Generation Interconnection

Feasibility Study Report

for

Queue Project AE2-027

HARROWGATE-LOCKS 115KV

72 MW Capacity / 120 MW Energy

July, 2019

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1 Introduction

This Feasibility Study has been prepared in accordance with the PJM Open Access Transmission Tariff, 36.2, as well as the Feasibility Study Agreement between the Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is Virginia Electric and Power Company (VEPCO).

2 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. Cost allocation rules for network upgrades can be found in PJM Manual 14A, Attachment B. 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 Interconnection Customer seeking to interconnect a wind or solar generation facility shall maintain meteorological data facilities as well as provide that meteorological data which is required per Schedule H to the Interconnection Service Agreement and Section 8 of Manual 14D.

An Interconnection Customer 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.

PJM utilizes manufacturer models to ensure the performance of turbines is properly captured during the simulations performed for stability verification and, where applicable, for compliance with low voltage ride through requirements. Turbine manufacturers provide such models to their customers. The list of manufacturer models PJM has already validated is contained in Attachment B of Manual 14G. Manufacturer models may be updated from time to time, for various reasons such as to reflect changes to the control systems or to more accurately represent the capabilities turbines and controls which are currently available in the field. Additionally, as new turbine models are developed, turbine manufacturers provide such new models which must be used in the conduct of these studies. PJM needs adequate time to evaluate the new models in

order to reduce delays to the System Impact Study process timeline for the Interconnection Customer as well as other Interconnection Customers in the study group. Therefore, PJM will require that any Interconnection Customer with a new manufacturer model must supply that model to PJM, along with a $10,000 fully refundable deposit, no later than three (3) months prior to the starting date of the System Impact Study (See Section 4.3 for starting dates) for the Interconnection Request which shall specify the use of the new model. The Interconnection Customer will be required to submit a completed dynamic model study request form (Attachment B-1 of Manual 14G) in order to document the request for the study.

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.

3 General

The Interconnection Customer (IC), has proposed a Solar generating facility located in Chesterfield County, Virginia. The installed facilities will have a total capability of 120 MW with 72 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is 12/01/2022. This study does not imply a TO commitment to this in-service date.

Queue Number	**AE2-027**
Project Name	HARROWGATE-LOCKS 115KV
Interconnection Customer	
State	Virginia
County	Chesterfield
Transmission Owner	Dominion
MFO	120
MWE	120
MWC	72
Fuel	Solar
Basecase Study Year	2022

3.1 Primary Point of Interconnection

AE2-027 “Harrowgate – Locks 115 kV” will interconnect with the Dominion’s transmission system through a new three breaker 115 kV switching station which will be adjacent to the transmission right-of-way. This is the primary Point of Interconnection (POI) chose by the IC with the ITO’s transmission system. The IC is responsible for securing right-of-way, permits and constructing the proposed attachment line from the solar facility site to the proposed new switching station. Attachment 1 shows a one-line diagram of the proposed

interconnection facilities. The IC may not install any facilities on Dominion's right-of-way without first obtaining the necessary approval from Dominion Energy.

3.2 Secondary Point of Interconnection

The IC requested that a secondary POI "Harrowgate – Locks 230 kV" be reviewed for network impacts (Option 2). This report does not provide costs for the physical interconnection of Option 2. It was just analyzed for network impacts. Results are shown in the Network Impacts – Option 2 section of this report.

3.3 Cost Summary

The AE2-027 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$1,700,000
Direct Connection Network Upgrade	$7,100,000
Non Direct Connection Network Upgrades	$0
Total Costs	**$8,800,000**

In addition, the AE2-027 project may be responsible for a contribution to the following costs:

Description	Total Cost
System Upgrades	**$23,170,000**

Cost allocations for these upgrades will be provided in the System Impact Study Report.

The Feasibility Study is used to make a preliminary determination of the type and scope of Attachment Facilities, Local Upgrades, and Network Upgrades that will be necessary to accommodate the Interconnection Request and to provide the Interconnection Customer a preliminary estimate of the time that will be required to construct any necessary facilities and upgrades and the Interconnection Customer's cost responsibility. The System Impact Study provides refined and comprehensive estimates of cost responsibility and construction lead times for new facilities and system upgrades. Facilities Studies will include, commensurate with the degree of engineering specificity as provided in the Facilities Study Agreement, good faith estimates of the cost, determined in accordance with Section 217 of the Tariff,

(a) to be charged to each affected New Service Customer for the Facilities and System Upgrades that are necessary to accommodate this queue project;

(b) the time required to complete detailed design and construction of the facilities and upgrades; and

(c) a description of any site-specific environmental issues or requirements that could reasonably be anticipated to affect the cost or time required to complete construction of such facilities and upgrades.

4 Transmission Owner Scope of Work

Dominion assessed the impact of the proposed Queue Project AE2-027 was evaluated as a 72.0 MW Capacity (120.0 MW Energy) injection at the AE2-027 115 kV substation in the Dominion Transmission System, for compliance with NERC Reliability Criteria on Dominion Transmission System. The system was assessed using the summer 2022 AE2 case provided to Dominion by PJM. When performing a generation analysis, Dominion's main analysis will be load flow study results under single contingency (both normal and stressed system conditions). Dominion Criteria considers a transmission facility overloaded if it exceeds 94% of its emergency rating under normal and stressed system conditions. A full listing of Dominion's Planning Criteria and interconnection requirements can be found in the Company's Facility Connection Requirements which are publicly available at: http://www.dominionenergy.com.

The results of these studies evaluate the system under a limited set of operating conditions and do not guarantee the full delivery of the capacity and associated energy of this proposed generation facility under all operating conditions. NERC Planning and Operating Reliability Criteria allow for the re-dispatch of generating units to resolve projected and actual deficiencies in real time and planning studies. Specifically in Planning Studies NERC Category C Contingency Conditions (Bus Fault, Tower Line, N-1-1, and Stuck Breaker scenarios) allow for re-dispatch of generating units to resolve potential reliability deficiencies. For Dominion Planning Criteria the re-dispatch of generating units for these contingency conditions is allowed as long as the projected loading does not exceed 100% of a facility Load Dump Rating.

The required Attachment Facilities, Direct Connection and Non-Direct Connection work for the interconnection of the AE2-027 generation project to the Dominion Transmission System is detailed in the following sections. The associated one-line with the generation project attachment facilities and primary direct and non-direct connection are shown in Attachment 1.

Note that the ITO findings were made from a conceptual review of this project. A more detailed review of the connection facilities and their cost will be identified in a future study phases. Further note that the cost estimate data contained in this document should be considered high level estimates since it was produced without a detailed engineering review. The applicant will be responsible for the actual cost of construction. ITO herein reserves the right to return to any issues in this document and, upon appropriate justification, request additional monies to complete any reinforcements to the transmission systems.

5 Attachment Facilities

To accommodate the proposed AE2-027 Project, Dominion Energy will install one span of overhead 115 kV line to the point of interconnection ("POI") including 115 kV interconnection metering. The total preliminary cost estimate for the Attachment work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Substation (Metering)	$ 500,000

Description	Total Cost
Transmission (one span)	$ 1,600,000
Total Attachment Facility Costs	$ 2,100,000

It is estimated to take 18-24 months to complete this work upon execution of an Interconnection Construction Service Agreement (ICSA). These preliminary cost estimates are based on typical engineering costs. A more detailed engineering cost estimates are normally done when the IC provides an exact site plan location for the generation substation during the Facility Study phase. See Attachment One.

6 Direct Connection Cost Estimate

To accommodate the proposed AE2-027 Project, Dominion Energy will build a new three breaker 115 kV Switching Station and re-arrange the existing section of line between Harrowgate and Locks Substations to allow for the proposed interconnection. The total preliminary cost estimate for the Direct Connection work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Three Breaker Ring and Associated Equipment	$ 5,500,000
Transmission (one span)	$ 1,600,000
Total Direct Connection Facility Costs	$ 7,100,000

It is estimated to take 24-30 months to complete this work upon execution of an Interconnection Construction Service Agreement (ICSA). These preliminary cost estimates are based on typical engineering costs. A more detailed engineering cost estimates are normally done when the IC provides an exact site plan location for the generation substation during the Facility Study phase. See Attachment 1.

7 Non-Direct Connection Cost Estimate

The total preliminary cost estimate for the Non-Direct Connection work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Rebuild 0.90 miles of 115 kV Line 100 from AE2-027 Tap to Harrowgate	$1,170,000
Add additional 500/230 kV transformer at Elmont Substation	$22,000,000
Total Non-Direct Connection Facility Costs	**$23,170,000**

Remote Terminal Work: During the Facilities Study, ITO's System Protection Engineering Department will review transmission line protection as well as anti-islanding required to accommodate the new generation and interconnection substation. System Protection Engineering will determine the minimal acceptable protection requirements to reliably interconnect the proposed generating facility with the transmission system. The review is based on maintaining system reliability by reviewing ITO's protection requirements with the known transmission system configuration which includes generating facilities in the area. This review may determine that transmission line protection and communication upgrades are required at remote substations.

8 Schedule

The schedule for the required Network Impact Reinforcements will be more clearly identified in future study phases. The estimate elapsed time to complete each of the required reinforcements is identified in the "System Reinforcements" section of the report.

9 Transmission Owner Analysis

9.1 Power Flow Analysis

PJM performed a power flow analysis of the transmission system using a 2022 summer peak load flow model and the results were verified by Dominion. Additionally, Dominion performed an analysis of its transmission system. At the Primary POI, the AE2-027 project contributes to overloads on the Dominion transmission system as shown in the "Network Impact – Option 1" section of the report. The estimated cost of system reinforcements necessary to mitigate these overloads is also provided. At the Secondary POI, the AE2-027 project contributes to overloads on the Dominion transmission system as shown in the "Network Impacts – Option 2" section of the report. Cost estimates are not provided for the secondary POI.

9.2 Short Circuit Analysis

PJM performed a short circuit analysis and the results were verified by Dominion. The connection of AE2-027 project to the system does not result in any newly overdutied circuit breakers on the Dominion transmission system and does not have a significant fault current contribution to existing overdutied circuit breakers

9.3 Stability Analysis

PJM will complete a dynamic stability analysis, if necessary, as part of the System Impact Study. The results of this analysis will be reviewed by Dominion. Should stability concerns be identified in PJM's study, Dominion will develop appropriate system reinforcement(s) and included the estimated cost of any reinforcement(s) in Dominion's System Impact Study report.

10 Interconnection Customer Requirements

10.1 System Protection

The IC must design its Customer Facilities in accordance with all applicable standards, including the standards in Dominion's "Dominion Energy Electric Transmission Generator Interconnection Requirements" documented

in Dominion's Facility Interconnection Requirements "Exhibit C" located at: https://www.dominionenergy.com/company/moving-energy/electric-transmission-access. Preliminary Protection requirements will be provided as part of the Facilities Study. Detailed Protection Requirements will be provided once the project enters the construction phase.

10.2 Compliance Issues and Interconnection Customer Requirements

The proposed Customer Facilities must be designed in accordance with Dominion's "Dominion's Facility Interconnection Requirements" document located at: https://www.dominionenergy.com/company/moving-energy/electric-transmission-access. In particular, the IC is responsible for the following:

1. The purchase and installation of a fully rated protection device (circuit breaker, circuit switcher, fuse) to protect the IC's GSU transformer(s).

2. The purchase and installation of the minimum required Dominion generation interconnection relaying and control facilities as described in the System Protection noted above. This includes over/under voltage protection, over/under frequency protection, and zero sequence voltage protection relays.

3. The purchase and installation of supervisory control and data acquisition ("SCADA") equipment to provide information in a compatible format to the Dominion Transmission System Control Center.

4. Compliance with the Dominion and PJM generator power factor and voltage control requirements.

The GSU(s) associated with the IC queue request shall meet the grounding requirements as noted in Dominion's "Dominion's Facility Interconnection Requirements" document located at: https://www.dominionenergy.com/company/moving-energy/electric-transmission-access.

The IC will also be required to meet all PJM, SERC, and NERC reliability criteria and operating procedures for standards compliance. For example, the IC will need to properly locate and report the over and under voltage and over and under frequency system protection elements for its units as well as the submission of the generator model and protection data required to satisfy the PJM and SERC audits. Failure to comply with these requirements may result in a disconnection of service if the violation is found to compromise the reliability of the Dominion system.

10.3 Power Factor Requirements

The IC shall design its non-synchronous Customer Facility with the ability to maintain a power factor of at least 0.95 leading (absorbing VARs) to 0.95 lagging (supplying VARs) measured at the high-side of the facility substation transformer(s) connected to the Dominion transmission system.

11 Revenue Metering and SCADA Requirements

11.1 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 Section 8 of Attachment O.

11.1.1 Meteorological Data Reporting Requirement

The solar generation facility shall provide the Transmission Provider with site-specific meteorological data including:

- Temperature (degrees Fahrenheit)
- Atmospheric pressure (hectopascals)
- Irradiance
- Forced outage data

11.2 Dominion Requirements

See Section 3.4.6 “Metering and Telecommunications” of Dominion’s “Dominion’s Facility Interconnection Requirements” document located at: https://www.dominionenergy.com/company/moving-energy/electric-transmission-access.

12 Network Impacts – Primary Point of Interconnection

The Queue Project AE2-027 was evaluated as a 120.0 MW (Capacity 72.0 MW) injection tapping the Harrowgate to Locks 115 kV line in the Dominion area. Project AE2-027 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-027 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Load Flow

12.1 Generation Deliverability

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

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
1668818	940430	AE2-027 TAP	DVP	314298	3HARROWG	DVP	1	DVP_P1-3: 6CHESTFA-TX#9	single	138.18	88.22	112.37	DC	33.37
1668819	940430	AE2-027 TAP	DVP	314298	3HARROWG	DVP	1	DVP_P1-2: LN 563	single	138.18	85.97	112.0	DC	35.97
1668820	940430	AE2-027 TAP	DVP	314298	3HARROWG	DVP	1	DVP_P1-2: LN 259	single	138.18	85.35	111.44	DC	36.05
1668823	940430	AE2-027 TAP	DVP	314298	3HARROWG	DVP	1	Base Case	single	138.18	68.21	94.11	DC	35.8

12.2 Multiple Facility Contingency

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

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
1667640	940430	AE2-027 TAP	DVP	314298	3HARROWG	DVP	1	DVP_P2-2: BASIN B7	bus	169.0	86.8	121.97	DC	59.43
1668058	940430	AE2-027 TAP	DVP	314298	3HARROWG	DVP	1	DVP_P4-6: T672	breaker	169.0	91.31	125.86	DC	58.38
1669449	940430	AE2-027 TAP	DVP	314298	3HARROWG	DVP	1	DVP_P7-1: LN 208-259	tower	169.0	84.43	120.0	DC	60.12
1669450	940430	AE2-027 TAP	DVP	314298	3HARROWG	DVP	1	DVP_P7-1: LN 259-2065	tower	169.0	85.36	120.7	DC	59.73
7563199	940430	AE2-027 TAP	DVP	314298	3HARROWG	DVP	1	DVP_P4-2: 16222	breaker	169.0	71.61	116.3	DC	75.53

12.3 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)

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
1667772	314218	6ELMONT	DVP	314908	8ELMONT	DVP	1	DVP_P4-2: H2T557	breaker	1050.6	147.37	148.66	DC	29.6
1667815	314908	8ELMONT	DVP	314911	8LADYSMITH	DVP	1	DVP_P4-2: WT576	breaker	3351.0	139.74	140.28	DC	39.42
1667816	314908	8ELMONT	DVP	314911	8LADYSMITH	DVP	1	DVP_P4-2: 57602	breaker	3351.0	139.74	140.28	DC	39.42

12.4 Potential Congestion due to Local Energy Deliverability

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.

Note: Only the most severely overloaded conditions are listed below. 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 shall study all overload conditions associated with the overloaded element(s) identified.

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
1669126	314212	6FOUR RIVERS	DVP	314150	6STJOHN	DVP	1	DVP_P1-2: LN 574	operation	898.64	113.91	114.55	DC	12.54
1669061	314214	6CHCKAHM	DVP	314903	8CHCKAHM	DVP	1	DVP_P1-2: LN 567	operation	828.8	92.81	93.65	DC	15.31
1668990	314218	6ELMONT	DVP	314908	8ELMONT	DVP	2	DVP_P1-2: LN 557	operation	879.84	105.65	106.63	DC	18.93
1669056	314218	6ELMONT	DVP	314908	8ELMONT	DVP	1	DVP_P1-2: LN 557	operation	920.92	102.45	103.39	DC	19.01
1669145	314225	6CHARCTY	DVP	314227	6LAKESIDE	DVP	1	DVP_P1-2: LN 557	operation	984.18	97.61	98.13	DC	11.33
7787219	314227	6LAKESIDE	DVP	314218	6ELMONT	DVP	1	DVP_P1-2: LN 557	operation	740.72	76.14	78.02	DC	13.92
1669104	314287	6CHESTF B	DVP	314225	6CHARCTY	DVP	1	DVP_P1-2: LN 557	operation	984.18	101.32	101.84	DC	11.33
1668333	314908	8ELMONT	DVP	314911	8LADYSMITH	DVP	1	DVP_P1-2: LN 576	operation	2442.12	191.61	192.34	DC	39.44
1668341	314908	8ELMONT	DVP	314911	8LADYSMITH	DVP	1	Base Case	operation	2442.12	126.05	126.58	DC	28.28
1668410	314914	8MDLTHAN	DVP	314918	8NO ANNA	DVP	1	DVP_P1-2: LN 574	operation	2442.12	173.54	173.72	DC	31.43
1668813	940430	AE2-027 TAP	DVP	314298	3HARROWG	DVP	1	DVP_P1-2: LN 259	operation	138.18	102.52	146.0	DC	60.08
1668817	940430	AE2-027 TAP	DVP	314298	3HARROWG	DVP	1	Base Case	operation	138.18	84.52	127.7	DC	59.66

12.5 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
1667640,1668820,1668823,1668819,1668818,1669450,1669449,7563199,1668058	1	AE2-027 TAP 115.0 kV - 3HARROWG 115.0 kV Ckt 1	dom-097 : Rebuild 0.90 miles of 115 kV Line 100 from AE2-027 Tap to Harrowgate with 768 ACSS. Project Type : FAC Cost : $1,170,000 Time Estimate : 30-36 Months	$1,170,000
1667772	2	6ELMONT 230.0 kV - 8ELMONT 500.0 kV Ckt 1	dom-013 : Add additional 500/230 kV transformer at Elmont Substation Project Type : CON Cost : $22,000,000 Time Estimate : 16-18 Months	$22,000,000
1667815,1667816	4	8ELMONT 500.0 kV - 8LADYSMITH 500.0 kV Ckt 1	b3020 : PJM baseline upgrade b3020: Rebuild 500kV Line #574 Ladysmith to Elmont - 26.2 miles long. The baseline project has an projected in-service date of 12/31/2022. Project Type : FAC Cost : $0 Time Estimate : N/A Months	$0
			TOTAL COST	$23,170,000

12.6 Flow Gate Details

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.

12.6.1 Contingency Descriptions

Contingency Name	Contingency Definition
DVP_P7-1: LN 259-2065	CONTINGENCY 'DVP_P7-1: LN 259-2065' OPEN BRANCH FROM BUS 314276 TO BUS 314287 CKT 1 /* 6BASIN 230.00 - 6CHESTF B 230.00 OPEN BRANCH FROM BUS 314276 TO BUS 314339 CKT 1 /* 6BASIN 230.00 - 6SPRUNCE 230.00 OPEN BRANCH FROM BUS 314339 TO BUS 315085 CKT 1 /* 6SPRUNCE 230.00 - 1SPRUNCC 13.800 OPEN BRANCH FROM BUS 314339 TO BUS 315086 CKT 1 /* 6SPRUNCE 230.00 - 1SPRUNCD 13.800 OPEN BUS 315085 /* ISLAND: 1SPRUNCC 13.800 OPEN BUS 315086 /* ISLAND: 1SPRUNCD 13.800 END

Contingency Name	Contingency Definition
DVP_P4-2: H2T557	CONTINGENCY 'DVP_P4-2: H2T557' /* ELMONT 500 KV OPEN BRANCH FROM BUS 314214 TO BUS 314903 CKT 1 /* 6CHCKAHM 230.00 - 8CHCKAHM 500.00 OPEN BRANCH FROM BUS 314903 TO BUS 314908 CKT 1 /* 8CHCKAHM 500.00 - 8ELMONT 500.00 OPEN BRANCH FROM BUS 314218 TO BUS 314908 CKT 2 /* 6ELMONT 230.00 - 8ELMONT 500.00 END
DVP_P1-2: LN 557	CONTINGENCY 'DVP_P1-2: LN 557' OPEN BRANCH FROM BUS 314214 TO BUS 314903 CKT 1 /* 6CHCKAHM 230.00 - 8CHCKAHM 500.00 OPEN BRANCH FROM BUS 314903 TO BUS 314908 CKT 1 /* 8CHCKAHM 500.00 - 8ELMONT 500.00 END
DVP_P1-2: LN 563	CONTINGENCY 'DVP_P1-2: LN 563' OPEN BRANCH FROM BUS 314902 TO BUS 314914 CKT 1 /* 8CARSON 500.00 - 8MDLTHAN 500.00 END
DVP_P1-2: LN 217	CONTINGENCY 'DVP_P1-2: LN 217' OPEN BRANCH FROM BUS 314225 TO BUS 314227 CKT 1 /* 6CHARCTY 230.00 - 6LAKESIDE 230.00 OPEN BRANCH FROM BUS 314225 TO BUS 314287 CKT 1 /* 6CHARCTY 230.00 - 6CHESTF B 230.00 OPEN BUS 314225 /* ISLAND: 6CHARCTY 230.00 END
DVP_P1-2: LN 567	CONTINGENCY 'DVP_P1-2: LN 567' OPEN BRANCH FROM BUS 314903 TO BUS 314924 CKT 1 /* 8CHCKAHM 500.00 - 8SURRY 500.00 END
DVP_P4-6: T672	CONTINGENCY 'DVP_P4-6: T672' /* BASIN 230 KV OPEN BUS 314276 /* 6BASIN 230.00 KV OPEN BUS 314275 /* ISLAND: 6BELMEAD 230.00 OPEN BUS 315053 /* ISLAND: 1BELMED1 13.800 OPEN BUS 315054 /* ISLAND: 1BELMED2 13.800 OPEN BUS 315055 /* ISLAND: 1BELMED3 13.800 END
DVP_P1-2: LN 574	CONTINGENCY 'DVP_P1-2: LN 574' OPEN BRANCH FROM BUS 314908 TO BUS 314911 CKT 1 /* 8ELMONT 500.00 - 8LADYSMITH 500.00 END
DVP_P1-3: 6CHESTF A-TX#9	CONTINGENCY 'DVP_P1-3: 6CHESTF A-TX#9' OPEN BRANCH FROM BUS 314284 TO BUS 314286 CKT 1 /* 3CHESTFLD 115.00 - 6CHESTF A 230.00 END

Contingency Name	Contingency Definition
DVP_P4-2: 16222	CONTINGENCY 'DVP_P4-2: 16222' /* LOCKS 115 KV OPEN BRANCH FROM BUS 314302 TO BUS 314314 CKT 1 /* 3HARVELL 115.00 - 3LOCKS 115.00 OPEN BRANCH FROM BUS 314314 TO BUS 314316 CKT 2 /* 3LOCKS 115.00 - 6LOCKS 230.00 END
DVP_P4-2: 57602	CONTINGENCY 'DVP_P4-2: 57602' /* NORTH ANNA 500 KV OPEN BRANCH FROM BUS 314914 TO BUS 314918 CKT 1 /* 8MDLTHAN 500.00 - 8NO ANNA 500.00 OPEN BRANCH FROM BUS 314232 TO BUS 314918 CKT 1 /* 6NO ANNA 230.00 - 8NO ANNA 500.00 END
DVP_P1-2: LN 576	CONTINGENCY 'DVP_P1-2: LN 576' OPEN BRANCH FROM BUS 314914 TO BUS 314918 CKT 1 /* 8MDLTHAN 500.00 - 8NO ANNA 500.00 END
Base Case	
DVP_P4-2: WT576	CONTINGENCY 'DVP_P4-2: WT576' /* NORTH ANNA 500 KV OPEN BRANCH FROM BUS 314914 TO BUS 314918 CKT 1 /* 8MDLTHAN 500.00 - 8NO ANNA 500.00 OPEN BRANCH FROM BUS 314232 TO BUS 314918 CKT 2 /* 6NO ANNA 230.00 - 8NO ANNA 500.00 END
DVP_P1-2: LN 100-A	CONTINGENCY 'DVP_P1-2: LN 100-A' OPEN BRANCH FROM BUS 314284 TO BUS 314344 CKT 1 /* 3CHESTFLD 115.00 - 3TYLER 115.00 OPEN BRANCH FROM BUS 314298 TO BUS 940430 CKT 1 /* 3HARROWG 115.00 - AE2-027 TAP 115.00 OPEN BRANCH FROM BUS 314298 TO BUS 314349 CKT 1 /* 3HARROWG 115.00 - 3WALTHAL 115.00 OPEN BRANCH FROM BUS 314344 TO BUS 314349 CKT 1 /* 3TYLER 115.00 - 3WALTHAL 115.00 OPEN BUS 314298 /* ISLAND: 3HARROWG 115.00 OPEN BUS 314344 /* ISLAND: 3TYLER 115.00 OPEN BUS 314349 /* ISLAND: 3WALTHAL 115.00 END
DVP_P7-1: LN 208-259	CONTINGENCY 'DVP_P7-1: LN 208-259' OPEN BRANCH FROM BUS 314286 TO BUS 314309 CKT 1 /* 6CHESTF A 230.00 - 6IRON208 230.00 OPEN BRANCH FROM BUS 314309 TO BUS 314338 CKT 1 /* 6IRON208 230.00 - 6SOUWEST 230.00 OPEN BUS 314309 /* ISLAND: 6IRON208 230.00 OPEN BRANCH FROM BUS 314276 TO BUS 314287 CKT 1 /* 6BASIN 230.00 - 6CHESTF B 230.00 END
DVP_P2-2: BASIN B7	CONTINGENCY 'DVP_P2-2: BASIN B7' /* BASIN 230 KV OPEN BRANCH FROM BUS 314276 TO BUS 314287 CKT 1 /* 6BASIN 230.00 - 6CHESTF B 230.00 OPEN BRANCH FROM BUS 314276 TO BUS 314339 CKT 1 /* 6BASIN 230.00 - 6SPRUNCE 230.00 OPEN BRANCH FROM BUS 314274 TO BUS 314276 CKT 2 /* 3BASIN 115.00 - 6BASIN 230.00 END

Contingency Name	Contingency Definition
DVP_P1-2: LN 259	CONTINGENCY 'DVP_P1-2: LN 259' OPEN BRANCH FROM BUS 314276 TO BUS 314287 CKT 1 /* 6BASIN 230.00 - 6CHESTF B 230.00 END

12.6.2 Index 1

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
1668058	940430	AE2-027 TAP	DVP	314298	3HARROWG	DVP	1	DVP_P4-6: T672	breaker	169.0	91.31	125.86	DC	58.38

Bus #	Bus	MW Impact
314314	3LOCKS	0.32
925051	AB2-160 C O1	8.23
925052	AB2-160 E O1	13.43
925821	AC1-061	0.01
932581	AC2-078 C O1	1.37
932582	AC2-078 E O1	2.24
935212	AD1-156 E	0.4
938631	AE1-085 C O1	3.53
938632	AE1-085 E O1	2.35
939191	AE1-149 C O1	3.85
939192	AE1-149 E O1	2.57
940071	AE1-249 C	10.85
940072	AE1-249 E	8.09
940431	AE2-027 C O1	35.03
940432	AE2-027 E O1	23.35
940651	AE2-052	1.29
942001	AE2-212 C	0.8
942002	AE2-212 E	0.53
942151	AE2-227 C O1	0.8
942152	AE2-227 E O1	0.53
942161	AE2-228 C O1	0.8
942162	AE2-228 E O1	0.53
942371	AE2-250 C O1	14.62
942372	AE2-250 E O1	7.71
CARR	CARR	0.05
CBM-S1	CBM-S1	0.89
CBM-S2	CBM-S2	1.08
CBM-W1	CBM-W1	0.8
CBM-W2	CBM-W2	5.68
CIN	CIN	0.37
CPLE	CPLE	0.57
G-007	G-007	0.18
IPL	IPL	0.23
LGEE	LGEE	0.11
MEC	MEC	0.85
MECS	MECS	0.31
O-066	O-066	1.12
RENSSELAER	RENSSELAER	0.04
WEC	WEC	0.1

12.6.3 Index 2

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
1667772	314218	6ELMONT	DVP	314908	8ELMONT	DVP	1	DVP_P4-2: H2T557	breaker	1050.6	147.37	148.66	DC	29.6

Bus #	Bus	MW Impact
314189	6PAPERMILL	8.73
314229	6MT RD221	0.17
314236	6NRTHEST	0.23
314250	6ROCKVILLE	0.39
314309	6IRON208	0.49
314539	3UNCAMP	2.16
314541	3WATKINS	0.6
314648	6SUNBURY	0.8
314651	6WINFALL	1.57
315043	1FOUR RIVERA	4.24
315044	1FOUR RIVERB	3.29
315045	1FOUR RIVERC	4.24
315046	1FOUR RIVERD	3.29
315047	1FOUR RIVERE	3.29
315048	1FOUR RIVERF	4.24
315053	1BELMED1	25.27
315054	1BELMED2	25.27
315055	1BELMED3	20.97
315058	1CHESTF3	26.83
315059	1CHESTF4	43.49
315067	1DARBY 1	3.07
315068	1DARBY 2	3.08
315069	1DARBY 3	3.09
315070	1DARBY 4	3.09
315073	1STONECA	9.28
315074	1HOPCGN1	11.19
315075	1HOPCGN2	11.05
315083	1SPRUNCA	14.77
315084	1SPRUNCB	14.77
315085	1SPRUNCC	10.95
315086	1SPRUNCD	10.95
315090	1YORKTN1	30.6
315091	1YORKTN2	31.75
901082	W1-029 E	41.2
907092	X1-038 E	5.4
913392	Y1-086 E	1.98
916042	Z1-036 E	40.19
916192	Z1-068 E	1.73
917122	Z2-027 E	0.95
919152	AA1-139 E	5.84
919211	AA1-145	12.27

Bus #	Bus	MW Impact
923801	AB2-015 C O1	7.63
923802	AB2-015 E O1	6.25
923832	AB2-022 E	1.12
923842	AB2-024 E	1.47
923852	AB2-025 E	1.07
924061	AB2-050	0.72
924241	AB2-068 O1	175.77
924511	AB2-100 C	10.3
924512	AB2-100 E	5.07
924812	AB2-134 E O1	14.7
925051	AB2-160 C O1	7.07
925052	AB2-160 E O1	11.54
925061	AB2-161 C O1	3.58
925062	AB2-161 E O1	5.84
925331	AB2-190 C	24.53
925332	AB2-190 E	10.51
925522	AC1-027 E	1.06
925861	AC1-065 C	4.33
925862	AC1-065 E	7.06
926291	AC1-107 O1	265.31
926411	AC1-112 C	0.42
926412	AC1-112 E	1.92
926472	AC1-118 E	1.06
926551	AC1-134	1.8
926662	AC1-147 E	1.23
926751	AC1-161 C O1	26.82
926752	AC1-161 E O1	11.45
926781	AC1-164 C	57.92
926782	AC1-164 E	26.02
927041	AC1-191 C O1	17.43
927042	AC1-191 E O1	8.68
927221	AC1-216 C O1	11.81
927222	AC1-216 E O1	9.29
930121	AB1-027 C	0.54
930122	AB1-027 E	1.89
932041	AC2-012 C	9.5
932042	AC2-012 E	15.5
932501	AC2-070 C	0.35
932502	AC2-070 E	1.2
932532	AC2-073 E	1.54
932581	AC2-078 C O1	4.69
932582	AC2-078 E O1	7.65
932591	AC2-079 C O1	5.74
932592	AC2-079 E O1	9.36
932831	AC2-110 C	1.73
932832	AC2-110 E	2.83
933061	AC2-130	3.44
933261	AC2-137 C	0.38
933262	AC2-137 E	2.03
933272	AC2-138 E	1.07
933291	AC2-141 C	26.82
933292	AC2-141 E	11.45

Bus #	Bus	MW Impact
933732	AC2-196 E	1.09
934011	AD1-025 C	20.31
934012	AD1-025 E	12.03
934061	AD1-033 C	6.88
934062	AD1-033 E	4.59
934141	AD1-041 C	6.72
934142	AD1-041 E	4.48
934211	AD1-048 C	0.46
934212	AD1-048 E	1.91
934392	AD1-063 E	1.38
934571	AD1-082 C	8.15
934572	AD1-082 E	4.65
934781	AD1-105 C	11.44
934782	AD1-105 E	7.95
935112	AD1-144 E	0.91
935161	AD1-151 C O1	19.71
935162	AD1-151 E O1	13.14
935212	AD1-156 E	1.68
936041	AD2-007	2.16
936051	AD2-008 C	3.54
936052	AD2-008 E	7.7
936151	AD2-021	0.36
936241	AD2-030 C	2.87
936242	AD2-030 E	1.47
936301	AD2-039 C	1.73
936302	AD2-039 E	2.83
936341	AD2-044 C	0.27
936342	AD2-044 E	0.3
936391	AD2-049 C	1.86
936392	AD2-049 E	1.86
936581	AD2-073 C	2.22
936582	AD2-073 E	1.1
936591	AD2-074 C	6.32
936592	AD2-074 E	10.32
936661	AD2-085 C	3.45
936662	AD2-085 E	5.64
936711	AD2-090 C O1	6.26
936712	AD2-090 E O1	4.17
937221	AD2-160 C O1	5.33
937222	AD2-160 E O1	2.8
937251	AD2-164	5.08
937541	AD2-215 C	1.67
937542	AD2-215 E	0.89
938031	AE1-004 C	1.73
938032	AE1-004 E	2.83
938181	AE1-027 C	2.14
938182	AE1-027 E	1.13
938191	AE1-028 C	1.24
938192	AE1-028 E	0.72
938531	AE1-072 C O1	15.94
938532	AE1-072 E O1	8.31
938551	AE1-074 C	3.1

Bus #	Bus	MW Impact
938552	AE1-074 E	1.56
938631	AE1-085 C O1	12.45
938632	AE1-085 E O1	8.3
938771	AE1-103 C O1	3.24
938772	AE1-103 E O1	4.47
939071	AE1-135 C O1	18.69
939072	AE1-135 E O1	12.46
939191	AE1-149 C O1	12.54
939192	AE1-149 E O1	8.36
939241	AE1-155 C	17.01
939242	AE1-155 E	11.34
939281	AE1-159 C O1	12.01
939282	AE1-159 E O1	7.1
939311	AE1-162 C	2.22
939312	AE1-162 E	1.48
939421	AE1-174 C	0.23
939422	AE1-174 E	0.34
939431	AE1-175 C	2.86
939432	AE1-175 E	1.42
939611	AE1-191 C	13.43
939612	AE1-191 E	8.96
939751	AE1-206 C O1	56.7
939752	AE1-206 E O1	37.8
940061	AE1-248 C O1	16.95
940062	AE1-248 E O1	11.3
940071	AE1-249 C	9.33
940072	AE1-249 E	6.96
940231	AE2-005 C	1.73
940232	AE2-005 E	2.83
940251	AE2-007	160.86
940431	AE2-027 C O1	17.76
940432	AE2-027 E O1	11.84
940471	AE2-031 C O1	25.91
940472	AE2-031 E O1	17.27
940481	AE2-033 C	15.17
940482	AE2-033 E	10.23
940541	AE2-040	3.07
940551	AE2-041	9.23
940651	AE2-052	4.2
940891	AE2-078 C	2.59
940892	AE2-078 E	1.33
940901	AE2-079 C	2.59
940902	AE2-079 E	1.33
940911	AE2-080 C	2.59
940912	AE2-080 E	1.33
941101	AE2-104 C O1	3.27
941102	AE2-104 E O1	5.2
941141	AE2-108 C	2.12
941142	AE2-108 E	2.92
941151	AE2-109 C	0.74
941152	AE2-109 E	1.02
941281	AE2-122 C O1	26.21

Bus #	Bus	MW Impact
941282	AE2-122 E O1	105.77
941291	AE2-123 C O1	26.94
941292	AE2-123 E O1	105.04
941301	AE2-124 C O1	24.47
941302	AE2-124 E O1	107.36
941501	AE2-147 C	14.21
941502	AE2-147 E	9.47
941581	AE2-155 C	1.1
941582	AE2-155 E	0.47
941591	AE2-156	16.67
941601	AE2-157 C O1	11.64
941602	AE2-157 E O1	7.76
942001	AE2-212 C	2.82
942002	AE2-212 E	1.88
942131	AE2-225 C	1.96
942132	AE2-225 E	1.31
942151	AE2-227 C O1	2.82
942152	AE2-227 E O1	1.88
942161	AE2-228 C O1	2.82
942162	AE2-228 E O1	1.88
942171	AE2-229 C	1.96
942172	AE2-229 E	1.31
942191	AE2-231 C O1	5.33
942192	AE2-231 E O1	3.55
942341	AE2-247 C	1.5
942342	AE2-247 E	2.07
942371	AE2-250 C O1	12.57
942372	AE2-250 E O1	6.63
942401	AE2-253 C	5.61
942402	AE2-253 E	2.52
942471	AE2-260 C O1	12.88
942472	AE2-260 E O1	18.27
942531	AE2-268 C	2.21
942532	AE2-268 E	1.24
942551	AE2-270	32.87
942851	AE2-304 C	0.56
942852	AE2-304 E	0.22
AA2-074	AA2-074	3.26
CARR	CARR	0.78
CBM-S1	CBM-S1	4.14
CBM-S2	CBM-S2	8.5
CBM-W2	CBM-W2	22.9
CIN	CIN	0.19
CPLE	CPLE	4.79
G-007	G-007	2.36
IPL	IPL	0.05
LGEE	LGEE	0.06
MEC	MEC	1.89
O-066	O-066	15.05
RENSSELAER	RENSSELAER	0.61
WEC	WEC	0.04

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ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
1667816	314908	8ELMONT	DVP	314911	8LADYSMITH	DVP	1	DVP_P4-2: 57602	breaker	3351.0	139.74	140.28	DC	39.42

Bus #	Bus	MW Impact
314189	6PAPERMILL	12.1
314229	6MT RD221	0.17
314236	6NRTHEST	0.26
314309	6IRON208	0.62
314539	3UNCAMP	4.19
314541	3WATKINS	1.18
314566	3CRESWEL	4.12
314572	3EMPORIA	0.68
314594	6PLYMOTH	1.44
314617	3TUNIS	1.39
314620	6CASHIE	1.42
314648	6SUNBURY	1.57
314651	6WINFALL	3.1
315053	1BELMED1	31.49
315054	1BELMED2	31.49
315055	1BELMED3	26.13
315058	1CHESTF3	33.44
315059	1CHESTF4	54.21
315060	1CHESTF5	13.99
315061	1CHESTG7	5.48
315062	1CHESTS7	2.49
315063	1CHESTG8	5.38
315064	1CHESTS8	2.77
315067	1DARBY 1	3.58
315068	1DARBY 2	3.58
315069	1DARBY 3	3.59
315070	1DARBY 4	3.6
315073	1STONECA	12.79
315074	1HOPCGN1	15.42
315075	1HOPCGN2	15.22
315083	1SPRUNCA	19.06
315084	1SPRUNCB	19.06
315085	1SPRUNCC	14.13
315086	1SPRUNCD	14.13
315090	1YORKTN1	53.17
315091	1YORKTN2	55.18
315233	1SURRY 2	34.93
900672	V4-068 E	0.5
901082	W1-029 E	81.18
907092	X1-038 E	10.47
913392	Y1-086 E	3.91
916042	Z1-036 E	79.67

Bus #	Bus	MW Impact
916192	Z1-068 E	3.39
916302	Z1-086 E	14.62
917122	Z2-027 E	1.88
918512	AA1-065 E OP	7.32
919152	AA1-139 E	11.5
920042	AA2-088 E OP	17.7
920692	AA2-178 E	7.05
923801	AB2-015 C O1	14.82
923802	AB2-015 E O1	12.16
923832	AB2-022 E	2.2
923842	AB2-024 E	2.04
923852	AB2-025 E	1.86
924241	AB2-068 O1	427.46
924501	AB2-099 C	0.97
924502	AB2-099 E	0.41
924511	AB2-100 C	19.0
924512	AB2-100 E	9.36
924812	AB2-134 E O1	22.53
925051	AB2-160 C O1	9.87
925052	AB2-160 E O1	16.11
925061	AB2-161 C O1	6.05
925062	AB2-161 E O1	9.87
925122	AB2-169 E	9.62
925331	AB2-190 C	37.04
925332	AB2-190 E	15.88
925522	AC1-027 E	2.07
925861	AC1-065 C	6.02
925862	AC1-065 E	9.82
926291	AC1-107 O1	645.22
926411	AC1-112 C	0.47
926412	AC1-112 E	2.15
926662	AC1-147 E	2.4
926751	AC1-161 C O1	55.45
926752	AC1-161 E O1	23.67
926781	AC1-164 C	77.55
926782	AC1-164 E	34.84
927041	AC1-191 C O1	17.0
927042	AC1-191 E O1	8.47
927221	AC1-216 C O1	18.1
927222	AC1-216 E O1	14.24
930121	AB1-027 C	0.6
930122	AB1-027 E	2.11
932041	AC2-012 C	18.45
932042	AC2-012 E	30.11
932501	AC2-070 C	0.39
932502	AC2-070 E	1.34
932532	AC2-073 E	2.15
932581	AC2-078 C O1	7.31
932582	AC2-078 E O1	11.92
932591	AC2-079 C O1	10.25
932592	AC2-079 E O1	16.72
932831	AC2-110 C	2.41

Bus #	Bus	MW Impact
932832	AC2-110 E	3.93
933061	AC2-130	4.5
933261	AC2-137 C	0.48
933262	AC2-137 E	2.58
933291	AC2-141 C	55.45
933292	AC2-141 E	23.67
933732	AC2-196 E	2.15
933991	AD1-023 C	22.13
933992	AD1-023 E	12.05
934011	AD1-025 C	31.12
934012	AD1-025 E	18.43
934061	AD1-033 C	13.54
934062	AD1-033 E	9.02
934141	AD1-041 C	9.39
934142	AD1-041 E	6.26
934211	AD1-048 C	0.56
934212	AD1-048 E	2.32
934392	AD1-063 E	1.93
934521	AD1-076 C	92.19
934522	AD1-076 E	46.94
934571	AD1-082 C	13.79
934572	AD1-082 E	7.87
935112	AD1-144 E	1.7
935161	AD1-151 C O1	29.77
935162	AD1-151 E O1	19.84
935212	AD1-156 E	2.52
936041	AD2-007	3.3
936051	AD2-008 C	5.42
936052	AD2-008 E	11.79
936151	AD2-021	0.45
936241	AD2-030 C	4.04
936242	AD2-030 E	2.06
936301	AD2-039 C	2.41
936302	AD2-039 E	3.93
936391	AD2-049 C	3.3
936392	AD2-049 E	3.3
936401	AD2-051 C O1	14.41
936402	AD2-051 E O1	6.19
936661	AD2-085 C	6.15
936662	AD2-085 E	10.04
936711	AD2-090 C O1	12.24
936712	AD2-090 E O1	8.16
937221	AD2-160 C O1	10.5
937222	AD2-160 E O1	5.51
937251	AD2-164	8.88
937541	AD2-215 C	3.15
937542	AD2-215 E	1.67
938031	AE1-004 C	2.41
938032	AE1-004 E	3.93
938171	AE1-026 C1 O	47.0
938172	AE1-026 C2 O	6.8
938173	AE1-026 E O1	14.19

Bus #	Bus	MW Impact
938181	AE1-027 C	4.21
938182	AE1-027 E	2.22
938191	AE1-028 C	2.44
938192	AE1-028 E	1.41
938221	AE1-035 C	3.72
938222	AE1-035 E	1.83
938491	AE1-068 C O1	93.04
938492	AE1-068 E O1	51.38
938501	AE1-069 C O1	72.98
938502	AE1-069 E O1	41.72
938531	AE1-072 C O1	31.41
938532	AE1-072 E O1	16.37
938551	AE1-074 C	4.27
938552	AE1-074 E	2.15
938631	AE1-085 C O1	19.6
938632	AE1-085 E O1	13.06
938661	AE1-088	2.91
938771	AE1-103 C O1	6.28
938772	AE1-103 E O1	8.67
939071	AE1-135 C O1	34.22
939072	AE1-135 E O1	22.82
939191	AE1-149 C O1	19.25
939192	AE1-149 E O1	12.83
939311	AE1-162 C	3.92
939312	AE1-162 E	2.61
939411	AE1-173 C	149.08
939412	AE1-173 E	99.39
939421	AE1-174 C	0.68
939422	AE1-174 E	1.02
939431	AE1-175 C	4.54
939432	AE1-175 E	2.25
939611	AE1-191 C	18.78
939612	AE1-191 E	12.52
939751	AE1-206 C O1	50.17
939752	AE1-206 E O1	33.45
940061	AE1-248 C O1	28.67
940062	AE1-248 E O1	19.11
940071	AE1-249 C	13.02
940072	AE1-249 E	9.71
940231	AE2-005 C	2.41
940232	AE2-005 E	3.93
940251	AE2-007	313.3
940431	AE2-027 C O1	23.65
940432	AE2-027 E O1	15.77
940471	AE2-031 C O1	55.27
940472	AE2-031 E O1	36.85
940481	AE2-033 C	26.48
940482	AE2-033 E	17.85
940491	AE2-034 C	14.4
940492	AE2-034 E	6.17
940521	AE2-037 C O1	13.19
940522	AE2-037 E O1	6.38

Bus #	Bus	MW Impact
940541	AE2-040	5.32
940551	AE2-041	12.87
940641	AE2-051 C O1	27.59
940642	AE2-051 E O1	18.39
940651	AE2-052	6.45
940891	AE2-078 C	4.35
940892	AE2-078 E	2.24
940901	AE2-079 C	4.35
940902	AE2-079 E	2.24
940911	AE2-080 C	4.35
940912	AE2-080 E	2.24
941031	AE2-094 C	60.67
941032	AE2-094 E	27.17
941101	AE2-104 C O1	6.23
941102	AE2-104 E O1	9.89
941281	AE2-122 C O1	51.29
941282	AE2-122 E O1	206.97
941291	AE2-123 C O1	52.71
941292	AE2-123 E O1	205.55
941301	AE2-124 C O1	47.92
941302	AE2-124 E O1	210.26
941501	AE2-147 C	27.99
941502	AE2-147 E	18.66
941541	AE2-151 C	1.79
941542	AE2-151 E	0.96
941581	AE2-155 C	1.23
941582	AE2-155 E	0.53
941591	AE2-156	32.41
941601	AE2-157 C O1	19.15
941602	AE2-157 E O1	12.77
942001	AE2-212 C	3.9
942002	AE2-212 E	2.6
942131	AE2-225 C	3.82
942132	AE2-225 E	2.55
942151	AE2-227 C O1	3.9
942152	AE2-227 E O1	2.6
942161	AE2-228 C O1	3.9
942162	AE2-228 E O1	2.6
942171	AE2-229 C	3.82
942172	AE2-229 E	2.55
942211	AE2-233 C	19.82
942212	AE2-233 E	7.7
942341	AE2-247 C	2.67
942342	AE2-247 E	3.68
942371	AE2-250 C O1	17.54
942372	AE2-250 E O1	9.25
942401	AE2-253 C	11.05
942402	AE2-253 E	4.96
942471	AE2-260 C O1	23.59
942472	AE2-260 E O1	33.45
942531	AE2-268 C	3.08
942532	AE2-268 E	1.73

Bus #	Bus	MW Impact
942551	AE2-270	49.64
942851	AE2-304 C	1.11
942852	AE2-304 E	0.43
942921	AE2-311 C O1	75.06
942922	AE2-311 E O1	50.04
942931	AE2-313 C	54.81
942932	AE2-313 E	36.54
943171	AE2-346 C	2.9
943172	AE2-346 E	1.24
AA2-074	AA2-074	8.66
CARR	CARR	2.6
CBM-S1	CBM-S1	26.71
CBM-S2	CBM-S2	26.05
CBM-W1	CBM-W1	27.98
CBM-W2	CBM-W2	174.3
CIN	CIN	13.06
CPLE	CPLE	12.73
G-007	G-007	8.75
IPL	IPL	8.22
LGEE	LGEE	3.85
MEC	MEC	27.8
MECS	MECS	11.67
O-066	O-066	55.56
RENSSELAER	RENSSELAER	2.06
WEC	WEC	3.43
Z1-043	Z1-043	13.49

Short Circuit

12.7 Short Circuit

The following Breakers are overduty: None

13 Network Impacts – Secondary Point of Interconnection

The Queue Project AE2-027 was evaluated as a 120.0 MW (Capacity 72.0 MW) injection tapping the Harrowgate to Locks 230 kV line in the Dominion area. Project AE2-027 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-027 was studied with a commercial probability of 0.53. Potential network impacts were as follows:

Summer Peak Load Flow

13.1 Generation Deliverability

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

None

13.2 Multiple Facility Contingency

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

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
13971670	314314	3LOCKS	DVP	314298	3HARROWG	DVP	1	DVP_P7-1: LN 205-2003-A	tower	169.0	81.05	90.65	DC	16.22

13.3 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)

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
1667772	314218	6ELMONT	DVP	314908	8ELMONT	DVP	1	DVP_P4-2: H2T557	breaker	1050.6	147.37	148.58	DC	27.8
1667811	314287	6CHESTF B	DVP	314276	6BASIN	DVP	1	DVP_P4-2: H8T217	breaker	549.0	135.78	141.43	DC	30.93
1668392	314287	6CHESTF B	DVP	314276	6BASIN	DVP	1	DVP_P1-2: LN 563	single	449.32	138.07	141.34	DC	14.63
1668394	314287	6CHESTF B	DVP	314276	6BASIN	DVP	1	DVP_P1-2: LN 217	single	449.32	139.39	143.52	DC	18.57
1668401	314287	6CHESTF B	DVP	314276	6BASIN	DVP	1	Base Case	single	449.32	100.52	103.55	DC	13.61
1668882	314303	6HOPEWLL	DVP	314286	6CHESTF A	DVP	1	DVP_P1-2: LN 259	single	449.32	125.87	128.36	DC	11.32
1668883	314303	6HOPEWLL	DVP	314286	6CHESTF A	DVP	1	DVP_P1-2: LN 217	single	449.32	124.33	126.75	DC	11.02
1668888	314303	6HOPEWLL	DVP	314286	6CHESTF A	DVP	1	Base Case	single	449.32	100.18	101.93	DC	7.97
1667815	314908	8ELMONT	DVP	314911	8LADYSMITH	DVP	1	DVP_P4-2: WT576	breaker	3351.0	139.74	140.27	DC	38.86
1667816	314908	8ELMONT	DVP	314911	8LADYSMITH	DVP	1	DVP_P4-2: 57602	breaker	3351.0	139.74	140.27	DC	38.86

13.4 Potential Congestion due to Local Energy Deliverability

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.

Note: Only the most severely overloaded conditions are listed below. 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 shall study all overload conditions associated with the overloaded element(s) identified.

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
1669126	314212	6FOUR RIVERS	DVP	314150	6STJOHN	DVP	1	DVP_P1-2: LN 574	operation	898.64	113.91	114.52	DC	11.98
1669061	314214	6CHCKAHM	DVP	314903	8CHCKAHM	DVP	1	DVP_P1-2: LN 567	operation	828.8	92.8	93.52	DC	13.13
1668990	314218	6ELMONT	DVP	314908	8ELMONT	DVP	2	DVP_P1-2: LN 557	operation	879.84	105.63	106.56	DC	17.78
1669056	314218	6ELMONT	DVP	314908	8ELMONT	DVP	1	DVP_P1-2: LN 557	operation	920.92	102.45	103.34	DC	17.86
1669145	314225	6CHARCTY	DVP	314227	6LAKESIDE	DVP	1	DVP_P1-2: LN 557	operation	984.18	97.61	99.97	DC	22.96
7787219	314227	6LAKESIDE	DVP	314218	6ELMONT	DVP	1	DVP_P1-2: LN 557	operation	740.72	76.13	78.61	DC	18.39
1668391	314287	6CHESTF B	DVP	314276	6BASIN	DVP	1	DVP_P1-2: LN 217	operation	449.32	165.7	172.6	DC	30.95
1668399	314287	6CHESTF B	DVP	314276	6BASIN	DVP	1	Base Case	operation	449.32	110.78	115.85	DC	22.68
1669104	314287	6CHESTF B	DVP	314225	6CHARCTY	DVP	1	DVP_P1-2: LN 557	operation	984.18	101.31	103.66	DC	22.96
1668889	314303	6HOPEWLL	DVP	314286	6CHESTF A	DVP	1	Base Case	operation	449.32	101.02	102.36	DC	13.29
13601034	314314	3LOCKS	DVP	314298	3HARROWG	DVP	1	DVP_P1-2: LN 259	operation	138.18	102.52	105.46	DC	9.01
1668333	314908	8ELMONT	DVP	314911	8LADYSMITH	DVP	1	DVP_P1-2: LN 576	operation	2442.12	191.6	192.33	DC	38.87
1668341	314908	8ELMONT	DVP	314911	8LADYSMITH	DVP	1	Base Case	operation	2442.12	126.05	126.54	DC	26.81
1668410	314914	8MDLTHAN	DVP	314918	8NO ANNA	DVP	1	DVP_P1-2: LN 574	operation	2442.12	173.55	173.74	DC	32.6
1668899	314918	8NO ANNA	DVP	314934	8SPOTSYL	DVP	1	Base Case	operation	3218.56	99.88	100.0	DC	19.55
13601026	940430	AE2-027 TAP	DVP	314301	6HARR205	DVP	1	DVP_P1-2: LN 563	operation	441.8	68.96	85.12	DC	71.41

13.5 Flow Gate Details

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.

13.5.1 Contingency Descriptions

Contingency Name	Contingency Definition
DVP_P4-2: WT576	CONTINGENCY 'DVP_P4-2: WT576' /* NORTH ANNA 500 KV OPEN BRANCH FROM BUS 314914 TO BUS 314918 CKT 1 /* 8MDLTHAN 500.00 - 8NO ANNA 500.00 OPEN BRANCH FROM BUS 314232 TO BUS 314918 CKT 2 /* 6NO ANNA 230.00 - 8NO ANNA 500.00 END
DVP_P4-2: H2T557	CONTINGENCY 'DVP_P4-2: H2T557' /* ELMONT 500 KV OPEN BRANCH FROM BUS 314214 TO BUS 314903 CKT 1 /* 6CHCKAHM 230.00 - 8CHCKAHM 500.00 OPEN BRANCH FROM BUS 314903 TO BUS 314908 CKT 1 /* 8CHCKAHM 500.00 - 8ELMONT 500.00 OPEN BRANCH FROM BUS 314218 TO BUS 314908 CKT 2 /* 6ELMONT 230.00 - 8ELMONT 500.00 END
DVP_P1-2: LN 557	CONTINGENCY 'DVP_P1-2: LN 557' OPEN BRANCH FROM BUS 314214 TO BUS 314903 CKT 1 /* 6CHCKAHM 230.00 - 8CHCKAHM 500.00 OPEN BRANCH FROM BUS 314903 TO BUS 314908 CKT 1 /* 8CHCKAHM 500.00 - 8ELMONT 500.00 END
DVP_P1-2: LN 563	CONTINGENCY 'DVP_P1-2: LN 563' OPEN BRANCH FROM BUS 314902 TO BUS 314914 CKT 1 /* 8CARSON 500.00 - 8MDLTHAN 500.00 END
DVP_P1-2: LN 217	CONTINGENCY 'DVP_P1-2: LN 217' OPEN BRANCH FROM BUS 314225 TO BUS 314227 CKT 1 /* 6CHARCTY 230.00 - 6LAKESIDE 230.00 OPEN BRANCH FROM BUS 314225 TO BUS 314287 CKT 1 /* 6CHARCTY 230.00 - 6CHESTF B 230.00 OPEN BUS 314225 /* ISLAND: 6CHARCTY 230.00 END
DVP_P1-2: LN 567	CONTINGENCY 'DVP_P1-2: LN 567' OPEN BRANCH FROM BUS 314903 TO BUS 314924 CKT 1 /* 8CHCKAHM 500.00 - 8SURRY 500.00 END

Contingency Name	Contingency Definition
DVP_P1-2: LN 574	CONTINGENCY 'DVP_P1-2: LN 574' OPEN BRANCH FROM BUS 314908 TO BUS 314911 CKT 1 /* 8ELMONT 500.00 - 8LADYSMITH 500.00 END
DVP_P1-2: LN 576	CONTINGENCY 'DVP_P1-2: LN 576' OPEN BRANCH FROM BUS 314914 TO BUS 314918 CKT 1 /* 8MDLTHAN 500.00 - 8NO ANNA 500.00 END
DVP_P7-1: LN 205-2003-A	CONTINGENCY 'DVP_P7-1: LN 205-2003-A' OPEN BRANCH FROM BUS 314287 TO BUS 314346 CKT 1 /* 6CHESTF B 230.00 - 6TYLER 230.00 OPEN BRANCH FROM BUS 314301 TO BUS 940430 CKT 1 /* 6HARR205 230.00 - AE2-027 TAP 230.00 OPEN BRANCH FROM BUS 314301 TO BUS 314346 CKT 1 /* 6HARR205 230.00 - 6TYLER 230.00 OPEN BRANCH FROM BUS 314314 TO BUS 314316 CKT 1 /* 3LOCKS 115.00 - 6LOCKS 230.00 OPEN BUS 314301 /* ISLAND: 6HARR205 230.00 OPEN BUS 314346 /* ISLAND: 6TYLER 230.00 OPEN BRANCH FROM BUS 314263 TO BUS 314287 CKT 1 /* 6TYLER1 230.00 - 6CHESTF B 230.00 OPEN BRANCH FROM BUS 314263 TO BUS 314299 CKT 1 /* 6TYLER1 230.00 - 6HARROWG 230.00 OPEN BRANCH FROM BUS 314299 TO BUS 314331 CKT 1 /* 6HARROWG 230.00 - 6POE 230.00 OPEN BRANCH FROM BUS 314329 TO BUS 314331 CKT 2 /* 3POE 115.00 - 6POE 230.00 OPEN BUS 314263 /* ISLAND: 6TYLER1 230.00 OPEN BUS 314299 /* ISLAND: 6HARROWG 230.00 END
DVP_P4-2: 57602	CONTINGENCY 'DVP_P4-2: 57602' /* NORTH ANNA 500 KV OPEN BRANCH FROM BUS 314914 TO BUS 314918 CKT 1 /* 8MDLTHAN 500.00 - 8NO ANNA 500.00 OPEN BRANCH FROM BUS 314232 TO BUS 314918 CKT 1 /* 6NO ANNA 230.00 - 8NO ANNA 500.00 END
Base Case	
DVP_P4-2: H8T217	CONTINGENCY 'DVP_P4-2: H8T217' /* LAKESIDE 230 KV OPEN BRANCH FROM BUS 314225 TO BUS 314227 CKT 1 /* 6CHARCTY 230.00 - 6LAKESIDE 230.00 OPEN BRANCH FROM BUS 314225 TO BUS 314287 CKT 1 /* 6CHARCTY 230.00 - 6CHESTF B 230.00 OPEN BUS 314225 /* ISLAND: 6CHARCTY 230.00 OPEN BRANCH FROM BUS 314226 TO BUS 314227 CKT 1 /* 3LAKESIDE 115.00 - 6LAKESIDE 230.00 END
DVP_P1-2: LN 259	CONTINGENCY 'DVP_P1-2: LN 259' OPEN BRANCH FROM BUS 314276 TO BUS 314287 CKT 1 /* 6BASIN 230.00 - 6CHESTF B 230.00 END

13.5.2 Index 1

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
13971670	314314	3LOCKS	DVP	314298	3HARROWG	DVP	1	DVP_P7-1: LN 205-2003-A	tower	169.0	81.05	90.65	DC	16.22

Bus #	Bus	MW Impact
314314	3LOCKS	0.45
923852	AB2-025 E	0.4
925051	AB2-160 C O1	11.47
925052	AB2-160 E O1	18.72
925061	AB2-161 C O1	1.17
925062	AB2-161 E O1	1.91
925821	AC1-061	0.01
932581	AC2-078 C O1	2.11
932582	AC2-078 E O1	3.45
934571	AD1-082 C	2.66
934572	AD1-082 E	1.52
935212	AD1-156 E	0.65
938631	AE1-085 C O1	5.44
938632	AE1-085 E O1	3.63
939071	AE1-135 C O1	6.06
939072	AE1-135 E O1	4.04
939191	AE1-149 C O1	5.94
939192	AE1-149 E O1	3.96
940061	AE1-248 C O1	5.54
940062	AE1-248 E O1	3.69
940071	AE1-249 C	15.14
940072	AE1-249 E	11.29
940431	AE2-027 C O2	9.73
940432	AE2-027 E O2	6.49
940481	AE2-033 C	5.59
940482	AE2-033 E	3.77
940541	AE2-040	6.7
940641	AE2-051 C O2	6.76
940642	AE2-051 E O2	4.5
940651	AE2-052	1.99
941601	AE2-157 C O2	3.98
941602	AE2-157 E O2	2.65
942471	AE2-260 C O2	4.15
942472	AE2-260 E O2	5.89
CARR	CARR	0.06
CBM-S1	CBM-S1	1.4
CBM-S2	CBM-S2	1.64
CBM-W1	CBM-W1	1.37
CBM-W2	CBM-W2	9.08
CIN	CIN	0.62
CPLE	CPLE	0.86

Bus #	Bus	MW Impact
G-007	G-007	0.22
IPL	IPL	0.39
LGEE	LGEE	0.18
MEC	MEC	1.39
MECS	MECS	0.56
O-066	O-066	1.39
RENSSELAER	RENSSELAER	0.05
WEC	WEC	0.17

13.5.3 Index 2

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
1667772	314218	6ELMONT	DVP	314908	8ELMONT	DVP	1	DVP_P4-2: H2T557	breaker	1050.6	147.37	148.58	DC	27.8

Bus #	Bus	MW Impact
314189	6PAPERMILL	8.73
314229	6MT RD221	0.17
314236	6NRTHEST	0.23
314250	6ROCKVILLE	0.39
314309	6IRON208	0.49
314539	3UNCAMP	2.16
314541	3WATKINS	0.6
314648	6SUNBURY	0.8
314651	6WINFALL	1.57
315043	1FOUR RIVERA	4.24
315044	1FOUR RIVERB	3.29
315045	1FOUR RIVERC	4.24
315046	1FOUR RIVERD	3.29
315047	1FOUR RIVERE	3.29
315048	1FOUR RIVERF	4.24
315053	1BELMED1	25.27
315054	1BELMED2	25.27
315055	1BELMED3	20.97
315058	1CHESTF3	26.83
315059	1CHESTF4	43.49
315067	1DARBY 1	3.07
315068	1DARBY 2	3.08
315069	1DARBY 3	3.09
315070	1DARBY 4	3.09
315073	1STONECA	9.28
315074	1HOPCGN1	11.19
315075	1HOPCGN2	11.05
315083	1SPRUNCA	14.77
315084	1SPRUNCB	14.77
315085	1SPRUNCC	10.95
315086	1SPRUNCD	10.95
315090	1YORKTN1	30.6
315091	1YORKTN2	31.75
901082	W1-029 E	41.2
907092	X1-038 E	5.4
913392	Y1-086 E	1.98
916042	Z1-036 E	40.19
916192	Z1-068 E	1.73
917122	Z2-027 E	0.95
919152	AA1-139 E	5.84
919211	AA1-145	12.27

Bus #	Bus	MW Impact
923801	AB2-015 C O1	7.63
923802	AB2-015 E O1	6.25
923832	AB2-022 E	1.12
923842	AB2-024 E	1.47
923852	AB2-025 E	1.07
924061	AB2-050	0.72
924241	AB2-068 O1	175.77
924511	AB2-100 C	10.3
924512	AB2-100 E	5.07
924812	AB2-134 E O1	14.7
925051	AB2-160 C O1	7.07
925052	AB2-160 E O1	11.54
925061	AB2-161 C O1	3.58
925062	AB2-161 E O1	5.84
925331	AB2-190 C	24.53
925332	AB2-190 E	10.51
925522	AC1-027 E	1.06
925861	AC1-065 C	4.33
925862	AC1-065 E	7.06
926291	AC1-107 O1	265.31
926411	AC1-112 C	0.42
926412	AC1-112 E	1.92
926472	AC1-118 E	1.06
926551	AC1-134	1.8
926662	AC1-147 E	1.23
926751	AC1-161 C O1	26.82
926752	AC1-161 E O1	11.45
926781	AC1-164 C	57.92
926782	AC1-164 E	26.02
927041	AC1-191 C O1	17.43
927042	AC1-191 E O1	8.68
927221	AC1-216 C O1	11.81
927222	AC1-216 E O1	9.29
930121	AB1-027 C	0.54
930122	AB1-027 E	1.89
932041	AC2-012 C	9.5
932042	AC2-012 E	15.5
932501	AC2-070 C	0.35
932502	AC2-070 E	1.2
932532	AC2-073 E	1.54
932581	AC2-078 C O1	4.69
932582	AC2-078 E O1	7.65
932591	AC2-079 C O1	5.74
932592	AC2-079 E O1	9.36
932831	AC2-110 C	1.73
932832	AC2-110 E	2.83
933061	AC2-130	3.44
933261	AC2-137 C	0.38
933262	AC2-137 E	2.03
933272	AC2-138 E	1.07
933291	AC2-141 C	26.82
933292	AC2-141 E	11.45

Bus #	Bus	MW Impact
933732	AC2-196 E	1.09
934011	AD1-025 C	20.31
934012	AD1-025 E	12.03
934061	AD1-033 C	6.88
934062	AD1-033 E	4.59
934141	AD1-041 C	6.72
934142	AD1-041 E	4.48
934211	AD1-048 C	0.46
934212	AD1-048 E	1.91
934392	AD1-063 E	1.38
934571	AD1-082 C	8.15
934572	AD1-082 E	4.65
934781	AD1-105 C	11.44
934782	AD1-105 E	7.95
935112	AD1-144 E	0.91
935161	AD1-151 C O1	19.71
935162	AD1-151 E O1	13.14
935212	AD1-156 E	1.68
936041	AD2-007	2.16
936051	AD2-008 C	3.54
936052	AD2-008 E	7.7
936151	AD2-021	0.36
936241	AD2-030 C	2.87
936242	AD2-030 E	1.47
936301	AD2-039 C	1.73
936302	AD2-039 E	2.83
936341	AD2-044 C	0.27
936342	AD2-044 E	0.3
936391	AD2-049 C	1.86
936392	AD2-049 E	1.86
936581	AD2-073 C	2.22
936582	AD2-073 E	1.1
936591	AD2-074 C	6.32
936592	AD2-074 E	10.32
936661	AD2-085 C	3.45
936662	AD2-085 E	5.64
936711	AD2-090 C O1	6.26
936712	AD2-090 E O1	4.17
937221	AD2-160 C O1	5.33
937222	AD2-160 E O1	2.8
937251	AD2-164	5.08
937541	AD2-215 C	1.67
937542	AD2-215 E	0.89
938031	AE1-004 C	1.73
938032	AE1-004 E	2.83
938181	AE1-027 C	2.14
938182	AE1-027 E	1.13
938191	AE1-028 C	1.24
938192	AE1-028 E	0.72
938531	AE1-072 C O1	15.94
938532	AE1-072 E O1	8.31
938551	AE1-074 C	3.1

Bus #	Bus	MW Impact
938552	AE1-074 E	1.56
938631	AE1-085 C O1	12.45
938632	AE1-085 E O1	8.3
938771	AE1-103 C O1	3.24
938772	AE1-103 E O1	4.47
939071	AE1-135 C O1	18.69
939072	AE1-135 E O1	12.46
939191	AE1-149 C O1	12.54
939192	AE1-149 E O1	8.36
939241	AE1-155 C	17.01
939242	AE1-155 E	11.34
939281	AE1-159 C O1	12.01
939282	AE1-159 E O1	7.1
939311	AE1-162 C	2.22
939312	AE1-162 E	1.48
939421	AE1-174 C	0.23
939422	AE1-174 E	0.34
939431	AE1-175 C	2.86
939432	AE1-175 E	1.42
939611	AE1-191 C	13.43
939612	AE1-191 E	8.96
939751	AE1-206 C O1	56.7
939752	AE1-206 E O1	37.8
940061	AE1-248 C O1	16.95
940062	AE1-248 E O1	11.3
940071	AE1-249 C	9.33
940072	AE1-249 E	6.96
940231	AE2-005 C	1.73
940232	AE2-005 E	2.83
940251	AE2-007	160.86
940431	AE2-027 C O2	16.68
940432	AE2-027 E O2	11.12
940481	AE2-033 C	15.17
940482	AE2-033 E	10.23
940541	AE2-040	4.13
940551	AE2-041	9.23
940641	AE2-051 C O2	16.67
940642	AE2-051 E O2	11.11
940651	AE2-052	4.2
940891	AE2-078 C	2.59
940892	AE2-078 E	1.33
940901	AE2-079 C	2.59
940902	AE2-079 E	1.33
940911	AE2-080 C	2.59
940912	AE2-080 E	1.33
941101	AE2-104 C O2	3.22
941102	AE2-104 E O2	5.12
941141	AE2-108 C	2.12
941142	AE2-108 E	2.92
941151	AE2-109 C	0.74
941152	AE2-109 E	1.02
941281	AE2-122 C O2	26.18

Bus #	Bus	MW Impact
941282	AE2-122 E O2	105.65
941291	AE2-123 C O2	26.91
941292	AE2-123 E O2	104.93
941301	AE2-124 C O2	24.5
941302	AE2-124 E O2	107.48
941501	AE2-147 C	14.21
941502	AE2-147 E	9.47
941581	AE2-155 C	1.1
941582	AE2-155 E	0.47
941591	AE2-156	16.8
941601	AE2-157 C O2	11.46
941602	AE2-157 E O2	7.64
942001	AE2-212 C	2.82
942002	AE2-212 E	1.88
942131	AE2-225 C	1.96
942132	AE2-225 E	1.31
942151	AE2-227 C O2	3.27
942152	AE2-227 E O2	2.18
942161	AE2-228 C O2	2.97
942162	AE2-228 E O2	1.98
942171	AE2-229 C	1.96
942172	AE2-229 E	1.31
942191	AE2-231 C O2	5.33
942192	AE2-231 E O2	3.55
942341	AE2-247 C	1.5
942342	AE2-247 E	2.07
942401	AE2-253 C	5.61
942402	AE2-253 E	2.52
942471	AE2-260 C O2	12.85
942472	AE2-260 E O2	18.23
942531	AE2-268 C	2.21
942532	AE2-268 E	1.24
942551	AE2-270	32.87
942851	AE2-304 C	0.56
942852	AE2-304 E	0.22
AA2-074	AA2-074	3.26
CARR	CARR	0.78
CBM-S1	CBM-S1	4.14
CBM-S2	CBM-S2	8.5
CBM-W2	CBM-W2	22.9
CIN	CIN	0.19
CPLE	CPLE	4.79
G-007	G-007	2.36
IPL	IPL	0.05
LGEE	LGEE	0.06
MEC	MEC	1.89
O-066	O-066	15.05
RENSSELAER	RENSSELAER	0.61
WEC	WEC	0.04

13.5.4 Index 3

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
1668394	314287	6CHESTF B	DVP	314276	6BASIN	DVP	1	DVP_P1-2: LN 217	single	449.32	139.39	143.52	DC	18.57

Bus #	Bus	MW Impact
314314	3LOCKS	0.18
314704	3LAWRENC	0.11
315065	1CHESTF6	27.23
315074	1HOPCGN1	7.61
315075	1HOPCGN2	7.51
315076	1HOPPOLC	1.06
315077	1HOPHCF1	1.66
315078	1HOPHCF2	1.66
315079	1HOPHCF3	1.66
315080	1HOPHCF4	2.52
315116	1SURRY 1	8.81
315117	1GRAVELC	0.31
315119	1GRAVEL3	0.89
315120	1GRAVEL4	0.91
315121	1GRAVEL5	0.89
315122	1GRAVEL6	0.91
315136	1ROSEMG1	0.72
315137	1ROSEMS1	0.45
315138	1ROSEMG2	0.34
315139	1GASTONA	1.04
315141	1GASTONB	1.04
923801	AB2-015 C O1	3.23
923851	AB2-025 C	0.23
923911	AB2-031 C O1	1.07
923991	AB2-040 C O1	0.43
924511	AB2-100 C	6.95
924811	AB2-134 C O1	1.04
925051	AB2-160 C O1	4.46
925061	AB2-161 C O1	2.21
925171	AB2-174 C O1	3.45
925331	AB2-190 C	14.0
925821	AC1-061	0.0
926071	AC1-086 C	9.61
927221	AC1-216 C O1	6.52
930861	AB1-132 C O1	0.8
931231	AB1-173 C	0.13
931241	AB1-173AC	0.13
932581	AC2-078 C O1	3.58
932591	AC2-079 C O1	2.94
934011	AD1-025 C	11.21
934201	AD1-047 C	3.83

Bus #	Bus	MW Impact
934571	AD1-082 C	5.03
935161	AD1-151 C O1	11.25
935211	AD1-156 C	0.31
936041	AD2-007	1.19
936051	AD2-008 C	1.95
936661	AD2-085 C	1.79
936711	AD2-090 C O1	2.72
937571	AD2-169 C	4.63
938631	AE1-085 C O1	9.31
938771	AE1-103 C O1	1.36
939071	AE1-135 C O1	12.84
939191	AE1-149 C O1	9.92
939311	AE1-162 C	0.87
940061	AE1-248 C O1	10.46
940071	AE1-249 C	5.88
940431	AE2-027 C O2	18.57
940481	AE2-033 C	11.56
940541	AE2-040	2.6
940641	AE2-051 C O2	13.74
940651	AE2-052	3.32
940891	AE2-078 C	1.04
940901	AE2-079 C	1.04
940911	AE2-080 C	1.04
941601	AE2-157 C O2	7.35
942001	AE2-212 C	3.22
942161	AE2-228 C O2	3.77
942341	AE2-247 C	0.78
942371	AE2-250 C O2	4.78
942471	AE2-260 C O2	8.81
942551	AE2-270	18.76
942711	AE2-287 C O2	5.42
CARR	CARR	0.27
CBM-S1	CBM-S1	2.46
CBM-S2	CBM-S2	3.57
CBM-W1	CBM-W1	1.56
CBM-W2	CBM-W2	15.11
CIN	CIN	0.76
CPLE	CPLE	1.94
IPL	IPL	0.46
LGEE	LGEE	0.22
MEC	MEC	1.99
MECS	MECS	0.29
RENSSELAER	RENSSELAER	0.21
WEC	WEC	0.2

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ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
1668882	314303	6HOPEWLL	DVP	314286	6CHESTF A	DVP	1	DVP_P1-2: LN 259	single	449.32	125.87	128.36	DC	11.32

Bus #	Bus	MW Impact
314314	3LOCKS	0.11
314507	3THOMPSN	0.09
315065	1CHESTF6	16.12
315074	1HOPCGN1	17.65
315075	1HOPCGN2	17.42
315076	1HOPPOLC	2.47
315077	1HOPHCF1	3.85
315078	1HOPHCF2	3.85
315079	1HOPHCF3	3.85
315080	1HOPHCF4	5.85
315098	1CHESPKA	0.12
315099	1CHESPKB	0.3
315116	1SURRY 1	16.45
315117	1GRAVELC	0.58
315119	1GRAVEL3	1.67
315120	1GRAVEL4	1.69
315121	1GRAVEL5	1.67
315122	1GRAVEL6	1.69
315260	1GOSPORTA	0.1
315261	1GOSPORTB	0.12
315262	1GOSPORTC	0.1
923851	AB2-025 C	0.16
924511	AB2-100 C	5.06
924811	AB2-134 C O1	2.22
925051	AB2-160 C O1	2.91
925061	AB2-161 C O1	2.17
925331	AB2-190 C	30.3
925821	AC1-061	0.0
926661	AC1-147 C	0.1
927221	AC1-216 C O1	13.9
932041	AC2-012 C	3.75
932581	AC2-078 C O1	3.43
932591	AC2-079 C O1	2.98
934011	AD1-025 C	23.9
934571	AD1-082 C	4.96
935111	AD1-144 C	0.08
935161	AD1-151 C O1	24.34
935211	AD1-156 C	0.21
936041	AD2-007	2.54
936051	AD2-008 C	4.16
936661	AD2-085 C	1.81

Bus #	Bus	MW Impact
937541	AD2-215 C	0.7
938631	AE1-085 C O1	8.94
939071	AE1-135 C O1	9.27
939191	AE1-149 C O1	9.47
939311	AE1-162 C	1.49
940061	AE1-248 C O1	10.3
940071	AE1-249 C	3.84
940251	AE2-007	62.04
940431	AE2-027 C O2	11.32
940481	AE2-033 C	8.03
940541	AE2-040	1.7
940641	AE2-051 C O2	9.29
940651	AE2-052	3.17
940891	AE2-078 C	1.87
940901	AE2-079 C	1.87
940911	AE2-080 C	1.87
941591	AE2-156	6.93
941601	AE2-157 C O2	7.2
942001	AE2-212 C	1.95
942161	AE2-228 C O2	2.24
942341	AE2-247 C	0.79
942371	AE2-250 C O2	3.57
942471	AE2-260 C O2	6.37
942551	AE2-270	40.6
CARR	CARR	0.22
CBM-S1	CBM-S1	2.14
CBM-S2	CBM-S2	3.04
CBM-W1	CBM-W1	1.44
CBM-W2	CBM-W2	13.23
CIN	CIN	0.7
CPLE	CPLE	1.65
IPL	IPL	0.42
LGEE	LGEE	0.2
MEC	MEC	1.78
MECS	MECS	0.33
RENSSELAER	RENSSELAER	0.17
WEC	WEC	0.18

13.5.6 Index 5

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
1667816	314908	8ELMONT	DVP	314911	8LADYSMITH	DVP	1	DVP_P4-2: 57602	breaker	3351.0	139.74	140.27	DC	38.86

Bus #	Bus	MW Impact
314189	6PAPERMILL	12.1
314229	6MT RD221	0.17
314236	6NRTHEST	0.26
314309	6IRON208	0.62
314539	3UNCAMP	4.19
314541	3WATKINS	1.18
314566	3CRESWEL	4.12
314572	3EMPORIA	0.68
314594	6PLYMOTH	1.44
314617	3TUNIS	1.39
314620	6CASHIE	1.42
314648	6SUNBURY	1.57
314651	6WINFALL	3.1
315053	1BELMED1	31.49
315054	1BELMED2	31.49
315055	1BELMED3	26.13
315058	1CHESTF3	33.44
315059	1CHESTF4	54.21
315060	1CHESTF5	13.99
315061	1CHESTG7	5.48
315062	1CHESTS7	2.49
315063	1CHESTG8	5.38
315064	1CHESTS8	2.77
315067	1DARBY 1	3.58
315068	1DARBY 2	3.58
315069	1DARBY 3	3.59
315070	1DARBY 4	3.6
315073	1STONECA	12.79
315074	1HOPCGN1	15.42
315075	1HOPCGN2	15.22
315083	1SPRUNCA	19.06
315084	1SPRUNCB	19.06
315085	1SPRUNCC	14.13
315086	1SPRUNCD	14.13
315090	1YORKTN1	53.17
315091	1YORKTN2	55.18
315233	1SURRY 2	34.93
900672	V4-068 E	0.5
901082	W1-029 E	81.18
907092	X1-038 E	10.47
913392	Y1-086 E	3.91
916042	Z1-036 E	79.67

Bus #	Bus	MW Impact
916192	Z1-068 E	3.39
916302	Z1-086 E	14.62
917122	Z2-027 E	1.88
918512	AA1-065 E OP	7.32
919152	AA1-139 E	11.5
920042	AA2-088 E OP	17.7
920692	AA2-178 E	7.05
923801	AB2-015 C O1	14.82
923802	AB2-015 E O1	12.16
923832	AB2-022 E	2.2
923842	AB2-024 E	2.04
923852	AB2-025 E	1.86
924241	AB2-068 O1	427.46
924501	AB2-099 C	0.97
924502	AB2-099 E	0.41
924511	AB2-100 C	19.0
924512	AB2-100 E	9.36
924812	AB2-134 E O1	22.53
925051	AB2-160 C O1	9.87
925052	AB2-160 E O1	16.11
925061	AB2-161 C O1	6.05
925062	AB2-161 E O1	9.87
925122	AB2-169 E	9.62
925331	AB2-190 C	37.04
925332	AB2-190 E	15.88
925522	AC1-027 E	2.07
925861	AC1-065 C	6.02
925862	AC1-065 E	9.82
926291	AC1-107 O1	645.22
926411	AC1-112 C	0.47
926412	AC1-112 E	2.15
926662	AC1-147 E	2.4
926751	AC1-161 C O1	55.45
926752	AC1-161 E O1	23.67
926781	AC1-164 C	77.55
926782	AC1-164 E	34.84
927041	AC1-191 C O1	17.0
927042	AC1-191 E O1	8.47
927221	AC1-216 C O1	18.1
927222	AC1-216 E O1	14.24
930121	AB1-027 C	0.6
930122	AB1-027 E	2.11
932041	AC2-012 C	18.45
932042	AC2-012 E	30.11
932501	AC2-070 C	0.39
932502	AC2-070 E	1.34
932532	AC2-073 E	2.15
932581	AC2-078 C O1	7.31
932582	AC2-078 E O1	11.92
932591	AC2-079 C O1	10.25
932592	AC2-079 E O1	16.72
932831	AC2-110 C	2.41

Bus #	Bus	MW Impact
932832	AC2-110 E	3.93
933061	AC2-130	4.5
933261	AC2-137 C	0.48
933262	AC2-137 E	2.58
933291	AC2-141 C	55.45
933292	AC2-141 E	23.67
933732	AC2-196 E	2.15
933991	AD1-023 C	22.13
933992	AD1-023 E	12.05
934011	AD1-025 C	31.12
934012	AD1-025 E	18.43
934061	AD1-033 C	13.54
934062	AD1-033 E	9.02
934141	AD1-041 C	9.39
934142	AD1-041 E	6.26
934211	AD1-048 C	0.56
934212	AD1-048 E	2.32
934392	AD1-063 E	1.93
934521	AD1-076 C	92.19
934522	AD1-076 E	46.94
934571	AD1-082 C	13.79
934572	AD1-082 E	7.87
935112	AD1-144 E	1.7
935161	AD1-151 C O1	29.77
935162	AD1-151 E O1	19.84
935212	AD1-156 E	2.52
936041	AD2-007	3.3
936051	AD2-008 C	5.42
936052	AD2-008 E	11.79
936151	AD2-021	0.45
936241	AD2-030 C	4.04
936242	AD2-030 E	2.06
936301	AD2-039 C	2.41
936302	AD2-039 E	3.93
936391	AD2-049 C	3.3
936392	AD2-049 E	3.3
936401	AD2-051 C O1	14.41
936402	AD2-051 E O1	6.19
936661	AD2-085 C	6.15
936662	AD2-085 E	10.04
936711	AD2-090 C O1	12.24
936712	AD2-090 E O1	8.16
937221	AD2-160 C O1	10.5
937222	AD2-160 E O1	5.51
937251	AD2-164	8.88
937541	AD2-215 C	3.15
937542	AD2-215 E	1.67
938031	AE1-004 C	2.41
938032	AE1-004 E	3.93
938171	AE1-026 C1 O	47.0
938172	AE1-026 C2 O	6.8
938173	AE1-026 E O1	14.19

Bus #	Bus	MW Impact
938181	AE1-027 C	4.21
938182	AE1-027 E	2.22
938191	AE1-028 C	2.44
938192	AE1-028 E	1.41
938221	AE1-035 C	3.72
938222	AE1-035 E	1.83
938491	AE1-068 C O1	93.04
938492	AE1-068 E O1	51.38
938501	AE1-069 C O1	72.97
938502	AE1-069 E O1	41.72
938531	AE1-072 C O1	31.41
938532	AE1-072 E O1	16.37
938551	AE1-074 C	4.27
938552	AE1-074 E	2.15
938631	AE1-085 C O1	19.6
938632	AE1-085 E O1	13.06
938661	AE1-088	2.91
938771	AE1-103 C O1	6.28
938772	AE1-103 E O1	8.67
939071	AE1-135 C O1	34.22
939072	AE1-135 E O1	22.82
939191	AE1-149 C O1	19.25
939192	AE1-149 E O1	12.83
939311	AE1-162 C	3.92
939312	AE1-162 E	2.61
939411	AE1-173 C	149.08
939412	AE1-173 E	99.39
939421	AE1-174 C	0.68
939422	AE1-174 E	1.02
939431	AE1-175 C	4.54
939432	AE1-175 E	2.25
939611	AE1-191 C	18.78
939612	AE1-191 E	12.52
939751	AE1-206 C O1	50.17
939752	AE1-206 E O1	33.45
940061	AE1-248 C O1	28.67
940062	AE1-248 E O1	19.11
940071	AE1-249 C	13.02
940072	AE1-249 E	9.71
940231	AE2-005 C	2.41
940232	AE2-005 E	3.93
940251	AE2-007	313.3
940431	AE2-027 C O2	23.31
940432	AE2-027 E O2	15.54
940471	AE2-031 C O2	50.13
940472	AE2-031 E O2	33.42
940481	AE2-033 C	26.48
940482	AE2-033 E	17.85
940491	AE2-034 C	14.4
940492	AE2-034 E	6.17
940541	AE2-040	5.76
940551	AE2-041	12.87

Bus #	Bus	MW Impact
940641	AE2-051 C O2	27.88
940642	AE2-051 E O2	18.58
940651	AE2-052	6.45
940891	AE2-078 C	4.35
940892	AE2-078 E	2.24
940901	AE2-079 C	4.35
940902	AE2-079 E	2.24
940911	AE2-080 C	4.35
940912	AE2-080 E	2.24
941031	AE2-094 C	60.67
941032	AE2-094 E	27.17
941101	AE2-104 C O2	6.27
941102	AE2-104 E O2	9.97
941281	AE2-122 C O2	51.27
941282	AE2-122 E O2	206.9
941291	AE2-123 C O2	52.69
941292	AE2-123 E O2	205.48
941301	AE2-124 C O2	47.93
941302	AE2-124 E O2	210.32
941501	AE2-147 C	27.99
941502	AE2-147 E	18.66
941541	AE2-151 C	1.79
941542	AE2-151 E	0.96
941581	AE2-155 C	1.23
941582	AE2-155 E	0.53
941591	AE2-156	32.43
941601	AE2-157 C O2	19.13
941602	AE2-157 E O2	12.75
942001	AE2-212 C	3.9
942002	AE2-212 E	2.6
942131	AE2-225 C	3.82
942132	AE2-225 E	2.55
942151	AE2-227 C O2	4.07
942152	AE2-227 E O2	2.71
942161	AE2-228 C O2	3.94
942162	AE2-228 E O2	2.63
942171	AE2-229 C	3.82
942172	AE2-229 E	2.55
942211	AE2-233 C	19.82
942212	AE2-233 E	7.7
942341	AE2-247 C	2.67
942342	AE2-247 E	3.68
942371	AE2-250 C O2	14.77
942372	AE2-250 E O2	7.79
942401	AE2-253 C	11.05
942402	AE2-253 E	4.96
942471	AE2-260 C O2	23.57
942472	AE2-260 E O2	33.43
942531	AE2-268 C	3.08
942532	AE2-268 E	1.73
942551	AE2-270	49.64
942851	AE2-304 C	1.11

Bus #	Bus	MW Impact
942852	AE2-304 E	0.43
942921	AE2-311 C O2	74.54
942922	AE2-311 E O2	49.69
942931	AE2-313 C	54.81
942932	AE2-313 E	36.54
943171	AE2-346 C	2.9
943172	AE2-346 E	1.24
AA2-074	AA2-074	8.66
CARR	CARR	2.6
CBM-S1	CBM-S1	26.71
CBM-S2	CBM-S2	26.05
CBM-W1	CBM-W1	27.98
CBM-W2	CBM-W2	174.33
CIN	CIN	13.06
CPLE	CPLE	12.73
G-007	G-007	8.75
IPL	IPL	8.23
LGEE	LGEE	3.85
MEC	MEC	27.8
MECS	MECS	11.67
O-066	O-066	55.56
RENSSELAER	RENSSELAER	2.06
WEC	WEC	3.43
Z1-043	Z1-043	13.49

Short Circuit

13.6 Short Circuit

The following Breakers are overduty: None

Affected Systems

14 Affected Systems

14.1 LG&E

LG&E Impacts to be determined during later study phases (as applicable).

14.2 MISO

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

14.3 TVA

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

14.4 Duke Energy Progress

Duke Energy Progress Impacts to be determined during later study phases (as applicable).

14.5 NYISO

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

Attachment 1

System Configuration