Generation Interconnection

Feasibility Study Report

for

Queue Project AF2-060

WATTSVILLE 12 KV

9 MW Capacity / 9 MW Energy

July 2020

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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 DPL.

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 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 Storage generating facility located in Accomack County, Virginia. The installed facilities will have a total capability of 9 MW with 9 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is December 31, 2020. This study does not imply a TO commitment to this in-service date.

Queue Number	AF2-060
Project Name	WATTSVILLE 12 KV
State	Virginia
County	Accomack
Transmission Owner	DPL
MFO	9
MWE	9
MWC	9
Fuel	Storage
Basecase Study Year	2023

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

AF2-060 will interconnect with the DPL distribution system behind A&N Electric Cooperative's (ANEC) 69/12 kV T2 transformer at the Wattsville substation.

5 Cost Summary

The AF2-060 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	$0
Total System Network Upgrade Costs	$46,500,000
Total Costs	$46,500,000

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 88-129. If at 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.

5.1 DPL Costs

Cost estimates will further be refined as a part of the Impact Study and Facilities Study for this project. The Interconnection Customer will be responsible for all costs incurred by DPL in connection with the AF2-060 project. DPL reserves the right to reassess issues presented in this document and, upon appropriate justification, submit additional costs related to the AF2-060 project.

6 Transmission Owner Scope of Work

There is no Delmarva Power & Light attachment facility or direct connection work scope. Attachment facilities and local upgrades (if required) along with terms and conditions to interconnect AF2-060 will be specified in a separate two party Interconnection Agreement (IA) between A&N Electric Cooperative (ANEC) and the Interconnection Customer as this project is considered FERC non-jurisdictional per the PJM Open Access Transmission Tariff (OATT). The Interconnection Customer is responsible for contacting ANEC directly for attachment facilities work scope.

7 Schedule

The Interconnection Customer is responsible for contacting ANEC directly for schedule to construct the physical interconnection for the AF2-060 project.

8 Transmission Owner Analysis

None

9 Interconnection Customer Requirements

9.1 Required Relaying and Communications

DPL will require over voltage relay protection on the high side of the 69/12 kV T2 to monitor for voltage impacts of the export. Interconnection Customer will be responsible for contacting ANEC to facilitate this work.

9.2 Interconnection Customer Scope of Direct Connection Work

The IC is responsible for all design and construction related to activities on their side of the Point of Interconnection. Protective relaying and metering design and installation must comply with DPL's applicable standards. The IC is also required to provide revenue metering and real-time telemetering data to PJM in conformance with the requirements contained in PJM Manuals M-01 and M-14 and the PJM Tariff.

9.3 Additional Interconnection Customer Responsibilities

The Interconnection Customer is responsible for contacting ANEC for any additional Interconnection Customer requirements.

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/

Metering for this project will be installed behind the ANEC transformer. DPL will require the following:
The Interconnection Customer will grant permission for PJM to send DPL the following telemetry that the Interconnection Customer sends to PJM: real time MW, MVAR, volts, amperes, generator status, and interval MWH and MVARH.

11 Summer Peak - Load Flow Analysis

The Queue Project AF2-060 was evaluated as a 9.0 MW (Capacity 9.0 MW) injection at the Wattsville 12 kV substation in the DPL area. Project AF2-060 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF2-060 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)

None

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	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
10157376 4	23212 8	PINEY13 8	138. 0	DP&L	23212 7	LORETT O	138. 0	DP& L	1	DPL_P1_2_C KT 13787	single	158.0	100.33	102.11	DC	2.82
10157319 3	23223 3	PRESTO N	69.0	DP&L	23282 1	TANYAR D	69.0	DP& L	1	DPL_P4- 2_DP11	breake r	93.0	159.15	159.64	DC	1.02
10157317 8	23223 4	TODD	69.0	DP&L	23223 3	PRESTO N	69.0	DP& L	1	DPL_P4- 2_DP11	breake r	93.0	164.1	164.59	DC	1.02
10157330 5	23224 1	VIENN_6 9	69.0	DP&L	23283 8	MARDEL A	69.0	DP& L	1	DPL_P4- 2_DP56	breake r	64.0	102.33	103.07	DC	0.9
10157345 9	23227 4	PINEY_6 9	69.0	DP&L	23227 2	M HERMO N	69.0	DP& L	1	DPL_P4- 2_DP15	breake r	174.0	101.09	102.33	DC	2.26
10157345 8	92468 0	AB2-120 TAP	138. 0	DP&L	23212 8	PINEY13 8	138. 0	DP& L	1	DPL_P4- 2_DP60C	breake r	226.0	105.06	105.82	DC	3.77

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	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
101573762	232128	PINEY138	138.0	DP&L	232127	LORETTO	138.0	DP&L	1	DPL_P1_2_CKT 13713	operation	158.0	108.74	109.54	DC	2.82
101573871	232274	PINEY_69	69.0	DP&L	232272	MHERMON	69.0	DP&L	1	DPL_P1_2_CKT 23002	operation	174.0	100.69	101.94	DC	2.28
101573611	232280	OAKHL_69	69.0	DP&L	232281	WATTSVIL	69.0	DP&L	1	DPL_P1_2_CKT 13789	operation	88.0	174.83	178.14	DC	2.91
101573614	232280	OAKHL_69	69.0	DP&L	232281	WATTSVIL	69.0	DP&L	1	Base Case	operation	67.0	102.66	106.55	DC	2.61
101573883	924680	AB2-120 TAP	138.0	DP&L	232128	PINEY138	138.0	DP&L	1	DPL_P1_2_PINEY138-WATTSVILLE	operation	226.0	103.75	104.48	DC	3.64

11.5 System Reinforcements - Summer Peak Load Flow - Primary POI

ID	Idx	Facility	Upgrade Description	Cost
101573193	2	**PRESTON 69.0 kV - TANYARD 69.0 kV Ckt 1**	**DPL** **b2946 (1005) : PJM baseline upgrade b2946 conversion of Preston station to a Ring Bus** **Project Type : CON** **Cost : $6,000,000** **Time Estimate : 30-36 Months**	$0
101573305	4	**VIENN_69 69.0 kV - MARDELA 69.0 kV Ckt 1**	**DPL** **s0835 (1021) : Rebuild the 6708 line from Vienna - Hebron (N. Salisbury to Hebron Section already completed) with new poles, conductor, foundations, insulators and OPGW** **Project Type : CON** **Cost : $15,000,000** **Time Estimate : 36-48 Months**	$0
101573178	3	**TODD 69.0 kV - PRESTON 69.0 kV Ckt 1**	**DPL** **b2946 (1005) : PJM baseline upgrade b2946 conversion of Preston station to a Ring Bus** **Project Type : CON** **Cost : $6,000,000** **Time Estimate : 30-36 Months** **ds6716r0001 (1017) : Previously identified in AB2-172, To mitigate the (DP&L) TODD to PRESTON 69 kV line (from bus 232234 to bus 232233 ckt 1) overload will require substation reinforcements at Todd Substation. Replace 600A Disconnect Switch at Todd** **Project Type : FAC** **Cost : $100,000** **Time Estimate : 12.0 Months** **ds6716r0002 (1031) : To mitigate the (DP&L) Preston - Tanyard 69 kV line (from bus 232821 to bus 232233 ckt 1) overload, it will require increasing the emergency rating of the Preston-Tanyard 69 kV line by replacing the terminal equipment at the Tanyard Tap** **Project Type : FAC** **Cost : $100,000** **Time Estimate : 9-12 Months**	$200,000
101573458	6	**AB2-120 TAP 138.0 kV - PINEY138 138.0 kV Ckt 1**	**DPL** **dt13764r0001 (1007) : Rebuild 13764 138 kV line from Piney Grove to AB2-120 Tap** **Project Type : FAC** **Cost : $15,000,000** **Time Estimate : 36-48 Months**	$15,000,000
101573764	1	**PINEY138 138.0 kV - LORETTO 138.0 kV Ckt 1**	**DPL** **dt13777r0001 (1015) : Reconductor Line** **Project Type : FAC** **Cost : $17,300,000** **Time Estimate : 32-48 Months**	$17,300,000

ID	Idx	Facility	Upgrade Description	Cost
101573459	5	**PINEY_69 69.0 kV - M HERMON 69.0 kV Ckt 1**	**DPL** **dt6728r0001 (1054) : To mitigate the (DPL) Piney Grove - Mt. Hermon 69 kV line (from bus 232272 to 232274) overload it will require increasing the emergency rating of the line by rebuilding the line with new poles, conductor, insulators and OPGW. Terminal upgrades will also be required at both substations** **Project Type : FAC** **Cost : $14,000,000** **Time Estimate : 36-48 Months**	$14,000,000
			TOTAL COST	**$46,500,000**

11.6 Flow Gate Details

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".

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
101573764	232128	PINEY138	DP&L	232127	LORETTO	DP&L	1	DPL_P1_2_CKT 13787	single	158.0	100.33	102.11	DC	2.82

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
232404	W1-003 C	0.8470	80/20	0.8470
232406	W1-004 FULL	0.8470	80/20	0.8470
232408	W1-005 C	0.8470	80/20	0.8470
232410	W1-006 C	0.8470	80/20	0.8470
232904	IR4	4.5157	80/20	4.5157
232905	BAYVIEW1	0.6798	80/20	0.6798
232912	OH NUG1	1.7852	80/20	1.7852
232913	OH NUG2	1.7614	80/20	1.7614
232914	OH NUG3	1.7852	80/20	1.7852
232915	OH NUG4	1.7852	80/20	1.7852
232916	OH NUG5	1.7852	80/20	1.7852
232917	OH NUG6	1.7773	80/20	1.7773
232918	OH NUG7	1.7733	80/20	1.7733
232921	TASLEY2G	1.1912	80/20	1.1912
917081	Z2-012 C	0.4133	80/20	0.4133
924681	AB2-120 C OP	12.0650	80/20	12.0650
930201	AB1-056 C	4.0733	80/20	4.0733
939151	AE1-145	6.2608	80/20	6.2608
939621	AE1-192 C O1	14.8172	80/20	14.8172
943361	AF1-007 C	0.1202	80/20	0.1202
945661	AF1-231 C	2.4098	80/20	2.4098
945781	AF1-243	1.5763	80/20	1.5763
957611	AF2-055 C	11.0341	80/20	11.0341
957661	AF2-060	2.8174	80/20	2.8174
957671	AF2-061 O1	12.5216	80/20	12.5216
959021	AF2-193 C O1	7.5268	80/20	7.5268
959031	AF2-194 C O1	7.5268	80/20	7.5268
NEWTON	NEWTON	0.0731	Confirmed LTF	0.0731
FARMERCITY	FARMERCITY	0.0038	Confirmed LTF	0.0038
CALDERWOOD	CALDERWOOD	0.0338	Confirmed LTF	0.0338
NY	NY	0.0332	Confirmed LTF	0.0332
PRAIRIE	PRAIRIE	0.1756	Confirmed LTF	0.1756
CHEOAH	CHEOAH	0.0340	Confirmed LTF	0.0340
EDWARDS	EDWARDS	0.0238	Confirmed LTF	0.0238
TILTON	TILTON	0.0428	Confirmed LTF	0.0428
GIBSON	GIBSON	0.0371	Confirmed LTF	0.0371
BLUEG	BLUEG	0.1180	Confirmed LTF	0.1180
TRIMBLE	TRIMBLE	0.0378	Confirmed LTF	0.0378
CATAWBA	CATAWBA	0.0238	Confirmed LTF	0.0238

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
101573193	232233	PRESTON	DP&L	232821	TANYARD	DP&L	1	DPL_P4-2_DP11	breaker	93.0	159.15	159.64	DC	1.02

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
232404	W1-003 C	0.3036	50/50	0.3036
232405	W1-003 E	0.5112	50/50	0.5112
232406	W1-004 FULL	0.3036	50/50	0.3036
232407	W1-004 E	0.5112	50/50	0.5112
232408	W1-005 C	0.3036	50/50	0.3036
232409	W1-005 E	0.5112	50/50	0.5112
232410	W1-006 C	0.3036	50/50	0.3036
232411	W1-006 E	0.5112	50/50	0.5112
232412	X1-032 E	0.4732	50/50	0.4732
232417	X3-008 C	0.5183	50/50	0.5183
232418	X3-008 E	4.9023	50/50	4.9023
232426	Y1-080 FULL	0.0598	50/50	0.0598
232427	Y1-080 E	0.5688	50/50	0.5688
232428	Y3-058 C	0.1521	50/50	0.1521
232429	Y3-058 E	1.4383	50/50	1.4383
232433	Z2-076 E	0.1512	Adder	0.18
232435	Z2-077 E	0.1512	Adder	0.18
232905	BAYVIEW1	0.2443	50/50	0.2443
232907	VN8	3.9453	50/50	3.9453
232919	VN10	0.3965	50/50	0.3965
232921	TASLEY2G	0.4282	50/50	0.4282
232926	CRISFLD1	0.2061	50/50	0.2061
293670	O-025 C	0.1383	50/50	0.1383
917081	Z2-012 C	0.1486	50/50	0.1486
917082	Z2-012 E	1.4052	50/50	1.4052
918831	AA1-102	0.7727	50/50	0.7727
923282	AB1-137 C	0.2879	Adder	0.34
923283	AB1-137 E	0.1234	Adder	0.15
924681	AB2-120 C OP	3.6460	Adder	4.29
924682	AB2-120 E OP	5.9488	Adder	7.0
924781	AB2-130 C OP	3.8511	50/50	3.8511
924782	AB2-130 E OP	6.2834	50/50	6.2834
924831	AB2-136 C	7.6302	50/50	7.6302
924832	AB2-136 E	8.0917	50/50	8.0917
925151	AB2-172 C OP	7.5117	50/50	7.5117
925152	AB2-172 E OP	12.2559	50/50	12.2559
925261	AB2-180 C	2.1652	50/50	2.1652
925262	AB2-180 E	0.9280	50/50	0.9280
927031	AC1-190 C	13.3011	50/50	13.3011
927032	AC1-190 E	5.7005	50/50	5.7005
927191	AC1-213 C	0.4276	50/50	0.4276
927192	AC1-213 E	0.2806	50/50	0.2806

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
930201	AB1-056 C	4.1164	Adder	4.84
930202	AB1-056 E	11.7229	Adder	13.79
930881	AB1-137 C	0.2879	Adder	0.34
930882	AB1-137 E	0.1234	Adder	0.15
932161	AC2-023 C	4.4912	50/50	4.4912
932162	AC2-023 E	3.2710	50/50	3.2710
938651	AE1-087 C	6.3256	50/50	6.3256
938652	AE1-087 E	1.5814	50/50	1.5814
938891	AE1-117 C O1	2.8516	Adder	3.35
938892	AE1-117 E O1	7.5929	Adder	8.93
938901	**AE1-118 C O1 (Withdrawn : 07/10/2020)**	**2.8640**	**Adder**	**3.37**
938902	**AE1-118 E O1 (Withdrawn : 07/10/2020)**	**7.6258**	**Adder**	**8.97**
939151	AE1-145	1.9210	Adder	2.26
939621	AE1-192 C O1	5.3260	50/50	5.3260
939622	AE1-192 E O1	2.6064	50/50	2.6064
942441	AE2-257 C	2.2451	Adder	2.64
942442	AE2-257 E	5.9190	Adder	6.96
943361	AF1-007 C	0.1214	Adder	0.14
943362	AF1-007 E	0.3452	Adder	0.41
944921	AF1-157 C O1	1.3116	Adder	1.54
944922	AF1-157 E O1	0.8744	Adder	1.03
945661	AF1-231 C	0.7320	Adder	0.86
945662	AF1-231 E	1.0980	Adder	1.29
945781	AF1-243	0.5666	50/50	0.5666
945791	AF1-244	0.9557	50/50	0.9557
945931	AF1-258	0.4949	50/50	0.4949
946041	**AF1-269 (Withdrawn : 05/12/2020)**	**2.9792**	**50/50**	**2.9792**
957611	AF2-055 C	3.9662	50/50	3.9662
957612	AF2-055 E	1.6998	50/50	1.6998
957661	AF2-060	0.4582	Adder	1.02
957671	AF2-061 O1	2.0363	Adder	4.52
959021	AF2-193 C O1	4.0314	Adder	8.95
959022	AF2-193 E O1	10.8747	Adder	24.14
959031	AF2-194 C O1	4.0314	Adder	8.95
959032	AF2-194 E O1	10.8747	Adder	24.14
959051	AF2-196 C	0.3245	Adder	0.72
959052	AF2-196 E	0.7572	Adder	1.68
959161	AF2-207 C O1	2.5390	50/50	2.5390
959162	AF2-207 E O1	3.8084	50/50	3.8084
959571	AF2-248 C	0.4379	50/50	0.4379
959572	AF2-248 E	0.4894	50/50	0.4894
959581	AF2-249 C	0.0773	50/50	0.0773
959582	AF2-249 E	0.3091	50/50	0.3091
959591	AF2-250 C	0.1417	50/50	0.1417
959592	AF2-250 E	0.1095	50/50	0.1095
960341	AF2-325 C	1.4218	50/50	1.4218
960342	AF2-325 E	1.9635	50/50	1.9635
960671	AF2-358 C O1	15.4410	50/50	15.4410

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
960672	AF2-358 E O1	10.2940	50/50	10.2940
960871	AF2-378 C	0.3573	50/50	0.3573
960872	AF2-378 E	0.4957	50/50	0.4957
960881	AF2-379 C	0.2067	50/50	0.2067
960882	AF2-379 E	0.2849	50/50	0.2849
960941	AF2-385 C O1	6.0451	50/50	6.0451
960942	AF2-385 E O1	3.4004	50/50	3.4004
961181	AF2-409 O1	14.9490	50/50	14.9490
NEWTON	NEWTON	0.0752	Confirmed LTF	0.0752
FARMERCITY	FARMERCITY	0.0039	Confirmed LTF	0.0039
CALDERWOOD	CALDERWOOD	0.0348	Confirmed LTF	0.0348
NY	NY	0.0288	Confirmed LTF	0.0288
PRAIRIE	PRAIRIE	0.1808	Confirmed LTF	0.1808
O-066	O-066	0.2890	Confirmed LTF	0.2890
CHEOAH	CHEOAH	0.0350	Confirmed LTF	0.0350
EDWARDS	EDWARDS	0.0245	Confirmed LTF	0.0245
TILTON	TILTON	0.0441	Confirmed LTF	0.0441
G-007	G-007	0.0374	Confirmed LTF	0.0374
GIBSON	GIBSON	0.0382	Confirmed LTF	0.0382
BLUEG	BLUEG	0.1215	Confirmed LTF	0.1215
TRIMBLE	TRIMBLE	0.0390	Confirmed LTF	0.0390
CATAWBA	CATAWBA	0.0245	Confirmed LTF	0.0245

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
101573178	232234	TODD	DP&L	232233	PRESTON	DP&L	1	DPL_P4-2_DP11	breaker	93.0	164.1	164.59	DC	1.02

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
232404	W1-003 C	0.3036	50/50	0.3036
232405	W1-003 E	0.5112	50/50	0.5112
232406	W1-004 FULL	0.3036	50/50	0.3036
232407	W1-004 E	0.5112	50/50	0.5112
232408	W1-005 C	0.3036	50/50	0.3036
232409	W1-005 E	0.5112	50/50	0.5112
232410	W1-006 C	0.3036	50/50	0.3036
232411	W1-006 E	0.5112	50/50	0.5112
232412	X1-032 E	0.4732	50/50	0.4732
232417	X3-008 C	0.5183	50/50	0.5183
232418	X3-008 E	4.9023	50/50	4.9023
232426	Y1-080 FULL	0.0598	50/50	0.0598
232427	Y1-080 E	0.5688	50/50	0.5688
232428	Y3-058 C	0.1521	50/50	0.1521
232429	Y3-058 E	1.4383	50/50	1.4383
232433	Z2-076 E	0.1512	Adder	0.18
232435	Z2-077 E	0.1512	Adder	0.18
232905	BAYVIEW1	0.2443	50/50	0.2443
232907	VN8	3.9453	50/50	3.9453
232919	VN10	0.3965	50/50	0.3965
232921	TASLEY2G	0.4282	50/50	0.4282
232926	CRISFLD1	0.2061	50/50	0.2061
293670	O-025 C	0.1383	50/50	0.1383
917081	Z2-012 C	0.1486	50/50	0.1486
917082	Z2-012 E	1.4052	50/50	1.4052
918831	AA1-102	0.7727	50/50	0.7727
923282	AB1-137 C	0.2879	Adder	0.34
923283	AB1-137 E	0.1234	Adder	0.15
924681	AB2-120 C OP	3.6460	Adder	4.29
924682	AB2-120 E OP	5.9488	Adder	7.0
924781	AB2-130 C OP	3.8511	50/50	3.8511
924782	AB2-130 E OP	6.2834	50/50	6.2834
924831	AB2-136 C	7.6302	50/50	7.6302
924832	AB2-136 E	8.0917	50/50	8.0917
925151	AB2-172 C OP	7.5117	50/50	7.5117
925152	AB2-172 E OP	12.2559	50/50	12.2559
925261	AB2-180 C	2.1652	50/50	2.1652
925262	AB2-180 E	0.9280	50/50	0.9280
927031	AC1-190 C	13.3011	50/50	13.3011
927032	AC1-190 E	5.7005	50/50	5.7005
927191	AC1-213 C	0.4276	50/50	0.4276
927192	AC1-213 E	0.2806	50/50	0.2806

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
930201	AB1-056 C	4.1164	Adder	4.84
930202	AB1-056 E	11.7229	Adder	13.79
930881	AB1-137 C	0.2879	Adder	0.34
930882	AB1-137 E	0.1234	Adder	0.15
932161	AC2-023 C	4.4912	50/50	4.4912
932162	AC2-023 E	3.2710	50/50	3.2710
938651	AE1-087 C	6.3256	50/50	6.3256
938652	AE1-087 E	1.5814	50/50	1.5814
938891	AE1-117 C O1	2.8516	Adder	3.35
938892	AE1-117 E O1	7.5929	Adder	8.93
938901	**AE1-118 C O1 (Withdrawn : 07/10/2020)**	**2.8640**	**Adder**	**3.37**
938902	**AE1-118 E O1 (Withdrawn : 07/10/2020)**	**7.6258**	**Adder**	**8.97**
939151	AE1-145	1.9210	Adder	2.26
939621	AE1-192 C O1	5.3260	50/50	5.3260
939622	AE1-192 E O1	2.6064	50/50	2.6064
942441	AE2-257 C	2.2451	Adder	2.64
942442	AE2-257 E	5.9190	Adder	6.96
943361	AF1-007 C	0.1214	Adder	0.14
943362	AF1-007 E	0.3452	Adder	0.41
944921	AF1-157 C O1	1.3116	Adder	1.54
944922	AF1-157 E O1	0.8744	Adder	1.03
945661	AF1-231 C	0.7320	Adder	0.86
945662	AF1-231 E	1.0980	Adder	1.29
945781	AF1-243	0.5666	50/50	0.5666
945791	AF1-244	0.9557	50/50	0.9557
945931	AF1-258	0.4949	50/50	0.4949
946041	**AF1-269 (Withdrawn : 05/12/2020)**	**2.9792**	**50/50**	**2.9792**
957611	AF2-055 C	3.9662	50/50	3.9662
957612	AF2-055 E	1.6998	50/50	1.6998
957661	AF2-060	0.4582	Adder	1.02
957671	AF2-061 O1	2.0363	Adder	4.52
959021	AF2-193 C O1	4.0314	Adder	8.95
959022	AF2-193 E O1	10.8747	Adder	24.14
959031	AF2-194 C O1	4.0314	Adder	8.95
959032	AF2-194 E O1	10.8747	Adder	24.14
959051	AF2-196 C	0.3245	Adder	0.72
959052	AF2-196 E	0.7572	Adder	1.68
959161	AF2-207 C O1	2.5390	50/50	2.5390
959162	AF2-207 E O1	3.8084	50/50	3.8084
959571	AF2-248 C	0.4379	50/50	0.4379
959572	AF2-248 E	0.4894	50/50	0.4894
959581	AF2-249 C	0.0773	50/50	0.0773
959582	AF2-249 E	0.3091	50/50	0.3091
959591	AF2-250 C	0.1417	50/50	0.1417
959592	AF2-250 E	0.1095	50/50	0.1095
960341	AF2-325 C	1.4218	50/50	1.4218
960342	AF2-325 E	1.9635	50/50	1.9635
960671	AF2-358 C O1	15.4410	50/50	15.4410

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
960672	AF2-358 E O1	10.2940	50/50	10.2940
960871	AF2-378 C	0.3573	50/50	0.3573
960872	AF2-378 E	0.4957	50/50	0.4957
960881	AF2-379 C	0.2067	50/50	0.2067
960882	AF2-379 E	0.2849	50/50	0.2849
960941	AF2-385 C O1	6.0451	50/50	6.0451
960942	AF2-385 E O1	3.4004	50/50	3.4004
961181	AF2-409 O1	14.9490	50/50	14.9490
NEWTON	NEWTON	0.0752	Confirmed LTF	0.0752
FARMERCITY	FARMERCITY	0.0039	Confirmed LTF	0.0039
CALDERWOOD	CALDERWOOD	0.0348	Confirmed LTF	0.0348
NY	NY	0.0288	Confirmed LTF	0.0288
PRAIRIE	PRAIRIE	0.1808	Confirmed LTF	0.1808
O-066	O-066	0.2890	Confirmed LTF	0.2890
CHEOAH	CHEOAH	0.0350	Confirmed LTF	0.0350
EDWARDS	EDWARDS	0.0245	Confirmed LTF	0.0245
TILTON	TILTON	0.0441	Confirmed LTF	0.0441
G-007	G-007	0.0374	Confirmed LTF	0.0374
GIBSON	GIBSON	0.0382	Confirmed LTF	0.0382
BLUEG	BLUEG	0.1215	Confirmed LTF	0.1215
TRIMBLE	TRIMBLE	0.0390	Confirmed LTF	0.0390
CATAWBA	CATAWBA	0.0245	Confirmed LTF	0.0245

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
101573305	232241	VIENN_69	DP&L	232838	MARDELA	DP&L	1	DPL_P4-2_DP56	breaker	64.0	102.33	103.07	DC	0.9

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
232417	X3-008 C	0.1889	50/50	0.1889
232418	X3-008 E	1.7872	50/50	1.7872
232426	Y1-080 FULL	0.0384	50/50	0.0384
232427	Y1-080 E	0.3652	50/50	0.3652
232919	VN10	0.3322	50/50	0.3322
924831	AB2-136 C	4.0942	50/50	4.0942
924832	AB2-136 E	4.3419	50/50	4.3419
925151	AB2-172 C OP	2.7385	50/50	2.7385
925152	AB2-172 E OP	4.4680	50/50	4.4680
927031	AC1-190 C	5.1726	50/50	5.1726
927032	AC1-190 E	2.2169	50/50	2.2169
938651	AE1-087 C	2.3061	50/50	2.3061
938652	AE1-087 E	0.5765	50/50	0.5765
939152	AE1-145 BAT	1.9916	Merchant Transmission	1.9916
945663	AF1-231 BAT	1.9002	50/50	1.9002
945782	AF1-243 BAT	0.5014	50/50	0.5014
945792	AF1-244 BAT	0.9508	50/50	0.9508
946041	**AF1-269 (Withdrawn : 05/12/2020)**	**1.9129**	**50/50**	**1.9129**
957613	AF2-055 BAT	3.0081	50/50	3.0081
957662	AF2-060 BAT	0.4750	Merchant Transmission	0.4750
957672	AF2-061 BAT	2.1111	Merchant Transmission	2.1111
959163	AF2-207 BAT	2.2740	Merchant Transmission	2.2740
959583	AF2-249 BAT	0.3913	50/50	0.3913
960341	AF2-325 C	0.6624	50/50	0.6624
960342	AF2-325 E	0.9147	50/50	0.9147
960671	AF2-358 C O1	10.6278	50/50	10.6278
960672	AF2-358 E O1	7.0852	50/50	7.0852
960871	AF2-378 C	0.1795	50/50	0.1795
960872	AF2-378 E	0.2490	50/50	0.2490
961181	AF2-409 O1	2.3120	Adder	5.13
WEC	WEC	0.0095	Confirmed LTF	0.0095
LGEE	LGEE	0.0171	Confirmed LTF	0.0171
CPLE	CPLE	0.0198	Confirmed LTF	0.0198
G-007A	G-007A	0.0527	Confirmed LTF	0.0527
VFT	VFT	0.1548	Confirmed LTF	0.1548
CBM-W2	CBM-W2	0.2457	Confirmed LTF	0.2457
CBM-W1	CBM-W1	0.3753	Confirmed LTF	0.3753
TVA	TVA	0.0420	Confirmed LTF	0.0420
CBM-S2	CBM-S2	0.1734	Confirmed LTF	0.1734
CBM-S1	CBM-S1	0.2556	Confirmed LTF	0.2556
MEC	MEC	0.0477	Confirmed LTF	0.0477

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
101573459	232274	PINEY_69	DP&L	232272	M HERMON	DP&L	1	DPL_P4-2_DP15	breaker	174.0	101.09	102.33	DC	2.26

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
232405	W1-003 E	0.9141	Adder	1.08
232407	W1-004 E	0.9141	Adder	1.08
232409	W1-005 E	0.9141	Adder	1.08
232411	W1-006 E	0.9141	Adder	1.08
232412	X1-032 E	0.6828	Adder	0.8
232905	BAYVIEW1	0.5266	50/50	0.5266
232914	OH NUG3	1.3527	50/50	1.3527
232915	OH NUG4	1.3527	50/50	1.3527
232916	OH NUG5	1.3527	50/50	1.3527
232921	TASLEY2G	0.9228	50/50	0.9228
917081	Z2-012 C	0.3201	50/50	0.3201
917082	Z2-012 E	3.0282	50/50	3.0282
924681	AB2-120 C OP	9.2256	50/50	9.2256
924682	AB2-120 E OP	15.0524	50/50	15.0524
939151	AE1-145	5.0328	50/50	5.0328
939621	AE1-192 C O1	11.4779	50/50	11.4779
939622	AE1-192 E O1	5.6168	50/50	5.6168
945661	AF1-231 C	1.5520	Adder	1.83
945662	AF1-231 E	2.3280	Adder	2.74
945781	AF1-243	1.2211	50/50	1.2211
945791	AF1-244	1.3028	Adder	1.53
957611	AF2-055 C	8.5474	50/50	8.5474
957612	AF2-055 E	3.6632	50/50	3.6632
957661	AF2-060	2.2648	50/50	2.2648
957671	AF2-061 O1	10.0656	50/50	10.0656
959163	AF2-207 BAT	2.0662	Merchant Transmission	2.0662
959583	AF2-249 BAT	0.1722	Merchant Transmission	0.1722
960881	AF2-379 C	0.0456	Adder	0.1
960882	AF2-379 E	0.0628	Adder	0.14
NEWTON	NEWTON	0.0612	Confirmed LTF	0.0612
FARMERCITY	FARMERCITY	0.0032	Confirmed LTF	0.0032
CALDERWOOD	CALDERWOOD	0.0283	Confirmed LTF	0.0283
NY	NY	0.0332	Confirmed LTF	0.0332
PRAIRIE	PRAIRIE	0.1472	Confirmed LTF	0.1472
O-066	O-066	0.4032	Confirmed LTF	0.4032
CHEOAH	CHEOAH	0.0285	Confirmed LTF	0.0285
EDWARDS	EDWARDS	0.0199	Confirmed LTF	0.0199
TILTON	TILTON	0.0359	Confirmed LTF	0.0359
G-007	G-007	0.0624	Confirmed LTF	0.0624
GIBSON	GIBSON	0.0311	Confirmed LTF	0.0311
BLUEG	BLUEG	0.0990	Confirmed LTF	0.0990
TRIMBLE	TRIMBLE	0.0317	Confirmed LTF	0.0317

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
CATAWBA	CATAWBA	0.0199	Confirmed LTF	0.0199

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
101573458	924680	AB2-120 TAP	DP&L	232128	PINEY138	DP&L	1	DPL_P4-2_DP60C	breaker	226.0	105.06	105.82	DC	3.77

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
232405	W1-003 E	1.7476	Adder	2.06
232407	W1-004 E	1.7476	Adder	2.06
232409	W1-005 E	1.7476	Adder	2.06
232411	W1-006 E	1.7476	Adder	2.06
232412	X1-032 E	1.1231	Adder	1.32
232912	OH NUG1	2.7254	50/50	2.7254
232913	OH NUG2	2.6891	50/50	2.6891
232914	OH NUG3	2.7254	50/50	2.7254
232915	OH NUG4	2.7254	50/50	2.7254
232916	OH NUG5	2.7254	50/50	2.7254
232917	OH NUG6	2.7133	50/50	2.7133
232918	OH NUG7	2.7073	50/50	2.7073
917082	Z2-012 E	4.6462	Adder	5.47
924681	AB2-120 C OP	20.3004	50/50	20.3004
924682	AB2-120 E OP	33.1216	50/50	33.1216
939151	AE1-145	7.1177	Adder	8.37
939621	AE1-192 C O1	17.6108	Adder	20.72
939622	AE1-192 E O1	8.6180	Adder	10.14
945661	AF1-231 C	3.1271	Adder	3.68
945662	AF1-231 E	5.5184	50/50	5.5184
945781	AF1-243	1.8735	Adder	2.2
945791	AF1-244	2.0376	Adder	2.4
957611	AF2-055 C	6.9506	Adder	15.43
957612	AF2-055 E	2.9788	Adder	6.61
957661	AF2-060	1.6976	Adder	3.77
957671	AF2-061 O1	7.5448	Adder	16.75
960881	AF2-379 C	0.1160	Adder	0.26
960882	AF2-379 E	0.1599	Adder	0.35
NEWTON	NEWTON	0.1236	Confirmed LTF	0.1236
FARMERCITY	FARMERCITY	0.0064	Confirmed LTF	0.0064
CALDERWOOD	CALDERWOOD	0.0572	Confirmed LTF	0.0572
NY	NY	0.0664	Confirmed LTF	0.0664
PRAIRIE	PRAIRIE	0.2970	Confirmed LTF	0.2970
O-066	O-066	0.8131	Confirmed LTF	0.8131
CHEOAH	CHEOAH	0.0576	Confirmed LTF	0.0576
EDWARDS	EDWARDS	0.0403	Confirmed LTF	0.0403
TILTON	TILTON	0.0725	Confirmed LTF	0.0725
G-007	G-007	0.1279	Confirmed LTF	0.1279
GIBSON	GIBSON	0.0628	Confirmed LTF	0.0628
BLUEG	BLUEG	0.1996	Confirmed LTF	0.1996
TRIMBLE	TRIMBLE	0.0640	Confirmed LTF	0.0640
CATAWBA	CATAWBA	0.0403	Confirmed LTF	0.0403

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
AA1-102	Kings Creek-Loretto 138kV	Partially in Service - Under Construction
AB1-056	Indian River 230kV I	Engineering and Procurement
AB1-137	Frankford 25kV	Engineering and Procurement
AB2-120	Piney Grove-New Church 138kV	Active
AB2-130	Laurel 69kV	Active
AB2-136	West Cambridge-Vienna 69kV	Active
AB2-172	Todd 69kV	Active
AB2-180	Rockawalkin 69kV	Active
AC1-190	East New Market 69kV	Active
AC1-213	North Salisbury 25kV	Active
AC2-023	Hebron 69kV	Active
AE1-087	Todd 69 kV	Active
AE1-117	Bethany 138 kV	Active
AE1-118	Bethany-138th Street 138 kV	Withdrawn
AE1-145	Wallops Island 69 kV	Active
AE1-192	Belle Haven-Tasley 69 kV	Active
AE2-257	Cedar Neck 69 kV	Active
AF1-007	Indian River 230 kV I	Active
AF1-157	Laurel-Sussex 69 kV	Active
AF1-231	New Church 138 kV	Active
AF1-243	Tasley 25 kV	Active
AF1-244	Kingston 25 kV	Active
AF1-258	Rockawalkin 69 kV	Active
AF1-269	Airey-Golden Hill 69 kV	Withdrawn
AF2-055	Plantation 69 kV	Active
AF2-060	Wattsville 12 kV	Active
AF2-061	Wattsville 69kV	Active
AF2-193	Indian River 230 kV I	Active
AF2-194	Indian River 230 kV II	Active
AF2-196	Cedar Neck 69 kV II	Active
AF2-207	Nelson 69 kV	Active
AF2-248	Edgewood 12 kV I	Active
AF2-249	Edgewood 12 kV II	Active
AF2-250	Edgewood 12 kV III	Active
AF2-325	Jacktown 12 kV	Active
AF2-358	Airey-Vienna 69 kV	Active
AF2-378	Cambridge 12 kV	Active
AF2-379	Princess Anne 25 kV	Active
AF2-385	Nelson 69 kV	Active

Queue Number	Project Name	Status
AF2-409	Vienna 138 kV	Active
W1-003	Oak Hall	In Service
W1-004	Oak Hall	In Service
W1-005	Oak Hall	In Service
W1-006	Oak Hall	In Service
X1-032	Costen 25kV	In Service
X3-008	Todd 69kV	Under Construction
Y1-080	Dorchester 12kV	In Service
Y3-058	Rockawalkin 69kV	In Service
Z2-012	Weirwood-Eastville 69kV	In Service
Z2-076	Worcester South 25kV	In Service
Z2-077	Worcester North 25kV	In Service

11.8 Contingency Descriptions

Contingency Name	Contingency Definition
DPL_P4-2_DP11	CONTINGENCY 'DPL_P4-2_DP11' /*STEELE BUS BREAKER TO MILFORD DISCONNECT BRANCH FROM BUS 232004 TO BUS 232000 CKT 1 /*MILFORD STEELE 230 230 DISCONNECT BRANCH FROM BUS 232000 TO BUS 232005 CKT 1 /*STEELE VIENNA 230 230 END
DPL_P4-2_DP15	CONTINGENCY 'DPL_P4-2_DP15' /*INDIAN RIVER BUS BREAKER TO PINEY GROVE DISCONNECT BRANCH FROM BUS 232007 TO BUS 232006 CKT 1 /*PINEY GR INDRIV 4 230 230 DISCONNECT BRANCH FROM BUS 232007 TO BUS 232128 CKT 1 /*PINEY GR PINEY GR 230 138 DISCONNECT BRANCH FROM BUS 232006 TO BUS 232004 CKT 1 /*MILFORD INDIAN RIVER 230 230 END
DPL_P1_2_PINEY138-WATTSVILLE	CONTINGENCY 'DPL_P1_2_PINEY138-WATTSVILLE' DISCONNECT BRANCH FROM BUS 232128 TO BUS 232133 CKT 1 END
DPL_P4-2_DP60C	CONTINGENCY 'DPL_P4-2_DP60C' /*PINEY GROVE BUS BREAKER DISCONNECT BRANCH FROM BUS 232128 TO BUS 232133 CKT 1 /*PINEY GROVE WATTSVILLE 138 138 DISCONNECT BRANCH FROM BUS 232128 TO BUS 232127 CKT 1 /*PINEY GROVE LORETTO 138 138 END
DPL_P1_2_CKT 23002	CONTINGENCY 'DPL_P1_2_CKT 23002' DISCONNECT BUS 232007 /INDIAN RIVER - PINEY GROVE 230 & PNY GRV AT-20 XFMER END
DPL_P4-2_DP56	CONTINGENCY 'DPL_P4-2_DP56' /*LORETTO BUS BREAKER DISCONNECT BRANCH FROM BUS 232127 TO BUS 232117 CKT 1 /*LORETTO VIENNA 138 1380 DISCONNECT BRANCH FROM BUS 232127 TO BUS 232128 CKT 1 /*LORETTO PINEY GROVE 138 138 END
DPL_P1_2_CKT 13787	CONTINGENCY 'DPL_P1_2_CKT 13787' OPEN LINE FROM BUS 232132 TO BUS 232130 CIRCUIT 1 /OAK HALL - POCOMOKE 138 END

Contingency Name	Contingency Definition
DPL_P1_2_CKT 13713	CONTINGENCY 'DPL_P1_2_CKT 13713' OPEN LINE FROM BUS 232129 TO BUS 232127 CIRCUIT 1 /KINGS CREEK - LORETTO 138 END
Base Case	
DPL_P1_2_CKT 13789	CONTINGENCY 'DPL_P1_2_CKT 13789' OPEN LINE FROM BUS 232132 TO BUS 232133 CIRCUIT 1 /OAK HALL - WATTSVILLE 138 END

12 Short Circuit Analysis

Short circuit will be studied in the System Impact Study phase.

13 Affected Systems

None