



**Generation Interconnection  
Feasibility Study Report  
for  
Queue Project AG1-151  
ENDLESS CAVERNS 115 KV  
100 MW Capacity / 100 MW Energy**

January 2021

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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 Dominion.

## 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.

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.

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 an uprate to a planned Storage generating facility located in Rockingham, Virginia. This project is an increase to the Interconnection Customer's AF1-028 project, which will share the same point of interconnection. The AG1-151 queue position is a 100 MW uprate (100 MW Capacity uprate) to the previous project. The total installed facilities will have a capability of 300 MW with 300 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this uprate project is October 30, 2023. This study does not imply a TO commitment to this in-service date.

<b>Queue Number</b>	<b>AG1-151</b>
<b>Project Name</b>	ENDLESS CAVERNS 115 KV
<b>State</b>	Virginia
<b>County</b>	Rockingham
<b>Transmission Owner</b>	Dominion
<b>MFO</b>	300
<b>MWE</b>	100
<b>MWC</b>	100
<b>Fuel</b>	Storage
<b>Basecase Study Year</b>	2024

Any new service customers who can feasibly be commercially operable prior to June 1st of the basecase study year are required to request interim deliverability analysis.

## 4 Point of Interconnection

### 1.1 Primary Point of Interconnection

AG1-151 "Endless Caverns 115 kV" will interconnect with the Dominion transmission system as an uprate to AF1-028, sharing the POI and Attachment Facilities.

The IC is responsible for securing right-of-way, permits, and constructing the proposed attachment line from the generating facility site to the Point of Interconnection. The IC may not install any facilities on Dominion's right-of-way without first obtaining the necessary approval from Dominion Energy.

Costs provided are contingent on the AF1-028 project being built. Should the AF1-028 project withdraw from the Interconnection Queue, the AG1-151 project will assume the Attachment, Direct Connection, and Non-Direct Connection costs identified in the AF1-028 study report for connection to the Dominion system.

Attachment 1 shows a one-line diagram of the proposed interconnection facilities.

### 1.2 Secondary Point of Interconnection

The IC requested that a secondary POI be reviewed for network impacts.

The secondary POI for AG1-151 is a direct connect to the Endless Caverns 230 kV substation.

This report does not provide costs for the interconnection of the secondary POI. The secondary POI was analyzed for network impacts. Network impact results are shown in the Summer Peak - Load Flow Analysis – Secondary Point of Interconnection section of this report.

## 5 Cost Summary

The AG1-151 project will be responsible for the following costs:

Description	Total Cost
<b>Total Physical Interconnection Costs</b>	\$ 0
<b>Total System Network Upgrade Costs</b>	\$47,690,900 <sup>1</sup>
<b>Total Costs</b>	\$47,690,900

This cost excludes a Federal Income Tax Gross Up charges. This tax may or may not be charged based on whether this project meets the eligibility requirements of IRS Notice 2016-36, 2016-25 I.R.B. (6/20/2016). If at

<sup>1</sup> This project currently causes and/or contributes to overloads of the Transmission System (see Summer Peak Load Flow Analysis section below) and therefore has potential to have cost allocation for the system reinforcements listed in the report. This will be re-evaluated in the System Impact phase. The results may vary with queue customers withdrawing from the queue and other generators deactivating over time. If a customer is the first to cause the need for a project (causes loading to exceed 100% of rating), then the customer is responsible. If a customer contributes to a facility that is already overloaded by a prior queue, then they may receive cost allocation.

a future date it is determined that the Federal Income Tax Gross charge is required, the Transmission Owner shall be reimbursed by the Interconnection Customer for such taxes.

Cost allocations for any System Upgrades will be provided in the System Impact Study Report.

## 6 Transmission Owner Scope of Work

The required Attachment Facilities, Direct Connection and Non-Direct Connection work for the interconnection of AG1-151 to the Dominion Transmission System is detailed in the following sections. The associated one-line showing the generation project attachment facilities and primary direct and non-direct connection is 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 phase. 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.

The total physical interconnection costs are given in the table below:

Description	Total Cost
<b>Total Physical Interconnection Costs</b>	\$ 0

AG1-151 "Endless Caverns 115 kV" will interconnect with the Dominion transmission system as an uprate to AF1-028, sharing the POI and Attachment Facilities.

As AG1-151 is sharing the POI and Attachment Facilities with AF1-028, there are no associated interconnection costs for this project. Should the AF1-028 project withdraw from the Interconnection Queue, the AG1-151 project will assume the Attachment, Direct Connection, and Non-Direct Connection costs identified in the AF1-028 study report for connection to the Dominion system.

It is estimated to take 18-30 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.

**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.

## 7 Schedule

The estimated schedule for the Attachment Facilities, Direct Connection and Non-Direct Connection work is identified in the “Transmission Owner Scope of Work” section of this report.

The estimated schedule for the required Network Impact Reinforcements is identified in the “System Reinforcements” section of this report.

If the customer is ultimately responsible for network upgrades, then the schedule for those upgrades will be refined in future study phases. The customer would need to wait for those upgrades to be completed prior to commercial operation unless determined deliverable by an interim deliverability study. The elapsed time to complete any network upgrades is provided in the System Reinforcements table of this report.

## 8 Transmission Owner Analysis

Dominion assessed the impact of the proposed AG1-151 for compliance with NERC Reliability Criteria on the Dominion Transmission System. The system was assessed using the summer 2024 AG1 case provided to Dominion by PJM.

When performing a generation analysis, Dominion’s main analysis includes load flow study results following a single contingency event for 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 Planning Event 3 and 6 Contingency Conditions (Loss of generator, transmission circuit, transformer, shunt device, or Single Pole of a DC line followed by the loss of a generator, transmission circuit, transformer, shunt device or single pole of a DC line) 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.

### 8.1 Power Flow Analysis

PJM performed a power flow analysis of the transmission system using a 2024 summer peak load flow model and the results were verified by Dominion. Additionally, Dominion performed an analysis of its transmission system and no further deficiencies were identified.

## 9 Interconnection Customer Requirements

### 9.1 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.

### 9.2 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 section 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.

### 9.3 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.

## **10 Revenue Metering and SCADA Requirements**

### **10.1 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.

### **10.2 Interconnected Transmission Owner Requirements**

The IC will be required to comply with all Interconnected Transmission Owner's revenue metering requirements for generation interconnection customers located at the following link:

<http://www.pjm.com/planning/design-engineering/to-tech-standards/>

## **11 Summer Peak - Load Flow Analysis - Primary POI**

The Queue Project AG1-151 was evaluated as a 100.0 MW (Capacity 100.0 MW) injection as an uprate to AF1-028 which is a direct connection at the Endless Caverns 115 kV substation in the Dominion area. Project AG1-151 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-151 was studied with a commercial probability of 53.0 %. Potential network impacts were as follows:

### 11.1 Generation Deliverability

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

None

### 11.2 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	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC D C	MW IMPACT
166908686	313706	3ELKTON	115.0	DVP	314798	3MERCK5	115.0	DVP	1	DVP_P7-1: LN 2017-2134-B	tower	251.0	94.66	107.32	DC	31.78
166908687	313706	3ELKTON	115.0	DVP	314798	3MERCK5	115.0	DVP	1	DVP_P7-1: LN 2017-2134-A	tower	251.0	94.62	107.28	DC	31.78
166908706	314802	3GROTOES	115.0	DVP	940450	AE2-029 TAP	115.0	DVP	1	DVP_P7-1: LN 2017-2134-B	tower	251.0	91.58	104.24	DC	31.78
166908707	314802	3GROTOES	115.0	DVP	940450	AE2-029 TAP	115.0	DVP	1	DVP_P7-1: LN 2017-2134-A	tower	251.0	91.54	104.2	DC	31.78
163156906	314803	6GROTOES	230.0	DVP	314806	6HARSNB G	230.0	DVP	1	DVP_P7-1: LN 253-2109	tower	549.0	94.81	104.42	DC	52.74
165530581	935200	AD1-155 TAP	138.0	AP	235513	01STRASB	138.0	AP	1	DVP_P7-1: LN 2017-2134-B	tower	229.0	98.42	118.32	DC	45.57
165530582	935200	AD1-155 TAP	138.0	AP	235513	01STRASB	138.0	AP	1	DVP_P7-1: LN 2017-2134-A	tower	229.0	98.38	118.28	DC	45.57
166908679	940450	AE2-029 TAP	115.0	DVP	313706	3ELKTON	115.0	DVP	1	DVP_P7-1: LN 2017-2134-B	tower	251.0	96.77	109.44	DC	31.78
166908680	940450	AE2-029 TAP	115.0	DVP	313706	3ELKTON	115.0	DVP	1	DVP_P7-1: LN 2017-2134-A	tower	251.0	96.73	109.4	DC	31.78

### 11.3 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	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC D C	MW IMPACT
165530557	235483	01MDWBR K	138.0	AP	935200	AD1-155 TAP	138.0	AP	1	DVP_P7-1: LN 2017-2134-B	tower	229.0	110.89	130.79	DC	45.57

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC D C	MW IMPACT
165530558	235483	01MDWBRK	138.0	AP	935200	AD1-155 TAP	138.0	AP	1	DVP_P7-1: LN 2017-2134-A	tower	229.0	110.84	130.74	DC	45.57
169354358	314749	6CHARLVL	230.0	DVP	314772	6PROFFIT	230.0	DVP	1	DVP_P1-2: LN 553	single	550.840026855	101.41	102.89	DC	8.18

#### 11.4 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	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC D C	MW IMPACT
169354357	314749	6CHARLVL	230.0	DVP	314772	6PROFFIT	230.0	DVP	1	DVP_P1-2: LN 553	operation	550.840026855	100.81	101.48	DC	8.18

## 11.5 System Reinforcements - Summer Peak Load Flow - Primary POI

ID	Idx	Facility	Upgrade Description	Cost
166908687,166908686	1	3ELKTON 115.0 kV - 3MERCK5 115.0 kV Ckt 1	<u>DVP</u> dom-264 (1651) : Reconductor 2.47miles of 115 kV line 119 from Elkton DP to Merck with 636 ACSR 150 C Project Type : FAC Cost : \$1,482,000 Time Estimate : 30-36 Months	\$1,482,000
165530558,165530557	6	01MDWBRK 138.0 kV - AD1-155 TAP 138.0 kV Ckt 1	<u>APS</u> PE-AG1-F-0003a (631) : Replace (1) 8 A ITH thermal relay at Strasburg. Project Type : FAC Cost : \$768,600 Time Estimate : 12.0 Months	\$2,433,900
165530582,165530581	4	AD1-155 TAP 138.0 kV - 01STRASB 138.0 kV Ckt 1	PE-AG1-F-0003b (632) : 1) Replace (1) 1200 A current transformer at Strasburg 2) Replace (3) 10 A thermal relays at Strasburg. Project Type : FAC Cost : \$1,665,300 Time Estimate : 12.0 Months	
163156906	3	6GROTOES 230.0 kV - 6HARSNBG 230.0 kV Ckt 1	<u>DVP</u> dom-375 (1762) : Rebuild 10.55 miles of 230 kV Line 260 from Grottoes to Harrisonburg with 2-636 ACSR 150 C. Project Type : FAC Cost : \$15,825,000 Time Estimate : 36-40 Months	\$15,825,000
166908706,166908707	2	3GROTOES 115.0 kV - AE2-029 TAP 115.0 kV Ckt 1	<u>DVP</u> dom-374 (1761) : Reconductor 4.94 miles of 115 kV Line 119 from Grottoes to AE2-029 Tap with 636 ACSR 150 C Project Type : FAC Cost : \$2,964,000 Time Estimate : 30-36 Months	\$2,964,000
169354358	7	6CHARLVL 230.0 kV - 6PROFFIT 230.0 kV Ckt 1	<u>DVP</u> dom-365 (1752) : Rebuild 8.72 miles of 230 kV Line 2054 from Charlottesville to Profit D.P. with 2-636 ACSR 150 C Project Type : FAC Cost : \$21,800,000 Time Estimate : 36-40 Months	\$21,800,000

ID	Idx	Facility	Upgrade Description	Cost
166908680,166 908679	5	AE2-029 TAP 115.0 kV - 3ELKTON 115.0 kV Ckt 1	<u>DVP</u> dom-400 (1787) : Reconductor 5.31 miles of 115 kV Line 119 from Elkton to AE2-029 Tap with 636 ACSR 150 C. Project Type : FAC Cost : \$3,186,000 Time Estimate : 30-36 Months	\$3,186,000
			TOTAL COST	\$47,690,900

## 11.6 Flow Gate Details - Primary POI

The following indices contain additional information about each facility presented in the body of the report. For each index, a description of the flowgate and its contingency was included for convenience. The intent of the indices is to provide more details on which projects/generators have contributions to the flowgate in question. All New Service Queue Requests, through the end of the Queue under study, that are contributors to a flowgate will be listed in the indices. Please note that there may be contributors that are subsequently queued after the queue under study that are not listed in the indices. Although this information is not used "as is" for cost allocation purposes, it can be used to gage the impact of other projects/generators. It should be noted the project/generator MW contributions presented in the body of the report are Full MW Impact contributions which are also noted in the indices column named "Full MW Impact", whereas the loading percentages reported in the body of the report, take into consideration the PJM Generator Deliverability Test rules such as commercial probability of each project as well as the ramping impact of "Adder" contributions. The MW Impact found and used in the analysis is shown in the indices column named "Gendeliv MW Impact".

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### 11.6.1 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
166908687	313706	3ELKTON	DVP	314798	3MERCK5	DVP	1	DVP_P7-1: LN 2017-2134-A	tower	251.0	94.62	107.28	DC	31.78

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
940451	AE2-029 C	8.0589	50/50	8.0589
940452	AE2-029 E	5.3726	50/50	5.3726
943572	AF1-028 BAT	63.5660	50/50	63.5660
961721	AG1-012 BAT	0.8236	Merchant Transmission	0.8236
963022	AG1-151 BAT	31.7830	50/50	31.7830
963631	AG1-214 C	1.4290	50/50	1.4290
963632	AG1-214 E	2.1434	50/50	2.1434
WEC	WEC	0.0737	Confirmed LTF	0.0737
LGEE	LGEE	0.1621	Confirmed LTF	0.1621
CPL	CPL	0.3099	Confirmed LTF	0.3099
CBM-W2	CBM-W2	2.6970	Confirmed LTF	2.6970
NY	NY	0.1510	Confirmed LTF	0.1510
TVA	TVA	0.4844	Confirmed LTF	0.4844
O-066	O-066	2.0392	Confirmed LTF	2.0392
SIGE	SIGE	0.0591	Confirmed LTF	0.0591
CBM-S2	CBM-S2	4.6249	Confirmed LTF	4.6249
CBM-S1	CBM-S1	0.1254	Confirmed LTF	0.1254
G-007	G-007	0.3192	Confirmed LTF	0.3192
MEC	MEC	0.4100	Confirmed LTF	0.4100
LAGN	LAGN	0.5827	Confirmed LTF	0.5827
CBM-W1	CBM-W1	3.0423	Confirmed LTF	3.0423

## 11.6.2 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
166908707	314802	3GROTOES	DVP	940450	AE2-029 TAP	DVP	1	DVP_P7-1: LN 2017-2134-A	tower	251.0	91.54	104.2	DC	31.78

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
943572	AF1-028 BAT	63.5660	50/50	63.5660
961721	AG1-012 BAT	0.8236	Merchant Transmission	0.8236
963022	AG1-151 BAT	31.7830	50/50	31.7830
963631	AG1-214 C	1.4290	50/50	1.4290
963632	AG1-214 E	2.1434	50/50	2.1434
WEC	WEC	0.0737	Confirmed LTF	0.0737
LGEE	LGEE	0.1621	Confirmed LTF	0.1621
CPLE	CPLE	0.3099	Confirmed LTF	0.3099
CBM-W2	CBM-W2	2.6970	Confirmed LTF	2.6970
NY	NY	0.1510	Confirmed LTF	0.1510
TVA	TVA	0.4844	Confirmed LTF	0.4844
O-066	O-066	2.0392	Confirmed LTF	2.0392
SIGE	SIGE	0.0591	Confirmed LTF	0.0591
CBM-S2	CBM-S2	4.6249	Confirmed LTF	4.6249
CBM-S1	CBM-S1	0.1254	Confirmed LTF	0.1254
G-007	G-007	0.3192	Confirmed LTF	0.3192
MEC	MEC	0.4100	Confirmed LTF	0.4100
LAGN	LAGN	0.5827	Confirmed LTF	0.5827
CBM-W1	CBM-W1	3.0423	Confirmed LTF	3.0423

### 11.6.3 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
163156906	314803	6GROTOES	DVP	314806	6HARSNBG	DVP	1	DVP_P7-1: LN 253-2109	tower	549.0	94.81	104.42	DC	52.74

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
943572	AF1-028 BAT	105.4840	50/50	105.4840
961721	AG1-012 BAT	1.1755	Merchant Transmission	1.1755
962883	AG1-137 BAT	70.3220	50/50	70.3220
963022	AG1-151 BAT	52.7420	50/50	52.7420
963471	AG1-196 O1	17.9655	50/50	17.9655
WEC	WEC	0.0923	Confirmed LTF	0.0923
LGEE	LGEE	0.2048	Confirmed LTF	0.2048
CPLE	CPLE	0.4334	Confirmed LTF	0.4334
CBM-W2	CBM-W2	3.4854	Confirmed LTF	3.4854
NY	NY	0.1974	Confirmed LTF	0.1974
TVA	TVA	0.6328	Confirmed LTF	0.6328
O-066	O-066	2.6382	Confirmed LTF	2.6382
SIGE	SIGE	0.0757	Confirmed LTF	0.0757
CBM-S2	CBM-S2	6.3266	Confirmed LTF	6.3266
CBM-S1	CBM-S1	0.1630	Confirmed LTF	0.1630
G-007	G-007	0.4127	Confirmed LTF	0.4127
MEC	MEC	0.5196	Confirmed LTF	0.5196
LAGN	LAGN	0.7613	Confirmed LTF	0.7613
CBM-W1	CBM-W1	3.7994	Confirmed LTF	3.7994

#### 11.6.4 Index 4

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
165530582	935200	AD1-155 TAP	AP	235513	01STRASB	AP	1	DVP_P7-1: LN 2017-2134-A	tower	229.0	98.38	118.28	DC	45.57

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
943572	AF1-028 BAT	91.1480	50/50	91.1480
963022	AG1-151 BAT	45.5740	50/50	45.5740
963633	AG1-214 BAT	0.9919	Merchant Transmission	0.9919
G-007A	G-007A	0.4004	Confirmed LTF	0.4004
VFT	VFT	1.0707	Confirmed LTF	1.0707
CALDERWOOD	CALDERWOOD	0.0914	Confirmed LTF	0.0914
PRAIRIE	PRAIRIE	0.3306	Confirmed LTF	0.3306
CHEOAH	CHEOAH	0.0926	Confirmed LTF	0.0926
CBM-N	CBM-N	0.1980	Confirmed LTF	0.1980
COTTONWOOD	COTTONWOOD	0.3276	Confirmed LTF	0.3276
HAMLET	HAMLET	0.1242	Confirmed LTF	0.1242
GIBSON	GIBSON	0.0622	Confirmed LTF	0.0622
BLUEG	BLUEG	0.2014	Confirmed LTF	0.2014
TRIMBLE	TRIMBLE	0.0640	Confirmed LTF	0.0640
CATAWBA	CATAWBA	0.0756	Confirmed LTF	0.0756

## 11.6.5 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
166908680	940450	AE2-029 TAP	DVP	313706	3ELKTON	DVP	1	DVP_P7-1: LN 2017-2134-A	tower	251.0	96.73	109.4	DC	31.78

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
940451	AE2-029 C	8.0589	50/50	8.0589
940452	AE2-029 E	5.3726	50/50	5.3726
943572	AF1-028 BAT	63.5660	50/50	63.5660
961721	AG1-012 BAT	0.8236	Merchant Transmission	0.8236
963022	AG1-151 BAT	31.7830	50/50	31.7830
963631	AG1-214 C	1.4290	50/50	1.4290
963632	AG1-214 E	2.1434	50/50	2.1434
WEC	WEC	0.0737	Confirmed LTF	0.0737
LGEE	LGEE	0.1621	Confirmed LTF	0.1621
CPLE	CPLE	0.3099	Confirmed LTF	0.3099
CBM-W2	CBM-W2	2.6970	Confirmed LTF	2.6970
NY	NY	0.1510	Confirmed LTF	0.1510
TVA	TVA	0.4844	Confirmed LTF	0.4844
O-066	O-066	2.0392	Confirmed LTF	2.0392
SIGE	SIGE	0.0591	Confirmed LTF	0.0591
CBM-S2	CBM-S2	4.6249	Confirmed LTF	4.6249
CBM-S1	CBM-S1	0.1254	Confirmed LTF	0.1254
G-007	G-007	0.3192	Confirmed LTF	0.3192
MEC	MEC	0.4100	Confirmed LTF	0.4100
LAGN	LAGN	0.5827	Confirmed LTF	0.5827
CBM-W1	CBM-W1	3.0423	Confirmed LTF	3.0423

### 11.6.6 Index 6

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
165530558	235483	01MDWBRK	AP	935200	AD1-155 TAP	AP	1	DVP_P7-1: LN 2017-2134-A	tower	229.0	110.84	130.74	DC	45.57

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
943572	AF1-028 BAT	91.1480	50/50	91.1480
961721	AG1-012 BAT	28.5444	50/50	28.5444
963022	AG1-151 BAT	45.5740	50/50	45.5740
963633	AG1-214 BAT	0.9919	Merchant Transmission	0.9919
G-007A	G-007A	0.4004	Confirmed LTF	0.4004
VFT	VFT	1.0707	Confirmed LTF	1.0707
CALDERWOOD	CALDERWOOD	0.0914	Confirmed LTF	0.0914
PRAIRIE	PRAIRIE	0.3306	Confirmed LTF	0.3306
CHEOAH	CHEOAH	0.0926	Confirmed LTF	0.0926
CBM-N	CBM-N	0.1980	Confirmed LTF	0.1980
COTTONWOOD	COTTONWOOD	0.3276	Confirmed LTF	0.3276
HAMLET	HAMLET	0.1242	Confirmed LTF	0.1242
GIBSON	GIBSON	0.0622	Confirmed LTF	0.0622
BLUEG	BLUEG	0.2014	Confirmed LTF	0.2014
TRIMBLE	TRIMBLE	0.0640	Confirmed LTF	0.0640
CATAWBA	CATAWBA	0.0756	Confirmed LTF	0.0756

## 11.6.7 Index 7

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
169354358	314749	6CHARLV	DVP	314772	6PROFFIT	DVP	1	DVP_P1-2: LN 553	single	550.84	101.41	102.89	DC	8.18

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
235034	01SHY_Z2-039	0.0089	80/20	0.0089
235035	01NHY_Z2-039	0.0145	80/20	0.0145
237092	AD1-085_C	0.1375	80/20	0.1375
313738	3CUSHAW	0.0822	80/20	0.0822
314677	6BUCKING	0.1994	80/20	0.1994
314859	4WSTVACO	3.8378	80/20	3.8378
315186	1LOWMORA	0.3753	80/20	0.3753
315188	1LOWMORC	0.3767	80/20	0.3767
315191	1BEARGRDN G1	3.5688	80/20	3.5688
315192	1BEARGRDN G2	3.5688	80/20	3.5688
315193	1BEARGRDN S1	4.6151	80/20	4.6151
315201	1BATH 1A	6.3455	80/20	6.3455
315202	1BATH 2B	6.3455	80/20	6.3455
315203	1BATH 3C	6.3493	80/20	6.3493
315204	1BATH 4D	6.3480	80/20	6.3480
315205	1BATH 5E	6.3556	80/20	6.3556
315206	1BATH 6F	6.3683	80/20	6.3683
315216	1CUNINGA	2.6813	80/20	2.6813
315217	1CUNINGB	2.6813	80/20	2.6813
315218	1CUNINGC	2.6813	80/20	2.6813
315219	1CUNINGD	5.9974	80/20	5.9974
315616	AA1-038 C	7.2579	80/20	7.2579
316152	AE1-098 C	0.1342	80/20	0.1342
316154	AE1-099 C	0.1342	80/20	0.1342
926001	AC1-076 C	-2.4492	Adder	-2.88
926451	AC1-116 C	0.1552	80/20	0.1552
926481	AC1-120 C O1	-5.1375	Adder	-6.04
926501	AC1-121 C O1	-1.7644	Adder	-2.08
926611	AC1-143 C O1	-3.6922	Adder	-4.34
932511	AC2-071 C (Withdrawn : 01/22/2021)	0.1965	80/20	0.1965
932541	AC2-074 C (Withdrawn : 01/22/2021)	0.1044	80/20	0.1044
932854	AC2-112 C	13.4979	80/20	13.4979
933501	AC2-165 C	3.1316	80/20	3.1316
935221	AD1-157 C	0.0718	80/20	0.0718
938371	AE1-056 C	1.9617	80/20	1.9617
938625	AE1-084 C	6.5460	80/20	6.5460
938821	AE1-108 C O1	9.1873	80/20	9.1873
939231	AE1-154 C	-1.7982	Adder	-2.12
940451	AE2-029 C	3.0342	80/20	3.0342
941011	AE2-092 C	10.1248	80/20	10.1248

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
942461	AE2-259 C O1	3.6732	80/20	3.6732
943571	AF1-028 O1	16.3520	80/20	16.3520
944071	AF1-075 C O1	4.3944	80/20	4.3944
946291	AF1-293 C O1	13.0557	80/20	13.0557
946591	AF1-323 C	3.0769	80/20	3.0769
958131	AF2-107 C	2.0472	80/20	2.0472
960111	AF2-302 C	1.1189	80/20	1.1189
961061	AF2-397 C	11.8318	80/20	11.8318
961101	AF2-401 C	-0.3764	Adder	-0.44
961801	AG1-022 C	1.1189	80/20	1.1189
962741	AG1-123 C O1	2.2471	80/20	2.2471
962881	AG1-137 C	3.9340	80/20	3.9340
963021	AG1-151 O1	8.1760	80/20	8.1760
963461	AG1-195	14.1540	80/20	14.1540
963471	AG1-196 O1	17.9835	80/20	17.9835
963631	AG1-214 C	0.8133	80/20	0.8133
964231	AG1-284 C O1	5.0064	80/20	5.0064
964621	AG1-325 C O1	3.4039	80/20	3.4039
964831	AG1-346 C	0.7638	80/20	0.7638
965531	AG1-421 C	12.9156	80/20	12.9156
965541	AG1-422	5.3815	80/20	5.3815
965581	AG1-426	2.0016	80/20	2.0016
965641	AG1-432 C O1	7.3464	80/20	7.3464
965831	AG1-451	1.2244	80/20	1.2244
966251	AG1-494 C	1.0572	80/20	1.0572
966671	AG1-537 C	4.1894	80/20	4.1894
966791	AG1-550 O1	6.2366	80/20	6.2366
966851	AG1-556	9.4770	80/20	9.4770
966861	AG1-557 C O1 (Withdrawn : 12/14/2020)	0.7346	80/20	0.7346
WEC	WEC	0.5582	Confirmed LTF	0.5582
LGEE	LGEE	1.1806	Confirmed LTF	1.1806
CPL	CPL	0.7262	Confirmed LTF	0.7262
CBM-W2	CBM-W2	16.5222	Confirmed LTF	16.5222
NY	NY	0.6299	Confirmed LTF	0.6299
TVA	TVA	2.6782	Confirmed LTF	2.6782
SIGE	SIGE	0.3493	Confirmed LTF	0.3493
CBM-S2	CBM-S2	15.7435	Confirmed LTF	15.7435
CBM-S1	CBM-S1	0.7247	Confirmed LTF	0.7247
MEC	MEC	2.8618	Confirmed LTF	2.8618
LAGN	LAGN	3.2428	Confirmed LTF	3.2428
CBM-W1	CBM-W1	24.0163	Confirmed LTF	24.0163

## 11.7 Queue Dependencies

The Queue Projects below are listed in one or more indices for the overloads identified in your report. These projects contribute to the loading of the overloaded facilities identified in your report. The percent overload of a facility and cost allocation you may have towards a particular reinforcement could vary depending on the action of these earlier projects. The status of each project at the time of the analysis is presented in the table. This list may change as earlier projects withdraw or modify their requests.

Queue Number	Project Name	Status
AA1-038	Lexington-Low Moor 230kV	Engineering and Procurement
AC1-076	Locust Grove-Paytes 115kV	Engineering and Procurement
AC1-116	Mount Eagle 34.5kV	Engineering and Procurement
AC1-120	Mitchell-Mountain Run 115kV	Engineering and Procurement
AC1-121	Mitchell-Mountain Run 115kV	Engineering and Procurement
AC1-143	Brandy-Remington 115kV	Engineering and Procurement
AC2-071	Buckingham 35kV	Withdrawn
AC2-074	Mt. Jackson 35kV	Withdrawn
AC2-112	Stuarts Draft-Waynesboro 115kV	Engineering and Procurement
AC2-165	Bremo-Powhatan 230kV	Engineering and Procurement
AD1-085	North Shenandoah-Stanley 34.5 kV	Engineering and Procurement
AD1-157	South Creek 34.5 kV	Engineering and Procurement
AE1-056	Red House-South Creek 115 kV	Active
AE1-084	Barterbrook-Stuarts Draft 115 kV	Active
AE1-098	Endless Caverns 34.5 kV	Engineering and Procurement
AE1-099	Endless Caverns 34.kV	Engineering and Procurement
AE1-108	Bremo-Scottsville 138 kV	Active
AE1-154	Louisa-South Anna 230 kV	Engineering and Procurement
AE2-029	Grottoes-Merck 115kV	Active
AE2-092	Kidds Store-Sherwood 115 kV	Active
AE2-259	Curdsville-Willis Mtn 115 kV	Active
AF1-028	Endless Caverns 115 kV	Active
AF1-075	Harrisburg-Endless Caverns 230 kV	Active
AF1-293	Kidds Store-Fort Union 115 kV	Active
AF1-323	Scottsville-Colleen 138 kV	Active
AF2-107	Clifford 138 kV	Active
AF2-302	Scottsville-Colleen 138 kV	Active
AF2-397	Fork Union-Mt. Eagle 230 kV	Active
AF2-401	Culpeper 34.5 kV	Engineering and Procurement
AG1-012	Mewdow Brook-Strasburg 138 kV II	Active
AG1-022	Scottsville-Colleen 138 kV	Active
AG1-123	Amherst-Riverville138 kV	Active
AG1-137	Harrisonburg 230 kV	Active
AG1-151	Endless Caverns 115 kV	Active
AG1-195	Valley 230 kV	Active
AG1-196	Grottoes-Dooms 230 kV	Active
AG1-214	Grottoes 12.5 kV	Active
AG1-284	Bremo-Cunningham DP 115 kV	Active
AG1-325	Barterbrook-Stuarts Draft 115 kV	Active

<b>Queue Number</b>	<b>Project Name</b>	<b>Status</b>
AG1-346	Mount Jackson DP 115 kV	Active
AG1-421	Lexington-Dooms 230 kV	Active
AG1-422	Lexington-Dooms 230 kV	Active
AG1-426	Bremo-Scottsville 138 kV	Active
AG1-432	Curdsville DP-Willis Mt. 115 kV	Active
AG1-451	Curdsville DP-Willis Mt. 115 kV	Active
AG1-494	Boxwood-Riverville 138 kV	Active
AG1-537	Barterbrook-Stuarts Draft 115 kV	Active
AG1-550	Mount Eagle-Fork Union 230 kV	Active
AG1-556	Lexington 115 kV	Active
AG1-557	Curdsville DP 115 kV	Withdrawn
Z2-039	PF Hydro	In Service

## 11.8 Contingency Descriptions - Primary POI

Contingency Name	Contingency Definition
<b>DVP_P7-1: LN 253-2109</b>	CONTINGENCY 'DVP_P7-1: LN 253-2109' /* . OPEN BRANCH FROM BUS 314806 TO BUS 314817 CKT 1 /* 6HARSNBG 230.00 - 6VALLEY 230.00 OPEN BRANCH FROM BUS 314750 TO BUS 314806 CKT 1 /* 6DAYTON 230.00 - 6HARSNBG 230.00 OPEN BRANCH FROM BUS 314750 TO BUS 314817 CKT 1 /* 6DAYTON 230.00 - 6VALLEY 230.00 OPEN BUS 314750 /* ISLAND: 6DAYTON 230.00 END
<b>DVP_P1-2: LN 553</b>	CONTINGENCY 'DVP_P1-2: LN 553' OPEN BRANCH FROM BUS 314908 TO BUS 314910 CKT 1 /* 8ELMONT 500.00 - 8CUNINGHAM 500.00 END
<b>DVP_P7-1: LN 2017-2134-B</b>	CONTINGENCY 'DVP_P7-1: LN 2017-2134-B' /* . OPEN BRANCH FROM BUS 314800 TO BUS 314805 CKT 1 /* 6END
<b>DVP_P7-1: LN 2017-2134-A</b>	CONTINGENCY 'DVP_P7-1: LN 2017-2134-A' /* . OPEN BRANCH FROM BUS 314800 TO BUS 944070 CKT 1 /* 6END

## 12 Short Circuit Analysis - Primary POI

The following Breakers are overdutied

Bus Number	Bus Name	BREAKER	Type	Capacity (Amps)	Duty Percentage Post Queue	Duty Percentage Pre Queue

### 12.1 System Reinforcements - Short Circuit

### **13 Summer Peak - Load Flow Analysis - Secondary POI**

The Queue Project AG1-151 was evaluated as a 100.0 MW (Capacity 100.0 MW) injection at the Endless Caverns 230 kV substation in the Dominion area. Project AG1-151 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-151 was studied with a commercial probability of 53.0 %. Potential network impacts were as follows:

### 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	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC D C	MW IMPACT
166908686	313706	3ELKTON	115.0	DVP	314798	3MERCK5	115.0	DVP	1	DVP_P7-1: LN 2017-2134-B	tower	251.0	94.66	107.32	DC	31.78
166908687	313706	3ELKTON	115.0	DVP	314798	3MERCK5	115.0	DVP	1	DVP_P7-1: LN 2017-2134-A	tower	251.0	94.62	107.28	DC	31.78
166908706	314802	3GROTOES	115.0	DVP	940450	AE2-029 TAP	115.0	DVP	1	DVP_P7-1: LN 2017-2134-B	tower	251.0	91.58	104.24	DC	31.78
166908707	314802	3GROTOES	115.0	DVP	940450	AE2-029 TAP	115.0	DVP	1	DVP_P7-1: LN 2017-2134-A	tower	251.0	91.54	104.2	DC	31.78
163156906	314803	6GROTOES	230.0	DVP	314806	6HARSNB G	230.0	DVP	1	DVP_P7-1: LN 253-2109	tower	549.0	94.81	106.3	DC	63.04
165530581	935200	AD1-155 TAP	138.0	AP	235513	01STRASB	138.0	AP	1	DVP_P7-1: LN 2017-2134-B	tower	229.0	98.42	118.32	DC	45.57
165530582	935200	AD1-155 TAP	138.0	AP	235513	01STRASB	138.0	AP	1	DVP_P7-1: LN 2017-2134-A	tower	229.0	98.38	118.28	DC	45.57
166908679	940450	AE2-029 TAP	115.0	DVP	313706	3ELKTON	115.0	DVP	1	DVP_P7-1: LN 2017-2134-B	tower	251.0	96.77	109.44	DC	31.78
166908680	940450	AE2-029 TAP	115.0	DVP	313706	3ELKTON	115.0	DVP	1	DVP_P7-1: LN 2017-2134-A	tower	251.0	96.73	109.4	DC	31.78

### 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	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC D C	MW IMPACT
165530557	235483	01MDWBR K	138.0	AP	935200	AD1-155 TAP	138.0	AP	1	DVP_P7-1: LN 2017-2134-B	tower	229.0	110.89	130.79	DC	45.57

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJE T LOADIN G %	POST PROJE T LOADIN G %	AC D C	MW IMPAC T
165530558	235483	01MDWBRK	138.0	AP	935200	AD1-155 TAP	138.0	AP	1	DVP_P7-1: LN 2017-2134-A	tower	229.0	110.84	130.74	DC	45.57
169354358	314749	6CHARLVL	230.0	DVP	314772	6PROFFIT	230.0	DVP	1	DVP_P1-2: LN 553	single	550.840026855	101.53	103.2	DC	9.15

### 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	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJE T LOADIN G %	POST PROJE T LOADIN G %	AC D C	MW IMPAC T
169354357	314749	6CHARLVL	230.0	DVP	314772	6PROFFIT	230.0	DVP	1	DVP_P1-2: LN 553	operation	550.840026855	100.81	101.56	DC	9.15

### 13.5 Flow Gate Details - Secondary POI

The following indices contain additional information about each facility presented in the body of the report. For each index, a description of the flowgate and its contingency was included for convenience. The intent of the indices is to provide more details on which projects/generators have contributions to the flowgate in question. All New Service Queue Requests, through the end of the Queue under study, that are contributors to a flowgate will be listed in the indices. Please note that there may be contributors that are subsequently queued after the queue under study that are not listed in the indices. Although this information is not used "as is" for cost allocation purposes, it can be used to gage the impact of other projects/generators. It should be noted the project/generator MW contributions presented in the body of the report are Full MW Impact contributions which are also noted in the indices column named "Full MW Impact", whereas the loading percentages reported in the body of the report, take into consideration the PJM Generator Deliverability Test rules such as commercial probability of each project as well as the ramping impact of "Adder" contributions. The MW Impact found and used in the analysis is shown in the indices column named "Gendeliv MW Impact".

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### 13.5.1 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
166908687	313706	3ELKTON	DVP	314798	3MERCK5	DVP	1	DVP_P7-1: LN 2017-2134-A	tower	251.0	94.62	107.28	DC	31.78

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
940451	AE2-029 C	8.0589	50/50	8.0589
940452	AE2-029 E	5.3726	50/50	5.3726
943572	AF1-028 BAT	63.5660	50/50	63.5660
961721	AG1-012 BAT	0.8236	Merchant Transmission	0.8236
963022	AG1-151 BAT	31.7830	50/50	31.7830
963471	AG1-196 O2	28.2030	50/50	28.2030
963631	AG1-214 C	1.4290	50/50	1.4290
963632	AG1-214 E	2.1434	50/50	2.1434
WEC	WEC	0.0737	Confirmed LTF	0.0737
LGEE	LGEE	0.1621	Confirmed LTF	0.1621
CPLE	CPLE	0.3099	Confirmed LTF	0.3099
CBM-W2	CBM-W2	2.6970	Confirmed LTF	2.6970
NY	NY	0.1510	Confirmed LTF	0.1510
TVA	TVA	0.4844	Confirmed LTF	0.4844
O-066	O-066	2.0392	Confirmed LTF	2.0392
SIGE	SIGE	0.0591	Confirmed LTF	0.0591
CBM-S2	CBM-S2	4.6249	Confirmed LTF	4.6249
CBM-S1	CBM-S1	0.1254	Confirmed LTF	0.1254
G-007	G-007	0.3192	Confirmed LTF	0.3192
MEC	MEC	0.4100	Confirmed LTF	0.4100
LAGN	LAGN	0.5827	Confirmed LTF	0.5827
CBM-W1	CBM-W1	3.0423	Confirmed LTF	3.0423

### 13.5.2 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
166908707	314802	3GROTOES	DVP	940450	AE2-029 TAP	DVP	1	DVP_P7-1: LN 2017-2134-A	tower	251.0	91.54	104.2	DC	31.78

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
943572	AF1-028 BAT	63.5660	50/50	63.5660
961721	AG1-012 BAT	0.8236	Merchant Transmission	0.8236
963022	AG1-151 BAT	31.7830	50/50	31.7830
963471	AG1-196 O2	28.2030	50/50	28.2030
963631	AG1-214 C	1.4290	50/50	1.4290
963632	AG1-214 E	2.1434	50/50	2.1434
WEC	WEC	0.0737	Confirmed LTF	0.0737
LGEE	LGEE	0.1621	Confirmed LTF	0.1621
CPLE	CPLE	0.3099	Confirmed LTF	0.3099
CBM-W2	CBM-W2	2.6970	Confirmed LTF	2.6970
NY	NY	0.1510	Confirmed LTF	0.1510
TVA	TVA	0.4844	Confirmed LTF	0.4844
O-066	O-066	2.0392	Confirmed LTF	2.0392
SIGE	SIGE	0.0591	Confirmed LTF	0.0591
CBM-S2	CBM-S2	4.6249	Confirmed LTF	4.6249
CBM-S1	CBM-S1	0.1254	Confirmed LTF	0.1254
G-007	G-007	0.3192	Confirmed LTF	0.3192
MEC	MEC	0.4100	Confirmed LTF	0.4100
LAGN	LAGN	0.5827	Confirmed LTF	0.5827
CBM-W1	CBM-W1	3.0423	Confirmed LTF	3.0423

### 13.5.3 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
163156906	314803	6GROTOES	DVP	314806	6HARSNBG	DVP	1	DVP_P7-1: LN 253-2109	tower	549.0	94.81	106.3	DC	63.04

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
943572	AF1-028 BAT	105.4840	50/50	105.4840
961721	AG1-012 BAT	1.1755	Merchant Transmission	1.1755
962883	AG1-137 BAT	70.3220	50/50	70.3220
963022	AG1-151 BAT	63.0390	50/50	63.0390
WEC	WEC	0.0923	Confirmed LTF	0.0923
LGEE	LGEE	0.2048	Confirmed LTF	0.2048
CPLE	CPLE	0.4334	Confirmed LTF	0.4334
CBM-W2	CBM-W2	3.4854	Confirmed LTF	3.4854
NY	NY	0.1974	Confirmed LTF	0.1974
TVA	TVA	0.6328	Confirmed LTF	0.6328
O-066	O-066	2.6382	Confirmed LTF	2.6382
SIGE	SIGE	0.0757	Confirmed LTF	0.0757
CBM-S2	CBM-S2	6.3266	Confirmed LTF	6.3266
CBM-S1	CBM-S1	0.1630	Confirmed LTF	0.1630
G-007	G-007	0.4127	Confirmed LTF	0.4127
MEC	MEC	0.5196	Confirmed LTF	0.5196
LAGN	LAGN	0.7613	Confirmed LTF	0.7613
CBM-W1	CBM-W1	3.7994	Confirmed LTF	3.7994

### 13.5.4 Index 4

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
165530582	935200	AD1-155 TAP	AP	235513	01STRASB	AP	1	DVP_P7-1: LN 2017-2134-A	tower	229.0	98.38	118.28	DC	45.57

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
943572	AF1-028 BAT	91.1480	50/50	91.1480
963022	AG1-151 BAT	45.5740	50/50	45.5740
963472	AG1-196 BAT	7.8307	Merchant Transmission	7.8307
963633	AG1-214 BAT	0.9919	Merchant Transmission	0.9919
G-007A	G-007A	0.4004	Confirmed LTF	0.4004
VFT	VFT	1.0707	Confirmed LTF	1.0707
CALDERWOOD	CALDERWOOD	0.0914	Confirmed LTF	0.0914
PRAIRIE	PRAIRIE	0.3306	Confirmed LTF	0.3306
CHEOAH	CHEOAH	0.0926	Confirmed LTF	0.0926
CBM-N	CBM-N	0.1980	Confirmed LTF	0.1980
COTTONWOOD	COTTONWOOD	0.3276	Confirmed LTF	0.3276
HAMLET	HAMLET	0.1242	Confirmed LTF	0.1242
GIBSON	GIBSON	0.0622	Confirmed LTF	0.0622
BLUEG	BLUEG	0.2014	Confirmed LTF	0.2014
TRIMBLE	TRIMBLE	0.0640	Confirmed LTF	0.0640
CATAWBA	CATAWBA	0.0756	Confirmed LTF	0.0756

### 13.5.5 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
166908680	940450	AE2-029 TAP	DVP	313706	3ELKTON	DVP	1	DVP_P7-1: LN 2017-2134-A	tower	251.0	96.73	109.4	DC	31.78

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
940451	AE2-029 C	8.0589	50/50	8.0589
940452	AE2-029 E	5.3726	50/50	5.3726
943572	AF1-028 BAT	63.5660	50/50	63.5660
961721	AG1-012 BAT	0.8236	Merchant Transmission	0.8236
963022	AG1-151 BAT	31.7830	50/50	31.7830
963471	AG1-196 O2	28.2030	50/50	28.2030
963631	AG1-214 C	1.4290	50/50	1.4290
963632	AG1-214 E	2.1434	50/50	2.1434
WEC	WEC	0.0737	Confirmed LTF	0.0737
LGEE	LGEE	0.1621	Confirmed LTF	0.1621
CPLE	CPLE	0.3099	Confirmed LTF	0.3099
CBM-W2	CBM-W2	2.6970	Confirmed LTF	2.6970
NY	NY	0.1510	Confirmed LTF	0.1510
TVA	TVA	0.4844	Confirmed LTF	0.4844
O-066	O-066	2.0392	Confirmed LTF	2.0392
SIGE	SIGE	0.0591	Confirmed LTF	0.0591
CBM-S2	CBM-S2	4.6249	Confirmed LTF	4.6249
CBM-S1	CBM-S1	0.1254	Confirmed LTF	0.1254
G-007	G-007	0.3192	Confirmed LTF	0.3192
MEC	MEC	0.4100	Confirmed LTF	0.4100
LAGN	LAGN	0.5827	Confirmed LTF	0.5827
CBM-W1	CBM-W1	3.0423	Confirmed LTF	3.0423

13.5.6 Index 6

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
165530558	235483	01MDWBRK	AP	935200	AD1-155 TAP	AP	1	DVP_P7-1: LN 2017-2134-A	tower	229.0	110.84	130.74	DC	45.57

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
943572	AF1-028 BAT	91.1480	50/50	91.1480
961721	AG1-012 BAT	28.5444	50/50	28.5444
963022	AG1-151 BAT	45.5740	50/50	45.5740
963472	AG1-196 BAT	7.8307	Merchant Transmission	7.8307
963633	AG1-214 BAT	0.9919	Merchant Transmission	0.9919
G-007A	G-007A	0.4004	Confirmed LTF	0.4004
VFT	VFT	1.0707	Confirmed LTF	1.0707
CALDERWOOD	CALDERWOOD	0.0914	Confirmed LTF	0.0914
PRAIRIE	PRAIRIE	0.3306	Confirmed LTF	0.3306
CHEOAH	CHEOAH	0.0926	Confirmed LTF	0.0926
CBM-N	CBM-N	0.1980	Confirmed LTF	0.1980
COTTONWOOD	COTTONWOOD	0.3276	Confirmed LTF	0.3276
HAMLET	HAMLET	0.1242	Confirmed LTF	0.1242
GIBSON	GIBSON	0.0622	Confirmed LTF	0.0622
BLUEG	BLUEG	0.2014	Confirmed LTF	0.2014
TRIMBLE	TRIMBLE	0.0640	Confirmed LTF	0.0640
CATAWBA	CATAWBA	0.0756	Confirmed LTF	0.0756

### 13.5.7 Index 7

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
169354358	314749	6CHARLV	DVP	314772	6PROFFIT	DVP	1	DVP_P1-2: LN 553	single	550.84	101.53	103.2	DC	9.15

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
235034	01SHY_Z2-039	0.0089	80/20	0.0089
235035	01NHY_Z2-039	0.0145	80/20	0.0145
237092	AD1-085_C	0.1375	80/20	0.1375
313738	3CUSHAW	0.0822	80/20	0.0822
314677	6BUCKING	0.1994	80/20	0.1994
314859	4WSTVACO	3.8378	80/20	3.8378
315186	1LOWMORA	0.3753	80/20	0.3753
315188	1LOWMORC	0.3767	80/20	0.3767
315191	1BEARGRDN G1	3.5688	80/20	3.5688
315192	1BEARGRDN G2	3.5688	80/20	3.5688
315193	1BEARGRDN S1	4.6151	80/20	4.6151
315201	1BATH 1A	6.3455	80/20	6.3455
315202	1BATH 2B	6.3455	80/20	6.3455
315203	1BATH 3C	6.3493	80/20	6.3493
315204	1BATH 4D	6.3480	80/20	6.3480
315205	1BATH 5E	6.3556	80/20	6.3556
315206	1BATH 6F	6.3683	80/20	6.3683
315216	1CUNINGA	2.6813	80/20	2.6813
315217	1CUNINGB	2.6813	80/20	2.6813
315218	1CUNINGC	2.6813	80/20	2.6813
315219	1CUNINGD	5.9974	80/20	5.9974
315616	AA1-038 C	7.2579	80/20	7.2579
316152	AE1-098 C	0.1342	80/20	0.1342
316154	AE1-099 C	0.1342	80/20	0.1342
926001	AC1-076 C	-2.4492	Adder	-2.88
926451	AC1-116 C	0.1552	80/20	0.1552
926481	AC1-120 C O1	-5.1375	Adder	-6.04
926501	AC1-121 C O1	-1.7644	Adder	-2.08
926611	AC1-143 C O1	-3.6922	Adder	-4.34
932511	AC2-071 C (Withdrawn : 01/22/2021)	0.1965	80/20	0.1965
932541	AC2-074 C (Withdrawn : 01/22/2021)	0.1044	80/20	0.1044
932854	AC2-112 C	13.4979	80/20	13.4979
933501	AC2-165 C	3.1316	80/20	3.1316
935221	AD1-157 C	0.0718	80/20	0.0718
938371	AE1-056 C	1.9617	80/20	1.9617
938625	AE1-084 C	6.5460	80/20	6.5460
938821	AE1-108 C O1	9.1873	80/20	9.1873
939231	AE1-154 C	-1.7982	Adder	-2.12
940451	AE2-029 C	3.0342	80/20	3.0342
941011	AE2-092 C	10.1248	80/20	10.1248

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
942461	AE2-259 C O1	3.6732	80/20	3.6732
943571	AF1-028 O1	16.3520	80/20	16.3520
944071	AF1-075 C O1	4.3944	80/20	4.3944
946291	AF1-293 C O1	13.0557	80/20	13.0557
946591	AF1-323 C	3.0769	80/20	3.0769
958131	AF2-107 C	2.0472	80/20	2.0472
960111	AF2-302 C	1.1189	80/20	1.1189
961061	AF2-397 C	11.8318	80/20	11.8318
961101	AF2-401 C	-0.3764	Adder	-0.44
961801	AG1-022 C	1.1189	80/20	1.1189
962751	AG1-124 C O2	2.9527	80/20	2.9527
962881	AG1-137 C	3.9340	80/20	3.9340
963021	AG1-151 O2	9.1470	80/20	9.1470
963271	AG1-176 C O2	5.1577	80/20	5.1577
963461	AG1-195	14.1525	80/20	14.1525
963471	AG1-196 O2	16.0515	80/20	16.0515
963631	AG1-214 C	0.8133	80/20	0.8133
964231	AG1-284 C O2	4.9207	80/20	4.9207
964621	AG1-325 C O2	3.4039	80/20	3.4039
964831	AG1-346 C	0.7638	80/20	0.7638
965531	AG1-421 C	12.9156	80/20	12.9156
965541	AG1-422	5.3815	80/20	5.3815
965581	AG1-426	2.0016	80/20	2.0016
965641	AG1-432 C O2	7.3464	80/20	7.3464
965831	AG1-451	1.2244	80/20	1.2244
966251	AG1-494 C	1.0572	80/20	1.0572
966671	AG1-537 C	4.1894	80/20	4.1894
966791	AG1-550 O2	4.1006	80/20	4.1006
966851	AG1-556 O2	7.9890	80/20	7.9890
966861	AG1-557 C O2 (Withdrawn : 12/14/2020)	1.0343	80/20	1.0343
WEC	WEC	0.5582	Confirmed LTF	0.5582
LGEE	LGEE	1.1806	Confirmed LTF	1.1806
CPL	CPL	0.7262	Confirmed LTF	0.7262
CBM-W2	CBM-W2	16.5222	Confirmed LTF	16.5222
NY	NY	0.6299	Confirmed LTF	0.6299
TVA	TVA	2.6782	Confirmed LTF	2.6782
SIGE	SIGE	0.3493	Confirmed LTF	0.3493
CBM-S2	CBM-S2	15.7435	Confirmed LTF	15.7435
CBM-S1	CBM-S1	0.7247	Confirmed LTF	0.7247
MEC	MEC	2.8618	Confirmed LTF	2.8618
LAGN	LAGN	3.2428	Confirmed LTF	3.2428
CBM-W1	CBM-W1	24.0163	Confirmed LTF	24.0163

## 13.6 Contingency Descriptions - Secondary POI

Contingency Name	Contingency Definition
<b>DVP_P7-1: LN 253-2109</b>	CONTINGENCY 'DVP_P7-1: LN 253-2109' /* . OPEN BRANCH FROM BUS 314806 TO BUS 314817 CKT 1 /* 6HARSNBG 230.00 - 6VALLEY 230.00 OPEN BRANCH FROM BUS 314750 TO BUS 314806 CKT 1 /* 6DAYTON 230.00 - 6HARSNBG 230.00 OPEN BRANCH FROM BUS 314750 TO BUS 314817 CKT 1 /* 6DAYTON 230.00 - 6VALLEY 230.00 OPEN BUS 314750 /* ISLAND: 6DAYTON 230.00 END
<b>DVP_P1-2: LN 553</b>	CONTINGENCY 'DVP_P1-2: LN 553' / 579 OPEN BRANCH FROM BUS 314908 TO BUS 314910 CKT 1 / 314908 8ELMONT 500 314910 8CUNINGHAM 500 1 END
<b>DVP_P7-1: LN 2017-2134-B</b>	CONTINGENCY 'DVP_P7-1: LN 2017-2134-B' /* . OPEN BRANCH FROM BUS 314800 TO BUS 314805 CKT 1 /* 6END
<b>DVP_P7-1: LN 2017-2134-A</b>	CONTINGENCY 'DVP_P7-1: LN 2017-2134-A' /* . OPEN BRANCH FROM BUS 314800 TO BUS 944070 CKT 1 /* 6END

## **14 Affected Systems**

### **14.1 TVA**

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

### **14.2 Duke Energy Progress**

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

## 15 Attachment 1: One Line Diagram