



# Reliability Analysis Update

Transmission Expansion Advisory  
Committee

August 10, 2017



# 2017 RTEP Evaluation of 2022 Conditions

May 18, 2017

- Preliminary 2022 Summer results posted
- Baseline N-1 Thermal
- Generator Deliverability - Thermal

July 5, 2017

- Posted additional preliminary 2022 Summer results:
  - N-1-1 Thermal & Voltage, Load Deliverability, N-1 Voltage
- Preliminary 2022 Light Load results and 2022 Winter results
- Noted determination of flowgates anticipated be excluded from window.

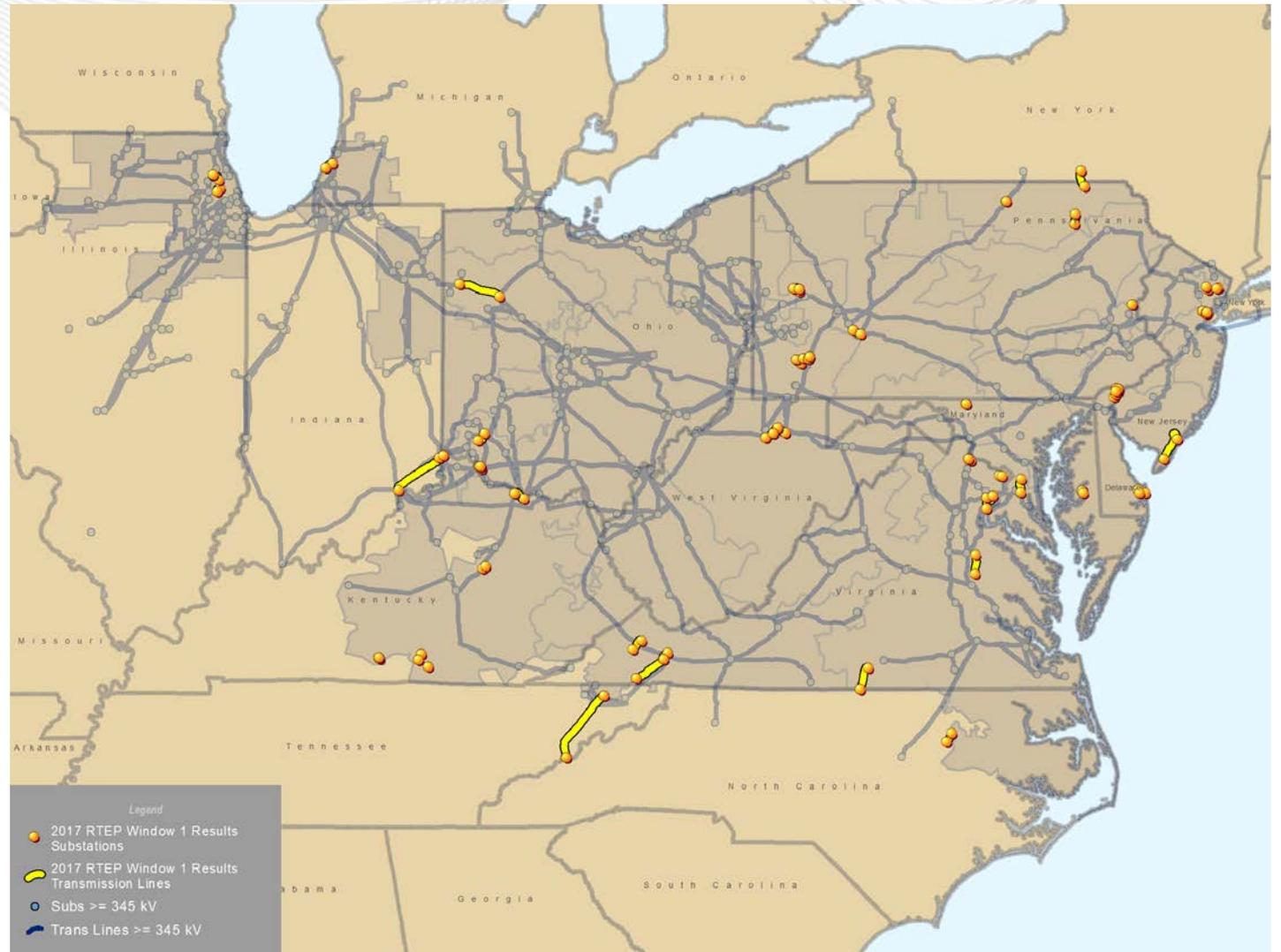
July 11, 2017

- 2017 Proposal Window #1 Opened

Friday, August 25, 2017 (anticipated)

- 2017 Proposal Window #1 Close

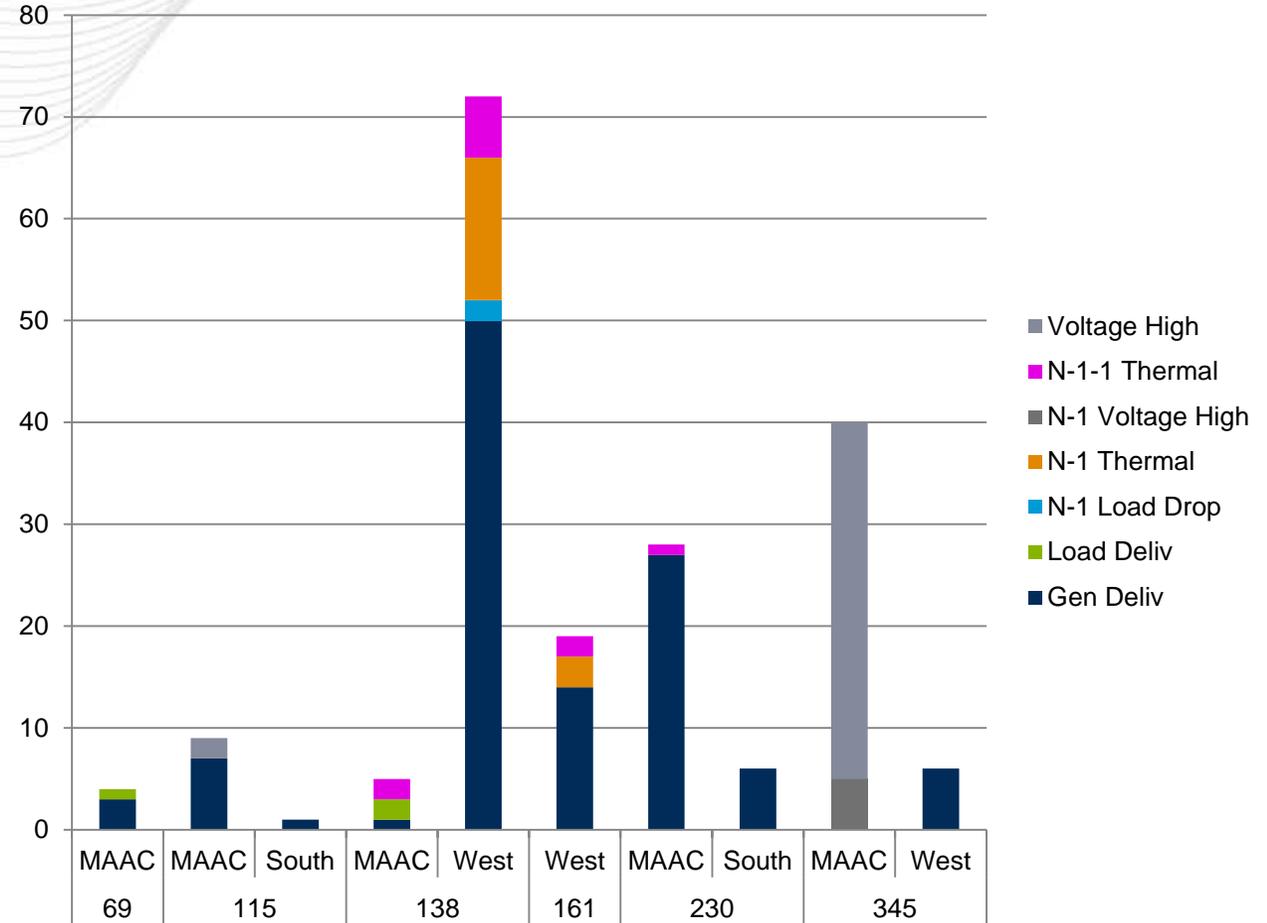
- 190 flowgates
- 2022 conditions
- Summer, Winter & Light Load
- Includes both voltage and thermal violations





# 2022 Analysis Violations

Count of FG #	Gen Deliv	Load Deliv	N-1 Load Drop	N-1 Thermal	N-1 Voltage High	N-1-1 Thermal	Voltage High	Grand Total
<b>69</b>	<b>3</b>	<b>1</b>						<b>4</b>
MAAC	3	1						4
South								0
<b>115</b>	<b>8</b>						<b>2</b>	<b>10</b>
MAAC	7						2	9
South	1							1
<b>138</b>	<b>51</b>	<b>2</b>	<b>2</b>	<b>14</b>		<b>8</b>		<b>77</b>
MAAC	1	2				2		5
West	50		2	14		6		72
<b>161</b>	<b>14</b>			<b>3</b>		<b>2</b>		<b>19</b>
West	14			3		2		19
<b>230</b>	<b>33</b>					<b>1</b>		<b>34</b>
MAAC	27					1		28
South	6							6
<b>345</b>	<b>6</b>				<b>5</b>		<b>35</b>	<b>46</b>
MAAC					5		35	40
West	6							6
<b>Grand Total</b>	<b>115</b>	<b>3</b>	<b>2</b>	<b>17</b>	<b>5</b>	<b>11</b>	<b>37</b>	<b>190</b>



# 2017 Proposal Window Update

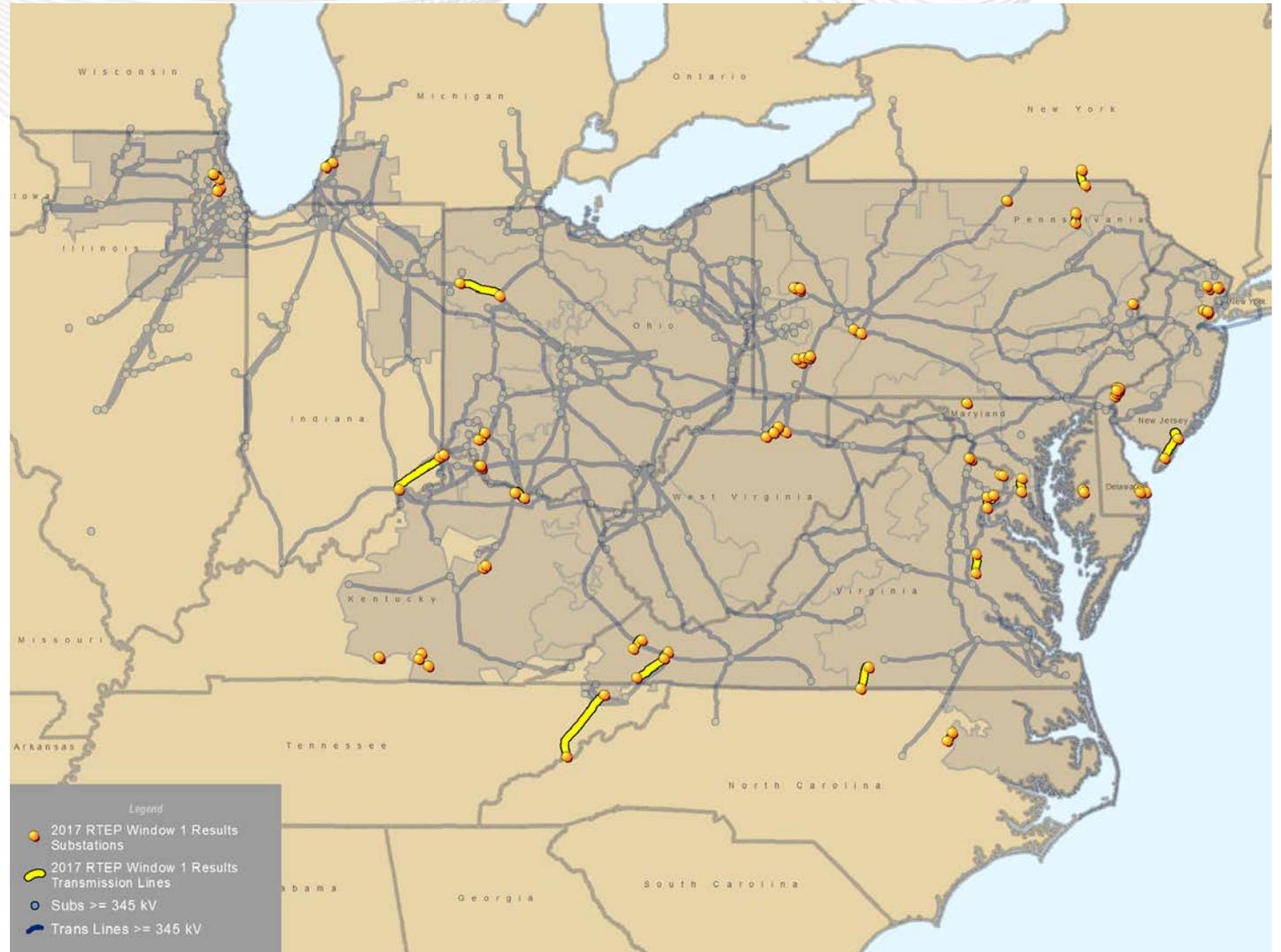
## Overview of 2022 Results

### Total of 190 flowgates identified

- 41 to be included in the window
  - 33 in West region
  - 5 in the South region
  - 3 in the MAAC region
  
- 149 flowgates excluded
  - Immediate need (PJM OA 1.5.8(m)) (Includes Retired Generator related)
  - < 200kV (PJM OA 1.5.8(n))

# 2017 RTEP Proposal Window 1 - Violations

- 41 flowgates are window eligible
- Includes both voltage and thermal violations

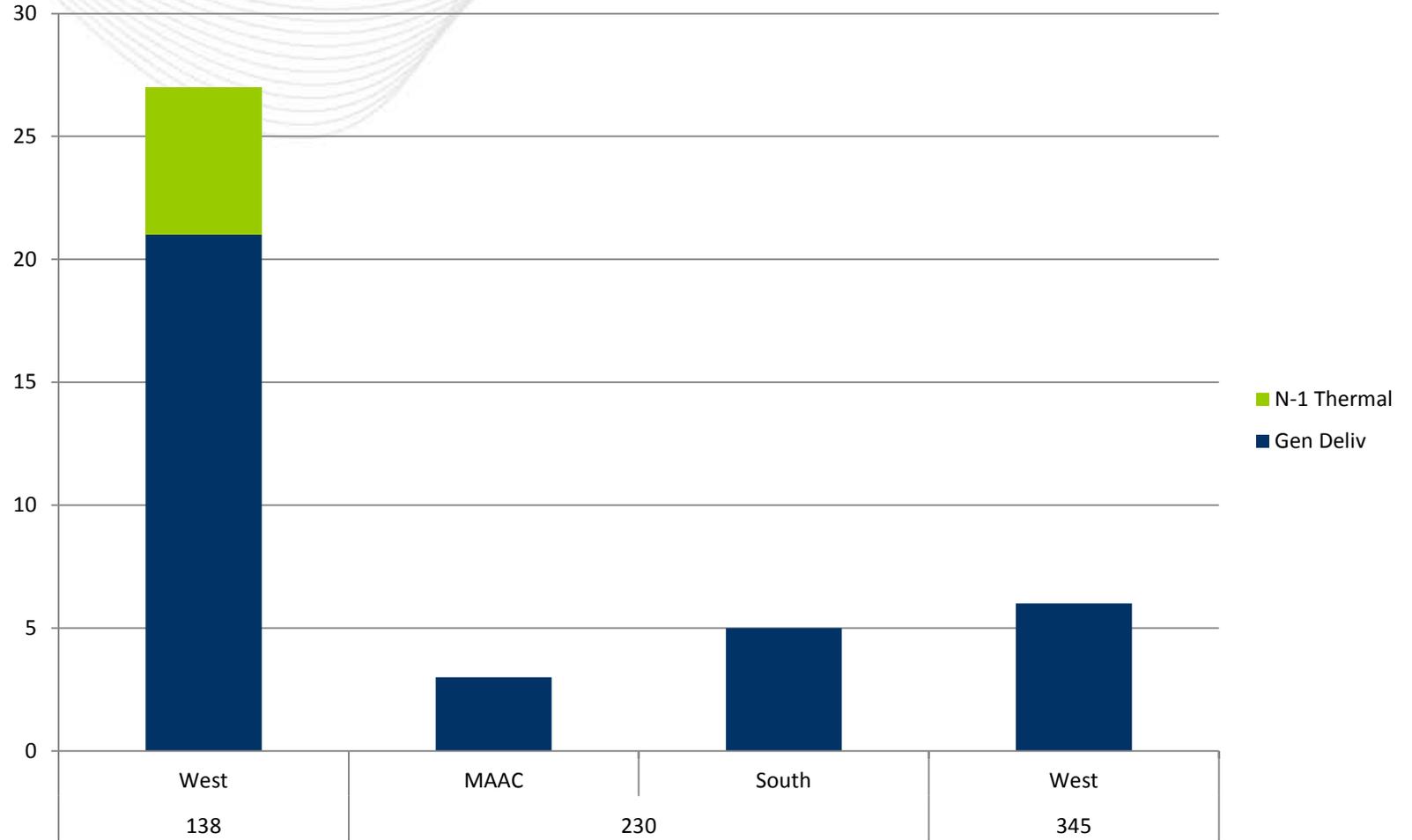




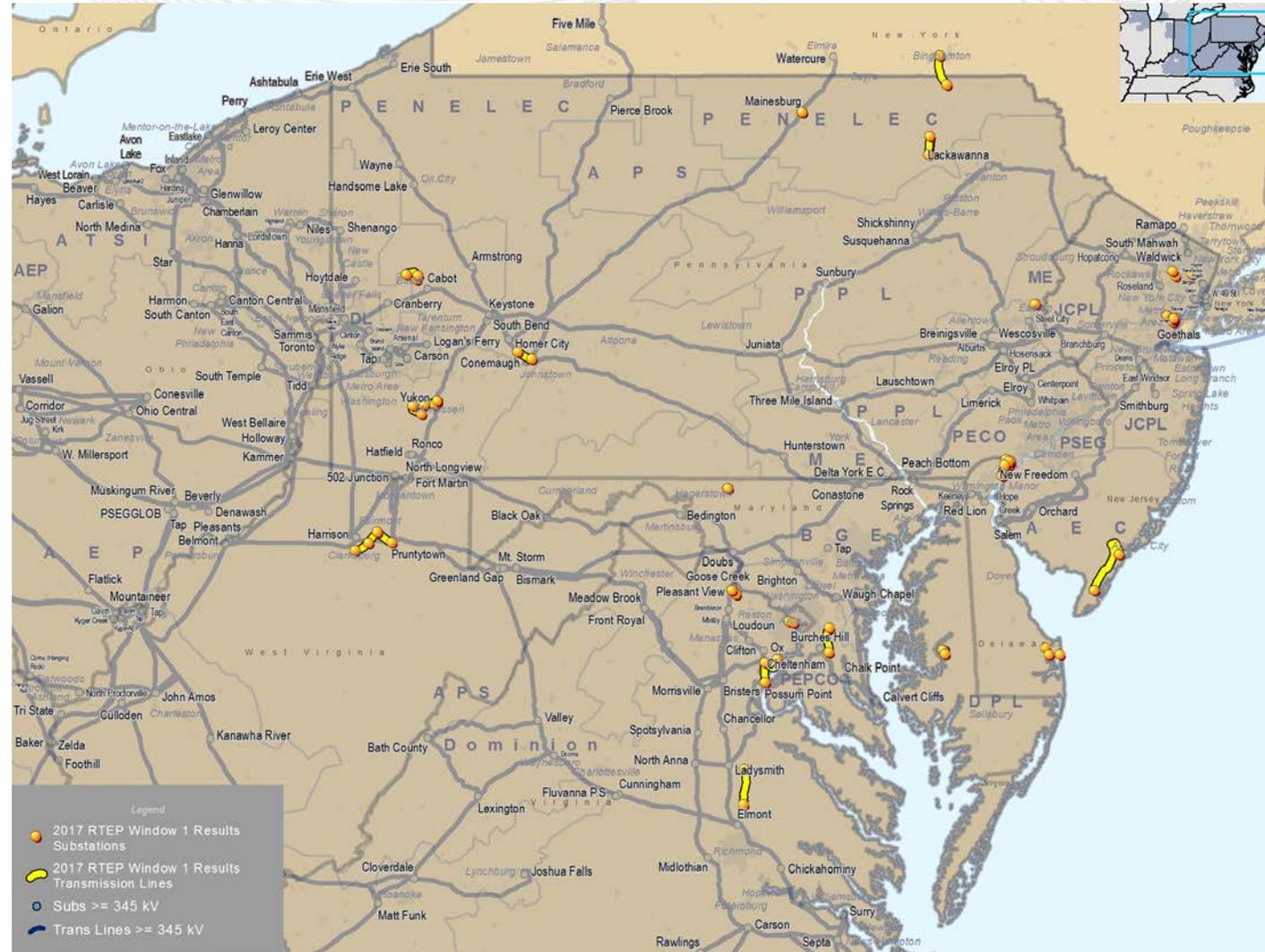
# 2017 RTEP Proposal Window 1 - Overview

Window Eligible Yes

Count of FG #	Gen Deliv	N-1 Thermal	Grand Total
<b>138</b>	<b>21</b>	<b>6</b>	<b>27</b>
West	21	6	27
<b>230</b>	<b>8</b>		<b>8</b>
MAAC	3		3
South	5		5
<b>345</b>	<b>6</b>		<b>6</b>
West	6		6
<b>Grand Total</b>	<b>35</b>	<b>6</b>	<b>41</b>



- 3 flowgates are window eligible



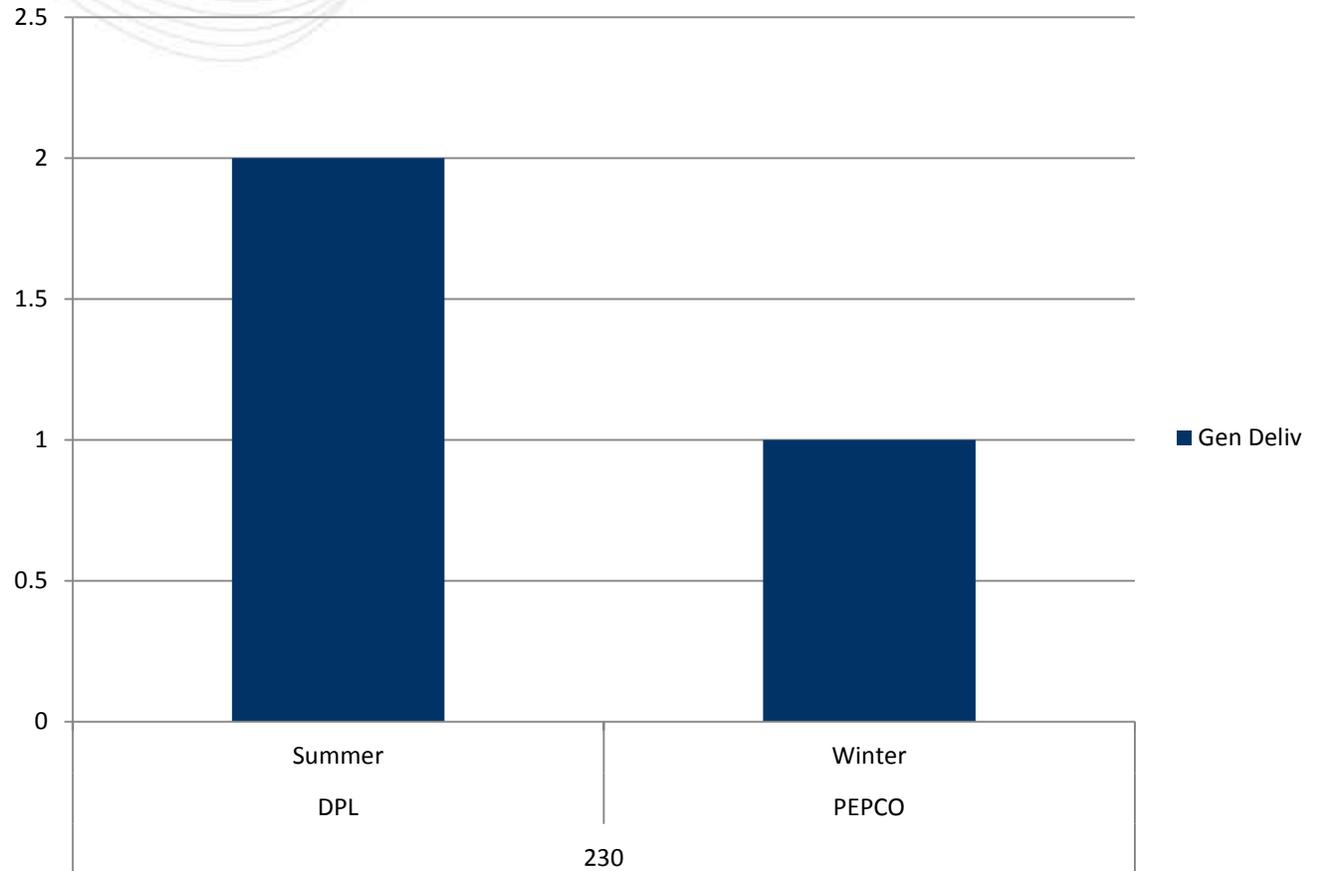


# 2017 RTEP Proposal Window 1 – MAAC Results

Region	MAAC
Window Eligible	Yes

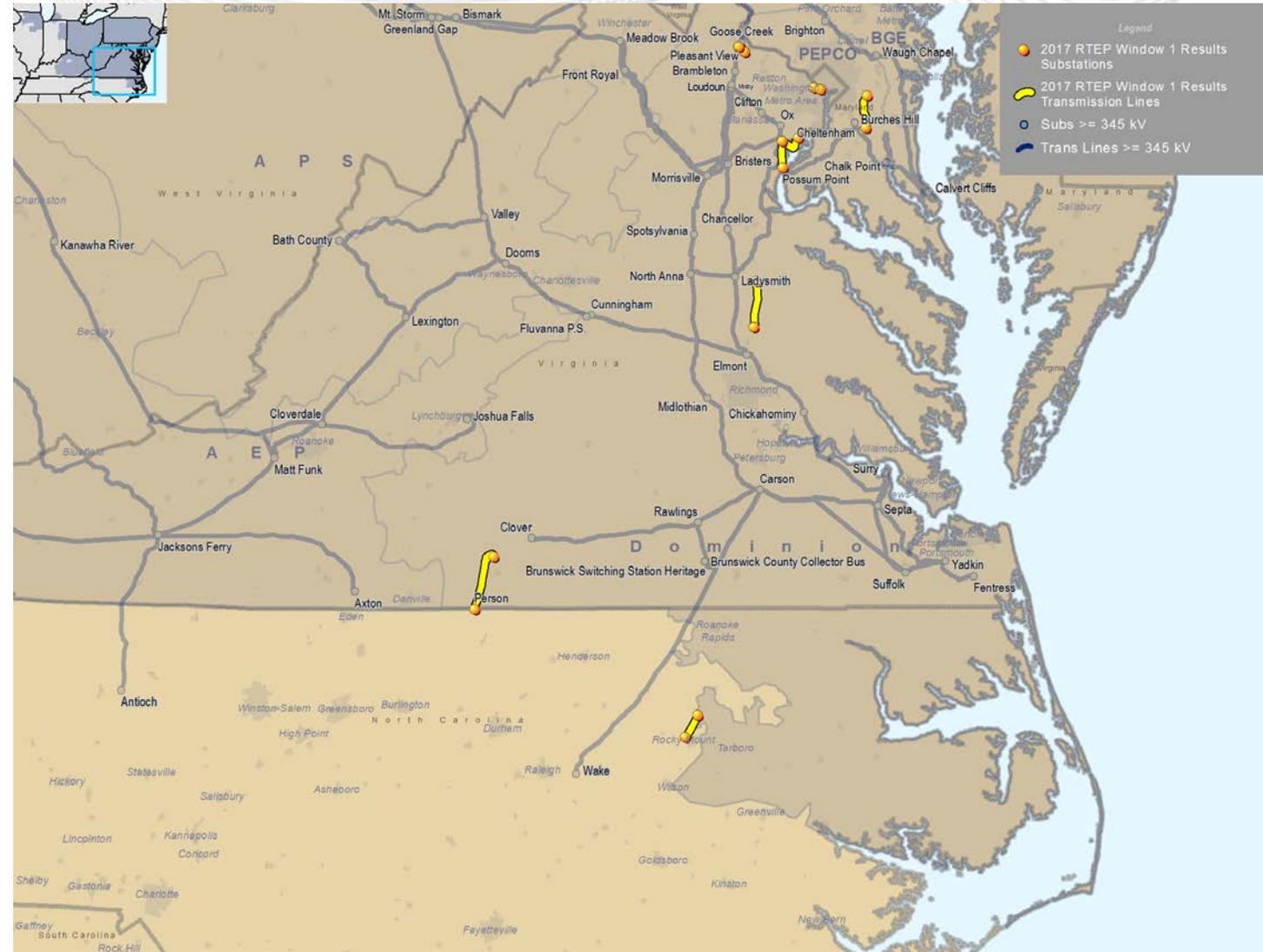
Count of FG #	Gen Deliv	Grand Total
<b>230</b>	<b>3</b>	<b>3</b>
<b>DPL</b>	<b>2</b>	<b>2</b>
Summer	2	2
<b>PEPCO</b>	<b>1</b>	<b>1</b>
Winter	1	1
<b>Grand Total</b>	<b>3</b>	<b>3</b>

Gen Deliv



# 2017 RTEP Proposal Window 1 – South Results

- 5 flowgates are window eligible
- Voltage
- Thermal



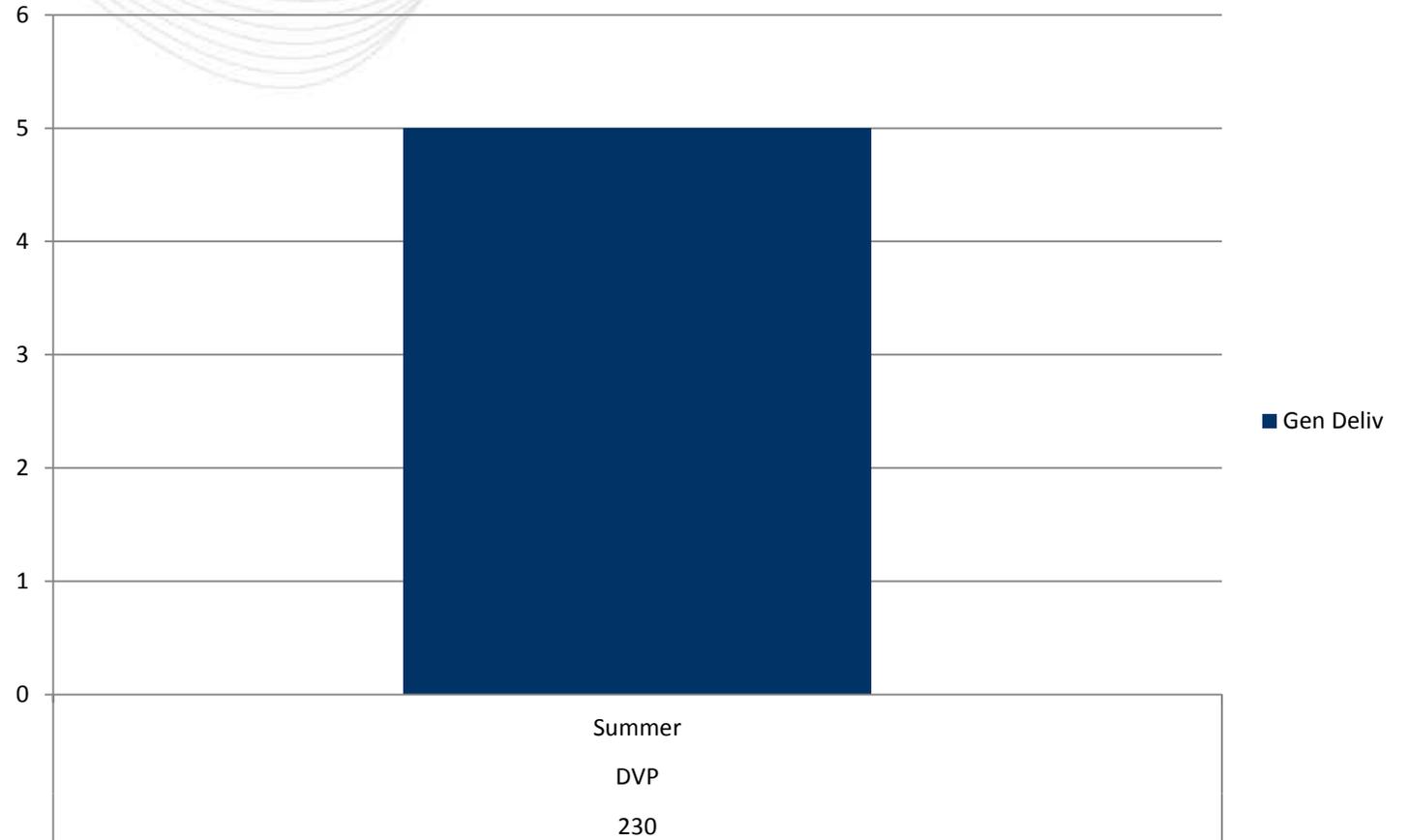


# 2017 RTEP Proposal Window 1 – South Results

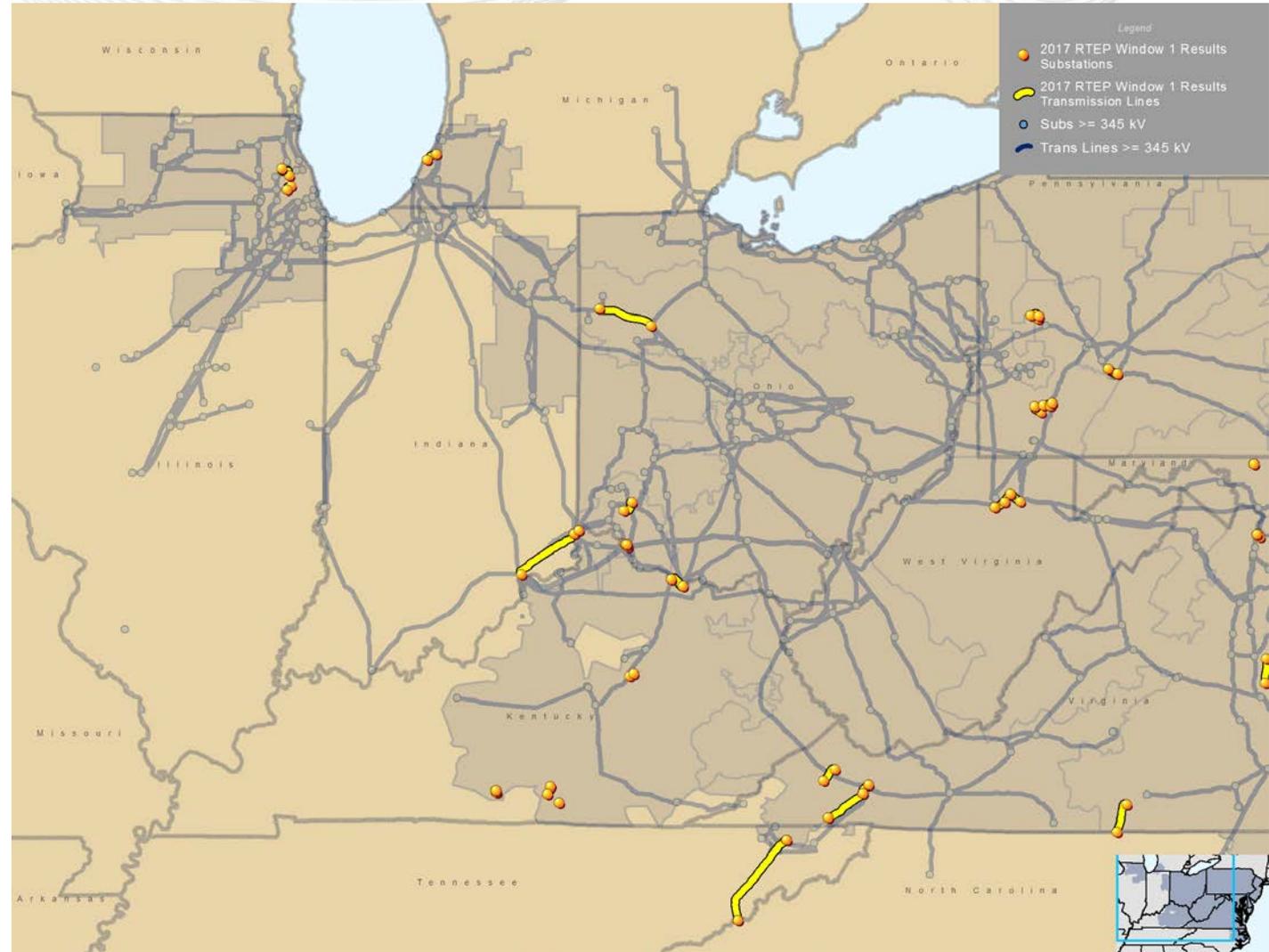
Region	South
Window Eligible	Yes

Count of FG #	Gen Deliv	Grand Total
<b>230</b>	<b>5</b>	<b>5</b>
DVP	5	5
Summer	5	5
<b>Grand Total</b>	<b>5</b>	<b>5</b>

## Gen Deliv



- 33 flowgates are window eligible
- Voltage
- Thermal

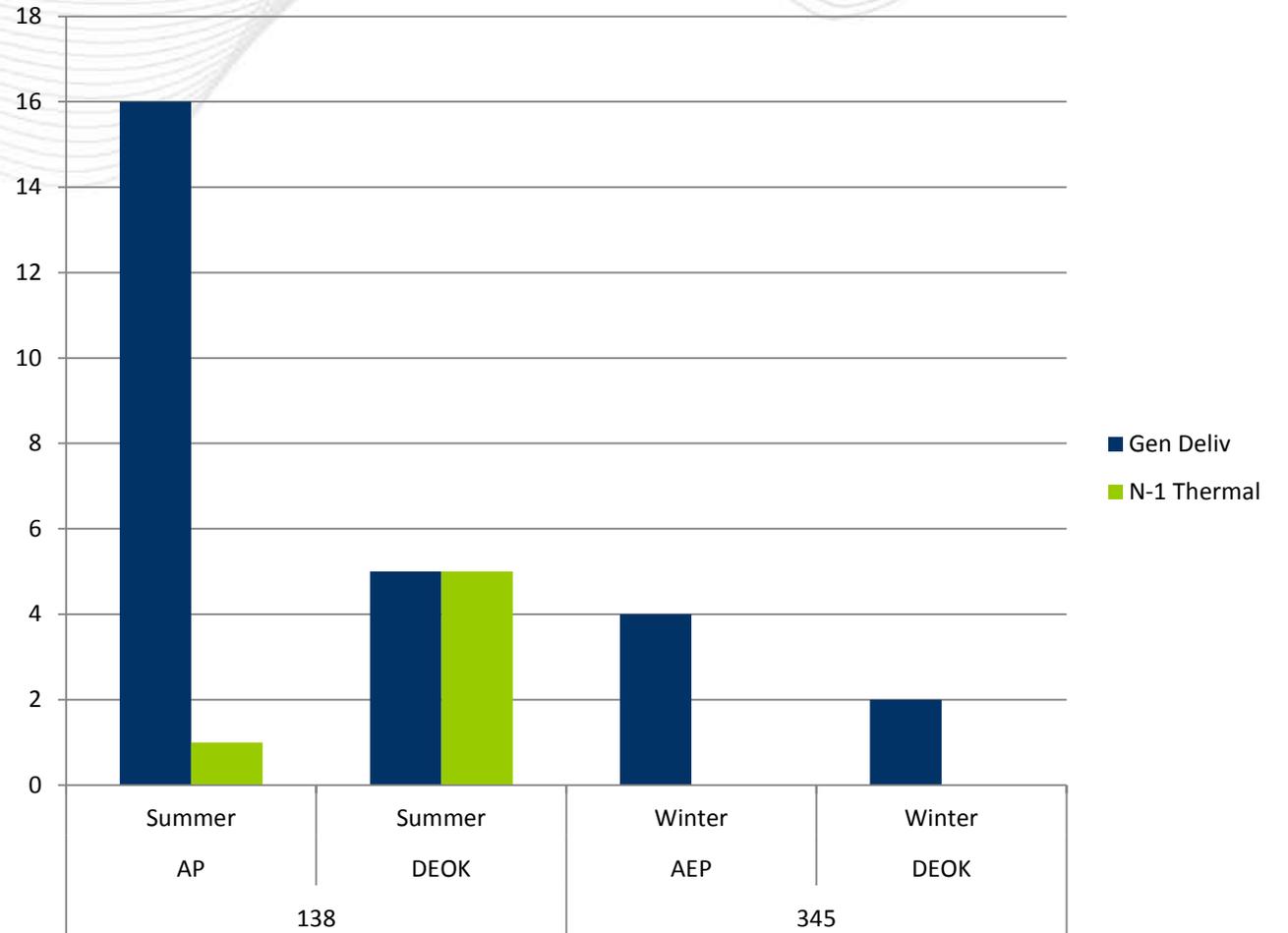




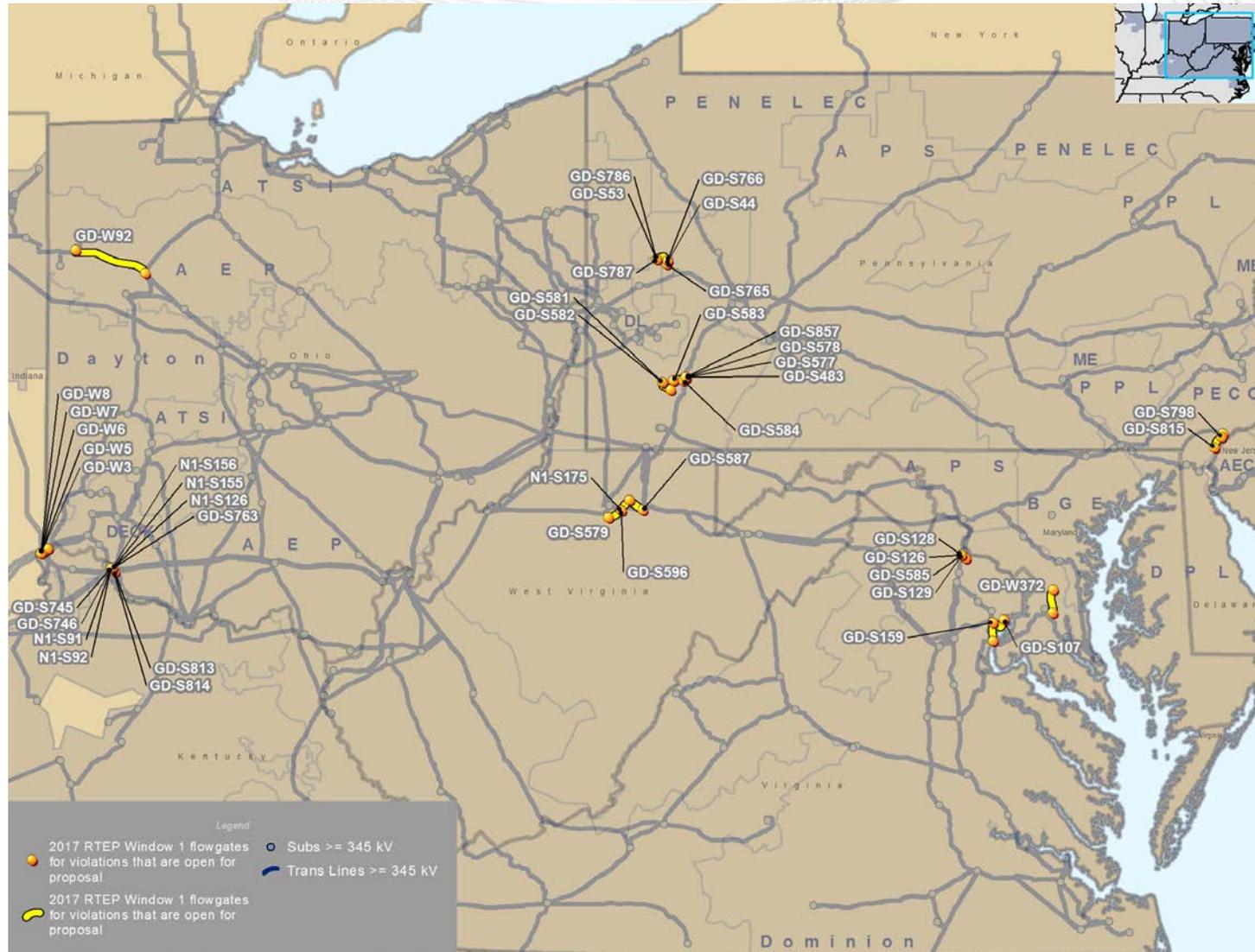
# 2017 RTEP Proposal Window 1 – West Results

Region	West
Window Eligible	Yes

Count of FG #	Gen Deliv	N-1 Thermal	Grand Total
<b>138</b>	<b>21</b>	<b>6</b>	<b>27</b>
<b>AP</b>	<b>16</b>	<b>1</b>	<b>17</b>
Summer	16	1	17
<b>DEOK</b>	<b>5</b>	<b>5</b>	<b>10</b>
Summer	5	5	10
<b>345</b>	<b>6</b>	<b>6</b>	<b>6</b>
<b>AEP</b>	<b>4</b>	<b>4</b>	<b>4</b>
Winter	4	4	4
<b>DEOK</b>	<b>2</b>	<b>2</b>	<b>2</b>
Winter	2	2	2
<b>Grand Total</b>	<b>27</b>	<b>6</b>	<b>33</b>



# 2017 RTEP Proposal Window 1 – All Results



# Dominion Update End of Life Criteria



# Dominion Transmission Zone

## Baseline Reliability - TO Criteria Violation

### Line #211 and #228 Chesterfield to Hopewell Partial Rebuild

Date Project Last Presented: 7/13/2017 TEAC

#### Problem Statement: Dominion “End of Life Criteria”

- 230kV Lines #211 and #228 run 11 miles from Chesterfield to Hopewell and are double circuit lines
- Approximately 8 miles of the lines were built on double circuit weathering steel (Corten) towers in 1969. Field reports and condition assessment indicate the Corten structures are in poor condition. Static fiber is also at end of life.
- These lines provide critical outlet for Chesterfield Power station along with HCF and Polyester.

#### Recommended Solution:

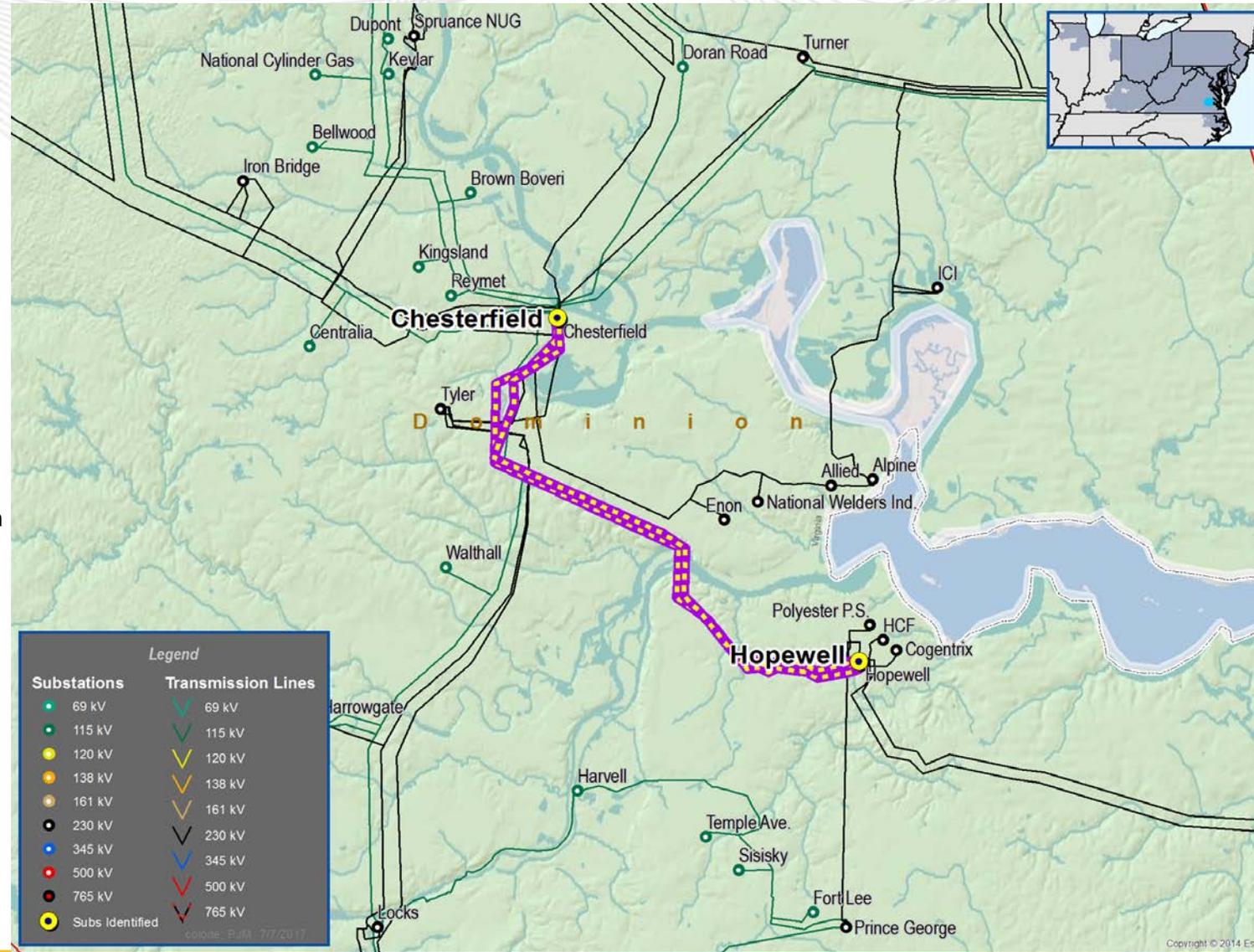
- Rebuild 8 miles of Line #211 and #228 to current standard. Proposed conductor is 2-636 ACSR. Summer emergency rating of the rebuilt section is 1046 MVA. Summer emergency rating of the entire lines after rebuild is 477 MVA with the remaining 3 mile section being the most limiting conductor. **(b2922)**
- Structures being considered include double circuit steel pole and double circuit galvanized steel tower.
- Fiber on the entire line will be replaced.

**Alternatives:** Replace fiber. Rebuild entire 11 miles of lines to current standard. Summer emergency rating of the new lines is 1046 MVA. Estimated project cost is \$34.1M.

**Estimated Project Cost:** \$28.1 M

**Projected IS Date:** Dec 2020

**Project Status:** Conceptual





# Dominion Transmission Zone

## Baseline Reliability - TO Criteria Violation

### Line #2144 Winfall to Swamp is at its End of Life

#### Problem Statement: Dominion “End of Life Criteria”

- 230kV Line #2144 Winfall - Swamp was constructed mostly on wood H frames in 1968. This line needs to be rebuilt to current standards based on Dominion’s “End of Life” criteria. The existing summer emergency rating of this line is 478 MVA. The existing conductor is 1109 ACAR (24/13).
- Rebuild is needed because:
  - Permanent retirement of Line #2144 changes 230kV Line #247 Suffolk - Swamp from a 230kV network line to a 31 mile long radial line serving 3900 customers.
  - The MW-mile for Line #247 Suffolk - Swamp would be 685 MW-mile based on the Winter 2025/26 projection. Dominion’s 700 MW-mile radial line criteria would be violated if 0.5 MW or more of new load were added in the future.
  - Contingencies result in reliability violations (low voltage) under stress case conditions (solar generation off line)

#### Potential Solution:

- Rebuild 230kV Line #2144 from Winfall to Swamp (4.3 miles) to current standards with a standard conductor (bundled 636 ACSR) having a summer emergency rating of 1047 MVA at 230kV.

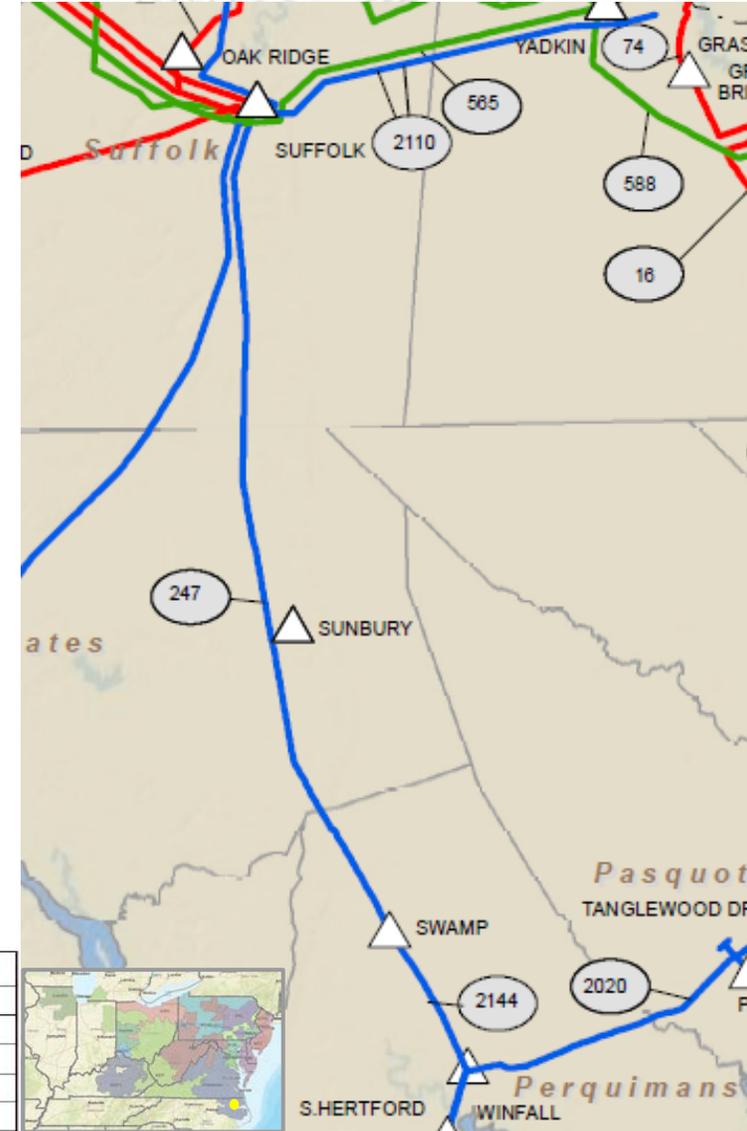
**Alternatives:** There are no other feasible alternatives that will maintain this network line.

**Estimated Project Cost:** \$6 M

**Possible IS Date:** 12/30/2022

**Project Status:** Conceptual

COLOR	VOLTAGE	TRANSMISSION LINE NUMBER
Green	500 KV.	500 thru 599
Blue	230 KV.	200 thru 299 & 2000 thru 2099
Red	115 KV.	1 thru 199
Orange	138 KV.	AS NOTED
Cyan	69 KV.	AS NOTED





# Dominion Transmission Zone Baseline Project

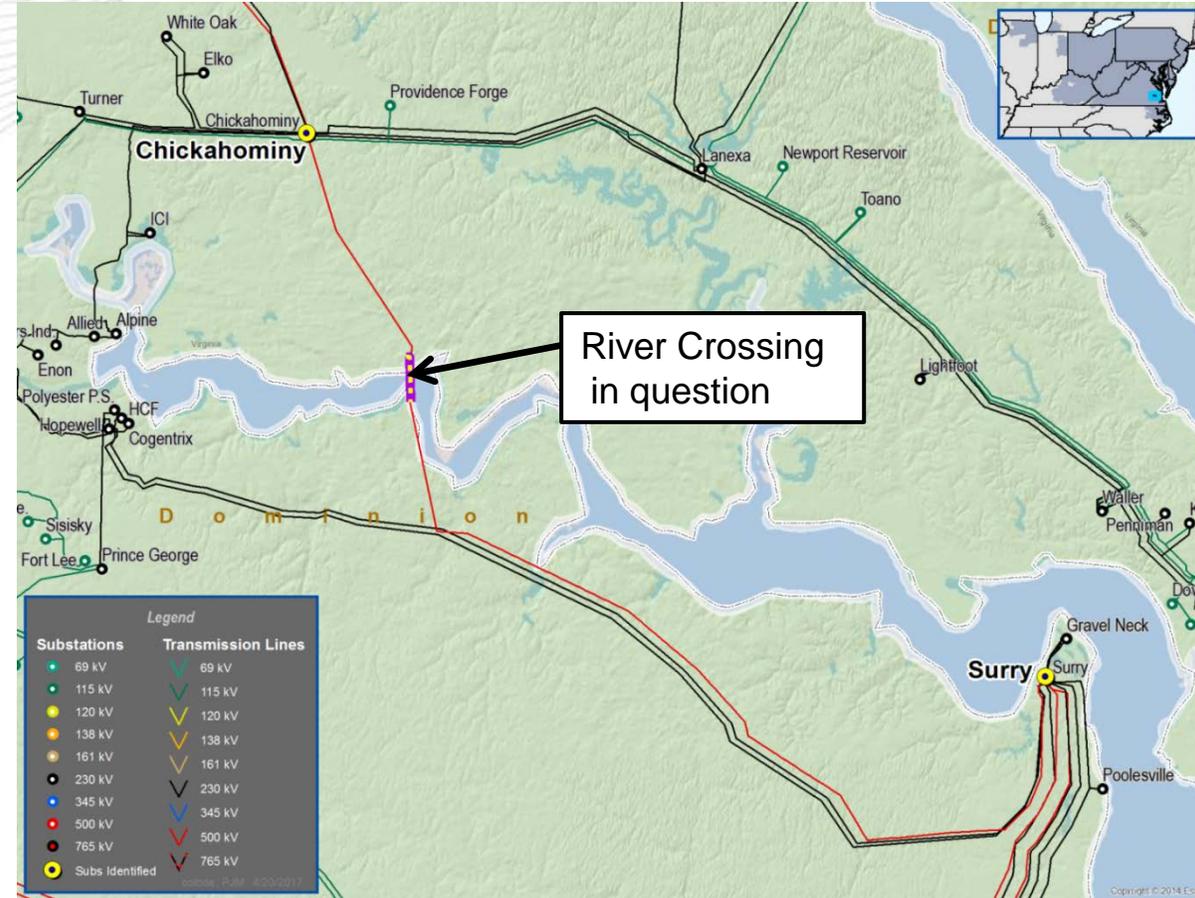
## Baseline Reliability - TO Criteria Violation

### Line #567 River Crossing Rebuild

Date Project Last Presented: 4/25/2017 SR RTEP

### Problem Statement: Dominion "End of Life Criteria"

- This project was previously presented as a Supplemental Project (s1280)
- Baseline project classification due to characteristics of the problem
- Dominion filed an application with the Virginia SCC in December of 2016 to replace four structures of 500kV Line #567 (Chickahominy – Surry PS).
- Two of these structures are located in the James River and are approximately 400 feet tall and the other two structures are located on the rivers edge.
- These structures have deteriorated to a point that they need to be replaced. A specialized conductor was used in the construction of the river crossing which limits the line to 1954 MVA.
- This is the only location on Dominion's system that this conductor is used.
- Loss of Line #567 results in multiple Generation Deliverability violations:
  - 230kV Line #259 Chesterfield – Basin is overloaded for the loss of Line #563 Carson – Midlothian or the loss of 230kV Line #217 Chesterfield – Lakeside
  - 230 kV Line #2154 Skiffes Creek – Kings Mill is overloaded for the loss of Line # 563 Carson – Midlothian
  - 230kV Line #2154 Skiffes Creek – Kings Mill – Penniman – Waller is overloaded for stuck breaker 56372 at Carson
  - 500kV – 230 kV Transformer at Carson is overloaded for stuck breaker 562T563 at Carson
  - 230kV Line #259 Chesterfield – Basin is overloaded for stuck breaker 205T217 at Chesterfield



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### Potential Solution:

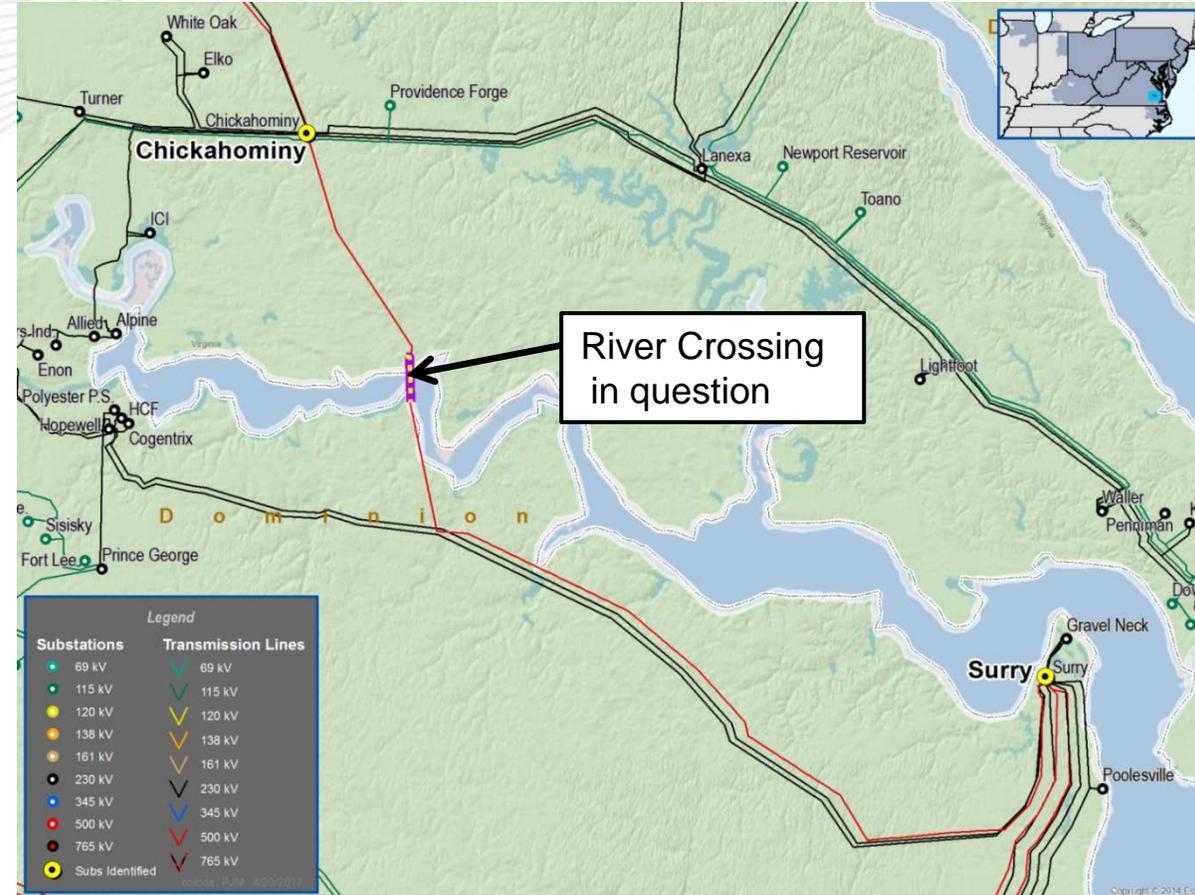
- Rebuild the four structures using galvanized steel and replace the river crossing conductor with 3-1534 ACSR.
- This will increase the 500kV Line #567 line rating from 1954 MVA to 2600 MVA.

**Alternatives:** No feasible alternatives

**Estimated Project Cost:** \$41 M

**Possible IS Date:** 12/30/2017

**Project Status:** Engineering



# Short Circuit Projects

## Problem: Short Circuit

- The China Tap 230kV breaker 'CS15' is overstressed

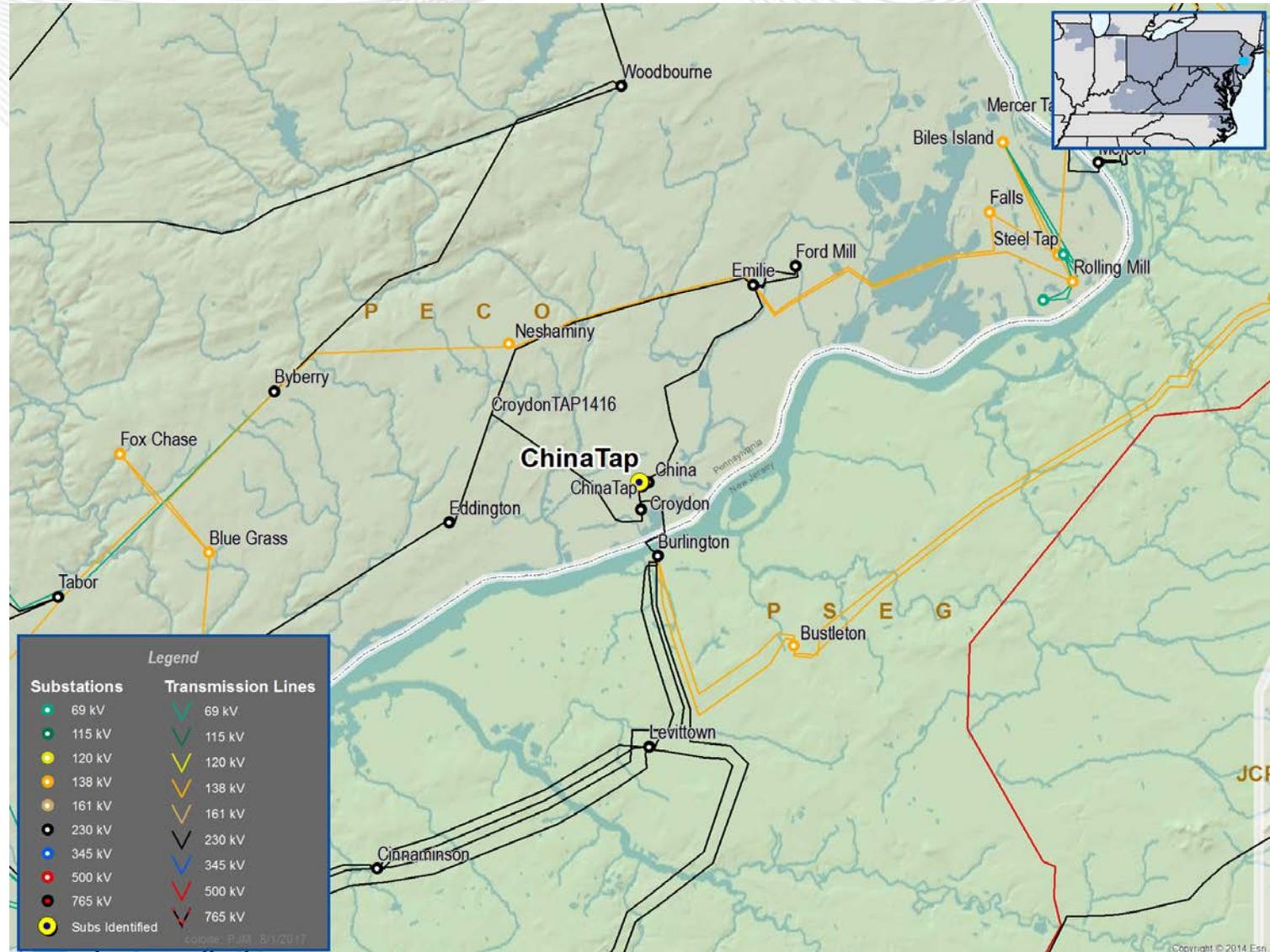
## Recommended Solution:

- Replace China Tap 230kV breaker 'CS15' with a 63kA breaker (b2923)

## Estimated Project Cost:

\$603 K

Required IS Date: 6/1/2019



## Problem: Short Circuit

- The Emilie 230kV breakers 'CS15' and 'CS25' are overstressed

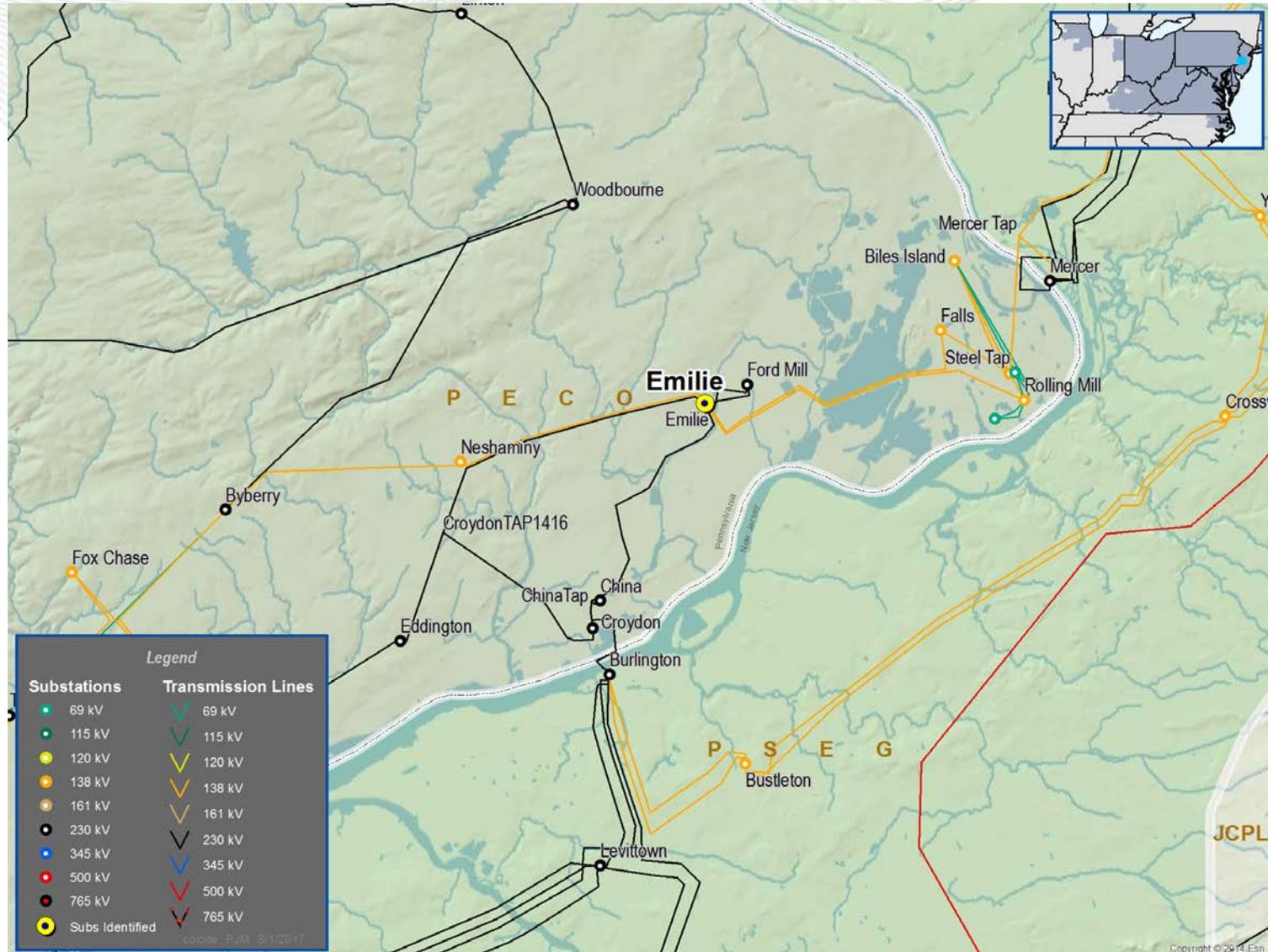
## Recommended Solution:

- Replace Emilie 230kV breakers 'CS15' and 'CS25' with 63kA breakers (b2924 & b2925)

## Estimated Project Cost:

\$603 K

Required IS Date: 6/1/2019



## Problem: Short Circuit

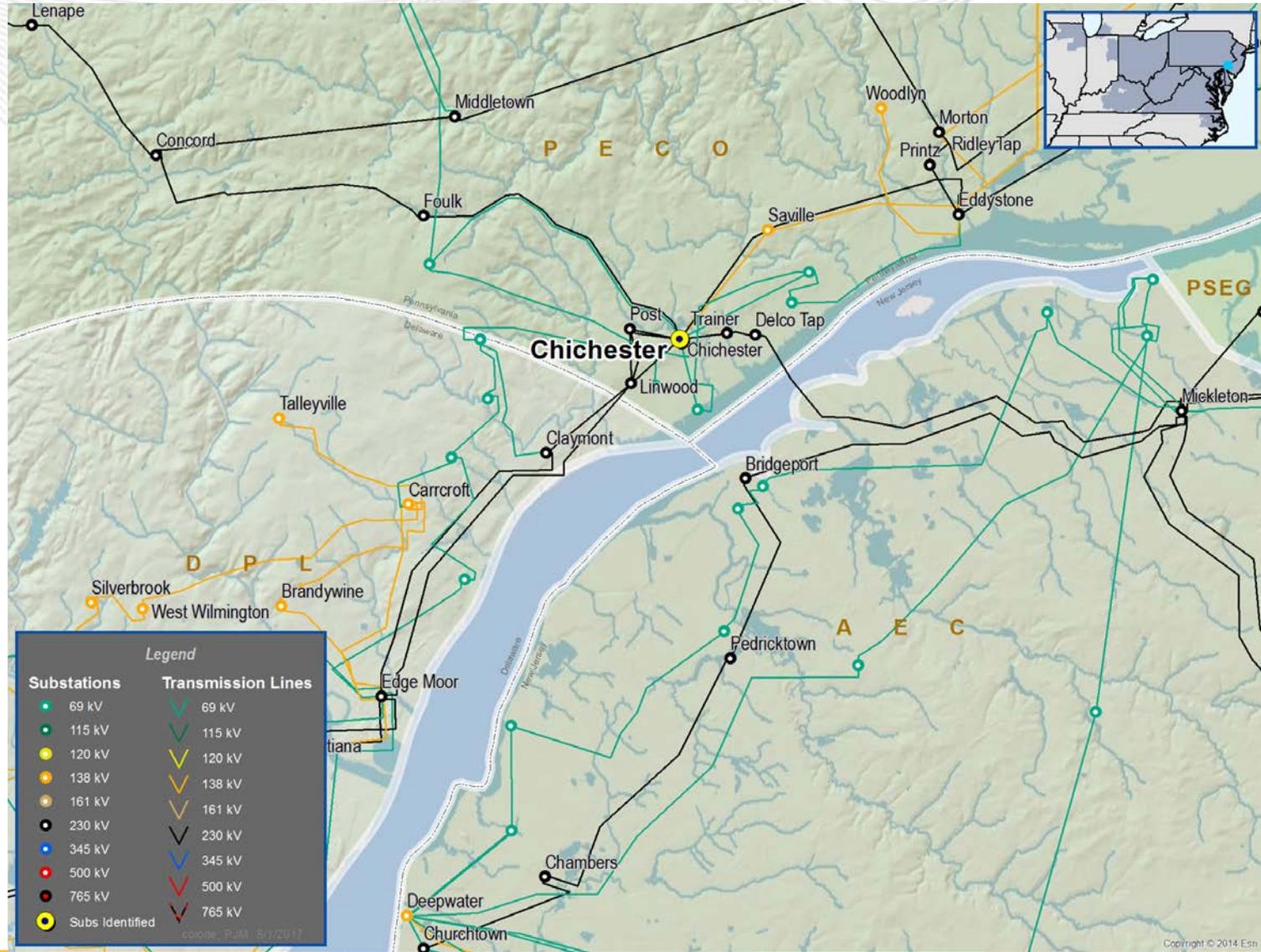
- The Chichester 230kV breaker '215' is overstressed

## Recommended Solution:

- Replace Chichester 230kV breaker '215' with a 63kA breaker (b2926)

**Estimated Project Cost:**  
\$342 K

**Required IS Date:** 6/1/2019



## Problem: Short Circuit

- The Plymouth Meeting 230kV breaker '125' is overstressed

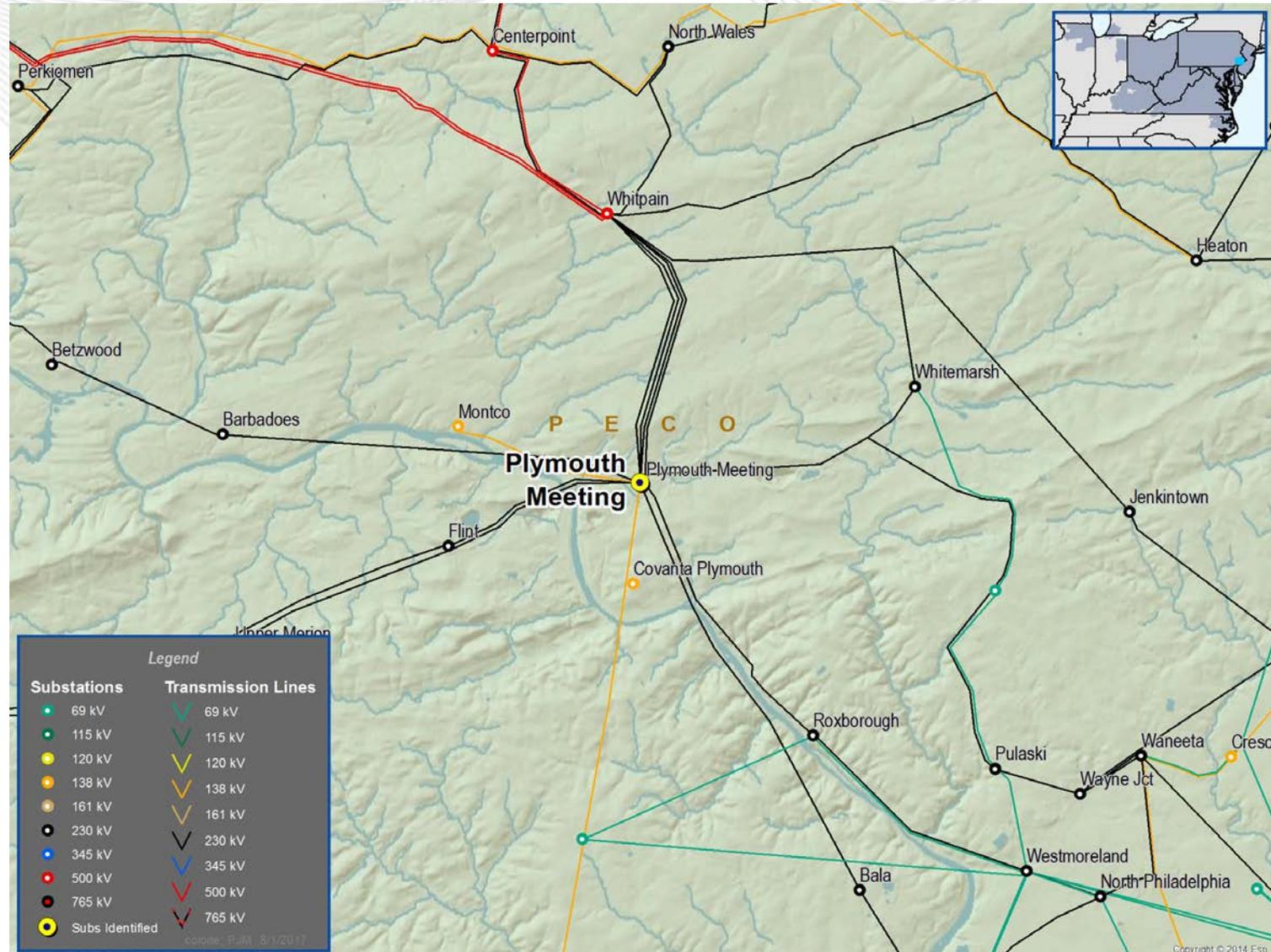
## Recommended Solution:

- Replace Plymouth Meeting 230kV breaker '125' with a 63kA breakers (b2927)

## Estimated Project Cost:

\$342 K

Required IS Date: 6/1/2019



# 2017 RTEP Next Steps

- Anticipate closing the 2017 Window #1 on Friday, 8/15/2017
- Present preliminary recommendations for immediate need violations and other violations that were excluded from the window
- Anticipate 15 year reliability results
- 18 month RTEP cycle Update



# Upcoming TEAC Meetings and anticipated PJM Board Review

**9/14 – TEAC Reliability Analysis Update**

**10/12 – TEAC Reliability Analysis Update**

**10/17 – PJM Board of Managers Review**

**11/9 – TEAC Reliability Analysis Update**

**12/4 – PJM Board of Managers Review**

**(If necessary, additional online/teleconference meetings to be held to review potential and recommended solutions)**

# Questions?

Email: [RTEP@pjm.com](mailto:RTEP@pjm.com)

- 8/7/2017 – Original Version Posted to PJM.com
- 8/9/2017 – Updated Version Posted to PJM.com
  - Slides 4,5,7 updated with current data for # of flowgates posted in window
  - Slide #19 updated to include information regarding violations under stress case conditions.