thermal violation.

    CONTINGENCY 'DP56'/*LORETTO BUS BREAKER
    DISCONNECT BRANCH FROM BUS 232127 TO BUS 232117 CKT 1/*LORETTO VIENNA 138 1380
    DISCONNECT BRANCH FROM BUS 232127 TO BUS 232128 CKT 1/*LORETTO PINEY GROVE 138 138
    END

    Please refer to Appendix 11 for a table containing the generators having contribution to this flowgate.

11. (DP&L - DP&L) The AB2-036 TAP-CHURCH 138 kV line (from bus 923950 to bus 232100 ckt 1) loads from 104.27% to 104.89% (DC power flow) of its emergency rating (159 MVA) for the tower line contingency outage of 'DBL_1NCB_A'. This project contributes approximately 2.18 MW to the thermal violation.

    CONTINGENCY 'DBL_1NCB_A'/* #1 & #2 KEENEY-STEELE 230
    OPEN LINE FROM BUS 231003 TO BUS 232000 CKT 1
    OPEN LINE FROM BUS 231003 TO BUS 923960 CKT 2
    END

    Please refer to Appendix 12 for a table containing the generators having contribution to this flowgate.

12. (DP&L - DP&L) The AB2-135 TAP-CHURC_69 69 kV line (from bus 924820 to bus 232203 ckt 1) loads from 135.02% to 135.66% (DC power flow) of its emergency rating (93

MVA) for the tower line contingency outage of 'DBL_4NC'. This project contributes approximately 1.33 MW to the thermal violation.

CONTINGENCY 'DBL_4NC'/* RED LION-CEDAR CREEK 230;RED LION-CARTANZA 230
OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1
OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1
END

Please refer to Appendix 13 for a table containing the generators having contribution to this flowgate.

13. (DP&L - DP&L) The AB2-135 TAP-CHURC_69 69 kV line (from bus 924820 to bus 232203 ckt 1) loads from 106.15% to 106.73% (DC power flow) of its emergency rating (93 MVA) for the line fault with failed breaker contingency outage of 'DP11'. This project contributes approximately 1.2 MW to the thermal violation.

CONTINGENCY 'DP11'/*STEELE BUS BREAKER TO MILFORD
DISCONNECT BRANCH FROM BUS 232004 TO BUS 232000 CKT 1/*MILFORD STEELE 230 230
DISCONNECT BRANCH FROM BUS 232000 TO BUS 232005 CKT 1/*STEELE VIENNA 230 230
END

Summer Peak Load Flow Analysis Reinforcements

New System Reinforcements

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

1. To mitigate the (DP&L) TOWNSEND-MIDLTNTP 138 kV line (from bus 232107 to bus 232106 ckt 1) overload will require increasing the emergency rating of the Townsend to Middletown Tap 138 kV line by rebuilding of a small section of the circuit. The rebuild includes the installation of new poles and the re-mounting of 138 kV disconnect switches. The estimate to perform this work is **$800,000** and will take **18 months** to complete.

2. To mitigate the (DP&L) NMEREDTH-AB2-135 TAP 69 kV line (from bus 232812 to bus 924820 ckt 1) overload will require increasing the emergency rating of the AB2-135 to New Meredith 69 kV line rebuilding the circuit. The rebuild includes the installation of new poles and a new disconnect switch. The estimate to perform this work is **$8,674,000** and will take **3 years** to complete.

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)

1. To mitigate the (DP&L) MILF_230-STEELE 230 kV line (from bus 232004 to bus 232000 ckt 1) overload will require increasing the emergency rating of the Milford to Steele 230 kV line by rebuilding the circuit. The rebuild includes the replacement of poles. The estimate to perform this work is **$43,965,000** and will take **4 years** to complete.

2. To mitigate the (DP&L) MIDLTNTP-MT PLSNT 138 kV line (from bus 232106 to bus 232104 ckt 1) overload will require increasing the emergency rating of the Townsend to Middletown Tap 138 kV line by rebuilding of a small section of the circuit. The rebuild includes the installation of new poles and the re-mounting of 138 kV disconnect switches. The estimate to perform this work is **$800,000** and will take **18 months** to complete.

3. To mitigate the (DP&L) TOWNSEND-MIDLTNTP 138 kV line (from bus 232107 to bus 232106 ckt 1) overload will require increasing the emergency rating of the Townsend to Middletown Tap 138 kV line by rebuilding of a small section of the circuit. The rebuild includes the installation of new poles and the re-mounting of 138 kV disconnect switches. The estimate to perform this work is **$800,000** and will take **18 months** to complete. (Same reinforcement as "New System" #1 above)

4. To mitigate the (DP&L) LORETTO 138/69 kV transformer (from bus 232127 to bus 232275 ckt 1) overload will require replacement of the Loretto AT1 autotransformer, which requires the reconfiguration of the 138 kV and 69 kV buses at Loretto Substation. The estimate to perform this work is **$4,377,000** and will take approximately **2 years** to complete.

5. To mitigate the (DP&L) KENT-NMEREDTH 69 kV line (from bus 232215 to bus 232812 ckt 1) overload will require increasing the emergency rating of the Kent to New Meredith 69 kV line by rebuilding of the circuit. The rebuild includes the installation of new poles, new disconnect switches, and new relays. The estimate to perform this work is **$9,720,000** and will take **24-36 months** to complete.

6. To mitigate the (DP&L) PRESTON-TANYARD 69 kV line (from bus 232233 to bus 232821 ckt 1) overload will require the replacement of a disconnect switch at Preston Substation. The estimate to perform this work is **$36,000** and will take approximately **1 year** to complete.

7. To mitigate the (DP&L) TODD-PRESTON 69 kV line (from bus 232234 to bus 232233 ckt 1) overload will require substation reinforcements at Preston Substation and Todd Substation. The estimate to perform this work is **$67,000** and will take approximately **1 year** to complete.

8. To mitigate the (DP&L) PINEY_69-M HERMON 69 kV line (from bus 232274 to bus 232272 ckt 1) overload will require rebuilding the Piney Grove – Mount Hermon 69 kV transmission line and substation reinforcements at Piney Grove Substation and Mount

Hermon Substation. The estimate to perform this work is **$9,688,000** and will take approximately **3 years** to complete.

9. To mitigate the (DP&L) LORET_69-FRUITLND 69 kV line (from bus 232275 to bus 232288 ckt 1) overload will require rebuilding the Loretto – Fruitland 69 kV transmission line and substation reinforcements at Loretto Substation and Fruitland Substation. The estimate to perform this work is **$7,196,000** and will take approximately **3 years** to complete.

10. To mitigate the (DP&L) FRUITLND-PEMBERTN 69 kV line (from bus 232288 to bus 232273 ckt 1) overload will require completion of PJM Supplemental Project **S0820** which will rebuil the North Salisbury-Pemberton 69 kV circuit and raise the emergency rating of this circuit to 174 MVA.

11. To mitigate the (DP&L) AB2-036 TAP-CHURCH 138 kV line (from bus 923950 to bus 232100 ckt 1) overload will require completion of PJM Supplemental Project **S0821** which will rebuild the Church-Steele 138 kV circuit and raise the emergency rating of this circuit to 286 MVA. The projected in-service date for the project is May 2017.

12 &13. To mitigate the (DP&L) AB2-135 TAP-CHURC_69 69 kV line (from bus 924820 to bus 232203 ckt 1) overloads will require increasing the emergency rating of the AB2-135 to Church 69 kV line by rebuilding the circuit. The rebuild includes the installation of new poles and a new disconnect switch. The estimate to perform this work is **$8,674,000** and will take **3 years** to complete.

Steady-State Voltage Requirements
(Results of the steady-state voltage studies should be inserted here)

None

Short Circuit
(Summary of impacted circuit breakers)

No issues identified.

Stability and Reactive Power Requirement
(Results of the dynamic studies should be inserted here)

To be completed during later study phases if required.

Light Load Analysis - 2020
Light Load Studies to be conducted during later study phases (as required by PJM Manual 14B).

Facilities Study Estimate
(If a Facilities Study is required, provide the estimated duration and cost estimate to perform Facilities Study)

7 months: $50,000

Delivery Energy Portion of Interconnection Request

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

1. (DP&L - DP&L) The PINEY138-LORETTO 138 kV line (from bus 232128 to bus 232127 ckt 1) loads from 118.37% to 122.29% (DC power flow) of its emergency rating (159 MVA) for the single line contingency outage of 'CKT 13713'. This project contributes approximately 6.23 MW to the thermal violation.

   CONTINGENCY 'CKT 13713'
   OPEN LINE FROM BUS 232129 TO BUS 232127 CIRCUIT 1/KINGS CREEK - LORETTO 138
   END

2. (DP&L - DP&L) The N_CHURCH-AB2-120 TAP 138 kV line (from bus 232131 to bus 924680 ckt 1) loads from 112.26% to 116.57% (DC power flow) of its emergency rating (226 MVA) for the single line contingency outage of 'CKT 13713'. This project contributes approximately 9.73 MW to the thermal violation.

   CONTINGENCY 'CKT 13713'
   OPEN LINE FROM BUS 232129 TO BUS 232127 CIRCUIT 1/KINGS CREEK - LORETTO 138
   END

3. (DP&L - DP&L) The PINEY_69-M HERMON 69 kV line (from bus 232274 to bus 232272 ckt 1) loads from 107.84% to 110.63% (DC power flow) of its emergency rating (174 MVA) for the single line contingency outage of 'CKT 23002'. This project contributes approximately 4.85 MW to the thermal violation.

   CONTINGENCY 'CKT 23002'
   DISCONNECT BUS 232007/INDIAN RIVER - PINEY GROVE 230 & PNY GRV AT-20 XFMER
   END

4. (DP&L - DP&L) The OAKHL_69-WATTSVIL 69 kV line (from bus 232280 to bus 232281 ckt 1) loads from 119.94% to 125.51% (DC power flow) of its emergency rating (89 MVA) for the single line contingency outage of 'CKT 13789'. This project contributes approximately 6.74 MW to the thermal violation.

CONTINGENCY 'CKT 13789'
OPEN LINE FROM BUS 232132 TO BUS 232133 CIRCUIT 1/OAK HALL - WATTSVILLE 138
END

5. (DP&L - DP&L) The SHORT 1-LAUREL 69 kV line (from bus 232828 to bus 232249 ckt 1) loads from 100.56% to 104.13% (DC power flow) of its emergency rating (57 MVA) for the single line contingency outage of 'CKT 23002'. This project contributes approximately 2.04 MW to the thermal violation.

   CONTINGENCY 'CKT 23002'
   DISCONNECT BUS 232007/INDIAN RIVER - PINEY GROVE 230 & PNY GRV AT-20 XFMER
   END

6. (DP&L - DP&L) The AB2-120 TAP-PINEY138 138 kV line (from bus 924680 to bus 232128 ckt 1) loads from 139.35% to 143.65% (DC power flow) of its emergency rating (226 MVA) for the single line contingency outage of 'CKT 13713'. This project contributes approximately 9.73 MW to the thermal violation.

   CONTINGENCY 'CKT 13713'
   OPEN LINE FROM BUS 232129 TO BUS 232127 CIRCUIT 1/KINGS CREEK - LORETTO 138
   END

7. (DP&L - DP&L) The AB2-120 TAP-PINEY138 138 kV line (from bus 924680 to bus 232128 ckt 1) loads from 112.1% to 115.75% (DC power flow) of its normal rating (172 MVA) for non-contingency condition. This project contributes approximately 6.28 MW to the thermal violation.

Appendices

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

(DP&L - DP&L) The NMEREDTH-AB2-135 TAP 69 kV line (from bus 232812 to bus 924820 ckt 1) loads from 84.15% to 84.8% (DC power flow) of its emergency rating (93 MVA) for the tower line contingency outage of 'DBL_4NC'. This project contributes approximately 1.33 MW to the thermal violation.

CONTINGENCY 'DBL_4NC' /* RED LION-CEDAR CREEK 230;RED LION-CARTANZA 230
OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1
OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1
END

Bus Number	*Bus Name*	*Full Contribution*
232900	*DEMECSMY*	*1.59*
232851	*DUP-SFR1*	*0.19*
232923	*MR1*	*1.32*
232924	*MR2*	*1.32*
232910	*NRG_G1*	*2.93*
232911	*NRG_G2*	*2.93*
297077	*V2-028 E*	*0.2*
904212	*V4-022E*	*0.21*
232813	*VAUGHN*	*0.16*
901004	*W1-003 E*	*0.3*
901014	*W1-004 E*	*0.3*
901024	*W1-005 E*	*0.3*
901034	*W1-006 E*	*0.3*
901411	*W1-062*	*1.69*
907052	*X1-032 E*	*0.26*
907324	*X1-096 E*	*5.97*
913412	*Y1-080 E*	*0.11*
915542	*Y3-058 E*	*0.6*
920582	*Z1-076 C*	*0.36*
920583	*Z1-076 E*	*0.58*
920592	*Z1-077 C*	*0.25*
920593	*Z1-077 E*	*0.41*
917082	*Z2-012 E*	*0.82*
920763	*Z2-076 E*	*0.15*
920773	*Z2-077 E*	*0.15*
921122	*AA1-059 C*	*0.28*
921123	*AA1-059 E*	*0.11*
921592	*AA1-140 C*	*0.58*
921593	*AA1-140 E*	*0.95*
921602	*AA1-141 C*	*0.38*
921603	*AA1-141 E*	*0.62*
921872	*AA2-069*	*41.18*

922213	*AA2-129 E*	*1.33*
922222	*AA2-130*	*0.13*
922752	*AB1-056 C OP*	*4.98*
922753	*AB1-056 E OP*	*14.19*
922762	*AB1-057 C*	*5.06*
922763	*AB1-057 E*	*14.42*
923282	*AB1-137 C*	*1.1*
923283	*AB1-137 E*	*0.47*
923902	*AB2-030 E*	*0.27*
923931	*AB2-033 C*	*0.47*
923932	*AB2-033 E*	*0.19*
924361	*AB2-084 C*	*0.25*
924362	*AB2-084 E*	*0.4*
924681	*AB2-120 C OP*	*2.53*
924682	*AB2-120 E OP*	*4.13*
924781	*AB2-130 C OP*	*3.13*
924782	*AB2-130 E OP*	*5.11*
925091	*AB2-166 C*	*0.14*
925092	*AB2-166 E*	*0.24*
925101	*AB2-167 C*	*0.35*
925102	*AB2-167 E*	*0.58*
925231	*AB2-177 C*	*0.17*
925232	*AB2-177 E*	*0.28*
925261	*AB2-180 C*	*0.9*
925262	*AB2-180 E*	*0.38*
925381	*AC1-009 C*	*0.5*
925382	*AC1-009 E*	*0.82*
925531	*AC1-028*	*0.25*
925651	*AC1-041 C*	*0.13*
925652	*AC1-041 E*	*0.21*
925731	*AC1-049 C*	*0.12*
925732	*AC1-049 E*	*0.19*
925741	*AC1-050 C*	*0.11*
925742	*AC1-050 E*	*0.18*
925761	*AC1-052 C*	*0.66*
925762	*AC1-052 E*	*0.27*
926131	*AC1-091 C*	*1.11*
926132	*AC1-091 E*	*1.82*
926141	*AC1-092 C*	*1.11*
926142	*AC1-092 E*	*1.82*
926151	*AC1-093 C*	*1.05*
926152	*AC1-093 E*	*1.73*
926161	*AC1-094 C*	*0.89*
926162	*AC1-094 E*	*1.46*
926171	*AC1-095 C*	*0.92*

926172	*AC1-095 E*	*0.69*
926911	*AC1-177*	*0.26*
926931	*AC1-180*	*0.38*
927191	*AC1-213 C*	*0.23*
927192	*AC1-213 E*	*0.12*
927321	*AC1-229 C*	*0.3*
927322	*AC1-229 E*	*0.49*

Appendix 2

(DP&L - DP&L) The MILF_230-STEELE 230 kV line (from bus 232004 to bus 232000 ckt 1) loads from 157.75% to 158.55% (DC power flow) of its emergency rating (551 MVA) for the tower line contingency outage of 'DBL_4NC'. This project contributes approximately 9.82 MW to the thermal violation.

CONTINGENCY 'DBL_4NC' /* RED LION-CEDAR CREEK 230;RED LION-CARTANZA 230
OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1
OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1
END

Bus Number	*Bus Name*	*Full Contribution*
232900	*DEMECSMY*	*5.8*
232616	*GEN FOOD*	*2.12*
232904	*IR4*	*51.07*
232923	*MR1*	*12.53*
232924	*MR2*	*12.53*
232922	*MR3*	*14.25*
232901	*NORTHST*	*6.29*
297077	*V2-028 E*	*1.28*
904212	*V4-022E*	*1.52*
901004	*W1-003 E*	*2.22*
901014	*W1-004 E*	*2.22*
901024	*W1-005 E*	*2.22*
901034	*W1-006 E*	*2.22*
901411	*W1-062*	*6.16*
903511	*W3-032A*	*43.16*
907052	*X1-032 E*	*1.89*
907324	*X1-096 E*	*42.96*
910572	*X3-008 E*	*3.32*
910592	*X3-015 E*	*3.81*
913412	*Y1-080 E*	*0.68*
915542	*Y3-058 E*	*4.1*
920582	*Z1-076 C*	*2.64*
920583	*Z1-076 E*	*4.3*
920592	*Z1-077 C*	*1.88*

920593	*Z1-077 E*	*3.07*
917082	*Z2-012 E*	*6.09*
920763	*Z2-076 E*	*1.22*
920773	*Z2-077 E*	*1.22*
921122	*AA1-059 C*	*1.99*
921123	*AA1-059 E*	*0.79*
921142	*AA1-061 C*	*3.72*
921143	*AA1-061 E*	*1.83*
921592	*AA1-140 C*	*4.6*
921593	*AA1-140 E*	*7.51*
921602	*AA1-141 C*	*2.84*
921603	*AA1-141 E*	*4.63*
921872	*AA2-069*	*390.53*
922213	*AA2-129 E*	*9.83*
922222	*AA2-130*	*0.92*
922752	*AB1-056 C OP*	*41.89*
922753	*AB1-056 E OP*	*119.31*
922762	*AB1-057 C*	*42.55*
922763	*AB1-057 E*	*121.26*
923282	*AB1-137 C*	*8.78*
923283	*AB1-137 E*	*3.76*
923902	*AB2-030 E*	*1.96*
923931	*AB2-033 C*	*3.52*
923932	*AB2-033 E*	*1.39*
924361	*AB2-084 C*	*1.79*
924362	*AB2-084 E*	*2.93*
924681	*AB2-120 C OP*	*18.79*
924682	*AB2-120 E OP*	*30.65*
924781	*AB2-130 C OP*	*19.74*
924782	*AB2-130 E OP*	*32.21*
924831	*AB2-136 C OP*	*7.6*
924832	*AB2-136 E OP*	*10.79*
925091	*AB2-166 C*	*0.95*
925092	*AB2-166 E*	*1.66*
925101	*AB2-167 C*	*2.63*
925102	*AB2-167 E*	*4.31*
925151	*AB2-172 C OP*	*5.08*
925152	*AB2-172 E OP*	*8.29*
925231	*AB2-177 C*	*1.25*
925232	*AB2-177 E*	*2.04*
925261	*AB2-180 C*	*6.18*
925262	*AB2-180 E*	*2.65*
925381	*AC1-009 C*	*3.73*
925382	*AC1-009 E*	*6.09*
925531	*AC1-028*	*1.79*

925651	*AC1-041 C*	*0.95*
925652	*AC1-041 E*	*1.55*
925731	*AC1-049 C*	*0.91*
925732	*AC1-049 E*	*1.51*
925741	*AC1-050 C*	*0.74*
925742	*AC1-050 E*	*1.21*
925761	*AC1-052 C*	*4.91*
925762	*AC1-052 E*	*1.96*
926131	*AC1-091 C*	*4.99*
926132	*AC1-091 E*	*8.18*
926141	*AC1-092 C*	*4.99*
926142	*AC1-092 E*	*8.18*
926151	*AC1-093 C*	*4.72*
926152	*AC1-093 E*	*7.78*
926161	*AC1-094 C*	*3.99*
926162	*AC1-094 E*	*6.59*
926171	*AC1-095 C*	*4.13*
926172	*AC1-095 E*	*3.13*
926911	*AC1-177*	*1.85*
926931	*AC1-180*	*2.77*
927031	*AC1-190 C*	*9.61*
927032	*AC1-190 E*	*4.12*
927191	*AC1-213 C*	*1.65*
927192	*AC1-213 E*	*0.85*
927311	*AC1-228 C*	*0.29*
927312	*AC1-228 E*	*0.51*
927321	*AC1-229 C*	*2.39*
927322	*AC1-229 E*	*3.89*

Appendix 3

(DP&L - DP&L) The MIDLTNTP-MT PLSNT 138 kV line (from bus 232106 to bus 232104 ckt 1) loads from 108.91% to 109.42% (DC power flow) of its emergency rating (348 MVA) for the tower line contingency outage of 'DBL_4NC'. This project contributes approximately 3.94 MW to the thermal violation.

```
CONTINGENCY 'DBL_4NC'                                   /* RED LION-CEDAR CREEK
230;RED LION-CARTANZA 230
  OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1
  OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1
  END
```

Bus Number	*Bus Name*	*Full Contribution*
232900	*DEMECSMY*	*2.08*
232851	*DUP-SFR1*	*0.39*
232902	*EASTMUNI*	*3.29*

232923	*MR1*	*3.37*
232924	*MR2*	*3.37*
232910	*NRG_G1*	*2.36*
232911	*NRG_G2*	*2.36*
292089	*T-011*	*0.16*
297076	*V2-028 C*	*0.09*
297077	*V2-028 E*	*0.75*
904212	*V4-022E*	*0.61*
232813	*VAUGHN*	*0.15*
232919	*VN10*	*0.55*
901004	*W1-003 E*	*0.89*
901014	*W1-004 E*	*0.89*
901024	*W1-005 E*	*0.89*
901034	*W1-006 E*	*0.89*
901411	*W1-062*	*2.21*
907052	*X1-032 E*	*0.79*
907324	*X1-096 E*	*18.29*
910571	*X3-008 C*	*0.31*
910572	*X3-008 E*	*2.68*
910591	*X3-015 C*	*0.29*
910592	*X3-015 E*	*2.52*
910821	*X3-066 C*	*0.16*
910822	*X3-066 E*	*1.41*
913361	*Y1-079 C*	*0.23*
913362	*Y1-079 E*	*1.96*
913411	*Y1-080 C*	*0.05*
913412	*Y1-080 E*	*0.43*
915751	*Y3-033*	*1.02*
915752	*Y3-033*	*38.64*
915541	*Y3-058 C*	*0.22*
915542	*Y3-058 E*	*1.86*
920582	*Z1-076 C*	*1.05*
920583	*Z1-076 E*	*1.71*
920592	*Z1-077 C*	*0.75*
920593	*Z1-077 E*	*1.22*
916281	*Z1-081 C*	*0.19*
916282	*Z1-081 E*	*1.65*
917082	*Z2-012 E*	*2.45*
920763	*Z2-076 E*	*0.4*
920773	*Z2-077 E*	*0.4*
920812	*Z2-097 C*	*1.57*
920813	*Z2-097 E*	*0.65*
921122	*AA1-059 C*	*0.85*
921123	*AA1-059 E*	*0.33*
921142	*AA1-061 C*	*2.88*

921143	*AA1-061 E*	*1.42*
921442	*AA1-110 C*	*1.78*
921443	*AA1-110 E*	*0.89*
921592	*AA1-140 C*	*1.52*
921593	*AA1-140 E*	*2.47*
921602	*AA1-141 C*	*1.13*
921603	*AA1-141 E*	*1.84*
921872	*AA2-069*	*104.95*
922213	*AA2-129 E*	*3.94*
922222	*AA2-130*	*0.39*
922752	*AB1-056 C OP*	*12.81*
922753	*AB1-056 E OP*	*36.48*
922762	*AB1-057 C*	*13.01*
922763	*AB1-057 E*	*37.08*
923282	*AB1-137 C*	*2.79*
923283	*AB1-137 E*	*1.2*
923322	*AB1-141 C OP*	*5.3*
923323	*AB1-141 E OP*	*2.47*
923332	*AB1-142 C OP*	*5.3*
923333	*AB1-142 E OP*	*2.47*
923452	*AB1-162 C OP*	*2.4*
923453	*AB1-162 E OP*	*3.92*
923602	*AB1-176 C*	*1.29*
923603	*AB1-176 E*	*2.12*
923902	*AB2-030 E*	*0.79*
923921	*AB2-032 C*	*5.34*
923922	*AB2-032 E*	*2.51*
923931	*AB2-033 C*	*1.41*
923932	*AB2-033 E*	*0.56*
923951	*AB2-036 C*	*11.73*
923952	*AB2-036 E*	*19.19*
923961	*AB2-037 C*	*12.75*
923962	*AB2-037 E*	*20.83*
924191	*AB2-063 C*	*2.87*
924192	*AB2-063 E*	*4.69*
924361	*AB2-084 C*	*0.75*
924362	*AB2-084 E*	*1.22*
924681	*AB2-120 C OP*	*7.5*
924682	*AB2-120 E OP*	*12.23*
924781	*AB2-130 C OP*	*7.74*
924782	*AB2-130 E OP*	*12.63*
924801	*AB2-133 C OP*	*14.21*
924802	*AB2-133 E OP*	*19.1*
924821	*AB2-135 C*	*12.06*
924822	*AB2-135 E*	*13.76*

924831	*AB2-136 C OP*	*5.2*
924832	*AB2-136 E OP*	*7.38*
924881	*AB2-142 C*	*1.14*
924882	*AB2-142 E*	*1.85*
924971	*AB2-153 C*	*2.98*
924972	*AB2-153 E*	*4.87*
925091	*AB2-166 C*	*0.4*
925092	*AB2-166 E*	*0.7*
925101	*AB2-167 C*	*1.05*
925102	*AB2-167 E*	*1.72*
925151	*AB2-172 C OP*	*4.11*
925152	*AB2-172 E OP*	*6.71*
925231	*AB2-177 C*	*0.49*
925232	*AB2-177 E*	*0.81*
925251	*AB2-179 C OP*	*26.3*
925252	*AB2-179 E OP*	*8.67*
925261	*AB2-180 C*	*2.8*
925262	*AB2-180 E*	*1.2*
925271	*AB2-185 C OP*	*4.42*
925272	*AB2-185 E OP*	*1.9*
925381	*AC1-009 C*	*1.5*
925382	*AC1-009 E*	*2.45*
925531	*AC1-028*	*0.76*
925651	*AC1-041 C*	*0.38*
925652	*AC1-041 E*	*0.61*
925731	*AC1-049 C*	*0.3*
925732	*AC1-049 E*	*0.5*
925741	*AC1-050 C*	*0.38*
925742	*AC1-050 E*	*0.63*
925761	*AC1-052 C*	*1.97*
925762	*AC1-052 E*	*0.79*
926131	*AC1-091 C*	*1.65*
926132	*AC1-091 E*	*2.7*
926141	*AC1-092 C*	*1.65*
926142	*AC1-092 E*	*2.7*
926151	*AC1-093 C*	*1.56*
926152	*AC1-093 E*	*2.57*
926161	*AC1-094 C*	*1.32*
926162	*AC1-094 E*	*2.18*
926171	*AC1-095 C*	*1.36*
926172	*AC1-095 E*	*1.03*
926721	*AC1-154 C*	*0.49*
926722	*AC1-154 E*	*0.82*
926911	*AC1-177*	*0.79*
926931	*AC1-180*	*1.18*

927031	*AC1-190 C*	*7.53*
927032	*AC1-190 E*	*3.23*
927191	*AC1-213 C*	*0.7*
927192	*AC1-213 E*	*0.36*
927241	*AC1-220 C OP*	*5.86*
927242	*AC1-220 E OP*	*4.16*
927272	*AC1-224 E*	*0.63*
927311	*AC1-228 C*	*0.24*
927312	*AC1-228 E*	*0.41*
927321	*AC1-229 C*	*0.76*
927322	*AC1-229 E*	*1.24*

Appendix 4

(DP&L - DP&L) The TOWNSEND-MIDLTNTP 138 kV line (from bus 232107 to bus 232106 ckt 1) loads from 119.63% to 120.14% (DC power flow) of its emergency rating (348 MVA) for the tower line contingency outage of 'DBL_4NC'. This project contributes approximately 3.94 MW to the thermal violation.

CONTINGENCY 'DBL_4NC' /* RED LION-CEDAR CREEK 230;RED LION-CARTANZA 230
OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1
OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1
END

Bus Number	*Bus Name*	*Full Contribution*
232900	*DEMECSMY*	*2.08*
232851	*DUP-SFR1*	*0.39*
232902	*EASTMUNI*	*3.29*
232923	*MR1*	*3.37*
232924	*MR2*	*3.37*
232910	*NRG_G1*	*2.36*
232911	*NRG_G2*	*2.36*
292089	*T-011*	*0.16*
297076	*V2-028 C*	*0.09*
297077	*V2-028 E*	*0.75*
904212	*V4-022E*	*0.61*
232813	*VAUGHN*	*0.15*
232919	*VN10*	*0.55*
901004	*W1-003 E*	*0.89*
901014	*W1-004 E*	*0.89*
901024	*W1-005 E*	*0.89*
901034	*W1-006 E*	*0.89*
901411	*W1-062*	*2.21*
907052	*X1-032 E*	*0.79*
907324	*X1-096 E*	*18.29*

910571	*X3-008 C*	*0.31*
910572	*X3-008 E*	*2.68*
910591	*X3-015 C*	*0.29*
910592	*X3-015 E*	*2.52*
910821	*X3-066 C*	*0.16*
910822	*X3-066 E*	*1.41*
913361	*Y1-079 C*	*0.23*
913362	*Y1-079 E*	*1.96*
913411	*Y1-080 C*	*0.05*
913412	*Y1-080 E*	*0.43*
915751	*Y3-033*	*1.02*
915752	*Y3-033*	*38.64*
915541	*Y3-058 C*	*0.22*
915542	*Y3-058 E*	*1.86*
920582	*Z1-076 C*	*1.05*
920583	*Z1-076 E*	*1.71*
920592	*Z1-077 C*	*0.75*
920593	*Z1-077 E*	*1.22*
916281	*Z1-081 C*	*0.19*
916282	*Z1-081 E*	*1.65*
917082	*Z2-012 E*	*2.45*
920763	*Z2-076 E*	*0.4*
920773	*Z2-077 E*	*0.4*
920812	*Z2-097 C*	*1.57*
920813	*Z2-097 E*	*0.65*
921122	*AA1-059 C*	*0.85*
921123	*AA1-059 E*	*0.33*
921142	*AA1-061 C*	*2.88*
921143	*AA1-061 E*	*1.42*
921442	*AA1-110 C*	*1.78*
921443	*AA1-110 E*	*0.89*
921592	*AA1-140 C*	*1.52*
921593	*AA1-140 E*	*2.47*
921602	*AA1-141 C*	*1.13*
921603	*AA1-141 E*	*1.84*
921872	*AA2-069*	*104.95*
922213	*AA2-129 E*	*3.94*
922222	*AA2-130*	*0.39*
922752	*AB1-056 C OP*	*12.81*
922753	*AB1-056 E OP*	*36.48*
922762	*AB1-057 C*	*13.01*
922763	*AB1-057 E*	*37.08*
923282	*AB1-137 C*	*2.79*
923283	*AB1-137 E*	*1.2*
923322	*AB1-141 C OP*	*5.3*

923323	*AB1-141 E OP*	*2.47*
923332	*AB1-142 C OP*	*5.3*
923333	*AB1-142 E OP*	*2.47*
923452	*AB1-162 C OP*	*2.4*
923453	*AB1-162 E OP*	*3.92*
923602	*AB1-176 C*	*1.29*
923603	*AB1-176 E*	*2.12*
923902	*AB2-030 E*	*0.79*
923921	*AB2-032 C*	*5.34*
923922	*AB2-032 E*	*2.51*
923931	*AB2-033 C*	*1.41*
923932	*AB2-033 E*	*0.56*
923951	*AB2-036 C*	*11.73*
923952	*AB2-036 E*	*19.19*
923961	*AB2-037 C*	*12.75*
923962	*AB2-037 E*	*20.83*
924191	*AB2-063 C*	*2.87*
924192	*AB2-063 E*	*4.69*
924361	*AB2-084 C*	*0.75*
924362	*AB2-084 E*	*1.22*
924681	*AB2-120 C OP*	*7.5*
924682	*AB2-120 E OP*	*12.23*
924781	*AB2-130 C OP*	*7.74*
924782	*AB2-130 E OP*	*12.63*
924801	*AB2-133 C OP*	*14.21*
924802	*AB2-133 E OP*	*19.1*
924821	*AB2-135 C*	*12.06*
924822	*AB2-135 E*	*13.76*
924831	*AB2-136 C OP*	*5.2*
924832	*AB2-136 E OP*	*7.38*
924881	*AB2-142 C*	*1.14*
924882	*AB2-142 E*	*1.85*
924971	*AB2-153 C*	*2.98*
924972	*AB2-153 E*	*4.87*
925091	*AB2-166 C*	*0.4*
925092	*AB2-166 E*	*0.7*
925101	*AB2-167 C*	*1.05*
925102	*AB2-167 E*	*1.72*
925151	*AB2-172 C OP*	*4.11*
925152	*AB2-172 E OP*	*6.71*
925231	*AB2-177 C*	*0.49*
925232	*AB2-177 E*	*0.81*
925251	*AB2-179 C OP*	*26.3*
925252	*AB2-179 E OP*	*8.67*
925261	*AB2-180 C*	*2.8*

925262	*AB2-180 E*	*1.2*
925271	*AB2-185 C OP*	*4.42*
925272	*AB2-185 E OP*	*1.9*
925381	*AC1-009 C*	*1.5*
925382	*AC1-009 E*	*2.45*
925531	*AC1-028*	*0.76*
925651	*AC1-041 C*	*0.38*
925652	*AC1-041 E*	*0.61*
925731	*AC1-049 C*	*0.3*
925732	*AC1-049 E*	*0.5*
925741	*AC1-050 C*	*0.38*
925742	*AC1-050 E*	*0.63*
925761	*AC1-052 C*	*1.97*
925762	*AC1-052 E*	*0.79*
926131	*AC1-091 C*	*1.65*
926132	*AC1-091 E*	*2.7*
926141	*AC1-092 C*	*1.65*
926142	*AC1-092 E*	*2.7*
926151	*AC1-093 C*	*1.56*
926152	*AC1-093 E*	*2.57*
926161	*AC1-094 C*	*1.32*
926162	*AC1-094 E*	*2.18*
926171	*AC1-095 C*	*1.36*
926172	*AC1-095 E*	*1.03*
926721	*AC1-154 C*	*0.49*
926722	*AC1-154 E*	*0.82*
926911	*AC1-177*	*0.79*
926931	*AC1-180*	*1.18*
927031	*AC1-190 C*	*7.53*
927032	*AC1-190 E*	*3.23*
927191	*AC1-213 C*	*0.7*
927192	*AC1-213 E*	*0.36*
927241	*AC1-220 C OP*	*5.86*
927242	*AC1-220 E OP*	*4.16*
927272	*AC1-224 E*	*0.63*
927311	*AC1-228 C*	*0.24*
927312	*AC1-228 E*	*0.41*
927321	*AC1-229 C*	*0.76*
927322	*AC1-229 E*	*1.24*

Appendix 5

(DP&L - DP&L) The LORETTO 138/69 kV transformer (from bus 232127 to bus 232275 ckt 1) loads from 105.09% to 106.25% (DC power flow) of its emergency rating (71 MVA) for the line

fault with failed breaker contingency outage of 'DP56'. This project contributes approximately 1.83 MW to the thermal violation.

CONTINGENCY 'DP56' /*LORETTO BUS BREAKER
DISCONNECT BRANCH FROM BUS 232127 TO BUS 232117 CKT 1 /*LORETTO VIENNA 138 1380
DISCONNECT BRANCH FROM BUS 232127 TO BUS 232128 CKT 1 /*LORETTO PINEY GROVE 138 138
END

Bus Number	*Bus Name*	*Full Contribution*
232926	*CRISFLD1*	*0.33*
904212	*V4-022E*	*0.28*
901004	*W1-003 E*	*0.43*
901014	*W1-004 E*	*0.43*
901024	*W1-005 E*	*0.43*
901034	*W1-006 E*	*0.43*
907052	*X1-032 E*	*0.58*
907323	*X1-096 C*	*0.64*
907324	*X1-096 E*	*16.04*
920582	*Z1-076 C*	*0.35*
920583	*Z1-076 E*	*0.57*
920592	*Z1-077 C*	*0.25*
920593	*Z1-077 E*	*0.41*
917082	*Z2-012 E*	*1.14*
921122	*AA1-059 C*	*0.74*
921123	*AA1-059 E*	*0.29*
918831	*AA1-102*	*1.23*
922213	*AA2-129 E*	*1.83*
922222	*AA2-130*	*0.35*
923902	*AB2-030 E*	*0.37*
923931	*AB2-033 C*	*0.66*
923932	*AB2-033 E*	*0.26*
924361	*AB2-084 C*	*0.55*
924362	*AB2-084 E*	*0.9*
924681	*AB2-120 C OP*	*3.2*
924682	*AB2-120 E OP*	*5.22*
925101	*AB2-167 C*	*0.35*
925102	*AB2-167 E*	*0.58*
925381	*AC1-009 C*	*0.7*
925382	*AC1-009 E*	*1.14*
925761	*AC1-052 C*	*0.92*
925762	*AC1-052 E*	*0.37*
926911	*AC1-177*	*0.69*
926931	*AC1-180*	*1.04*

Appendix 6

(DP&L - DP&L) The KENT-NMEREDTH 69 kV line (from bus 232215 to bus 232812 ckt 1) loads from 109.21% to 109.85% (DC power flow) of its emergency rating (93 MVA) for the tower line contingency outage of 'DBL_4NC'. This project contributes approximately 1.33 MW to the thermal violation.

```
CONTINGENCY 'DBL_4NC'                                   /* RED LION-CEDAR CREEK
230;RED LION-CARTANZA 230
  OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1
  OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1
  END
```

Bus Number	*Bus Name*	*Full Contribution*
232900	*DEMECSMY*	*1.59*
232851	*DUP-SFR1*	*0.19*
232923	*MR1*	*1.32*
232924	*MR2*	*1.32*
232910	*NRG_G1*	*2.93*
232911	*NRG_G2*	*2.93*
297077	*V2-028 E*	*0.2*
904212	*V4-022E*	*0.21*
232813	*VAUGHN*	*0.16*
901004	*W1-003 E*	*0.3*
901014	*W1-004 E*	*0.3*
901024	*W1-005 E*	*0.3*
901034	*W1-006 E*	*0.3*
901411	*W1-062*	*1.69*
907052	*X1-032 E*	*0.26*
907324	*X1-096 E*	*5.97*
913412	*Y1-080 E*	*0.11*
915542	*Y3-058 E*	*0.6*
920582	*Z1-076 C*	*0.36*
920583	*Z1-076 E*	*0.58*
920592	*Z1-077 C*	*0.25*
920593	*Z1-077 E*	*0.41*
917082	*Z2-012 E*	*0.82*
920763	*Z2-076 E*	*0.15*
920773	*Z2-077 E*	*0.15*
921122	*AA1-059 C*	*0.28*
921123	*AA1-059 E*	*0.11*
921592	*AA1-140 C*	*0.58*
921593	*AA1-140 E*	*0.95*
921602	*AA1-141 C*	*0.38*
921603	*AA1-141 E*	*0.62*
921872	*AA2-069*	*41.18*

922213	*AA2-129 E*	*1.33*
922222	*AA2-130*	*0.13*
922752	*AB1-056 C OP*	*4.98*
922753	*AB1-056 E OP*	*14.19*
922762	*AB1-057 C*	*5.06*
922763	*AB1-057 E*	*14.42*
923282	*AB1-137 C*	*1.1*
923283	*AB1-137 E*	*0.47*
923902	*AB2-030 E*	*0.27*
923931	*AB2-033 C*	*0.47*
923932	*AB2-033 E*	*0.19*
924361	*AB2-084 C*	*0.25*
924362	*AB2-084 E*	*0.4*
924681	*AB2-120 C OP*	*2.53*
924682	*AB2-120 E OP*	*4.13*
924781	*AB2-130 C OP*	*3.13*
924782	*AB2-130 E OP*	*5.11*
925091	*AB2-166 C*	*0.14*
925092	*AB2-166 E*	*0.24*
925101	*AB2-167 C*	*0.35*
925102	*AB2-167 E*	*0.58*
925231	*AB2-177 C*	*0.17*
925232	*AB2-177 E*	*0.28*
925261	*AB2-180 C*	*0.9*
925262	*AB2-180 E*	*0.38*
925381	*AC1-009 C*	*0.5*
925382	*AC1-009 E*	*0.82*
925531	*AC1-028*	*0.25*
925651	*AC1-041 C*	*0.13*
925652	*AC1-041 E*	*0.21*
925731	*AC1-049 C*	*0.12*
925732	*AC1-049 E*	*0.19*
925741	*AC1-050 C*	*0.11*
925742	*AC1-050 E*	*0.18*
925761	*AC1-052 C*	*0.66*
925762	*AC1-052 E*	*0.27*
926131	*AC1-091 C*	*1.11*
926132	*AC1-091 E*	*1.82*
926141	*AC1-092 C*	*1.11*
926142	*AC1-092 E*	*1.82*
926151	*AC1-093 C*	*1.05*
926152	*AC1-093 E*	*1.73*
926161	*AC1-094 C*	*0.89*
926162	*AC1-094 E*	*1.46*
926171	*AC1-095 C*	*0.92*

926172	*AC1-095 E*	*0.69*
926911	*AC1-177*	*0.26*
926931	*AC1-180*	*0.38*
927191	*AC1-213 C*	*0.23*
927192	*AC1-213 E*	*0.12*
927321	*AC1-229 C*	*0.3*
927322	*AC1-229 E*	*0.49*

Appendix 7

(DP&L - DP&L) The PRESTON-TANYARD 69 kV line (from bus 232233 to bus 232821 ckt 1) loads from 123.81% to 124.92% (DC power flow) of its emergency rating (93 MVA) for the line fault with failed breaker contingency outage of 'DP11'. This project contributes approximately 2.29 MW to the thermal violation.

CONTINGENCY 'DP11' /*STEELE BUS BREAKER TO MILFORD
DISCONNECT BRANCH FROM BUS 232004 TO BUS 232000 CKT 1 /*MILFORD STEELE 230 230
DISCONNECT BRANCH FROM BUS 232000 TO BUS 232005 CKT 1 /*STEELE VIENNA 230 230
END

Bus Number	*Bus Name*	*Full Contribution*
232926	*CRISFLD1*	*0.23*
293670	*O-025 C*	*0.15*
297076	*V2-028 C*	*0.09*
297077	*V2-028 E*	*0.81*
904212	*V4-022E*	*0.36*
232919	*VN10*	*0.59*
232907	*VN8*	*4.3*
901003	*W1-003 C*	*0.07*
901004	*W1-003 E*	*0.52*
901013	*W1-004 C*	*0.07*
901014	*W1-004 E*	*0.52*
901023	*W1-005 C*	*0.07*
901024	*W1-005 E*	*0.52*
901033	*W1-006 C*	*< 0.01*
901034	*W1-006 E*	*0.52*
907052	*X1-032 E*	*0.47*
907323	*X1-096 C*	*0.44*
907324	*X1-096 E*	*11.19*
910571	*X3-008 C*	*0.56*
910572	*X3-008 E*	*4.78*
910591	*X3-015 C*	*0.4*
910592	*X3-015 E*	*3.43*

913411	*Y1-080 C*	*0.06*
913412	*Y1-080 E*	*0.56*
915541	*Y3-058 C*	*0.17*
915542	*Y3-058 E*	*1.43*
920582	*Z1-076 C*	*0.61*
920583	*Z1-076 E*	*1.*
920592	*Z1-077 C*	*0.44*
920593	*Z1-077 E*	*0.71*
916441	*Z1-100*	*0.09*
916451	*Z1-101*	*0.09*
916461	*Z1-102*	*0.09*
920602	*Z1-103*	*0.09*
917082	*Z2-012 E*	*1.42*
920763	*Z2-076 E*	*0.18*
920773	*Z2-077 E*	*0.18*
920952	*AA1-025*	*0.08*
920962	*AA1-026*	*0.08*
920972	*AA1-027*	*0.08*
920982	*AA1-028*	*0.08*
921122	*AA1-059 C*	*0.52*
921123	*AA1-059 E*	*0.2*
921142	*AA1-061 C*	*4.87*
921143	*AA1-061 E*	*2.4*
918831	*AA1-102*	*0.86*
921592	*AA1-140 C*	*0.67*
921593	*AA1-140 E*	*1.1*
921602	*AA1-141 C*	*0.65*
921603	*AA1-141 E*	*1.07*
922213	*AA2-129 E*	*2.29*
922222	*AA2-130*	*0.24*
922752	*AB1-056 C OP*	*4.91*
922753	*AB1-056 E OP*	*13.99*
922762	*AB1-057 C*	*4.99*
922763	*AB1-057 E*	*14.22*
923282	*AB1-137 C*	*1.14*
923283	*AB1-137 E*	*0.49*
923902	*AB2-030 E*	*0.46*
923931	*AB2-033 C*	*0.82*
923932	*AB2-033 E*	*0.33*
924361	*AB2-084 C*	*0.45*
924362	*AB2-084 E*	*0.73*
924681	*AB2-120 C OP*	*4.32*
924682	*AB2-120 E OP*	*7.05*
924781	*AB2-130 C OP*	*4.57*
924782	*AB2-130 E OP*	*7.45*

924831	*AB2-136 C OP*	*7.47*
924832	*AB2-136 E OP*	*10.6*
925091	*AB2-166 C*	*0.26*
925092	*AB2-166 E*	*0.45*
925101	*AB2-167 C*	*0.61*
925102	*AB2-167 E*	*1.*
925151	*AB2-172 C OP*	*7.33*
925152	*AB2-172 E OP*	*11.95*
925231	*AB2-177 C*	*0.29*
925232	*AB2-177 E*	*0.47*
925261	*AB2-180 C*	*2.15*
925262	*AB2-180 E*	*0.92*
925381	*AC1-009 C*	*0.87*
925382	*AC1-009 E*	*1.42*
925531	*AC1-028*	*0.51*
925651	*AC1-041 C*	*0.22*
925652	*AC1-041 E*	*0.36*
925731	*AC1-049 C*	*0.13*
925732	*AC1-049 E*	*0.22*
925741	*AC1-050 C*	*0.35*
925742	*AC1-050 E*	*0.58*
925761	*AC1-052 C*	*1.15*
925762	*AC1-052 E*	*0.46*
926911	*AC1-177*	*0.48*
926931	*AC1-180*	*0.72*
927031	*AC1-190 C*	*12.97*
927032	*AC1-190 E*	*5.56*
927191	*AC1-213 C*	*0.47*
927192	*AC1-213 E*	*0.24*
927311	*AC1-228 C*	*0.42*
927312	*AC1-228 E*	*0.73*
927321	*AC1-229 C*	*0.31*
927322	*AC1-229 E*	*0.5*

Appendix 8

(DP&L - DP&L) The TODD-PRESTON 69 kV line (from bus 232234 to bus 232233 ckt 1) loads from 129.83% to 130.94% (DC power flow) of its emergency rating (93 MVA) for the line fault with failed breaker contingency outage of 'DP11'. This project contributes approximately 2.29 MW to the thermal violation.

CONTINGENCY 'DP11' /*STEELE BUS BREAKER TO MILFORD
DISCONNECT BRANCH FROM BUS 232004 TO BUS 232000 CKT 1 /*MILFORD STEELE 230 230

DISCONNECT BRANCH FROM BUS 232000 TO BUS 232005 CKT 1 /*STEELE VIENNA 230 230
END

Bus Number	*Bus Name*	*Full Contribution*
232926	*CRISFLD1*	*0.23*
293670	*O-025 C*	*0.15*
297076	*V2-028 C*	*0.09*
297077	*V2-028 E*	*0.81*
904212	*V4-022E*	*0.36*
232919	*VN10*	*0.59*
232907	*VN8*	*4.3*
901003	*W1-003 C*	*0.07*
901004	*W1-003 E*	*0.52*
901013	*W1-004 C*	*0.07*
901014	*W1-004 E*	*0.52*
901023	*W1-005 C*	*0.07*
901024	*W1-005 E*	*0.52*
901033	*W1-006 C*	*< 0.01*
901034	*W1-006 E*	*0.52*
907052	*X1-032 E*	*0.47*
907323	*X1-096 C*	*0.44*
907324	*X1-096 E*	*11.19*
910571	*X3-008 C*	*0.56*
910572	*X3-008 E*	*4.78*
910591	*X3-015 C*	*0.4*
910592	*X3-015 E*	*3.43*
913411	*Y1-080 C*	*0.06*
913412	*Y1-080 E*	*0.56*
915541	*Y3-058 C*	*0.17*
915542	*Y3-058 E*	*1.43*
920582	*Z1-076 C*	*0.61*
920583	*Z1-076 E*	*1.*
920592	*Z1-077 C*	*0.44*
920593	*Z1-077 E*	*0.71*
916441	*Z1-100*	*0.09*
916451	*Z1-101*	*0.09*
916461	*Z1-102*	*0.09*
920602	*Z1-103*	*0.09*
917082	*Z2-012 E*	*1.42*
920763	*Z2-076 E*	*0.18*
920773	*Z2-077 E*	*0.18*
920952	*AA1-025*	*0.08*
920962	*AA1-026*	*0.08*
920972	*AA1-027*	*0.08*
920982	*AA1-028*	*0.08*

921122	*AA1-059 C*	*0.52*
921123	*AA1-059 E*	*0.2*
921142	*AA1-061 C*	*4.87*
921143	*AA1-061 E*	*2.4*
918831	*AA1-102*	*0.86*
921592	*AA1-140 C*	*0.67*
921593	*AA1-140 E*	*1.1*
921602	*AA1-141 C*	*0.65*
921603	*AA1-141 E*	*1.07*
922213	*AA2-129 E*	*2.29*
922222	*AA2-130*	*0.24*
922752	*AB1-056 C OP*	*4.91*
922753	*AB1-056 E OP*	*13.99*
922762	*AB1-057 C*	*4.99*
922763	*AB1-057 E*	*14.22*
923282	*AB1-137 C*	*1.14*
923283	*AB1-137 E*	*0.49*
923902	*AB2-030 E*	*0.46*
923931	*AB2-033 C*	*0.82*
923932	*AB2-033 E*	*0.33*
924361	*AB2-084 C*	*0.45*
924362	*AB2-084 E*	*0.73*
924681	*AB2-120 C OP*	*4.32*
924682	*AB2-120 E OP*	*7.05*
924781	*AB2-130 C OP*	*4.57*
924782	*AB2-130 E OP*	*7.45*
924831	*AB2-136 C OP*	*7.47*
924832	*AB2-136 E OP*	*10.6*
925091	*AB2-166 C*	*0.26*
925092	*AB2-166 E*	*0.45*
925101	*AB2-167 C*	*0.61*
925102	*AB2-167 E*	*1.*
925151	*AB2-172 C OP*	*7.33*
925152	*AB2-172 E OP*	*11.95*
925231	*AB2-177 C*	*0.29*
925232	*AB2-177 E*	*0.47*
925261	*AB2-180 C*	*2.15*
925262	*AB2-180 E*	*0.92*
925381	*AC1-009 C*	*0.87*
925382	*AC1-009 E*	*1.42*
925531	*AC1-028*	*0.51*
925651	*AC1-041 C*	*0.22*
925652	*AC1-041 E*	*0.36*
925731	*AC1-049 C*	*0.13*
925732	*AC1-049 E*	*0.22*

925741	*AC1-050 C*	*0.35*
925742	*AC1-050 E*	*0.58*
925761	*AC1-052 C*	*1.15*
925762	*AC1-052 E*	*0.46*
926911	*AC1-177*	*0.48*
926931	*AC1-180*	*0.72*
927031	*AC1-190 C*	*12.97*
927032	*AC1-190 E*	*5.56*
927191	*AC1-213 C*	*0.47*
927192	*AC1-213 E*	*0.24*
927311	*AC1-228 C*	*0.42*
927312	*AC1-228 E*	*0.73*
927321	*AC1-229 C*	*0.31*
927322	*AC1-229 E*	*0.5*

Appendix 9

(DP&L - DP&L) The PINEY_69-M HERMON 69 kV line (from bus 232274 to bus 232272 ckt 1) loads from 108.18% to 110.95% (DC power flow) of its emergency rating (174 MVA) for the line fault with failed breaker contingency outage of 'DP15'. This project contributes approximately 4.83 MW to the thermal violation.

CONTINGENCY 'DP15' /*INDIAN RIVER BUS BREAKER TO PINEY GROVE
DISCONNECT BRANCH FROM BUS 232007 TO BUS 232006 CKT 1 /*PINEY GR INDRIV 4 230 230
DISCONNECT BRANCH FROM BUS 232007 TO BUS 232128 CKT 1 /*PINEY GR PINEY GR 230 138
DISCONNECT BRANCH FROM BUS 232006 TO BUS 232004 CKT 1 /*MILFORD INDIAN RIVER 230 230
END

Bus Number	*Bus Name*	*Full Contribution*
232905	*BAYVIEW1*	*0.57*
232926	*CRISFLD1*	*0.35*
232912	*OH NUG1*	*2.03*
232913	*OH NUG2*	*2.*
232914	*OH NUG3*	*2.03*
232915	*OH NUG4*	*2.03*
232916	*OH NUG5*	*2.03*
232917	*OH NUG6*	*2.02*
232918	*OH NUG7*	*2.02*
232921	*TASLEY2G*	*1.41*
904210	*V4-022C*	*0.09*
904212	*V4-022E*	*0.75*
901003	*W1-003 C*	*0.14*

901004	*W1-003 E*	*1.07*
901013	*W1-004 C*	*0.14*
901014	*W1-004 E*	*1.07*
901023	*W1-005 C*	*0.14*
901024	*W1-005 E*	*1.07*
901033	*W1-006 C*	*< 0.01*
901034	*W1-006 E*	*1.07*
907052	*X1-032 E*	*0.82*
907323	*X1-096 C*	*0.69*
907324	*X1-096 E*	*17.31*
920582	*Z1-076 C*	*1.54*
920583	*Z1-076 E*	*2.52*
920592	*Z1-077 C*	*1.1*
920593	*Z1-077 E*	*1.8*
916441	*Z1-100*	*0.19*
916451	*Z1-101*	*0.19*
916461	*Z1-102*	*0.19*
920602	*Z1-103*	*0.19*
917081	*Z2-012 C*	*0.35*
917082	*Z2-012 E*	*2.99*
920952	*AA1-025*	*0.17*
920962	*AA1-026*	*0.17*
920972	*AA1-027*	*0.17*
920982	*AA1-028*	*0.17*
921122	*AA1-059 C*	*0.8*
921123	*AA1-059 E*	*0.32*
918831	*AA1-102*	*1.32*
921602	*AA1-141 C*	*1.86*
921603	*AA1-141 E*	*3.04*
922213	*AA2-129 E*	*4.76*
922222	*AA2-130*	*0.37*
923902	*AB2-030 E*	*0.97*
923931	*AB2-033 C*	*1.73*
923932	*AB2-033 E*	*0.68*
924361	*AB2-084 C*	*0.78*
924362	*AB2-084 E*	*1.27*
924681	*AB2-120 C OP*	*9.17*
924682	*AB2-120 E OP*	*14.96*
925101	*AB2-167 C*	*1.54*
925102	*AB2-167 E*	*2.53*
925231	*AB2-177 C*	*0.82*
925232	*AB2-177 E*	*1.34*
925381	*AC1-009 C*	*1.83*
925382	*AC1-009 E*	*2.99*
925651	*AC1-041 C*	*0.68*

925652	*AC1-041 E*	*1.1*
925761	*AC1-052 C*	*2.41*
925762	*AC1-052 E*	*0.97*
926911	*AC1-177*	*0.74*
926931	*AC1-180*	*1.12*

Appendix 10

(DP&L - DP&L) The LORET_69-FRUITLND 69 kV line (from bus 232275 to bus 232288 ckt 1) loads from 107.33% to 109.86% (DC power flow) of its emergency rating (137 MVA) for the line fault with failed breaker contingency outage of 'DP56'. This project contributes approximately 3.47 MW to the thermal violation.

CONTINGENCY 'DP56' /*LORETTO BUS BREAKER
DISCONNECT BRANCH FROM BUS 232127 TO BUS 232117 CKT 1 /*LORETTO VIENNA 138 1380
DISCONNECT BRANCH FROM BUS 232127 TO BUS 232128 CKT 1 /*LORETTO PINEY GROVE 138 138
END

Bus Number	*Bus Name*	*Full Contribution*
232905	*BAYVIEW1*	*0.41*
232926	*CRISFLD1*	*0.62*
232912	*OH NUG1*	*1.47*
232913	*OH NUG2*	*1.45*
232914	*OH NUG3*	*1.47*
232915	*OH NUG4*	*1.47*
232916	*OH NUG5*	*1.47*
232917	*OH NUG6*	*1.47*
232918	*OH NUG7*	*1.46*
232921	*TASLEY2G*	*1.01*
904210	*V4-022C*	*0.06*
904212	*V4-022E*	*0.54*
901003	*W1-003 C*	*0.11*
901004	*W1-003 E*	*0.82*
901013	*W1-004 C*	*0.11*
901014	*W1-004 E*	*0.82*
901023	*W1-005 C*	*0.11*
901024	*W1-005 E*	*0.82*
901033	*W1-006 C*	*< 0.01*
901034	*W1-006 E*	*0.82*
907052	*X1-032 E*	*1.1*
907323	*X1-096 C*	*1.21*
907324	*X1-096 E*	*30.34*
920582	*Z1-076 C*	*0.67*
920583	*Z1-076 E*	*1.09*

920592	*Z1-077 C*	*0.48*
920593	*Z1-077 E*	*0.78*
916441	*Z1-100*	*0.14*
916451	*Z1-101*	*0.14*
916461	*Z1-102*	*0.14*
920602	*Z1-103*	*0.14*
917081	*Z2-012 C*	*0.25*
917082	*Z2-012 E*	*2.15*
920952	*AA1-025*	*0.13*
920962	*AA1-026*	*0.13*
920972	*AA1-027*	*0.13*
920982	*AA1-028*	*0.13*
921122	*AA1-059 C*	*1.4*
921123	*AA1-059 E*	*0.55*
918831	*AA1-102*	*2.32*
921602	*AA1-141 C*	*0.52*
921603	*AA1-141 E*	*0.85*
922213	*AA2-129 E*	*3.46*
922222	*AA2-130*	*0.65*
923902	*AB2-030 E*	*0.69*
923931	*AB2-033 C*	*1.24*
923932	*AB2-033 E*	*0.49*
924361	*AB2-084 C*	*1.04*
924362	*AB2-084 E*	*1.7*
924681	*AB2-120 C OP*	*6.05*
924682	*AB2-120 E OP*	*9.88*
925101	*AB2-167 C*	*0.66*
925102	*AB2-167 E*	*1.09*
925231	*AB2-177 C*	*0.23*
925232	*AB2-177 E*	*0.38*
925381	*AC1-009 C*	*1.32*
925382	*AC1-009 E*	*2.15*
925651	*AC1-041 C*	*0.12*
925652	*AC1-041 E*	*0.2*
925761	*AC1-052 C*	*1.73*
925762	*AC1-052 E*	*0.69*
926911	*AC1-177*	*1.31*
926931	*AC1-180*	*1.96*

Appendix 11

(DP&L - DP&L) The FRUITLND-PEMBERTN 69 kV line (from bus 232288 to bus 232273 ckt 1) loads from 116.09% to 119.9% (DC power flow) of its emergency rating (91 MVA) for the line fault with failed breaker contingency outage of 'DP56'. This project contributes approximately 3.47 MW to the thermal violation.

CONTINGENCY 'DP56' /*LORETTO BUS BREAKER
DISCONNECT BRANCH FROM BUS 232127 TO BUS 232117 CKT 1 /*LORETTO VIENNA 138 1380
DISCONNECT BRANCH FROM BUS 232127 TO BUS 232128 CKT 1 /*LORETTO PINEY GROVE 138 138
END

Bus Number	*Bus Name*	*Full Contribution*
232905	*BAYVIEW1*	*0.41*
232926	*CRISFLD1*	*0.62*
232912	*OH NUG1*	*1.47*
232913	*OH NUG2*	*1.45*
232914	*OH NUG3*	*1.47*
232915	*OH NUG4*	*1.47*
232916	*OH NUG5*	*1.47*
232917	*OH NUG6*	*1.47*
232918	*OH NUG7*	*1.46*
232921	*TASLEY2G*	*1.01*
904210	*V4-022C*	*0.06*
904212	*V4-022E*	*0.54*
901003	*W1-003 C*	*0.11*
901004	*W1-003 E*	*0.82*
901013	*W1-004 C*	*0.11*
901014	*W1-004 E*	*0.82*
901023	*W1-005 C*	*0.11*
901024	*W1-005 E*	*0.82*
901033	*W1-006 C*	*< 0.01*
901034	*W1-006 E*	*0.82*
907052	*X1-032 E*	*1.1*
907323	*X1-096 C*	*1.21*
907324	*X1-096 E*	*30.34*
920582	*Z1-076 C*	*0.67*
920583	*Z1-076 E*	*1.09*
920592	*Z1-077 C*	*0.48*
920593	*Z1-077 E*	*0.78*
916441	*Z1-100*	*0.14*
916451	*Z1-101*	*0.14*
916461	*Z1-102*	*0.14*
920602	*Z1-103*	*0.14*
917081	*Z2-012 C*	*0.25*
917082	*Z2-012 E*	*2.15*
920952	*AA1-025*	*0.13*
920962	*AA1-026*	*0.13*
920972	*AA1-027*	*0.13*
920982	*AA1-028*	*0.13*

921122	*AA1-059 C*	*1.4*
921123	*AA1-059 E*	*0.55*
918831	*AA1-102*	*2.32*
921602	*AA1-141 C*	*0.52*
921603	*AA1-141 E*	*0.85*
922213	*AA2-129 E*	*3.46*
922222	*AA2-130*	*0.65*
923902	*AB2-030 E*	*0.69*
923931	*AB2-033 C*	*1.24*
923932	*AB2-033 E*	*0.49*
924361	*AB2-084 C*	*1.04*
924362	*AB2-084 E*	*1.7*
924681	*AB2-120 C OP*	*6.05*
924682	*AB2-120 E OP*	*9.88*
925101	*AB2-167 C*	*0.66*
925102	*AB2-167 E*	*1.09*
925231	*AB2-177 C*	*0.23*
925232	*AB2-177 E*	*0.38*
925381	*AC1-009 C*	*1.32*
925382	*AC1-009 E*	*2.15*
925651	*AC1-041 C*	*0.12*
925652	*AC1-041 E*	*0.2*
925761	*AC1-052 C*	*1.73*
925762	*AC1-052 E*	*0.69*
926911	*AC1-177*	*1.31*
926931	*AC1-180*	*1.96*

Appendix 12

(DP&L - DP&L) The AB2-036 TAP-CHURCH 138 kV line (from bus 923950 to bus 232100 ckt 1) loads from 104.27% to 104.89% (DC power flow) of its emergency rating (159 MVA) for the tower line contingency outage of 'DBL_1NCB_A'. This project contributes approximately 2.18 MW to the thermal violation.

```
CONTINGENCY 'DBL_1NCB_A'                    /* #1 & #2 KEENEY-STEELE 230
  OPEN LINE FROM BUS 231003 TO BUS 232000 CKT 1
  OPEN LINE FROM BUS 231003 TO BUS 923960 CKT 2
  END
```

Bus Number	*Bus Name*	*Full Contribution*
232926	*CRISFLD1*	*0.21*
232902	*EASTMUNI*	*1.62*
297076	*V2-028 C*	*0.05*
297077	*V2-028 E*	*0.44*
904212	*V4-022E*	*0.34*

232919	*VN10*	*0.32*
232907	*VN8*	*3.65*
901003	*W1-003 C*	*0.06*
901004	*W1-003 E*	*0.49*
901013	*W1-004 C*	*0.06*
901014	*W1-004 E*	*0.49*
901023	*W1-005 C*	*0.06*
901024	*W1-005 E*	*0.49*
901033	*W1-006 C*	*< 0.01*
901034	*W1-006 E*	*0.49*
907052	*X1-032 E*	*0.44*
907323	*X1-096 C*	*0.41*
907324	*X1-096 E*	*10.36*
910571	*X3-008 C*	*0.17*
910572	*X3-008 E*	*1.48*
910591	*X3-015 C*	*0.17*
910592	*X3-015 E*	*1.43*
913411	*Y1-080 C*	*0.03*
913412	*Y1-080 E*	*0.25*
915541	*Y3-058 C*	*0.12*
915542	*Y3-058 E*	*1.03*
920582	*Z1-076 C*	*0.58*
920583	*Z1-076 E*	*0.94*
920592	*Z1-077 C*	*0.41*
920593	*Z1-077 E*	*0.67*
916441	*Z1-100*	*0.09*
916451	*Z1-101*	*0.09*
916461	*Z1-102*	*0.09*
920602	*Z1-103*	*0.09*
917082	*Z2-012 E*	*1.35*
920763	*Z2-076 E*	*0.2*
920773	*Z2-077 E*	*0.2*
920952	*AA1-025*	*0.08*
920962	*AA1-026*	*0.08*
920972	*AA1-027*	*0.08*
920982	*AA1-028*	*0.08*
921122	*AA1-059 C*	*0.48*
921123	*AA1-059 E*	*0.19*
921142	*AA1-061 C*	*1.6*
921143	*AA1-061 E*	*0.79*
918831	*AA1-102*	*0.79*
921592	*AA1-140 C*	*0.75*
921593	*AA1-140 E*	*1.22*
921602	*AA1-141 C*	*0.62*
921603	*AA1-141 E*	*1.*

922213	*AA2-129 E*	*2.18*
922222	*AA2-130*	*0.22*
922752	*AB1-056 C OP*	*6.17*
922753	*AB1-056 E OP*	*17.56*
922762	*AB1-057 C*	*6.26*
922763	*AB1-057 E*	*17.85*
923282	*AB1-137 C*	*1.35*
923283	*AB1-137 E*	*0.58*
923322	*AB1-141 C OP*	*-1.22*
923332	*AB1-142 C OP*	*-1.22*
923902	*AB2-030 E*	*0.44*
923931	*AB2-033 C*	*0.78*
923932	*AB2-033 E*	*0.31*
923951	*AB2-036 C*	*14.82*
923952	*AB2-036 E*	*24.24*
923961	*AB2-037 C*	*12.93*
923962	*AB2-037 E*	*21.12*
924361	*AB2-084 C*	*0.42*
924362	*AB2-084 E*	*0.69*
924681	*AB2-120 C OP*	*4.13*
924682	*AB2-120 E OP*	*6.73*
924781	*AB2-130 C OP*	*3.74*
924782	*AB2-130 E OP*	*6.11*
924831	*AB2-136 C OP*	*2.94*
924832	*AB2-136 E OP*	*4.17*
924881	*AB2-142 C*	*0.96*
924882	*AB2-142 E*	*1.57*
925091	*AB2-166 C*	*0.21*
925092	*AB2-166 E*	*0.38*
925101	*AB2-167 C*	*0.57*
925102	*AB2-167 E*	*0.94*
925151	*AB2-172 C OP*	*2.27*
925152	*AB2-172 E OP*	*3.7*
925231	*AB2-177 C*	*0.27*
925232	*AB2-177 E*	*0.44*
925261	*AB2-180 C*	*1.55*
925262	*AB2-180 E*	*0.66*
925381	*AC1-009 C*	*0.83*
925382	*AC1-009 E*	*1.35*
925531	*AC1-028*	*0.41*
925651	*AC1-041 C*	*0.2*
925652	*AC1-041 E*	*0.33*
925731	*AC1-049 C*	*0.15*
925732	*AC1-049 E*	*0.25*
925741	*AC1-050 C*	*0.22*

925742	*AC1-050 E*	*0.35*
925761	*AC1-052 C*	*1.09*
925762	*AC1-052 E*	*0.44*
926911	*AC1-177*	*0.45*
926931	*AC1-180*	*0.67*
927031	*AC1-190 C*	*4.18*
927032	*AC1-190 E*	*1.79*
927191	*AC1-213 C*	*0.38*
927192	*AC1-213 E*	*0.2*
927311	*AC1-228 C*	*0.13*
927312	*AC1-228 E*	*0.23*
927321	*AC1-229 C*	*0.37*
927322	*AC1-229 E*	*0.6*

Appendix 13

(DP&L - DP&L) The AB2-135 TAP-CHURC_69 69 kV line (from bus 924820 to bus 232203 ckt 1) loads from 135.02% to 135.66% (DC power flow) of its emergency rating (93 MVA) for the tower line contingency outage of 'DBL_4NC'. This project contributes approximately 1.33 MW to the thermal violation.

```
CONTINGENCY 'DBL_4NC'                                   /* RED LION-CEDAR CREEK
230;RED LION-CARTANZA 230
  OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1
  OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1
  END
```

Bus Number	*Bus Name*	*Full Contribution*
232900	*DEMECSMY*	*1.59*
232851	*DUP-SFR1*	*0.19*
232923	*MR1*	*1.32*
232924	*MR2*	*1.32*
232910	*NRG_G1*	*2.93*
232911	*NRG_G2*	*2.93*
904212	*V4-022E*	*0.21*
232813	*VAUGHN*	*0.16*
901004	*W1-003 E*	*0.3*
901014	*W1-004 E*	*0.3*
901024	*W1-005 E*	*0.3*
901034	*W1-006 E*	*0.3*
901411	*W1-062*	*1.69*
907052	*X1-032 E*	*0.26*
907324	*X1-096 E*	*5.97*
915542	*Y3-058 E*	*0.6*
920582	*Z1-076 C*	*0.36*

920583	*Z1-076 E*	*0.58*
920592	*Z1-077 C*	*0.25*
920593	*Z1-077 E*	*0.41*
917082	*Z2-012 E*	*0.82*
920763	*Z2-076 E*	*0.15*
920773	*Z2-077 E*	*0.15*
921122	*AA1-059 C*	*0.28*
921123	*AA1-059 E*	*0.11*
921592	*AA1-140 C*	*0.58*
921593	*AA1-140 E*	*0.95*
921602	*AA1-141 C*	*0.38*
921603	*AA1-141 E*	*0.62*
921872	*AA2-069*	*41.18*
922213	*AA2-129 E*	*1.33*
922222	*AA2-130*	*0.13*
922752	*AB1-056 C OP*	*4.98*
922753	*AB1-056 E OP*	*14.19*
922762	*AB1-057 C*	*5.06*
922763	*AB1-057 E*	*14.42*
923282	*AB1-137 C*	*1.1*
923283	*AB1-137 E*	*0.47*
923902	*AB2-030 E*	*0.27*
923931	*AB2-033 C*	*0.47*
923932	*AB2-033 E*	*0.19*
924361	*AB2-084 C*	*0.25*
924362	*AB2-084 E*	*0.4*
924681	*AB2-120 C OP*	*2.53*
924682	*AB2-120 E OP*	*4.13*
924781	*AB2-130 C OP*	*3.13*
924782	*AB2-130 E OP*	*5.11*
924821	*AB2-135 C*	*22.27*
924822	*AB2-135 E*	*25.4*
925091	*AB2-166 C*	*0.14*
925092	*AB2-166 E*	*0.24*
925101	*AB2-167 C*	*0.35*
925102	*AB2-167 E*	*0.58*
925231	*AB2-177 C*	*0.17*
925232	*AB2-177 E*	*0.28*
925261	*AB2-180 C*	*0.9*
925262	*AB2-180 E*	*0.38*
925381	*AC1-009 C*	*0.5*
925382	*AC1-009 E*	*0.82*
925531	*AC1-028*	*0.25*
925651	*AC1-041 C*	*0.13*
925652	*AC1-041 E*	*0.21*

925731	*AC1-049 C*	*0.12*
925732	*AC1-049 E*	*0.19*
925761	*AC1-052 C*	*0.66*
925762	*AC1-052 E*	*0.27*
926131	*AC1-091 C*	*1.11*
926132	*AC1-091 E*	*1.82*
926141	*AC1-092 C*	*1.11*
926142	*AC1-092 E*	*1.82*
926151	*AC1-093 C*	*1.05*
926152	*AC1-093 E*	*1.73*
926161	*AC1-094 C*	*0.89*
926162	*AC1-094 E*	*1.46*
926171	*AC1-095 C*	*0.92*
926172	*AC1-095 E*	*0.69*
926911	*AC1-177*	*0.26*
926931	*AC1-180*	*0.38*
927191	*AC1-213 C*	*0.23*
927192	*AC1-213 E*	*0.12*
927321	*AC1-229 C*	*0.3*
927322	*AC1-229 E*	*0.49*