



**Generation Interconnection
Feasibility Study Report
for
Queue Project AE2-137
YUKON-ROBBINS 138 KV II
87 MW Capacity / 84 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 West Penn Power.

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.

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 Natural Gas generating facility located in Westmoreland County, Pennsylvania. The installed facilities will have a capability of 625 MW with 600 MW of this output being recognized by PJM as capacity. This queue request is for an additional 84 MW of energy and 87 MWs being recognized by PJM as capacity.

Note that this project is an increase to the Interconnection Customer's AA2-161 projects, which will share the same property and connection point. The conduct of light load analysis as required under the PJM planning process is not performed during the Generation Interconnection Feasibility Study phase of the PJM study process. Additional reinforcement requirements for this Interconnection Request may be defined during the conduct of the light load analysis which shall be performed following execution of the System Impact Study agreement.

| | |
|---------------------------------|-------------------------|
| Queue Number | AE2-137 |
| Project Name | YUKON-ROBBINS 138 KV II |
| Interconnection Customer | |
| State | Pennsylvania |
| County | Westmoreland |
| Transmission Owner | West Penn Power - APS |
| MFO | 625 |
| MWE | 84 |
| MWC | 87 |
| Fuel | Natural Gas |
| Basecase Study Year | 2022 |

3.1 Point of Interconnection

AE2-137 is an update to the AA2-161 project. As such, no direct connection facilities are required for the IC request.

3.2 Cost Summary

The AE2-137 project will be responsible for the following costs:

| Description | Total Cost |
|--|-------------|
| Attachment Facilities | \$ 0 |
| Direct Connection Network Upgrade | \$ 0 |
| Non Direct Connection Network Upgrades | \$ 0 |
| Total Costs | \$ 0 |

In addition, the AE2-137 project may be responsible for a contribution to the following costs

| Description | Total Cost |
|-----------------|---------------|
| System Upgrades | \$ 51,853,100 |

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

AE2-137 is an uprate to the AA2-161 project. As such, no direct connection facilities are required for the IC request.

5 Attachment Facilities

There is no Attachment Facility scope of work required.

6 Direct Connection Cost Estimate

There is no Direct Connection scope of work required.

7 Non-Direct Connection Cost Estimate

There is no Non-Direct Connection scope of work required.

8 Schedule

No Attachment, Direct and Non-Direct Connection facilities are required for this connection.

9 Transmission Owner Analysis

N/A

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 FE's "Requirements for Transmission Connected Facilities" document located at:

<http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx>. 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 FE's "Requirements for Transmission Connected Facilities" document located at: <http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx>. In particular, the IC is responsible for the following:

1. The purchase and installation of a fully rated 138 kV circuit breaker to protect the AE2-137 generator lead line. A single circuit breaker must be used to protect this line; if the project has several GSU transformers, the individual GSU transformer breakers cannot be used to protect this line.
2. The purchase and installation of the minimum required FE generation interconnection relaying and control facilities. 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 FE Transmission System Control Center.
4. Compliance with the FE and PJM generator power factor and voltage control requirements.
5. The execution of a back-up service agreement to serve the customer load supplied from the AE2-137 generation project metering point when the units are out-of-service. This assumes the intent of the IC is to net the generation with the load.

The IC will also be required to meet all PJM, ReliabilityFirst, 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 ReliabilityFirst 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 FE system.

10.3 Power Factor Requirements

The existing 541 MW portion of the Customer Facility shall retain its existing ability to maintain a power factor of at least 0.95 leading (absorbing VARs) to 0.90 lagging (supplying VARs) measured at the generator's

terminals. The increase of 84 MW to the Customer Facilities associated with the AE2-137 project shall be designed with the ability to maintain a Power Factor of at least 1.0 (unity) to 0.90 lagging (supplying VARs) measured at the generator's terminals.

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.

11.2 FE Requirements

The IC will be required to comply with all FE revenue metering requirements for generation interconnection customers which can be found in FE's "Requirements for Transmission Connected Facilities" document located at: <http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx>

12 Network Impacts

The Queue Project AE2-137 was evaluated as a 84.0 MW (Capacity 87.0 MW) uprate to AA2-161 tapping the Yukon to Robbins 138kV line and the Wycoff to Springdale 138kV lines in the APS area. Project AE2-137 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-137 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Load Flow

13 Generation Deliverability

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

None

14 Multiple Facility Contingency

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

None

15 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 |
|---------|-----------|-----------|---------------|---------|----------|-------------|--------|---|---------|------------|-----------------------|------------------------|-------|-----------|
| 1509872 | 235124 | 01MITCHL | AP | 254011 | 15ELRAMA | DLCO | 1 | AP-P2-3-WP-138-183T | breaker | 590.0 | 120.75 | 122.41 | DC | 9.78 |
| 1511033 | 235124 | 01MITCHL | AP | 254011 | 15ELRAMA | DLCO | 1 | DLC_P71_ELRAMA-ROUTE51_ELRAMA-WYCOFFTAP | tower | 590.0 | 145.55 | 147.7 | DC | 12.67 |
| 1511034 | 235124 | 01MITCHL | AP | 254011 | 15ELRAMA | DLCO | 1 | APS-P7-WP-138-9904 | tower | 590.0 | 145.5 | 147.65 | DC | 12.67 |
| 1510047 | 235135 | 01ALLENP | AP | 235161 | 01CHARLR | AP | 1 | AP-P2-3-WP-138-183T | breaker | 295.0 | 108.4 | 109.36 | DC | 6.28 |
| 1509839 | 235140 | 01BELMON | AP | 235161 | 01CHARLR | AP | 1 | AP-P2-3-WP-138-183T | breaker | 229.0 | 126.19 | 127.5 | DC | 6.67 |
| 1511244 | 235161 | 01CHARLR | AP | 235260 | 01UNIONJ | AP | 1 | DLC_P71_ELRAMA-ROUTE51_ELRAMA-WYCOFFTAP | tower | 302.0 | 101.54 | 102.28 | DC | 4.94 |
| 1511245 | 235161 | 01CHARLR | AP | 235260 | 01UNIONJ | AP | 1 | APS-P7-WP-138-9904 | tower | 302.0 | 101.54 | 102.28 | DC | 4.94 |
| 1510046 | 235183 | 01FRAZR | AP | 235135 | 01ALLENP | AP | 1 | AP-P2-3-WP-138-183T | breaker | 295.0 | 108.47 | 109.43 | DC | 6.28 |
| 1510083 | 235247 | 01SHEPLR | AP | 235124 | 01MITCHL | AP | 1 | AP-P2-3-WP-138-183T | breaker | 292.0 | 106.38 | 107.26 | DC | 5.73 |
| 1509840 | 235251 | 01SMTH61 | AP | 235209 | 01LAYTON | AP | 1 | AP-P2-3-WP-138-183T | breaker | 297.0 | 126.97 | 128.11 | DC | 7.53 |
| 1509963 | 235252 | 01SMTH62 | AP | 235247 | 01SHEPLR | AP | 1 | AP-P2-3-WP-138-183T | breaker | 566.0 | 113.04 | 115.23 | DC | 12.4 |
| 1509838 | 235277 | 01YUKON | AP | 235251 | 01SMTH61 | AP | 1 | AP-P2-3-WP-138-183T | breaker | 297.0 | 127.17 | 128.31 | DC | 7.53 |
| 1509931 | 235277 | 01YUKON | AP | 235252 | 01SMTH62 | AP | 1 | AP-P2-3-WP-138-183T | breaker | 566.0 | 115.37 | 117.56 | DC | 12.4 |
| 1511101 | 235283 | 01ROUTE51 | AP | 235161 | 01CHARLR | AP | 1 | APS-P7-WP-138-9904 | tower | 342.0 | 121.72 | 124.89 | DC | 10.87 |
| 1511102 | 235283 | 01ROUTE51 | AP | 235161 | 01CHARLR | AP | 1 | DLC_P71_ELRAMA-ROUTE51_ELRAMA-WYCOFFTAP | tower | 342.0 | 121.72 | 124.89 | DC | 10.87 |
| 1511107 | 235283 | 01ROUTE51 | AP | 235161 | 01CHARLR | AP | 2 | APS-P7-WP-138-9904 | tower | 342.0 | 119.25 | 122.37 | DC | 10.65 |
| 1511108 | 235283 | 01ROUTE51 | AP | 235161 | 01CHARLR | AP | 2 | DLC_P71_ELRAMA-ROUTE51_ELRAMA-WYCOFFTAP | tower | 342.0 | 119.25 | 122.37 | DC | 10.65 |
| 1510821 | 254011 | 15ELRAMA | DLCO | 254018 | 15WILSON | DLCO | 2 | DLC_P12_Z-11 | single | 717.0 | 106.33 | 108.12 | DC | 12.82 |
| 1510877 | 254011 | 15ELRAMA | DLCO | 254018 | 15WILSON | DLCO | 1 | DLC_P12_Z-17 | single | 717.0 | 102.4 | 104.14 | DC | 12.42 |
| 1511057 | 254011 | 15ELRAMA | DLCO | 254018 | 15WILSON | DLCO | 1 | DLC_P71_Z-18_DRAV-ELRAMA | tower | 717.0 | 132.68 | 134.93 | DC | 16.16 |
| 1509231 | 254018 | 15WILSON | DLCO | 254023 | 15WMIFFN | DLCO | 1 | DLC_P22_DRAV_Z-138 | bus | 419.0 | 134.93 | 137.5 | DC | 10.73 |
| 1509284 | 254018 | 15WILSON | DLCO | 254028 | 15DRAVO | DLCO | 1 | DLC_P22_DRAV_Z-138 | bus | 510.0 | 125.82 | 128.22 | DC | 12.24 |
| 1509695 | 254018 | 15WILSON | DLCO | 254023 | 15WMIFFN | DLCO | 1 | DLC_P24_WILS_6-7_138 | breaker | 419.0 | 140.19 | 142.79 | DC | 10.87 |
| 1509696 | 254018 | 15WILSON | DLCO | 254023 | 15WMIFFN | DLCO | 1 | DLC_P23_DRAV_Z-107 | breaker | 419.0 | 134.93 | 137.5 | DC | 10.73 |
| 1509809 | 254018 | 15WILSON | DLCO | 254028 | 15DRAVO | DLCO | 1 | DLC_P23_DRAV_Z-15 | breaker | 510.0 | 125.82 | 128.22 | DC | 12.24 |
| 1509810 | 254018 | 15WILSON | DLCO | 254028 | 15DRAVO | DLCO | 1 | DLC_P24_DRAV_Z-1-3_138 | breaker | 510.0 | 108.72 | 110.66 | DC | 9.87 |
| 1510796 | 254018 | 15WILSON | DLCO | 254028 | 15DRAVO | DLCO | 1 | DLC_P12_Z-13 | single | 510.0 | 107.41 | 109.43 | DC | 10.26 |
| 1510798 | 254018 | 15WILSON | DLCO | 254028 | 15DRAVO | DLCO | 1 | DLC_P12_Z-74 | single | 510.0 | 104.34 | 106.35 | DC | 10.26 |
| 1510807 | 254018 | 15WILSON | DLCO | 254023 | 15WMIFFN | DLCO | 1 | DLC_P12_Z-72 | single | 419.0 | 107.03 | 109.04 | DC | 8.43 |

| 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 |
|---------|-----------|----------|---------------|---------|----------|-------------|--------|--------------------------|---------|------------|-----------------------|------------------------|-------|-----------|
| 1511055 | 254018 | 15WILSON | DLCO | 254028 | 15DRAVO | DLCO | 1 | DLC_P71_Z-13_DRAV-ELRAMA | tower | 510.0 | 135.83 | 138.37 | DC | 12.92 |
| 1511056 | 254018 | 15WILSON | DLCO | 254028 | 15DRAVO | DLCO | 1 | DLC_P71_Z-73_DRAV-ELRAMA | tower | 510.0 | 132.38 | 134.92 | DC | 12.92 |
| 1509218 | 254023 | 15WMIFFN | DLCO | 254028 | 15DRAVO | DLCO | 1 | DLC_P22_DRAV_2_138 | bus | 382.0 | 140.6 | 143.4 | DC | 10.73 |
| 1509650 | 254023 | 15WMIFFN | DLCO | 254028 | 15DRAVO | DLCO | 1 | DLC_P24_WILS_6-7_138 | breaker | 382.0 | 146.36 | 149.21 | DC | 10.87 |
| 1509651 | 254023 | 15WMIFFN | DLCO | 254028 | 15DRAVO | DLCO | 1 | DLC_P23_DRAV_Z-107 | breaker | 382.0 | 140.6 | 143.4 | DC | 10.73 |
| 1510739 | 254023 | 15WMIFFN | DLCO | 254028 | 15DRAVO | DLCO | 1 | DLC_P12_Z-72 | single | 382.0 | 110.01 | 112.22 | DC | 8.43 |
| 1510127 | 254028 | 15DRAVO | DLCO | 254025 | 15BETTIS | DLCO | 1 | DLC_P24_DRAV_1-3_138 | breaker | 252.0 | 101.53 | 102.69 | DC | 6.51 |

16 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 |
|---------|-----------|-------------|---------------|---------|-----------|-------------|--------|------------------------|-----------|------------|-----------------------|------------------------|-------|-----------|
| 1510822 | 254011 | 15ELRAMA | DLCO | 254018 | 15WILSON | DLCO | 2 | DLC_P12_Z-11 | operation | 717.0 | 105.93 | 107.72 | DC | 12.82 |
| 1510876 | 254011 | 15ELRAMA | DLCO | 254018 | 15WILSON | DLCO | 1 | DLC_P12_Z-17 | operation | 717.0 | 102.72 | 104.45 | DC | 12.42 |
| 1510795 | 254018 | 15WILSON | DLCO | 254028 | 15DRAVO | DLCO | 1 | DLC_P12_Z-13 | operation | 510.0 | 107.61 | 109.62 | DC | 10.26 |
| 1510808 | 254018 | 15WILSON | DLCO | 254023 | 15WMIFFN | DLCO | 1 | DLC_P12_Z-72 | operation | 419.0 | 106.32 | 107.22 | DC | 8.43 |
| 1510740 | 254023 | 15WMIFFN | DLCO | 254028 | 15DRAVO | DLCO | 1 | DLC_P12_Z-72 | operation | 382.0 | 109.23 | 110.23 | DC | 8.43 |
| 1510407 | 920570 | AA2-161 TAP | AP | 235283 | 01ROUTE51 | AP | 3 | PJM_P1_APS_B_G692 | operation | 376.0 | 121.33 | 126.84 | DC | 20.73 |
| 1510408 | 920570 | AA2-161 TAP | AP | 235283 | 01ROUTE51 | AP | 3 | Base Case | operation | 308.0 | 118.9 | 125.67 | DC | 20.84 |
| 1510338 | 920580 | AA2-161 TAP | AP | 235283 | 01ROUTE51 | AP | 1 | APS-P1_2-WP-138-9903-A | operation | 365.0 | 164.41 | 173.76 | DC | 34.12 |
| 1510341 | 920580 | AA2-161 TAP | AP | 235283 | 01ROUTE51 | AP | 1 | Base Case | operation | 297.0 | 138.41 | 146.28 | DC | 23.36 |

17 System Reinforcements

| ID | Index | Facility | Upgrade Description | Cost |
|---------------------------------|-------|--|---|--------------|
| 1509651,1509218,1509650,1510739 | 20 | 15WMIFFN 138.0 kV - 15DRAVO 138.0 kV Ckt 1 | <p>b3061 (376) : PJM baseline upgrade b3061: Reconductor the West Mifflin - Dravosburg (Z-73) and Dravosburg - Elrama (Z-75) 138 kV lines. The baseline project has a projected in-service date of 06/01/2021. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> <p>b3065 (380) : PJM baseline upgrade b3065: Install 138 kV tie breaker at Wilson. The baseline project has a projected in-service date of 06/01/2021. Project Type : CON Cost : \$0 Time Estimate : N/A</p> | \$0 |
| 1509838 | 11 | 01YUKON 138.0 kV - 01SMTH61 138.0 kV Ckt 1 | <p>Invalid Contingency - Baseline Projects: It has been determined that this contingency is invalid; therefore the violation is invalid. This is due to the following baseline projects in APS. The necessary contingency corrections will be evaluated and revised in the AE2 impact study phase.</p> <p>b3028: PJM Baseline Upgrade b3028. Upgrade substation disconnect leads at William 138 kV Substation. The baseline project has a projected in-service date of 06/01/2021. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> <p>b3006: PJM Baseline Upgrade b3006. Replace four Yukon 500/138 kV transformers with three transformers with higher rating and reconfigure 500 kV bus. The baseline project has a projected in-service date of 06/01/2021. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> <p>b3083: Replace substation conductor at Butler (138 kV) Replace substation conductor and line trap at Karns City (138 kV). The baseline project has a projected in-service date of 06/01/2021. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> <p>b3081: PJM Baseline Upgrade b3081. Replace 138 kV breaker and substation conductor at Krendale. The baseline project has a projected in-service date of 06/01/2022. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> | \$0 |
| 1511245,1511244 | 4 | 01CHARLR 138.0 kV - 01UNIONJ 138.0 kV Ckt 1 | <p>WP-0003 (173) : Reconductor 4/0 Cu Line Project Type : FAC Cost : \$11,960,000 Time Estimate : 20.0 Months</p> | \$11,960,000 |

| ID | Index | Facility | Upgrade Description | Cost |
|-----------------------------|-------|--|---|------|
| 1510046 | 5 | 01FRAZR 138.0 kV - 01ALLENP 138.0 kV Ckt 1 | <p><u>1510046</u> Invalid Contingency - Baseline Projects: It has been determined that this contingency is invalid; therefore the violation is invalid. This is due to the following baseline projects in APS. The necessary contingency corrections will be evaluated and revised in the AE2 impact study phase.</p> <p>b3028: PJM Baseline Upgrade b3028. Upgrade substation disconnect leads at William 138 kV Substation. The baseline project has a projected in-service date of 06/01/2021. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> <p>b3006: PJM Baseline Upgrade b3006. Replace four Yukon 500/138 kV transformers with three transformers with higher rating and reconfigure 500 kV bus. The baseline project has a projected in-service date of 06/01/2021. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> <p>b3083: Replace substation conductor at Butler (138 kV) Replace substation conductor and line trap at Karns City (138 kV). The baseline project has a projected in-service date of 06/01/2021. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> <p>b3081: PJM Baseline Upgrade b3081. Replace 138 kV breaker and substation conductor at Krendale. The baseline project has a projected in-service date of 06/01/2022. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> | \$0 |
| 1511034,1509872,15 11033 | 1 | 01MITCHL 138.0 kV - 15ELRAMA 138.0 kV Ckt 1 | <p><u>1511033,1511034</u> b3012.1 (375) : PJM baseline upgrade b3012.1: Construct two new 138 kV ties on separate pole lines from FEs new substation to DUQs new substation. The estimated line length is approximately 4.7 miles. The line is planned to use multiple ACSS conductors per phase. The baseline project has a projected in-service date of 06/01/2021. Project Type : CON Cost : \$0 Time Estimate : N/A</p> | \$0 |

| ID | Index | Facility | Upgrade Description | Cost |
|-----------------|-------|---|--|--------------|
| 1511107,1511108 | 15 | 01ROUTE51 138.0 kV - 01CHARLR 138.0 kV Ckt 2 | <p>WP-0011 (206) : Replace Wavetrap at Charleroi Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months</p> <p>WP-0011a (207) : Replace KD-4 Line Relay at Charleroi Project Type : FAC Cost : \$325,000 Time Estimate : 12.0 Months</p> <p>WP-0011b (208) : Replace KD-41 Line Relay at Charleroi Project Type : FAC Cost : \$325,000 Time Estimate : 12.0 Months</p> <p>WP-0011c (209) : Replace Charleroi Bus Taps Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months</p> <p>WP-0011d (210) : Replace Bus Side Disconnect Leads at Charleroi Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months</p> <p>WP-0011e (211) : Replace Disconnect Leads at Charleroi Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months</p> <p>WP-0011f (212) : Replace Bus Side Breaker Risers at Charleroi Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months</p> <p>WP-0011g (213) : Replace Line Side Breaker Risers Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months</p> <p>WP-0011h (214) : Replace Line Riser at Charleroi Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months</p> <p>WP-0011i (215) : Replace 1024 Line Conductor Project Type : FAC Cost : \$5,850,000 Time Estimate : 9.0 Months</p> <p>WP-0011j (216) : Replace 954 Line Conductor Project Type : FAC Cost : \$6,999,200 Time Estimate : 9.0 Months</p> <p>WP-0011k (217) : Replace Bus Side Disconnect Switch Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months</p> <p>WP-0011l (218) : Replace Line Side Disconnect Switch Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months</p> <p>WP-0011m (219) : Replace Airswitch at Charleroi Project Type : FAC Cost : \$195,000 Time Estimate : 9.0 Months</p> | \$14,864,200 |

| ID | Index | Facility | Upgrade Description | Cost |
|---------|-------|--|---|------|
| 1509839 | 3 | 01BELMON 138.0 kV - 01CHARLR 138.0 kV Ckt 1 | <p>1509839 Invalid Contingency - Baseline Projects: It has been determined that this contingency is invalid; therefore the violation is invalid. This is due to the following baseline projects in APS. The necessary contingency corrections will be evaluated and revised in the AE2 impact study phase.</p> <p>b3028: PJM Baseline Upgrade b3028. Upgrade substation disconnect leads at William 138 kV Substation. The baseline project has a projected in-service date of 06/01/2021. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> <p>b3006: PJM Baseline Upgrade b3006. Replace four Yukon 500/138 kV transformers with three transformers with higher rating and reconfigure 500 kV bus. The baseline project has a projected in-service date of 06/01/2021. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> <p>b3083: Replace substation conductor at Butler (138 kV) Replace substation conductor and line trap at Karns City (138 kV). The baseline project has a projected in-service date of 06/01/2021. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> <p>b3081: PJM Baseline Upgrade b3081. Replace 138 kV breaker and substation conductor at Krendale. The baseline project has a projected in-service date of 06/01/2022. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> | \$0 |

| ID | Index | Facility | Upgrade Description | Cost |
|---------|-------|---|---|------|
| 1510127 | 21 | 15DRAVO 138.0 kV - 15BETTIS 138.0 kV Ckt 1 | <p>b3012.1 (375) : PJM baseline upgrade b3012.1: Construct two new 138 kV ties on separate pole lines from FEs new substation to DUQs new substation. The estimated line length is approximately 4.7 miles. The line is planned to use multiple ACSS conductors per phase. The baseline project has a projected in-service date of 06/01/2021. Project Type : CON Cost : \$0 Time Estimate : N/A</p> <p>b3061 (376) : PJM baseline upgrade b3061: Reconductor the West Mifflin - Dravosburg (Z-73) and Dravosburg - Elrama (Z-75) 138 kV lines. The baseline project has a projected in-service date of 06/01/2021. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> <p>b3062 (377) : PJM baseline upgrade b3062: Install 138 kV tie breaker at West Mifflin. The baseline project has a projected in-service date of 06/01/2021. Project Type : CON Cost : \$0 Time Estimate : N/A</p> <p>b3063 (378) : PJM baseline upgrade b3063: Reconductor the Wilson - Dravosburg (Z-72) 138 kV line (~5 miles). The baseline project has a projected in-service date of 06/01/2021. Project Type : CON Cost : \$0 Time Estimate : N/A</p> <p>b3064 (379) : PJM baseline upgrade b3064: Expand Elrama 138 kV substation to loop in the existing USS Steel Clariton - Piney Fork 138 kV line. The baseline project has a projected in-service date of 06/01/2021. Project Type : CON Cost : \$0 Time Estimate : N/A</p> <p>b3065 (380) : PJM baseline upgrade b3065: Install 138 kV tie breaker at Wilson. The baseline project has a projected in-service date of 06/01/2021. Project Type : CON Cost : \$0 Time Estimate : N/A</p> | \$0 |

| ID | Index | Facility | Upgrade Description | Cost |
|---|-------|--|---|------|
| 1509840 | 7 | 01SMTH61 138.0 kV - 01LAYTON 138.0 kV Ckt 1 | <p>1509840 Invalid Contingency - Baseline Projects: It has been determined that this contingency is invalid; therefore the violation is invalid. This is due to the following baseline projects in APS. The necessary contingency corrections will be evaluated and revised in the AE2 impact study phase.</p> <p>b3028: PJM Baseline Upgrade b3028. Upgrade substation disconnect leads at William 138 kV Substation. The baseline project has a projected in-service date of 06/01/2021. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> <p>b3006: PJM Baseline Upgrade b3006. Replace four Yukon 500/138 kV transformers with three transformers with higher rating and reconfigure 500 kV bus. The baseline project has a projected in-service date of 06/01/2021. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> <p>b3083: Replace substation conductor at Butler (138 kV) Replace substation conductor and line trap at Karns City (138 kV). The baseline project has a projected in-service date of 06/01/2021. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> <p>b3081: PJM Baseline Upgrade b3081. Replace 138 kV breaker and substation conductor at Krendale. The baseline project has a projected in-service date of 06/01/2022. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> | \$0 |
| 1509809,1511055, 1511056,1509284, 1509810,1510796, 1510798 | 19 | 15WILSON 138.0 kV - 15DRAVO 138.0 kV Ckt 1 | <p>b3062 (377) : PJM baseline upgrade b3062: Install 138 kV tie breaker at West Mifflin. The baseline project has a projected in-service date of 06/01/2021. Project Type : CON Cost : \$0 Time Estimate : N/A</p> <p>b3063 (378) : PJM baseline upgrade b3063: Reconnector the Wilson - Dravosburg (Z-72) 138 kV line (~5 miles). The baseline project has a projected in-service date of 06/01/2021. Project Type : CON Cost : \$0 Time Estimate : N/A</p> | \$0 |

| ID | Index | Facility | Upgrade Description | Cost |
|-------------------------------------|-------|--|--|------|
| 1509696,1509695, 1510807,1509231 | 18 | 15WILSON 138.0 kV - 15WMIFFN 138.0 kV Ckt 1 | <p>b3062 (377) : PJM baseline upgrade b3062: Install 138 kV tie breaker at West Mifflin. The baseline project has a projected in-service date of 06/01/2021. Project Type : CON Cost : \$0 Time Estimate : N/A</p> <p>b3064 (379) : PJM baseline upgrade b3064: Expand Elrama 138 kV substation to loop in the existing USS Steel Clariton - Piney Fork 138 kV line. The baseline project has a projected in-service date of 06/01/2021. Project Type : CON Cost : \$0 Time Estimate : N/A</p> <p>b3065 (380) : PJM baseline upgrade b3065: Install 138 kV tie breaker at Wilson. The baseline project has a projected in-service date of 06/01/2021. Project Type : CON Cost : \$0 Time Estimate : N/A</p> | \$0 |
| 1509963 | 8 | 01SMTH62 138.0 kV - 01SHEPLR 138.0 kV Ckt 1 | <p><u>1509963</u> Invalid Contingency - Baseline Projects: It has been determined that this contingency is invalid; therefore the violation is invalid. This is due to the following baseline projects in APS. The necessary contingency corrections will be evaluated and revised in the AE2 impact study phase.</p> <p>b3028: PJM Baseline Upgrade b3028. Upgrade substation disconnect leads at William 138 kV Substation. The baseline project has a projected in-service date of 06/01/2021. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> <p>b3006: PJM Baseline Upgrade b3006. Replace four Yukon 500/138 kV transformers with three transformers with higher rating and reconfigure 500 kV bus. The baseline project has a projected in-service date of 06/01/2021. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> <p>b3083: Replace substation conductor at Butler (138 kV) Replace substation conductor and line trap at Karns City (138 kV). The baseline project has a projected in-service date of 06/01/2021. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> <p>b3081: PJM Baseline Upgrade b3081. Replace 138 kV breaker and substation conductor at Krendale. The baseline project has a projected in-service date of 06/01/2022. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> | \$0 |

| ID | Index | Facility | Upgrade Description | Cost |
|---------|-------|--|---|------|
| 1510047 | 2 | 01ALLENP 138.0 kV - 01CHARLR 138.0 kV Ckt 1 | <p>1510047 Invalid Contingency - Baseline Projects: It has been determined that this contingency is invalid; therefore the violation is invalid. This is due to the following baseline projects in APS. The necessary contingency corrections will be evaluated and revised in the AE2 impact study phase.</p> <p>b3028: PJM Baseline Upgrade b3028. Upgrade substation disconnect leads at William 138 kV Substation. The baseline project has a projected in-service date of 06/01/2021. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> <p>b3006: PJM Baseline Upgrade b3006. Replace four Yukon 500/138 kV transformers with three transformers with higher rating and reconfigure 500 kV bus. The baseline project has a projected in-service date of 06/01/2021. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> <p>b3083: Replace substation conductor at Butler (138 kV) Replace substation conductor and line trap at Karns City (138 kV). The baseline project has a projected in-service date of 06/01/2021. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> <p>b3081: PJM Baseline Upgrade b3081. Replace 138 kV breaker and substation conductor at Krendale. The baseline project has a projected in-service date of 06/01/2022. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> | \$0 |

| ID | Index | Facility | Upgrade Description | Cost |
|-----------------|-------|--|---|------|
| 1509931 | 13 | 01YUKON 138.0 kV - 01SMTH62 138.0 kV Ckt 1 | <p>1509931 Invalid Contingency - Baseline Projects: It has been determined that this contingency is invalid; therefore the violation is invalid. This is due to the following baseline projects in APS. The necessary contingency corrections will be evaluated and revised in the AE2 impact study phase.</p> <p>b3028: PJM Baseline Upgrade b3028. Upgrade substation disconnect leads at William 138 kV Substation. The baseline project has a projected in-service date of 06/01/2021. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> <p>b3006: PJM Baseline Upgrade b3006. Replace four Yukon 500/138 kV transformers with three transformers with higher rating and reconfigure 500 kV bus. The baseline project has a projected in-service date of 06/01/2021. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> <p>b3083: Replace substation conductor at Butler (138 kV) Replace substation conductor and line trap at Karns City (138 kV). The baseline project has a projected in-service date of 06/01/2021. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> <p>b3081: PJM Baseline Upgrade b3081. Replace 138 kV breaker and substation conductor at Krendale. The baseline project has a projected in-service date of 06/01/2022. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> | \$0 |
| 1510877,1511057 | 17 | 15ELRAMA 138.0 kV - 15WILSON 138.0 kV Ckt 1 | <p>b3064 (379) : PJM baseline upgrade b3064: Expand Elrama 138 kV substation to loop in the existing USS Steel Clariton - Piney Fork 138 kV line. The baseline project has a projected in-service date of 06/01/2021. Project Type : CON Cost : \$0 Time Estimate : N/A</p> | \$0 |
| 1510821 | 16 | 15ELRAMA 138.0 kV - 15WILSON 138.0 kV Ckt 2 | <p>b3064 (379) : PJM baseline upgrade b3064: Expand Elrama 138 kV substation to loop in the existing USS Steel Clariton - Piney Fork 138 kV line. The baseline project has a projected in-service date of 06/01/2021. Project Type : CON Cost : \$0 Time Estimate : N/A</p> | \$0 |

| ID | Index | Facility | Upgrade Description | Cost |
|---------|-------|--|---|------|
| 1510083 | 6 | 01SHEPLR 138.0 kV - 01MITCHL 138.0 kV Ckt 1 | <p>1510083 Invalid Contingency - Baseline Projects: It has been determined that this contingency is invalid; therefore the violation is invalid. This is due to the following baseline projects in APS. The necessary contingency corrections will be evaluated and revised in the AE2 impact study phase.</p> <p>b3028: PJM Baseline Upgrade b3028. Upgrade substation disconnect leads at William 138 kV Substation. The baseline project has a projected in-service date of 06/01/2021. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> <p>b3006: PJM Baseline Upgrade b3006. Replace four Yukon 500/138 kV transformers with three transformers with higher rating and reconfigure 500 kV bus. The baseline project has a projected in-service date of 06/01/2021. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> <p>b3083: Replace substation conductor at Butler (138 kV) Replace substation conductor and line trap at Karns City (138 kV). The baseline project has a projected in-service date of 06/01/2021. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> <p>b3081: PJM Baseline Upgrade b3081. Replace 138 kV breaker and substation conductor at Krendale. The baseline project has a projected in-service date of 06/01/2022. Project Type : FAC Cost : \$0 Time Estimate : N/A</p> | \$0 |

| ID | Index | Facility | Upgrade Description | Cost |
|-------------------|-------|---|--|--------------|
| 1511102,1511101 | 14 | 01ROUTE51 138.0 kV - 01CHARLR 138.0 kV Ckt 1 | <p>WP-0010 (193) : Replace Wavetrap at Charleroi Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months</p> <p>WP-0010a (194) : Replace Charleroi Line Relays Project Type : FAC Cost : \$325,000 Time Estimate : 12.0 Months</p> <p>WP-0010b (195) : Replace Bus Side Breaker Risers Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months</p> <p>WP-0010c (196) : Replace Line Side Breaker Risers Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months</p> <p>WP-0010e (198) : Replace 954 Line Conductor Project Type : FAC Cost : \$9,363,900 Time Estimate : 9.0 Months</p> <p>WP-0010f (199) : Replace Line Riser at Charleroi Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months</p> <p>WP-0010g (200) : Replace Line Riser at Charleroi Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months</p> <p>WP-0010h (201) : Replace 1024 Line Conductor Project Type : FAC Cost : \$14,300,000 Time Estimate : 9.0 Months</p> <p>WP-0010i (202) : Replace Line Side Disconnect Switch Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months</p> <p>WP-0010k (204) : Replace Charleroi Bus Conductor Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months</p> <p>WP-0010l (205) : Replace Charleroi Bus Taps Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months</p> | \$25,028,900 |
| TOTAL COST | | | \$ 51,853,100 | |

18 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 gauge 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.

18.1 Contingency Description

| Contingency Name | Contingency Definition |
|--------------------------|--|
| DLC_P71_Z-13_DRAV-ELRAMA | CONTINGENCY 'DLC_P71_Z-13_DRAV-ELRAMA' OPEN BRANCH FROM BUS 254023 TO BUS 254018 CKT 1 OPEN BRANCH FROM BUS 254028 TO BUS 254011 CKT 1 END |
| DLC_P24_WILS_6-7_138 | CONTINGENCY 'DLC_P24_WILS_6-7_138' OPEN BRANCH FROM BUS 254018 TO BUS 254028 CKT 1 OPEN BRANCH FROM BUS 254018 TO BUS 254021 CKT 1 END |
| PJM_P1_APS_B_G692 | CONTINGENCY 'PJM_P1_APS_B_G692' / 200011 KEystone 500 235104 01CABOT 500 1 OPEN BRANCH FROM BUS 200011 TO BUS 235104 CKT 1 END |
| DLC_P71_Z-18_DRAV-ELRAMA | CONTINGENCY 'DLC_P71_Z-18_DRAV-ELRAMA' OPEN BRANCH FROM BUS 254011 TO BUS 254018 CKT 2 /*WILSON-ELRAMA Z-18 OPEN BRANCH FROM BUS 254028 TO BUS 254011 CKT 1 /*DRAVOS-ELRAMA END |
| AP-P2-3-WP-138-RT51M | CONTINGENCY 'AP-P2-3-WP-138-RT51M' /* ROUTE 51 M STUCK BRK DISCONNECT BRANCH FROM BUS 235283 TO BUS 920580 CKT 1 /* 01ROUTE51 138 01SPGDL 138 #1 DISCONNECT BRANCH FROM BUS 235283 TO BUS 235277 CKT 2 /* 01ROUTE51 138 01YUKON 138 #2 END |
| APS-P7-WP-138-9902-A | CONTINGENCY 'APS-P7-WP-138-9902-A' /* ROUTE 51 - YUKON #3 & #4 138 KV LINES OPEN BRANCH FROM BUS 235283 TO BUS 920570 CKT 3 /* 01ROUTE51 138.00 AA2-161 TAP 138.00 OPEN BUS 235270 /* 01WESTRV 138.00 END |

| Contingency Name | Contingency Definition |
|---------------------------|--|
| APS-P7-WP-138-9903 | CONTINGENCY 'APS-P7-WP-138-9903' /* ROUTE 51 - HUNTINGDON & ROUTE 51 - SPRINGDALE 138 KV LINES OPEN BUS 235238 /* 01ROBBIN 138.00 OPEN BRANCH FROM BUS 235283 TO BUS 920580 CKT 1 /* 01ROUTE51 138.00 01SPGDL 138.00 END |
| APS-P7-WP-138-9904 | CONTINGENCY 'APS-P7-WP-138-9904' /* ROUTE 51 - ELRAMA #1 & #2 138 KV LINES OPEN BUS 235870 /* 01WYCOFF TAP 138.00 OPEN BUS 235275 /* 01WYCOFF 138.00 OPEN BRANCH FROM BUS 235283 TO BUS 254011 CKT 2 /* 01ROUTE51 138.00 15ELRAMA 138.00 END |
| DLC_P22_DRAV_2_138 | CONTINGENCY 'DLC_P22_DRAV_2_138' OPEN BRANCH FROM BUS 254028 TO BUS 254025 CKT 1 /*DRAVOS-BETTIS (Z-107)*/ OPEN BRANCH FROM BUS 254028 TO BUS 254021 CKT 1 /*DRAVOS-WMIFFN (Z-74)*/ OPEN BRANCH FROM BUS 254028 TO BUS 254018 CKT 1 /*DRAVOS-WILSON (Z-72)*/ END |
| DLC_P23_DRAV_Z-107 | CONTINGENCY 'DLC_P23_DRAV_Z-107' OPEN BRANCH FROM BUS 254028 TO BUS 254025 CKT 1 /*DRAVOS-BETTIS (Z-107)*/ OPEN BRANCH FROM BUS 254028 TO BUS 254021 CKT 1 /*DRAVOS-WMIFFN (Z-74)*/ OPEN BRANCH FROM BUS 254028 TO BUS 254018 CKT 1 /*DRAVOS-WILSON (Z-72)*/ END |
| AP-P2-3-WP-138-246_NO_FSA | CONTINGENCY 'AP-P2-3-WP-138-246_NO_FSA' /* 255 DISCONNECT BRANCH FROM BUS 920580 TO BUS 235277 CKT 1 /* AA2-161 TAP 138 01YUKON 138 DISCONNECT BRANCH FROM BUS 920580 TO BUS 235283 CKT 1 /* AA2-161 TAP 138 01ROUTE51 138 DISCONNECT BRANCH FROM BUS 235266 TO BUS 235281 CKT 1 /* 01WALTZM 138 01WALTZT 138 DISCONNECT BRANCH FROM BUS 235266 TO BUS 235891 CKT 2 /* 01WALTZM 138 01WALTZ ML 25 DISCONNECT BRANCH FROM BUS 235244 TO BUS 235281 CKT 1 /* 01SEWICK 138 01WALTZT 138 DISCONNECT BRANCH FROM BUS 235277 TO BUS 235281 CKT 1 /* 01YUKON 138 01WALTZT 138 END |
| AP-P2-3-WP-138-183T | CONTINGENCY 'AP-P2-3-WP-138-183T' /* SPRINGDALE-WYCOFF STK BKR AT SPRINGDALE OPEN BRANCH FROM BUS 235256 TO BUS 235181 CKT 1 OPEN BRANCH FROM BUS 235256 TO BUS 235222 CKT 1 OPEN BRANCH FROM BUS 235256 TO BUS 235195 CKT 1 OPEN BRANCH FROM BUS 235256 TO BUS 235190 CKT 1 OPEN BRANCH FROM BUS 235256 TO BUS 254064 CKT 1 OPEN BUS 235283 OPEN BUS 235275 OPEN BUS 235613 OPEN BUS 235614 END |
| APS-P1_2-WP-138-9903-A | CONTINGENCY 'APS-P1_2-WP-138-9903-A' /* ROUTE 51 - YUKON #3 138 KV LINE OPEN BRANCH FROM BUS 235283 TO BUS 920570 CKT 3 /* 01ROUTE51 138.00 01YUKON 138.00 END |

| Contingency Name | Contingency Definition |
|---|---|
| APS-P7-WP-138-9901-A | CONTINGENCY 'APS-P7-WP-138-9901-A' /* ROUTE 51 - YUKON #1 & #2 138 KV LINES OPEN BRANCH FROM BUS 235283 TO BUS 920580 CKT 1 /* 01ROUTE51 138.00 AA2-161 TAP 138.00 OPEN BRANCH FROM BUS 235283 TO BUS 235277 CKT 2 /* 01ROUTE51 138.00 01YUKON 138.00 END |
| DLC_P23_DRAV_Z-15 | CONTINGENCY 'DLC_P23_DRAV_Z-15' OPEN BRANCH FROM BUS 254028 TO BUS 254026 CKT 1 /*DRAVOS-USSILL (Z-79)*/ OPEN BRANCH FROM BUS 254028 TO BUS 253988 CKT 1 /*DRAVOS-CARSON (Z-71)*/ OPEN BRANCH FROM BUS 254028 TO BUS 254023 CKT 1 /*DRAVOS-WMIFFN (Z-73)*/ OPEN BRANCH FROM BUS 254028 TO BUS 254033 CKT 1 /*DRAVOS-WILMRD (Z-77)*/ OPEN BRANCH FROM BUS 254028 TO BUS 254024 CKT 1 /*DRAVOS-USS CLAIRTON (Z-15)*/ OPEN BRANCH FROM BUS 254028 TO BUS 254011 CKT 1 /*DRAVOS-ELRAMA END |
| DLC_P24_DRAV_1-3_138 | CONTINGENCY 'DLC_P24_DRAV_1-3_138' OPEN BRANCH FROM BUS 254028 TO BUS 254026 CKT 1 /*DRAVOS-USSILL (Z-79)*/ OPEN BRANCH FROM BUS 254028 TO BUS 253988 CKT 1 /*DRAVOS-CARSON (Z-71)*/ OPEN BRANCH FROM BUS 254028 TO BUS 254023 CKT 1 /*DRAVOS-WMIFFN (Z-73)*/ OPEN BRANCH FROM BUS 254028 TO BUS 254033 CKT 1 /*DRAVOS-WILMRD (Z-77)*/ OPEN BRANCH FROM BUS 254028 TO BUS 254002 CKT 1 /*DRAVOS-HOMESTD (Z-87)*/ OPEN BRANCH FROM BUS 254028 TO BUS 254027 CKT 1 /*DRAVOS 138-69*/ OPEN BRANCH FROM BUS 253986 TO BUS 254028 CKT 1 /*DRAVOS-BRENTWOOD (Z-70)*/ OPEN BRANCH FROM BUS 254028 TO BUS 254024 CKT 1 /*DRAVOS-USS CLAIRTON (Z-15)*/ OPEN BRANCH FROM BUS 254028 TO BUS 254011 CKT 1 /*DRAVOS-ELRAMA END |
| DLC_P71_ELRAMA-ROUTE51_ELRAMA-WYCOFFTAP | CONTINGENCY 'DLC_P71_ELRAMA-ROUTE51_ELRAMA-WYCOFFTAP' OPEN BUS 235870 /* WYCOFF TAP */ OPEN BRANCH FROM BUS 254011 TO BUS 235283 CKT 2 END |
| Base Case | |
| DLC_P12_Z-72 | CONTINGENCY 'DLC_P12_Z-72' OPEN BRANCH FROM BUS 254018 TO BUS 254028 CKT 1 END |
| DLC_P12_Z-74 | CONTINGENCY 'DLC_P12_Z-74' OPEN BRANCH FROM BUS 254023 TO BUS 254028 CKT 1 END |
| DLC_P12_Z-13 | CONTINGENCY 'DLC_P12_Z-13' DISCONNECT BRANCH FROM BUS 254018 TO BUS 254023 CKT 1 END |
| DLC_P12_Z-11 | CONTINGENCY 'DLC_P12_Z-11' /* WILSON - ELRAMA Z-11Z 138 KV LINE OPEN BRANCH FROM BUS 254018 TO BUS 254011 CKT 1 END |

| Contingency Name | Contingency Definition |
|---------------------------------|--|
| DLC_P12_Z-17 | CONTINGENCY 'DLC_P12_Z-17' /* WILSON - ELRAMA Z-18 138 KV LINE OPEN BRANCH FROM BUS 254018 TO BUS 254011 CKT 2 END |
| DLC_P22_DRAV_1_138 | CONTINGENCY 'DLC_P22_DRAV_1_138' OPEN BRANCH FROM BUS 254028 TO BUS 254026 CKT 1 /*DRAVOS-USSILL (Z-79)*/ OPEN BRANCH FROM BUS 254028 TO BUS 253988 CKT 1 /*DRAVOS-CARSON (Z-71)*/ OPEN BRANCH FROM BUS 254028 TO BUS 254023 CKT 1 /*DRAVOS-WMIFFN (Z-73)*/ OPEN BRANCH FROM BUS 254028 TO BUS 254033 CKT 1 /*DRAVOS-WILMRD (Z-77)*/ OPEN BRANCH FROM BUS 254028 TO BUS 254024 CKT 1 /*DRAVOS-USS CLAIRTON (Z-15)*/ OPEN BRANCH FROM BUS 254028 TO BUS 254011 CKT 1 /*DRAVOS-ELRAMA END |
| DLC_P71_Z-73_DRAV-ELRAMA | CONTINGENCY 'DLC_P71_Z-73_DRAV-ELRAMA' OPEN BRANCH FROM BUS 254028 TO BUS 254023 CKT 1 OPEN BRANCH FROM BUS 254028 TO BUS 254011 CKT 1 END |
| AP-P2-4-WP-138-450-A_FSA | CONTINGENCY 'AP-P2-4-WP-138-450-A_FSA' /* AA2-161 STK BUS TIE 1 ADDED 11-15-2016 CDP DISCONNECT BRANCH FROM BUS 920570 TO BUS 235283 CKT 3 /* AA2-161 TAP 138 01ROUTE51 138 DISCONNECT BRANCH FROM BUS 920580 TO BUS 235283 CKT 1 /* AA2-161 TAP 138 01ROUTE51 138 END |

18.2 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 |
|---------|-----------|----------|---------------|---------|----------|-------------|--------|--------------------|-------|------------|-----------------------|------------------------|-------|-----------|
| 1511034 | 235124 | 01MITCHL | AP | 254011 | 15ELRAMA | DLCO | 1 | APS-P7-WP-138-9904 | tower | 590.0 | 145.5 | 147.65 | DC | 12.67 |

| Bus # | Bus | MW Impact |
|------------|--------------|-----------|
| 235098 | U2-073A E | 6.2 |
| 235099 | U2-073B E | 2.72 |
| 236523 | 01WDPWR_K20 | 0.03 |
| 236665 | K20 E | 1.54 |
| 917651 | Z2-106 | 2.27 |
| 918341 | AA1-047 C | 0.59 |
| 918342 | AA1-047 E | 3.92 |
| 920571 | AA2-161 C | 74.71 |
| 920572 | AA2-161 E | 4.08 |
| 924002 | AB2-041 E | 0.8 |
| 929522 | U2-030 E | 2.82 |
| 930261 | AB1-065 C | 0.24 |
| 930262 | AB1-065 E | 0.39 |
| 931152 | AB1-166 E | 7.6 |
| 934441 | AD1-068 C | 0.62 |
| 934442 | AD1-068 E | 3.57 |
| 934451 | AD1-069 C | 1.55 |
| 934452 | AD1-069 E | 8.98 |
| 936011 | AD2-002 | 2.75 |
| 936851 | AD2-108 | 0.86 |
| 936861 | AD2-109 | 1.14 |
| 936881 | AD2-112 C | 3.62 |
| 936882 | AD2-112 E | 1.44 |
| 938202 | AE1-029 E | 0.26 |
| 938361 | AE1-054 | 0.85 |
| 938583 | AE1-079 CBAT | 0.05 |
| 938584 | AE1-079 EBAT | 0.11 |
| 938801 | AE1-106 C | 4.45 |
| 938802 | AE1-106 E | 3.06 |
| 939973 | AE1-237 C2 | 0.05 |
| 939974 | AE1-237 EBAT | 0.07 |
| 940513 | AE2-036 EBAT | 0.12 |
| 941311 | AE2-125 C | 0.88 |
| 941312 | AE2-125 E | 0.58 |
| 941401 | AE2-137 | 12.67 |
| 942731 | AE2-289 C | 0.6 |
| 942732 | AE2-289 E | 3.5 |
| 943143 | AE2-343 BAT | 0.11 |
| BLUEG | BLUEG | 8.72 |
| CALDERWOOD | CALDERWOOD | 0.6 |
| CANNELTON | CANNELTON | 0.51 |

| Bus # | Bus | MW Impact |
|--------------|------------|------------------|
| CATAWBA | CATAWBA | 0.22 |
| CBM-N | CBM-N | 1.21 |
| CHEOAH | CHEOAH | 0.54 |
| CHILHOWEE | CHILHOWEE | 0.2 |
| COFFEEN | COFFEEN | 0.92 |
| COTTONWOOD | COTTONWOOD | 2.82 |
| DUCKCREEK | DUCKCREEK | 2.11 |
| EDWARDS | EDWARDS | 0.97 |
| ELMERSMITH | ELMERSMITH | 0.87 |
| FARMERCITY | FARMERCITY | 0.59 |
| G-007A | G-007A | 4.49 |
| GIBSON | GIBSON | 0.36 |
| HAMLET | HAMLET | 0.24 |
| NEWTON | NEWTON | 2.4 |
| NYISO | NYISO | 5.22 |
| PRAIRIE | PRAIRIE | 4.24 |
| SANTEETLA | SANTEETLA | 0.16 |
| SMITHLAND | SMITHLAND | 0.31 |
| TATANKA | TATANKA | 1.1 |
| TILTON | TILTON | 1.15 |
| TRIMBLE | TRIMBLE | 0.97 |
| TVA | TVA | 2.24 |
| UNIONPOWER | UNIONPOWER | 0.96 |
| VFT | VFT | 12.08 |

18.3 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 |
|---------|-----------|----------|---------------|---------|----------|-------------|--------|---------------------|---------|------------|-----------------------|------------------------|-------|-----------|
| 1510047 | 235135 | 01ALLENP | AP | 235161 | 01CHARLR | AP | 1 | AP-P2-3-WP-138-183T | breaker | 295.0 | 108.4 | 109.36 | DC | 6.28 |

| Bus # | Bus | MW Impact |
|------------|-------------|-----------|
| 236523 | 01WDPWR_K20 | 0.03 |
| 236665 | K20 E | 1.44 |
| 920571 | AA2-161 C | 37.01 |
| 920572 | AA2-161 E | 2.02 |
| 931152 | AB1-166 E | 1.3 |
| 934451 | AD1-069 C | 2.18 |
| 934452 | AD1-069 E | 12.64 |
| 938361 | AE1-054 | 0.79 |
| 941311 | AE2-125 C | 0.78 |
| 941312 | AE2-125 E | 0.52 |
| 941401 | AE2-137 | 6.28 |
| BLUEG | BLUEG | 3.82 |
| CALDERWOOD | CALDERWOOD | 0.3 |
| CANNELTON | CANNELTON | 0.22 |
| CATAWBA | CATAWBA | 0.13 |
| CBM-N | CBM-N | 0.59 |
| CHEOAH | CHEOAH | 0.27 |
| CHILHOWEE | CHILHOWEE | 0.1 |
| COFFEEN | COFFEEN | 0.4 |
| COTTONWOOD | COTTONWOOD | 1.31 |
| DUCKCREEK | DUCKCREEK | 0.9 |
| EDWARDS | EDWARDS | 0.41 |
| ELMERSMITH | ELMERSMITH | 0.38 |
| FARMERCITY | FARMERCITY | 0.26 |
| G-007A | G-007A | 2.0 |
| GIBSON | GIBSON | 0.16 |
| HAMLET | HAMLET | 0.18 |
| NEWTON | NEWTON | 1.04 |
| NYISO | NYISO | 2.56 |
| PRAIRIE | PRAIRIE | 1.86 |
| SANTEETLA | SANTEETLA | 0.08 |
| SMITHLAND | SMITHLAND | 0.14 |
| TATANKA | TATANKA | 0.48 |
| TILTON | TILTON | 0.49 |
| TRIMBLE | TRIMBLE | 0.43 |
| TVA | TVA | 1.07 |
| UNIONPOWER | UNIONPOWER | 0.46 |
| VFT | VFT | 5.41 |

18.4 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 |
|---------|-----------|----------|---------------|---------|----------|-------------|--------|---------------------|---------|------------|-----------------------|------------------------|-------|-----------|
| 1509839 | 235140 | 01BELMON | AP | 235161 | 01CHARLR | AP | 1 | AP-P2-3-WP-138-183T | breaker | 229.0 | 126.19 | 127.5 | DC | 6.67 |

| Bus # | Bus | MW Impact |
|------------|------------|-----------|
| 920571 | AA2-161 C | 39.32 |
| 920572 | AA2-161 E | 2.15 |
| 941401 | AE2-137 | 6.67 |
| BLUEG | BLUEG | 3.44 |
| CALDERWOOD | CALDERWOOD | 0.28 |
| CANNELTON | CANNELTON | 0.2 |
| CATAWBA | CATAWBA | 0.13 |
| CBM-N | CBM-N | 0.53 |
| CHEOAH | CHEOAH | 0.25 |
| CHILHOWEE | CHILHOWEE | 0.09 |
| COFFEEN | COFFEEN | 0.36 |
| COTTONWOOD | COTTONWOOD | 1.21 |
| DUCKCREEK | DUCKCREEK | 0.8 |
| EDWARDS | EDWARDS | 0.37 |
| ELMERSMITH | ELMERSMITH | 0.35 |
| FARMERCITY | FARMERCITY | 0.23 |
| G-007A | G-007A | 1.83 |
| GIBSON | GIBSON | 0.14 |
| HAMLET | HAMLET | 0.18 |
| NEWTON | NEWTON | 0.93 |
| NYISO | NYISO | 2.31 |
| PRAIRIE | PRAIRIE | 1.68 |
| SANTEETLA | SANTEETLA | 0.07 |
| SMITHLAND | SMITHLAND | 0.13 |
| TATANKA | TATANKA | 0.43 |
| TILTON | TILTON | 0.44 |
| TRIMBLE | TRIMBLE | 0.38 |
| TVA | TVA | 0.98 |
| UNIONPOWER | UNIONPOWER | 0.42 |
| VFT | VFT | 4.95 |

18.5 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 |
|---------|-----------|----------|---------------|---------|----------|-------------|--------|--------------------|-------|------------|-----------------------|------------------------|-------|-----------|
| 1511245 | 235161 | 01CHARLR | AP | 235260 | 01UNIONJ | AP | 1 | APS-P7-WP-138-9904 | tower | 302.0 | 101.54 | 102.28 | DC | 4.94 |

| Bus # | Bus | MW Impact |
|------------|------------|-----------|
| 920571 | AA2-161 C | 29.12 |
| 920572 | AA2-161 E | 1.59 |
| 931152 | AB1-166 E | 1.68 |
| 934451 | AD1-069 C | 0.61 |
| 934452 | AD1-069 E | 3.55 |
| 936011 | AD2-002 | 1.14 |
| 941401 | AE2-137 | 4.94 |
| BLUEG | BLUEG | 3.34 |
| CALDERWOOD | CALDERWOOD | 0.23 |
| CANNELTON | CANNELTON | 0.19 |
| CATAWBA | CATAWBA | 0.09 |
| CBM-N | CBM-N | 0.45 |
| CHEOAH | CHEOAH | 0.21 |
| CHILHOWEE | CHILHOWEE | 0.08 |
| COFFEEN | COFFEEN | 0.35 |
| COTTONWOOD | COTTONWOOD | 1.08 |
| DUCKCREEK | DUCKCREEK | 0.8 |
| EDWARDS | EDWARDS | 0.37 |
| ELMERSMITH | ELMERSMITH | 0.33 |
| FARMERCITY | FARMERCITY | 0.23 |
| G-007A | G-007A | 1.64 |
| GIBSON | GIBSON | 0.14 |
| HAMLET | HAMLET | 0.1 |
| NEWTON | NEWTON | 0.92 |
| NYISO | NYISO | 1.94 |
| PRAIRIE | PRAIRIE | 1.62 |
| SANTEETLA | SANTEETLA | 0.06 |
| SMITHLAND | SMITHLAND | 0.12 |
| TATANKA | TATANKA | 0.42 |
| TILTON | TILTON | 0.44 |
| TRIMBLE | TRIMBLE | 0.37 |
| TVA | TVA | 0.86 |
| UNIONPOWER | UNIONPOWER | 0.37 |
| VFT | VFT | 4.42 |

18.6 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 |
|---------|-----------|----------|---------------|---------|----------|-------------|--------|---------------------|---------|------------|-----------------------|------------------------|-------|-----------|
| 1510046 | 235183 | 01FRAZR | AP | 235135 | 01ALLENP | AP | 1 | AP-P2-3-WP-138-183T | breaker | 295.0 | 108.47 | 109.43 | DC | 6.28 |

| Bus # | Bus | MW Impact |
|------------|-------------|-----------|
| 236523 | 01WDPWR_K20 | 0.03 |
| 236665 | K20 E | 1.44 |
| 920571 | AA2-161 C | 37.01 |
| 920572 | AA2-161 E | 2.02 |
| 931152 | AB1-166 E | 1.3 |
| 934451 | AD1-069 C | 2.18 |
| 934452 | AD1-069 E | 12.64 |
| 938361 | AE1-054 | 0.79 |
| 941311 | AE2-125 C | 0.78 |
| 941312 | AE2-125 E | 0.52 |
| 941401 | AE2-137 | 6.28 |
| BLUEG | BLUEG | 3.82 |
| CALDERWOOD | CALDERWOOD | 0.3 |
| CANNELTON | CANNELTON | 0.22 |
| CATAWBA | CATAWBA | 0.13 |
| CBM-N | CBM-N | 0.59 |
| CHEOAH | CHEOAH | 0.27 |
| CHILHOWEE | CHILHOWEE | 0.1 |
| COFFEEN | COFFEEN | 0.4 |
| COTTONWOOD | COTTONWOOD | 1.31 |
| DUCKCREEK | DUCKCREEK | 0.9 |
| EDWARDS | EDWARDS | 0.41 |
| ELMERSMITH | ELMERSMITH | 0.38 |
| FARMERCITY | FARMERCITY | 0.26 |
| G-007A | G-007A | 2.0 |
| GIBSON | GIBSON | 0.16 |
| HAMLET | HAMLET | 0.18 |
| NEWTON | NEWTON | 1.04 |
| NYISO | NYISO | 2.56 |
| PRAIRIE | PRAIRIE | 1.86 |
| SANTEETLA | SANTEETLA | 0.08 |
| SMITHLAND | SMITHLAND | 0.14 |
| TATANKA | TATANKA | 0.48 |
| TILTON | TILTON | 0.49 |
| TRIMBLE | TRIMBLE | 0.43 |
| TVA | TVA | 1.07 |
| UNIONPOWER | UNIONPOWER | 0.46 |
| VFT | VFT | 5.41 |

18.7 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 |
|---------|-----------|----------|---------------|---------|----------|-------------|--------|---------------------|---------|------------|-----------------------|------------------------|-------|-----------|
| 1510083 | 235247 | 01SHEPLR | AP | 235124 | 01MITCHL | AP | 1 | AP-P2-3-WP-138-183T | breaker | 292.0 | 106.38 | 107.26 | DC | 5.73 |

| Bus # | Bus | MW Impact |
|------------|------------|-----------|
| 920571 | AA2-161 C | 33.81 |
| 920572 | AA2-161 E | 1.85 |
| 931152 | AB1-166 E | 1.66 |
| 941401 | AE2-137 | 5.73 |
| BLUEG | BLUEG | 3.36 |
| CALDERWOOD | CALDERWOOD | 0.25 |
| CANNELTON | CANNELTON | 0.2 |
| CATAWBA | CATAWBA | 0.1 |
| CBM-N | CBM-N | 0.47 |
| CHEOAH | CHEOAH | 0.22 |
| CHILHOWEE | CHILHOWEE | 0.08 |
| COFFEEN | COFFEEN | 0.35 |
| COTTONWOOD | COTTONWOOD | 1.12 |
| DUCKCREEK | DUCKCREEK | 0.8 |
| EDWARDS | EDWARDS | 0.37 |
| ELMERSMITH | ELMERSMITH | 0.34 |
| FARMERCITY | FARMERCITY | 0.23 |
| G-007A | G-007A | 1.74 |
| GIBSON | GIBSON | 0.14 |
| HAMLET | HAMLET | 0.12 |
| NEWTON | NEWTON | 0.92 |
| NYISO | NYISO | 2.02 |
| PRAIRIE | PRAIRIE | 1.64 |
| SANTEETLA | SANTEETLA | 0.07 |
| SMITHLAND | SMITHLAND | 0.12 |
| TATANKA | TATANKA | 0.42 |
| TILTON | TILTON | 0.44 |
| TRIMBLE | TRIMBLE | 0.37 |
| TVA | TVA | 0.9 |
| UNIONPOWER | UNIONPOWER | 0.39 |
| VFT | VFT | 4.7 |

18.8 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 |
|---------|-----------|----------|---------------|---------|----------|-------------|--------|---------------------|---------|------------|-----------------------|------------------------|-------|-----------|
| 1509840 | 235251 | 01SMTH61 | AP | 235209 | 01LAYTON | AP | 1 | AP-P2-3-WP-138-183T | breaker | 297.0 | 126.97 | 128.11 | DC | 7.53 |

| Bus # | Bus | MW Impact |
|------------|------------|-----------|
| 920571 | AA2-161 C | 44.41 |
| 920572 | AA2-161 E | 2.42 |
| 938361 | AE1-054 | 1.15 |
| 941401 | AE2-137 | 7.53 |
| BLUEG | BLUEG | 3.09 |
| CALDERWOOD | CALDERWOOD | 0.24 |
| CANNELTON | CANNELTON | 0.18 |
| CATAWBA | CATAWBA | 0.11 |
| CBM-N | CBM-N | 0.42 |
| CHEOAH | CHEOAH | 0.22 |
| CHILHOWEE | CHILHOWEE | 0.08 |
| COFFEEN | COFFEEN | 0.32 |
| COTTONWOOD | COTTONWOOD | 1.06 |
| DUCKCREEK | DUCKCREEK | 0.72 |
| EDWARDS | EDWARDS | 0.33 |
| ELMERSMITH | ELMERSMITH | 0.31 |
| FARMERCITY | FARMERCITY | 0.21 |
| G-007A | G-007A | 1.66 |
| GIBSON | GIBSON | 0.13 |
| HAMLET | HAMLET | 0.15 |
| NEWTON | NEWTON | 0.84 |
| NYISO | NYISO | 1.82 |
| PRAIRIE | PRAIRIE | 1.51 |
| SANTEETLA | SANTEETLA | 0.06 |
| SMITHLAND | SMITHLAND | 0.11 |
| TATANKA | TATANKA | 0.38 |
| TILTON | TILTON | 0.4 |
| TRIMBLE | TRIMBLE | 0.34 |
| TVA | TVA | 0.87 |
| UNIONPOWER | UNIONPOWER | 0.37 |
| VFT | VFT | 4.48 |

18.9 Index 8

| 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 |
|---------|-----------|----------|---------------|---------|----------|-------------|--------|---------------------|---------|------------|-----------------------|------------------------|-------|-----------|
| 1509963 | 235252 | 01SMTH62 | AP | 235247 | 01SHEPLR | AP | 1 | AP-P2-3-WP-138-183T | breaker | 566.0 | 113.04 | 115.23 | DC | 12.4 |

| Bus # | Bus | MW Impact |
|------------|------------|-----------|
| 236665 | K20 E | 0.7 |
| 920571 | AA2-161 C | 73.13 |
| 920572 | AA2-161 E | 3.99 |
| 931152 | AB1-166 E | 2.51 |
| 934451 | AD1-069 C | 0.67 |
| 934452 | AD1-069 E | 3.91 |
| 938361 | AE1-054 | 0.21 |
| 941311 | AE2-125 C | 0.64 |
| 941312 | AE2-125 E | 0.43 |
| 941401 | AE2-137 | 12.4 |
| BLUEG | BLUEG | 6.8 |
| CALDERWOOD | CALDERWOOD | 0.53 |
| CANNELTON | CANNELTON | 0.4 |
| CATAWBA | CATAWBA | 0.23 |
| CBM-N | CBM-N | 1.0 |
| CHEOAH | CHEOAH | 0.48 |
| CHILHOWEE | CHILHOWEE | 0.17 |
| COFFEEN | COFFEEN | 0.71 |
| COTTONWOOD | COTTONWOOD | 2.32 |
| DUCKCREEK | DUCKCREEK | 1.6 |
| EDWARDS | EDWARDS | 0.74 |
| ELMERSMITH | ELMERSMITH | 0.68 |
| FARMERCITY | FARMERCITY | 0.46 |
| G-007A | G-007A | 3.57 |
| GIBSON | GIBSON | 0.28 |
| HAMLET | HAMLET | 0.31 |
| NEWTON | NEWTON | 1.85 |
| NYISO | NYISO | 4.34 |
| PRAIRIE | PRAIRIE | 3.32 |
| SANTEETLA | SANTEETLA | 0.14 |
| SMITHLAND | SMITHLAND | 0.25 |
| TATANKA | TATANKA | 0.85 |
| TILTON | TILTON | 0.88 |
| TRIMBLE | TRIMBLE | 0.76 |
| TVA | TVA | 1.88 |
| UNIONPOWER | UNIONPOWER | 0.81 |
| VFT | VFT | 9.65 |

18.10 Index 11

| 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 |
|---------|-----------|----------|---------------|---------|----------|-------------|--------|---------------------|---------|------------|-----------------------|------------------------|-------|-----------|
| 1509838 | 235277 | 01YUKON | AP | 235251 | 01SMTH61 | AP | 1 | AP-P2-3-WP-138-183T | breaker | 297.0 | 127.17 | 128.31 | DC | 7.53 |

| Bus # | Bus | MW Impact |
|------------|------------|-----------|
| 920571 | AA2-161 C | 44.41 |
| 920572 | AA2-161 E | 2.42 |
| 938361 | AE1-054 | 1.15 |
| 941401 | AE2-137 | 7.53 |
| BLUEG | BLUEG | 3.09 |
| CALDERWOOD | CALDERWOOD | 0.24 |
| CANNELTON | CANNELTON | 0.18 |
| CATAWBA | CATAWBA | 0.11 |
| CBM-N | CBM-N | 0.42 |
| CHEOAH | CHEOAH | 0.22 |
| CHILHOWEE | CHILHOWEE | 0.08 |
| COFFEEN | COFFEEN | 0.32 |
| COTTONWOOD | COTTONWOOD | 1.06 |
| DUCKCREEK | DUCKCREEK | 0.72 |
| EDWARDS | EDWARDS | 0.33 |
| ELMERSMITH | ELMERSMITH | 0.31 |
| FARMERCITY | FARMERCITY | 0.21 |
| G-007A | G-007A | 1.66 |
| GIBSON | GIBSON | 0.13 |
| HAMLET | HAMLET | 0.15 |
| NEWTON | NEWTON | 0.84 |
| NYISO | NYISO | 1.82 |
| PRAIRIE | PRAIRIE | 1.51 |
| SANTEETLA | SANTEETLA | 0.06 |
| SMITHLAND | SMITHLAND | 0.11 |
| TATANKA | TATANKA | 0.38 |
| TILTON | TILTON | 0.4 |
| TRIMBLE | TRIMBLE | 0.34 |
| TVA | TVA | 0.87 |
| UNIONPOWER | UNIONPOWER | 0.37 |
| VFT | VFT | 4.48 |

18.11 Index 13

| 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 |
|---------|-----------|----------|---------------|---------|----------|-------------|--------|---------------------|---------|------------|-----------------------|------------------------|-------|-----------|
| 1509931 | 235277 | 01YUKON | AP | 235252 | 01SMTH62 | AP | 1 | AP-P2-3-WP-138-183T | breaker | 566.0 | 115.37 | 117.56 | DC | 12.4 |

| Bus # | Bus | MW Impact |
|------------|------------|-----------|
| 236665 | K20 E | 0.7 |
| 920571 | AA2-161 C | 73.13 |
| 920572 | AA2-161 E | 3.99 |
| 931152 | AB1-166 E | 2.51 |
| 934451 | AD1-069 C | 0.67 |
| 934452 | AD1-069 E | 3.91 |
| 938361 | AE1-054 | 0.21 |
| 941311 | AE2-125 C | 0.64 |
| 941312 | AE2-125 E | 0.43 |
| 941401 | AE2-137 | 12.4 |
| BLUEG | BLUEG | 6.8 |
| CALDERWOOD | CALDERWOOD | 0.53 |
| CANNELTON | CANNELTON | 0.4 |
| CATAWBA | CATAWBA | 0.23 |
| CBM-N | CBM-N | 1.0 |
| CHEOAH | CHEOAH | 0.48 |
| CHILHOWEE | CHILHOWEE | 0.17 |
| COFFEEN | COFFEEN | 0.71 |
| COTTONWOOD | COTTONWOOD | 2.32 |
| DUCKCREEK | DUCKCREEK | 1.6 |
| EDWARDS | EDWARDS | 0.74 |
| ELMERSMITH | ELMERSMITH | 0.68 |
| FARMERCITY | FARMERCITY | 0.46 |
| G-007A | G-007A | 3.57 |
| GIBSON | GIBSON | 0.28 |
| HAMLET | HAMLET | 0.31 |
| NEWTON | NEWTON | 1.85 |
| NYISO | NYISO | 4.34 |
| PRAIRIE | PRAIRIE | 3.32 |
| SANTEETLA | SANTEETLA | 0.14 |
| SMITHLAND | SMITHLAND | 0.25 |
| TATANKA | TATANKA | 0.85 |
| TILTON | TILTON | 0.88 |
| TRIMBLE | TRIMBLE | 0.76 |
| TVA | TVA | 1.88 |
| UNIONPOWER | UNIONPOWER | 0.81 |
| VFT | VFT | 9.65 |

18.12 Index 14

| 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 |
|---------|-----------|-----------|---------------|---------|----------|-------------|--------|---|-------|------------|-----------------------|------------------------|-------|-----------|
| 1511102 | 235283 | 01ROUTE51 | AP | 235161 | 01CHARLR | AP | 1 | DLC_P71_ELRAMA-ROUTE51_ELRAMA-WYCOFFTAP | tower | 342.0 | 121.72 | 124.89 | DC | 10.87 |

| Bus # | Bus | MW Impact |
|------------|------------|-----------|
| 920571 | AA2-161 C | 64.07 |
| 920572 | AA2-161 E | 3.5 |
| 931152 | AB1-166 E | 1.47 |
| 936851 | AD2-108 | 0.8 |
| 936881 | AD2-112 C | 3.37 |
| 936882 | AD2-112 E | 1.34 |
| 941401 | AE2-137 | 10.87 |
| BLUEG | BLUEG | 4.57 |
| CALDERWOOD | CALDERWOOD | 0.38 |
| CANNELTON | CANNELTON | 0.27 |
| CATAWBA | CATAWBA | 0.18 |
| CBM-N | CBM-N | 0.77 |
| CHEOAH | CHEOAH | 0.34 |
| CHILHOWEE | CHILHOWEE | 0.12 |
| COFFEEN | COFFEEN | 0.48 |
| COTTONWOOD | COTTONWOOD | 1.61 |
| DUCKCREEK | DUCKCREEK | 1.07 |
| EDWARDS | EDWARDS | 0.49 |
| ELMERSMITH | ELMERSMITH | 0.46 |
| FARMERCITY | FARMERCITY | 0.31 |
| G-007A | G-007A | 2.37 |
| GIBSON | GIBSON | 0.19 |
| HAMLET | HAMLET | 0.25 |
| NEWTON | NEWTON | 1.25 |
| NYISO | NYISO | 3.35 |
| PRAIRIE | PRAIRIE | 2.24 |
| SANTEETLA | SANTEETLA | 0.1 |
| SMITHLAND | SMITHLAND | 0.17 |
| TATANKA | TATANKA | 0.57 |
| TILTON | TILTON | 0.59 |
| TRIMBLE | TRIMBLE | 0.51 |
| TVA | TVA | 1.32 |
| UNIONPOWER | UNIONPOWER | 0.57 |
| VFT | VFT | 6.43 |

18.13 Index 15

| 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 |
|---------|-----------|-----------|---------------|---------|----------|-------------|--------|---|-------|------------|-----------------------|------------------------|-------|-----------|
| 1511108 | 235283 | 01ROUTE51 | AP | 235161 | 01CHARLR | AP | 2 | DLC_P71_ELRAMA-ROUTE51_ELRAMA-WYCOFFTAP | tower | 342.0 | 119.25 | 122.37 | DC | 10.65 |

| Bus # | Bus | MW Impact |
|------------|------------|-----------|
| 920571 | AA2-161 C | 62.77 |
| 920572 | AA2-161 E | 3.43 |
| 931152 | AB1-166 E | 1.44 |
| 936851 | AD2-108 | 0.79 |
| 936881 | AD2-112 C | 3.3 |
| 936882 | AD2-112 E | 1.31 |
| 941401 | AE2-137 | 10.65 |
| BLUEG | BLUEG | 4.48 |
| CALDERWOOD | CALDERWOOD | 0.37 |
| CANNELTON | CANNELTON | 0.26 |
| CATAWBA | CATAWBA | 0.18 |
| CBM-N | CBM-N | 0.76 |
| CHEOAH | CHEOAH | 0.34 |
| CHILHOWEE | CHILHOWEE | 0.12 |
| COFFEEN | COFFEEN | 0.47 |
| COTTONWOOD | COTTONWOOD | 1.58 |
| DUCKCREEK | DUCKCREEK | 1.04 |
| EDWARDS | EDWARDS | 0.48 |
| ELMERSMITH | ELMERSMITH | 0.45 |
| FARMERCITY | FARMERCITY | 0.3 |
| G-007A | G-007A | 2.33 |
| GIBSON | GIBSON | 0.18 |
| HAMLET | HAMLET | 0.25 |
| NEWTON | NEWTON | 1.22 |
| NYISO | NYISO | 3.28 |
| PRAIRIE | PRAIRIE | 2.2 |
| SANTEETLA | SANTEETLA | 0.1 |
| SMITHLAND | SMITHLAND | 0.17 |
| TATANKA | TATANKA | 0.56 |
| TILTON | TILTON | 0.57 |
| TRIMBLE | TRIMBLE | 0.5 |
| TVA | TVA | 1.29 |
| UNIONPOWER | UNIONPOWER | 0.56 |
| VFT | VFT | 6.3 |

18.14 Index 16

| 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 |
|---------|-----------|----------|---------------|---------|----------|-------------|--------|--------------|--------|------------|-----------------------|------------------------|-------|-----------|
| 1510821 | 254011 | 15ELRAMA | DLCO | 254018 | 15WILSON | DLCO | 2 | DLC_P12_Z-11 | single | 717.0 | 106.33 | 108.12 | DC | 12.82 |

| Bus # | Bus | MW Impact |
|------------|--------------|-----------|
| 235570 | 01LAKEL1 | 0.21 |
| 235571 | 01LAKEL2 | 0.21 |
| 235610 | 01SPRGD1 | 0.4 |
| 235611 | 01SPRGD2 | 0.4 |
| 235612 | 01SPRGD3 | 1.6 |
| 235613 | 01SPRGD4 | 1.57 |
| 235614 | 01SPRGD5 | 1.66 |
| 235615 | 01GANS 8 | 0.37 |
| 235616 | 01GANS 9 | 0.37 |
| 236523 | 01WDPWR_K20 | 0.03 |
| 236578 | 01GRABLE_P34 | 0.04 |
| 237505 | 01ELLIOTTS | 0.09 |
| 292626 | T-174 1 | 1.13 |
| 292627 | T-174 2 | 1.13 |
| 292628 | T-174 3 | 1.13 |
| 292629 | T-174 4 | 2.29 |
| 917651 | Z2-106 | 1.78 |
| 920571 | AA2-161 C | 75.56 |
| 930621 | AB1-106 | 0.06 |
| 934451 | AD1-069 C | 1.28 |
| 936011 | AD2-002 | 1.88 |
| 936851 | AD2-108 | 0.89 |
| 936861 | AD2-109 | 0.82 |
| 936881 | AD2-112 C | 3.73 |
| 938361 | AE1-054 | 0.71 |
| 938801 | AE1-106 C | 3.23 |
| 941311 | AE2-125 C | 0.78 |
| 941401 | AE2-137 | 12.82 |
| BLUEG | BLUEG | 7.9 |
| CALDERWOOD | CALDERWOOD | 0.55 |
| CANNELTON | CANNELTON | 0.46 |
| CATAWBA | CATAWBA | 0.21 |
| CBM-N | CBM-N | 1.13 |
| CHEOAH | CHEOAH | 0.5 |
| CHILHOWEE | CHILHOWEE | 0.18 |
| COFFEEN | COFFEEN | 0.84 |
| COTTONWOOD | COTTONWOOD | 2.57 |
| DUCKCREEK | DUCKCREEK | 1.91 |
| EDWARDS | EDWARDS | 0.88 |
| ELMERSMITH | ELMERSMITH | 0.79 |
| FARMERCITY | FARMERCITY | 0.54 |
| G-007A | G-007A | 4.14 |

| Bus # | Bus | MW Impact |
|-------------------|------------|------------------|
| GIBSON | GIBSON | 0.33 |
| HAMLET | HAMLET | 0.24 |
| NEWTON | NEWTON | 2.17 |
| NYISO | NYISO | 4.9 |
| PRAIRIE | PRAIRIE | 3.85 |
| SANTEETLA | SANTEETLA | 0.14 |
| SMITHLAND | SMITHLAND | 0.28 |
| TATANKA | TATANKA | 1.0 |
| TILTON | TILTON | 1.04 |
| TRIMBLE | TRIMBLE | 0.88 |
| TVA | TVA | 2.05 |
| UNIONPOWER | UNIONPOWER | 0.88 |
| VFT | VFT | 11.15 |

18.15 Index 17

| 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 |
|---------|-----------|----------|---------------|---------|----------|-------------|--------|--------------------------|-------|------------|-----------------------|------------------------|-------|-----------|
| 1511057 | 254011 | 15ELRAMA | DLCO | 254018 | 15WILSON | DLCO | 1 | DLC_P71_Z-18_DRAV-ELRAMA | tower | 717.0 | 132.68 | 134.93 | DC | 16.16 |

| Bus # | Bus | MW Impact |
|------------|--------------|-----------|
| 236523 | 01WDPWR_K20 | 0.03 |
| 236578 | 01GRABLE_P34 | 0.05 |
| 236665 | K20 E | 1.62 |
| 916332 | Z1-088_89 E | 0.18 |
| 917651 | Z2-106 | 2.24 |
| 918341 | AA1-047 C | 0.55 |
| 918342 | AA1-047 E | 3.65 |
| 920571 | AA2-161 C | 95.27 |
| 920572 | AA2-161 E | 5.2 |
| 931152 | AB1-166 E | 9.65 |
| 934451 | AD1-069 C | 1.62 |
| 934452 | AD1-069 E | 9.38 |
| 936011 | AD2-002 | 2.37 |
| 936851 | AD2-108 | 1.12 |
| 936861 | AD2-109 | 1.04 |
| 936881 | AD2-112 C | 4.7 |
| 936882 | AD2-112 E | 1.87 |
| 938202 | AE1-029 E | 0.3 |
| 938361 | AE1-054 | 0.89 |
| 938583 | AE1-079 CBAT | 0.05 |
| 938584 | AE1-079 EBAT | 0.13 |
| 938801 | AE1-106 C | 4.07 |
| 938802 | AE1-106 E | 2.8 |
| 939973 | AE1-237 C2 | 0.05 |
| 939974 | AE1-237 EBAT | 0.08 |
| 940513 | AE2-036 EBAT | 0.13 |
| 941311 | AE2-125 C | 0.98 |
| 941312 | AE2-125 E | 0.65 |
| 941401 | AE2-137 | 16.16 |
| 943143 | AE2-343 BAT | 0.13 |
| BLUEG | BLUEG | 9.96 |
| CALDERWOOD | CALDERWOOD | 0.69 |
| CANNELTON | CANNELTON | 0.58 |
| CATAWBA | CATAWBA | 0.26 |
| CBM-N | CBM-N | 1.43 |
| CHEOAH | CHEOAH | 0.63 |
| CHILHOWEE | CHILHOWEE | 0.23 |
| COFFEEN | COFFEEN | 1.05 |
| COTTONWOOD | COTTONWOOD | 3.24 |
| DUCKCREEK | DUCKCREEK | 2.41 |
| EDWARDS | EDWARDS | 1.11 |

| Bus # | Bus | MW Impact |
|--------------|------------|------------------|
| ELMERSMITH | ELMERSMITH | 0.99 |
| FARMERCITY | FARMERCITY | 0.68 |
| G-007A | G-007A | 5.22 |
| GIBSON | GIBSON | 0.42 |
| HAMLET | HAMLET | 0.3 |
| NEWTON | NEWTON | 2.74 |
| NYISO | NYISO | 6.18 |
| PRAIRIE | PRAIRIE | 4.85 |
| SANTEETLA | SANTEETLA | 0.18 |
| SMITHLAND | SMITHLAND | 0.36 |
| TATANKA | TATANKA | 1.26 |
| TILTON | TILTON | 1.31 |
| TRIMBLE | TRIMBLE | 1.11 |
| TVA | TVA | 2.58 |
| UNIONPOWER | UNIONPOWER | 1.11 |
| VFT | VFT | 14.06 |

18.16 Index 18

| 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 |
|---------|-----------|----------|---------------|---------|----------|-------------|--------|----------------------|---------|------------|-----------------------|------------------------|-------|-----------|
| 1509695 | 254018 | 15WILSON | DLCO | 254023 | 15WMIFFN | DLCO | 1 | DLC_P24_WILS_6-7_138 | breaker | 419.0 | 140.19 | 142.79 | DC | 10.87 |

| Bus # | Bus | MW Impact |
|------------|------------|-----------|
| 236665 | K20 E | 1.09 |
| 917651 | Z2-106 | 1.51 |
| 920571 | AA2-161 C | 64.1 |
| 920572 | AA2-161 E | 3.5 |
| 931152 | AB1-166 E | 6.7 |
| 934451 | AD1-069 C | 1.09 |
| 934452 | AD1-069 E | 6.31 |
| 936011 | AD2-002 | 1.59 |
| 936851 | AD2-108 | 0.75 |
| 936861 | AD2-109 | 0.7 |
| 936881 | AD2-112 C | 3.16 |
| 936882 | AD2-112 E | 1.25 |
| 938361 | AE1-054 | 0.32 |
| 941311 | AE2-125 C | 0.66 |
| 941312 | AE2-125 E | 0.44 |
| 941401 | AE2-137 | 10.87 |
| BLUEG | BLUEG | 6.7 |
| CALDERWOOD | CALDERWOOD | 0.47 |
| CANNELTON | CANNELTON | 0.39 |
| CATAWBA | CATAWBA | 0.17 |
| CBM-N | CBM-N | 0.96 |
| CHEOAH | CHEOAH | 0.42 |
| CHILHOWEE | CHILHOWEE | 0.15 |
| COFFEEN | COFFEEN | 0.71 |
| COTTONWOOD | COTTONWOOD | 2.18 |
| DUCKCREEK | DUCKCREEK | 1.62 |
| EDWARDS | EDWARDS | 0.75 |
| ELMERSMITH | ELMERSMITH | 0.67 |
| FARMERCITY | FARMERCITY | 0.45 |
| G-007A | G-007A | 3.51 |
| GIBSON | GIBSON | 0.28 |
| HAMLET | HAMLET | 0.2 |
| NEWTON | NEWTON | 1.84 |
| NYISO | NYISO | 4.16 |
| PRAIRIE | PRAIRIE | 3.26 |
| SANTEETLA | SANTEETLA | 0.12 |
| SMITHLAND | SMITHLAND | 0.24 |
| TATANKA | TATANKA | 0.85 |
| TILTON | TILTON | 0.88 |
| TRIMBLE | TRIMBLE | 0.75 |
| TVA | TVA | 1.74 |
| UNIONPOWER | UNIONPOWER | 0.74 |

| Bus # | Bus | MW Impact |
|--------------|------------|------------------|
| VFT | VFT | 9.46 |

18.17 Index 19

| 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 |
|---------|-----------|----------|---------------|---------|---------|-------------|--------|--------------------------|-------|------------|-----------------------|------------------------|-------|-----------|
| 1511055 | 254018 | 15WILSON | DLCO | 254028 | 15DRAVO | DLCO | 1 | DLC_P71_Z-13_DRAV-ELRAMA | tower | 510.0 | 135.83 | 138.37 | DC | 12.92 |

| Bus # | Bus | MW Impact |
|------------|--------------|-----------|
| 236523 | 01WDPWR_K20 | 0.03 |
| 236665 | K20 E | 1.3 |
| 917651 | Z2-106 | 1.79 |
| 920571 | AA2-161 C | 76.21 |
| 920572 | AA2-161 E | 4.16 |
| 931152 | AB1-166 E | 6.42 |
| 934451 | AD1-069 C | 1.29 |
| 934452 | AD1-069 E | 7.5 |
| 936011 | AD2-002 | 1.89 |
| 936851 | AD2-108 | 0.9 |
| 936861 | AD2-109 | 0.83 |
| 936881 | AD2-112 C | 3.76 |
| 936882 | AD2-112 E | 1.49 |
| 938202 | AE1-029 E | 0.24 |
| 938361 | AE1-054 | 0.71 |
| 938801 | AE1-106 C | 3.26 |
| 938802 | AE1-106 E | 2.24 |
| 940513 | AE2-036 EBAT | 0.11 |
| 941311 | AE2-125 C | 0.78 |
| 941312 | AE2-125 E | 0.52 |
| 941401 | AE2-137 | 12.92 |
| BLUEG | BLUEG | 7.97 |
| CALDERWOOD | CALDERWOOD | 0.55 |
| CANNELTON | CANNELTON | 0.47 |
| CATAWBA | CATAWBA | 0.21 |
| CBM-N | CBM-N | 1.14 |
| CHEOAH | CHEOAH | 0.5 |
| CHILHOWEE | CHILHOWEE | 0.18 |
| COFFEEN | COFFEEN | 0.84 |
| COTTONWOOD | COTTONWOOD | 2.59 |
| DUCKCREEK | DUCKCREEK | 1.93 |
| EDWARDS | EDWARDS | 0.89 |
| ELMERSMITH | ELMERSMITH | 0.79 |
| FARMERCITY | FARMERCITY | 0.54 |
| G-007A | G-007A | 4.17 |
| GIBSON | GIBSON | 0.33 |
| HAMLET | HAMLET | 0.24 |
| NEWTON | NEWTON | 2.19 |
| NYISO | NYISO | 4.94 |
| PRAIRIE | PRAIRIE | 3.88 |
| SANTEETLA | SANTEETLA | 0.15 |

| Bus # | Bus | MW Impact |
|--------------|------------|------------------|
| SMITHLAND | SMITHLAND | 0.29 |
| TATANKA | TATANKA | 1.01 |
| TILTON | TILTON | 1.05 |
| TRIMBLE | TRIMBLE | 0.89 |
| TVA | TVA | 2.07 |
| UNIONPOWER | UNIONPOWER | 0.89 |
| VFT | VFT | 11.25 |

18.18 Index 20

| 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 |
|---------|-----------|----------|---------------|---------|---------|-------------|--------|----------------------|---------|------------|-----------------------|------------------------|-------|-----------|
| 1509650 | 254023 | 15WMIFFN | DLCO | 254028 | 15DRAVO | DLCO | 1 | DLC_P24_WILS_6-7_138 | breaker | 382.0 | 146.36 | 149.21 | DC | 10.87 |

| Bus # | Bus | MW Impact |
|------------|------------|-----------|
| 236665 | K20 E | 1.09 |
| 917651 | Z2-106 | 1.51 |
| 920571 | AA2-161 C | 64.1 |
| 920572 | AA2-161 E | 3.5 |
| 931152 | AB1-166 E | 6.7 |
| 934451 | AD1-069 C | 1.09 |
| 934452 | AD1-069 E | 6.31 |
| 936011 | AD2-002 | 1.59 |
| 936851 | AD2-108 | 0.75 |
| 936861 | AD2-109 | 0.7 |
| 936881 | AD2-112 C | 3.16 |
| 936882 | AD2-112 E | 1.25 |
| 938361 | AE1-054 | 0.32 |
| 941311 | AE2-125 C | 0.66 |
| 941312 | AE2-125 E | 0.44 |
| 941401 | AE2-137 | 10.87 |
| BLUEG | BLUEG | 6.7 |
| CALDERWOOD | CALDERWOOD | 0.47 |
| CANNELTON | CANNELTON | 0.39 |
| CATAWBA | CATAWBA | 0.17 |
| CBM-N | CBM-N | 0.96 |
| CHEOAH | CHEOAH | 0.42 |
| CHILHOWEE | CHILHOWEE | 0.15 |
| COFFEEN | COFFEEN | 0.71 |
| COTTONWOOD | COTTONWOOD | 2.18 |
| DUCKCREEK | DUCKCREEK | 1.62 |
| EDWARDS | EDWARDS | 0.75 |
| ELMERSMITH | ELMERSMITH | 0.67 |
| FARMERCITY | FARMERCITY | 0.45 |
| G-007A | G-007A | 3.51 |
| GIBSON | GIBSON | 0.28 |
| HAMLET | HAMLET | 0.2 |
| NEWTON | NEWTON | 1.84 |
| NYISO | NYISO | 4.16 |
| PRAIRIE | PRAIRIE | 3.26 |
| SANTEETLA | SANTEETLA | 0.12 |
| SMITHLAND | SMITHLAND | 0.24 |
| TATANKA | TATANKA | 0.85 |
| TILTON | TILTON | 0.88 |
| TRIMBLE | TRIMBLE | 0.75 |
| TVA | TVA | 1.74 |
| UNIONPOWER | UNIONPOWER | 0.74 |

| Bus # | Bus | MW Impact |
|--------------|------------|------------------|
| VFT | VFT | 9.46 |

18.19 Index 21

| 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 |
|---------|-----------|----------|---------------|---------|----------|-------------|--------|----------------------|---------|------------|-----------------------|------------------------|-------|-----------|
| 1510127 | 254028 | 15DRAVO | DLCO | 254025 | 15BETTIS | DLCO | 1 | DLC_P24_DRAV_1-3_138 | breaker | 252.0 | 101.53 | 102.69 | DC | 6.51 |

| Bus # | Bus | MW Impact |
|------------|------------|-----------|
| 236665 | K20 E | 0.65 |
| 920571 | AA2-161 C | 38.41 |
| 920572 | AA2-161 E | 2.1 |
| 931152 | AB1-166 E | 3.22 |
| 934451 | AD1-069 C | 0.65 |
| 934452 | AD1-069 E | 3.79 |
| 938361 | AE1-054 | 0.19 |
| 941401 | AE2-137 | 6.51 |
| BLUEG | BLUEG | 4.17 |
| CALDERWOOD | CALDERWOOD | 0.3 |
| CANNELTON | CANNELTON | 0.24 |
| CATAWBA | CATAWBA | 0.11 |
| CBM-N | CBM-N | 0.56 |
| CHEOAH | CHEOAH | 0.27 |
| CHILHOWEE | CHILHOWEE | 0.1 |
| COFFEEN | COFFEEN | 0.44 |
| COTTONWOOD | COTTONWOOD | 1.37 |
| DUCKCREEK | DUCKCREEK | 1.01 |
| EDWARDS | EDWARDS | 0.46 |
| ELMERSMITH | ELMERSMITH | 0.42 |
| FARMERCITY | FARMERCITY | 0.28 |
| G-007A | G-007A | 2.06 |
| GIBSON | GIBSON | 0.17 |
| HAMLET | HAMLET | 0.14 |
| NEWTON | NEWTON | 1.15 |
| NYISO | NYISO | 2.43 |
| PRAIRIE | PRAIRIE | 2.04 |
| SANTEETLA | SANTEETLA | 0.08 |
| SMITHLAND | SMITHLAND | 0.15 |
| TATANKA | TATANKA | 0.53 |
| TILTON | TILTON | 0.55 |
| TRIMBLE | TRIMBLE | 0.46 |
| TVA | TVA | 1.09 |
| UNIONPOWER | UNIONPOWER | 0.47 |
| VFT | VFT | 5.54 |

Affected Systems

19 Affected Systems

19.1 LG&E

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

19.2 MISO

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

19.3 TVA

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

19.4 Duke Energy Progress

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

19.5 NYISO

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

Short Circuit

20 Short Circuit

The following Breakers are overduty: None

Attachment 1 – One Line

Attachment 2 – Project Location