



# Sub Regional RTEP Committee Mid-Atlantic

March 23, 2018

# First Review

## Baseline Reliability and Supplemental Projects

## Problem Statement:

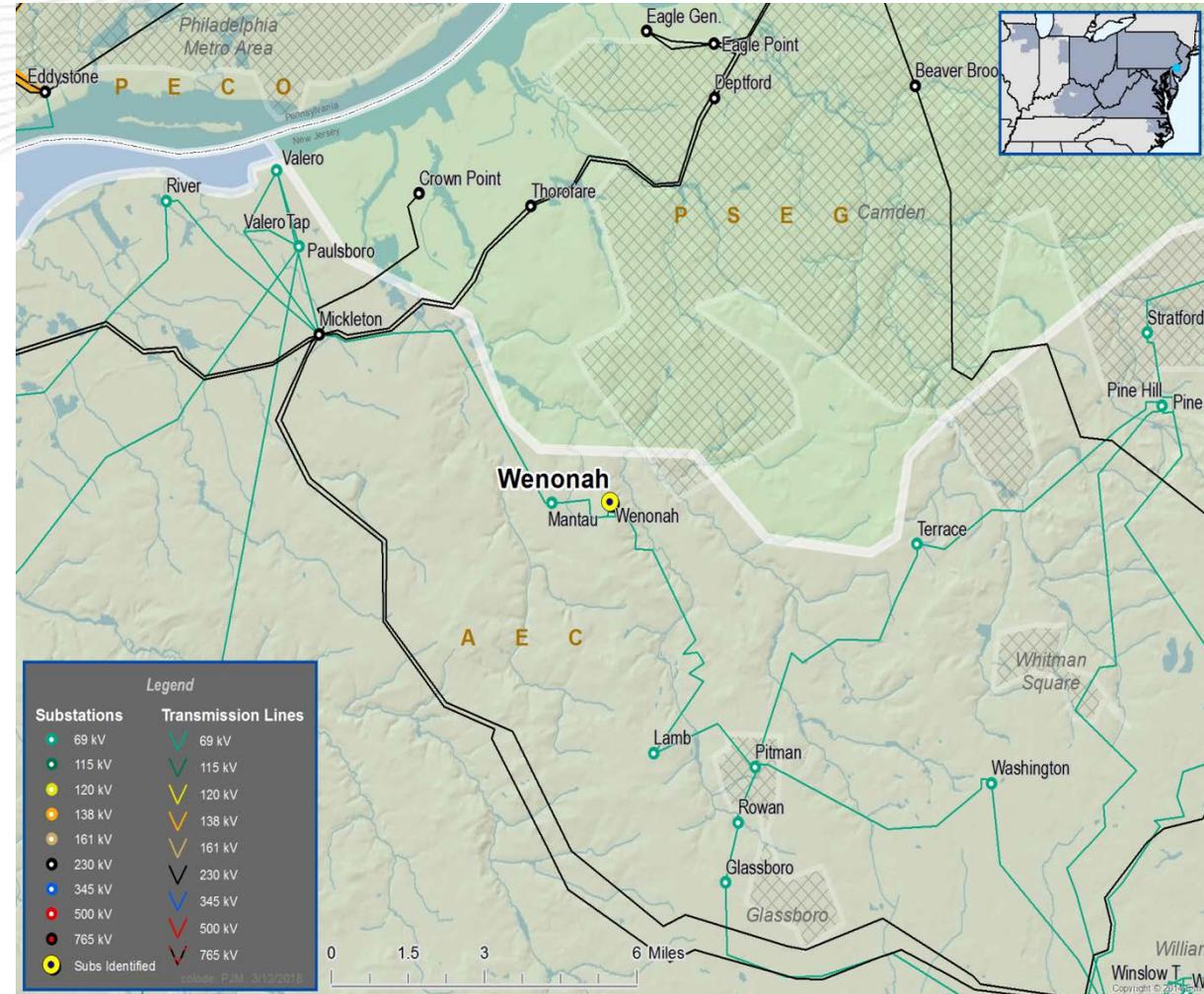
Wenonah, a 69/12kV distribution substation, T1 and T2 distribution transformers are deteriorated based on equipment condition assessments. Additionally, there are no existing 69kV breakers in the substation (the current design is not built to the existing standard).

## Potential/ Alternative Solution:

- Retire Wenonah substation, shift load to Mantua substation, and have the 69kV 0785 line from Mantua to Lamb bypass the existing Wenonah substation.
- Replace Wenonah T1 & T2 transformers and install high side 69kV bus.

**Preliminary In-Service:** 12/31/2020

**Status:** Conceptual



**Problem Statement:**

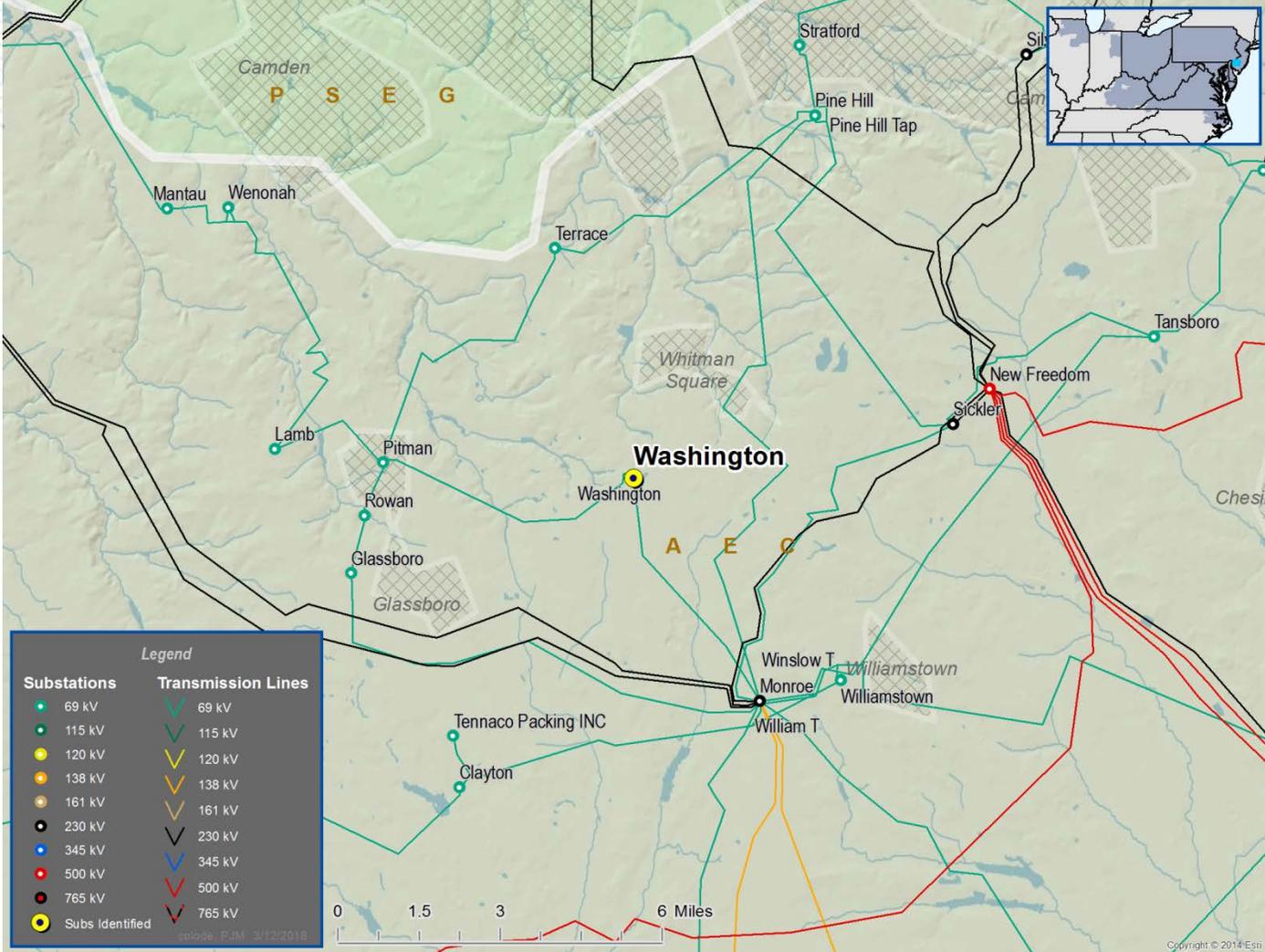
At Washington Substation, a 69/12kV distribution substation, the two existing transformers are projected to experience overloads beginning in summer 2020. A third transformer is required to alleviate the projected overloads.

**Potential/ Alternative Solution:**

- Convert the 69kV line bus to a ring bus.
- Expand existing line bus.

**Preliminary In-Service:** 12/31/2020

**Status:** Conceptual



### Problem Statement:

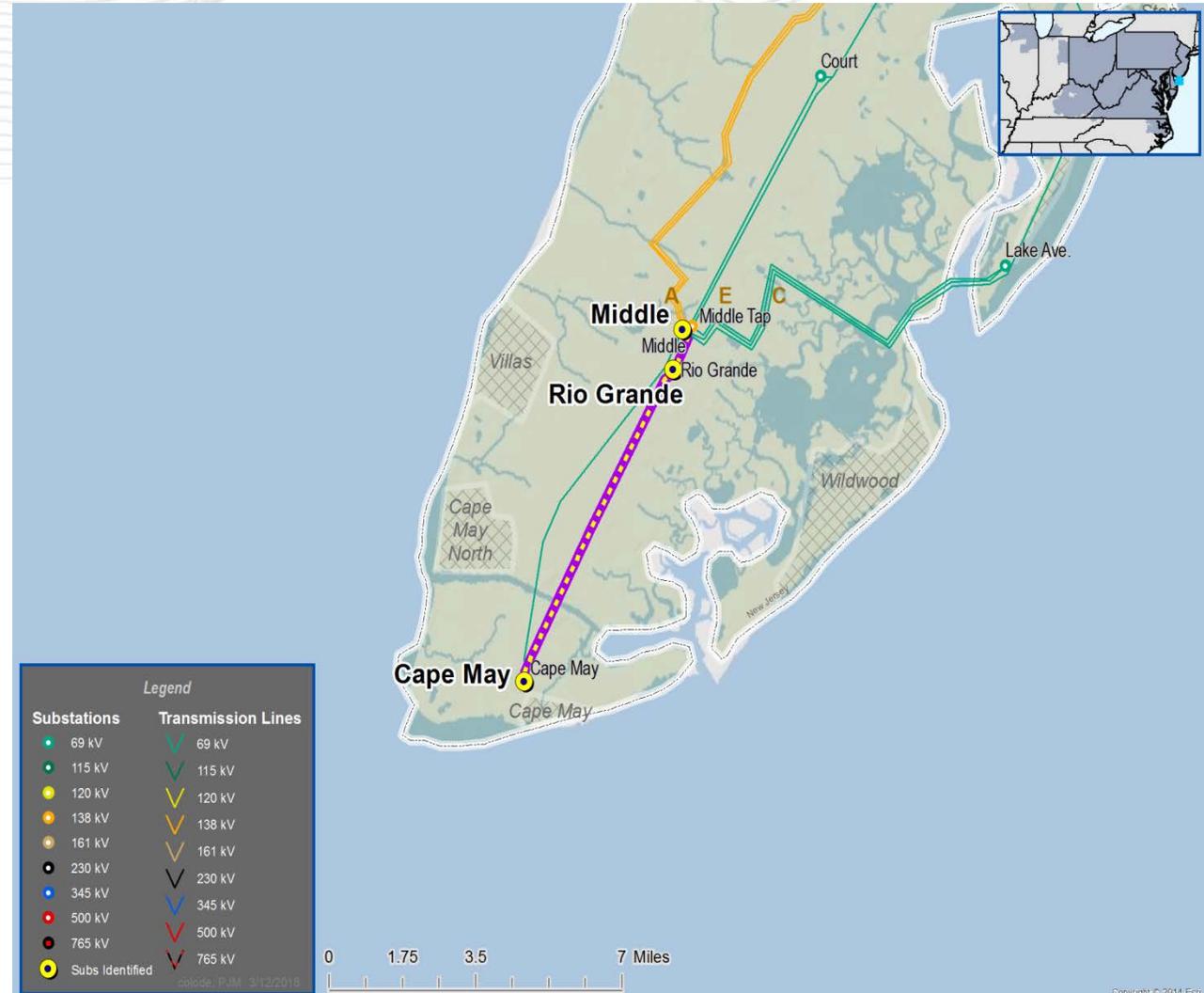
This project is needed to mitigate performance risk associated with the current equipment material and condition. Specifically, based on inspection data, deteriorated and cracked poles were identified, which places this line in the top quartile of the ACE age and condition ranking.

### Potential/ Alternative Solution:

- Rebuild line 0735 #2 between Middle, Rio Grande, and Cape May substations. All structures, conductor, and static wire will be replaced with new weathering steel poles, conductor, and OPGW.
- Obtain new ROW to install a new line on an alternate route.

Preliminary In-Service: 12/31/2021

Status: Conceptual



## Problem Statement:

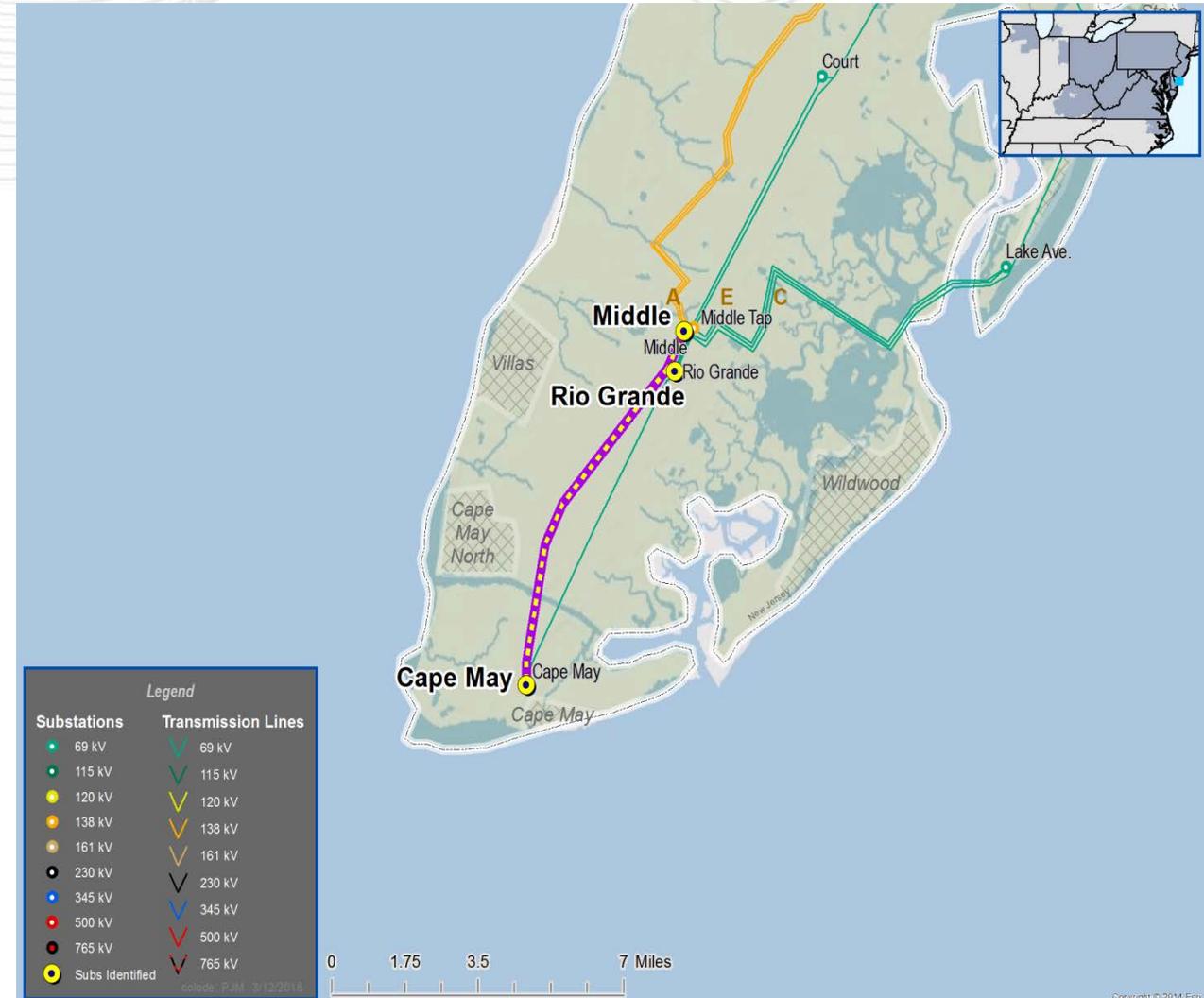
This project is needed to mitigate performance risk associated with the current equipment material and condition. Specifically, based on inspection data, deteriorated poles were identified, which places this line in the top quartile of the ACE age and condition ranking.

## Potential/ Alternative Solution:

- Rebuild line 0737 #1 between Middle, Rio Grande, and Cape May substations. All structures, conductor, and static wire will be replaced with new weathering steel poles, conductor, and OPGW.
- Obtain new ROW to install a new line on an alternate route.

Preliminary In-Service: 12/31/2022

Status: Conceptual



## Problem Statement:

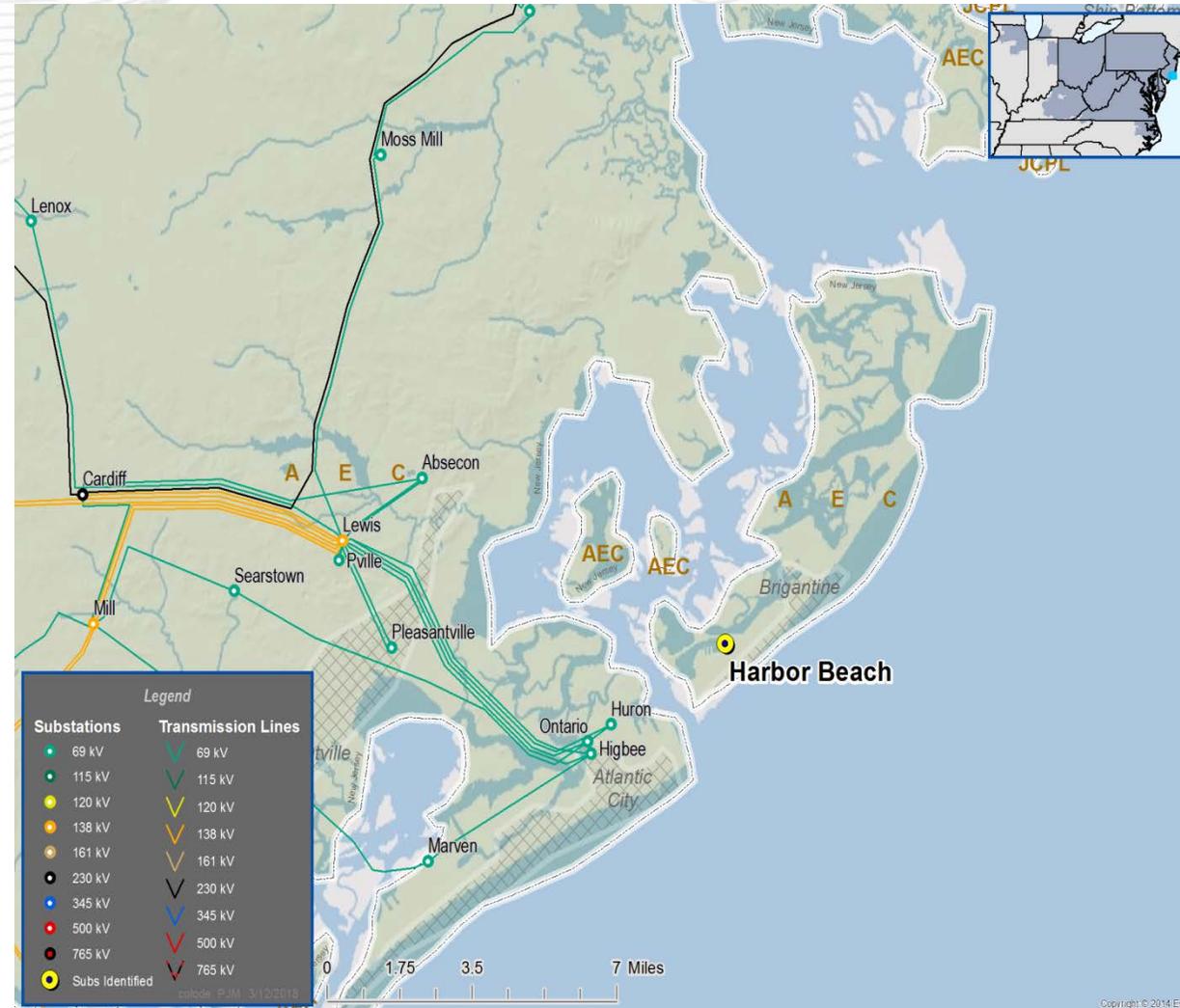
Brigantine Island is supplied by the existing Harbor Beach and Brigantine Substations, which are served by two 23kV sources. The N-1 contingency loading is projected to reach the emergency limit of the 23kV lines. Additionally, the existing lines, transformers, and switchgear have been identified as being in deteriorated condition.

## Potential/ Alternative Solution:

- Build a new six breaker 69kV GIS ring bus at Harbor Beach. Install two new 69kV sources from Huron and from Ontario. Retire the two existing Brigantine Island 23kV substations and 23kV lines.
- Build a new 69kV ring bus at Harbor Beach. Also build a new 69kV ring bus at Brigantine. Install two new 69kV sources from Huron and from Ontario to serve Harbor Beach and Brigantine. Retire the two existing Brigantine Island 23kV substations and lines.

**Preliminary In-Service:** 12/31/2022

**Status:** Conceptual



## Problem Statement:

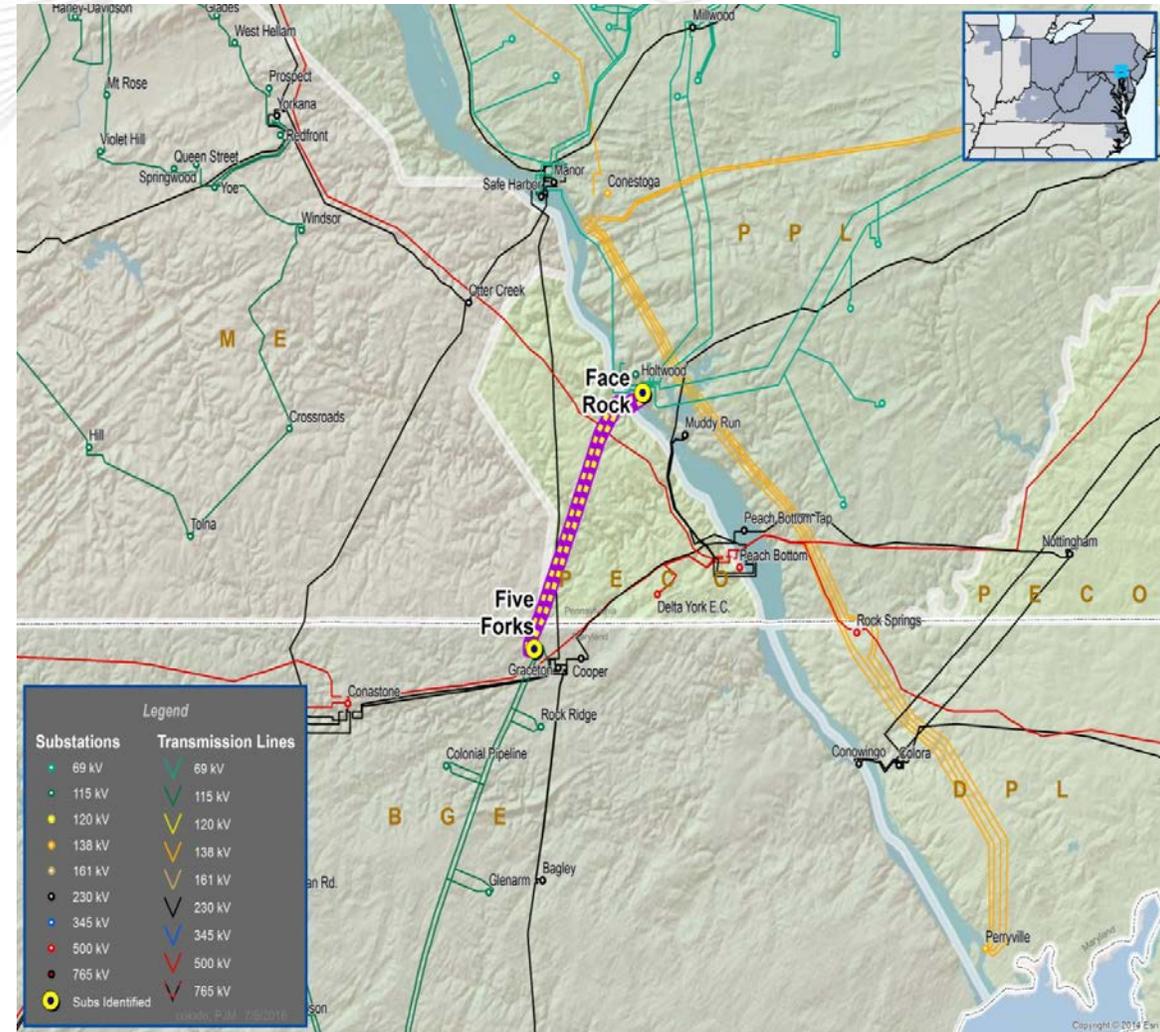
- The BGE owned portion of the 110901-1/110901-2 115kV tie-line consists of double lattice towers operating as a six wire circuit
- The BGE-owned portion of the line is approximately two miles long extending from BGE's Five Forks station to the Maryland/Pennsylvania state line.
- The towers were installed in the 1910's and are experiencing hardware deterioration and avian-related issues
- The existing 300kcm 19-strand AAC conductor and hardware was installed in the 1930's and is showing signs of corrosion and annealing along with having past splice failures

## Potential/ Alternative Solution:

- Replace double lattice towers with single monopole structures and install single 795kcm 30/19 ACSR conductor, connect into single dead end switch and the existing breaker at Five Forks
  - Coordinates with PPL Supplemental Project S1154 presented -7/26/2016
- Abandon Line: This is not a viable alternative as it serves as network outlet to Holtwood Hydro Generation Plant
- Shunt splices on all six conductors: Should only be used as temporary measure until re-conductor can be completed and does not address all issues
- Re-conductor using existing towers: Does not address tower corrosion and clearance issues that would need to be addressed, difficult to locate faults

Preliminary In-Service: 12/1/2020

Status: Conceptual



**Problem Statement:**

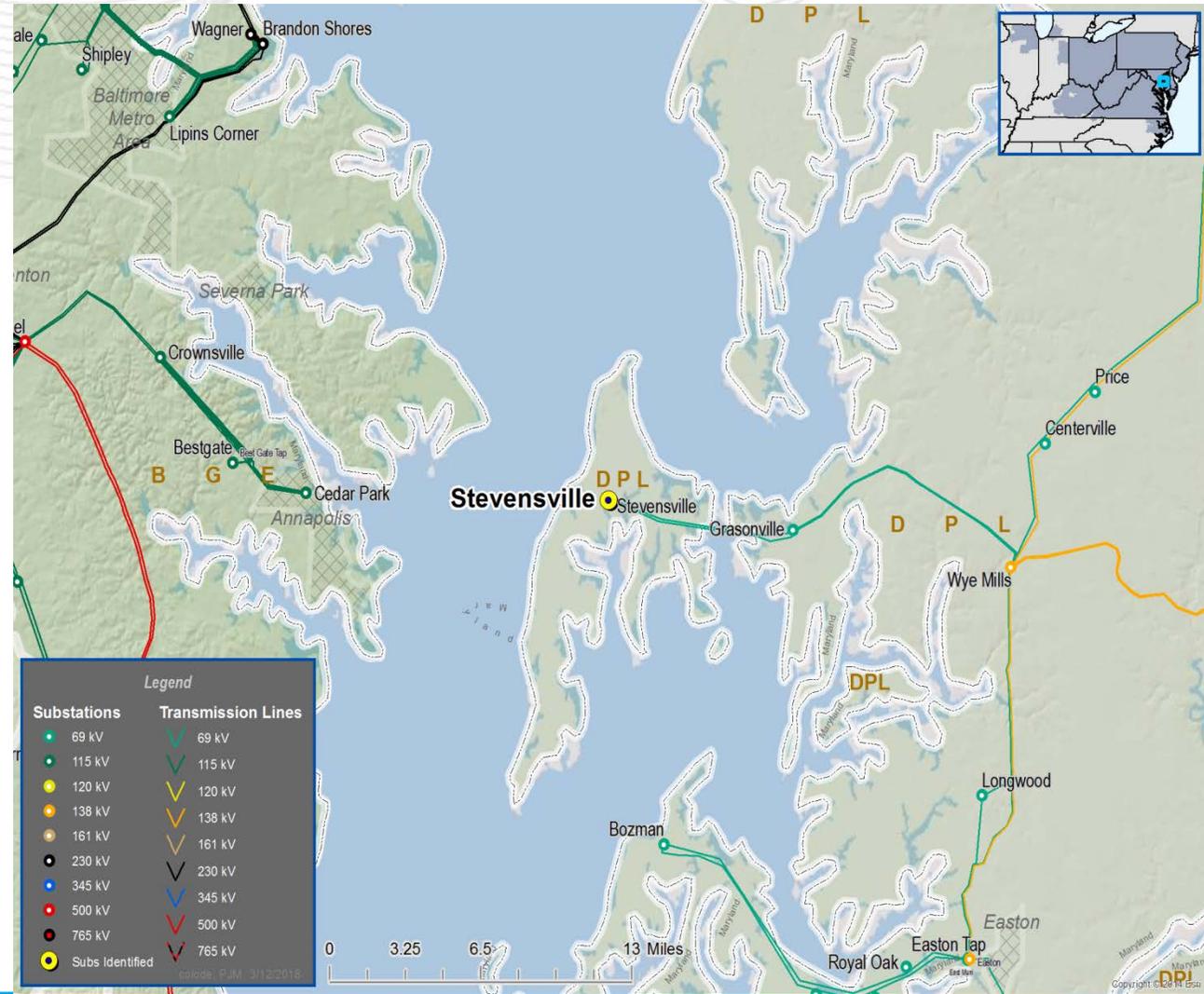
This area faces repeated outages due to the existing substation configuration and the remote location at the edge of DPL territory. There are no 69kV breakers at the substation.

**Potential/ Alternative Solution:**

- Install a 3 breaker 69kV line bus, which will isolate faults and limit customer interruptions.
- Install a 69kV ring bus. This option is limited by physical site size and neighboring wetlands.
- Do nothing, which would allow for similar outages to occur again in the future.

**Preliminary In-Service:** 12/31/2019

**Status:** Conceptual



**Problem Statement:**

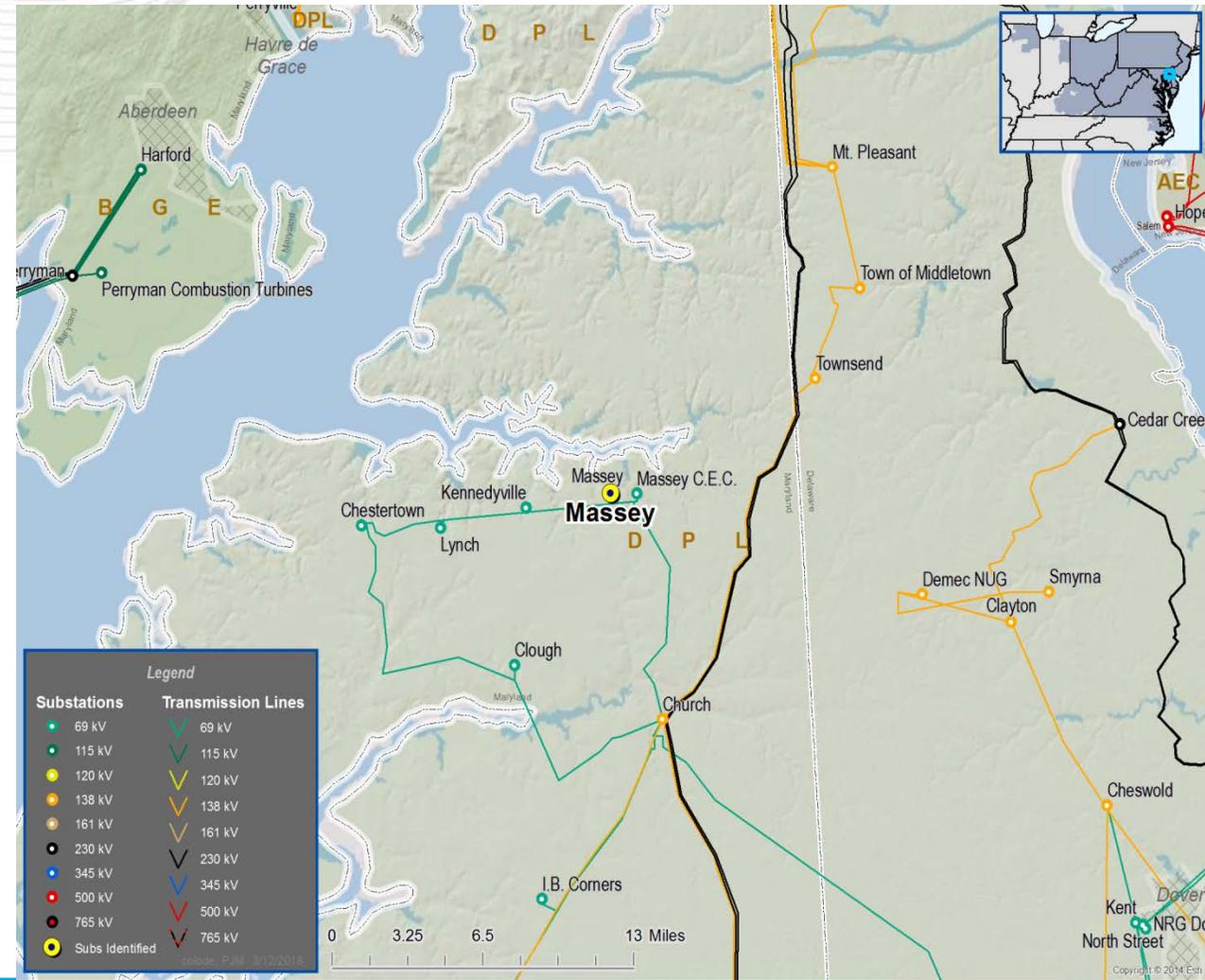
This area faces repeated outages due to the existing tapped substation configuration and the remote location.

**Potential/ Alternative Solution:**

- Install a 3 breaker 69kV line bus, which will isolate faults and limit customer interruptions.
- Install a 69kV ring bus. This option is limited by physical site size.
- Do nothing, which would allow for similar outages to occur again in the future.

Preliminary In-Service: 12/31/2019

Status: Conceptual



### Problem Statement:

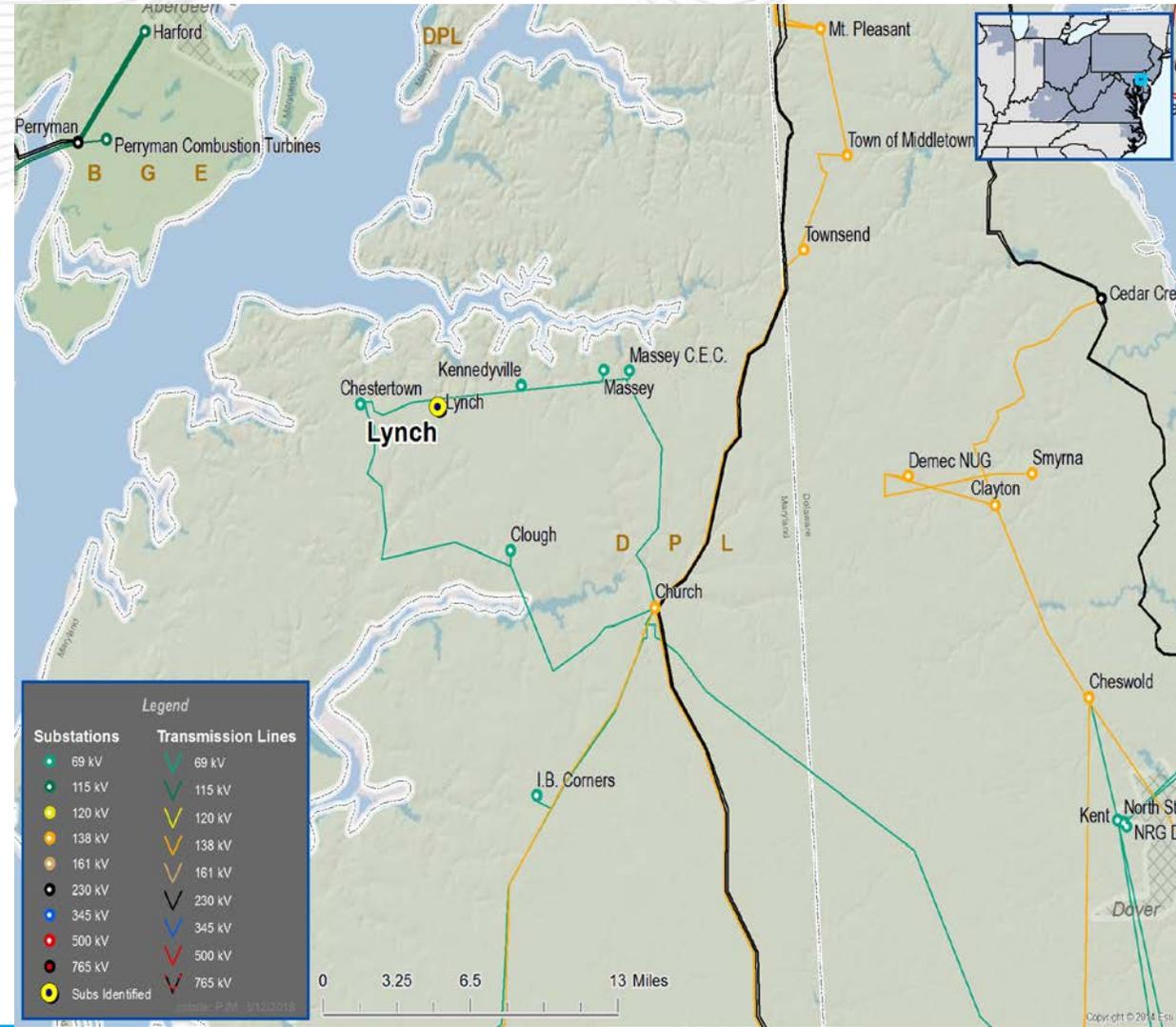
This area faces repeated outages due to the existing tapped substation configuration and the remote location.

### Potential/ Alternative Solution:

- Install a 3 breaker 69kV line bus, which will isolate faults and limit customer interruptions.
- Install a 69kV ring bus. This option is limited by physical site size.
- Do nothing, which would allow for similar outages to occur again in the future.

Preliminary In-Service: 12/31/2019

Status: Conceptual



### Problem Statement:

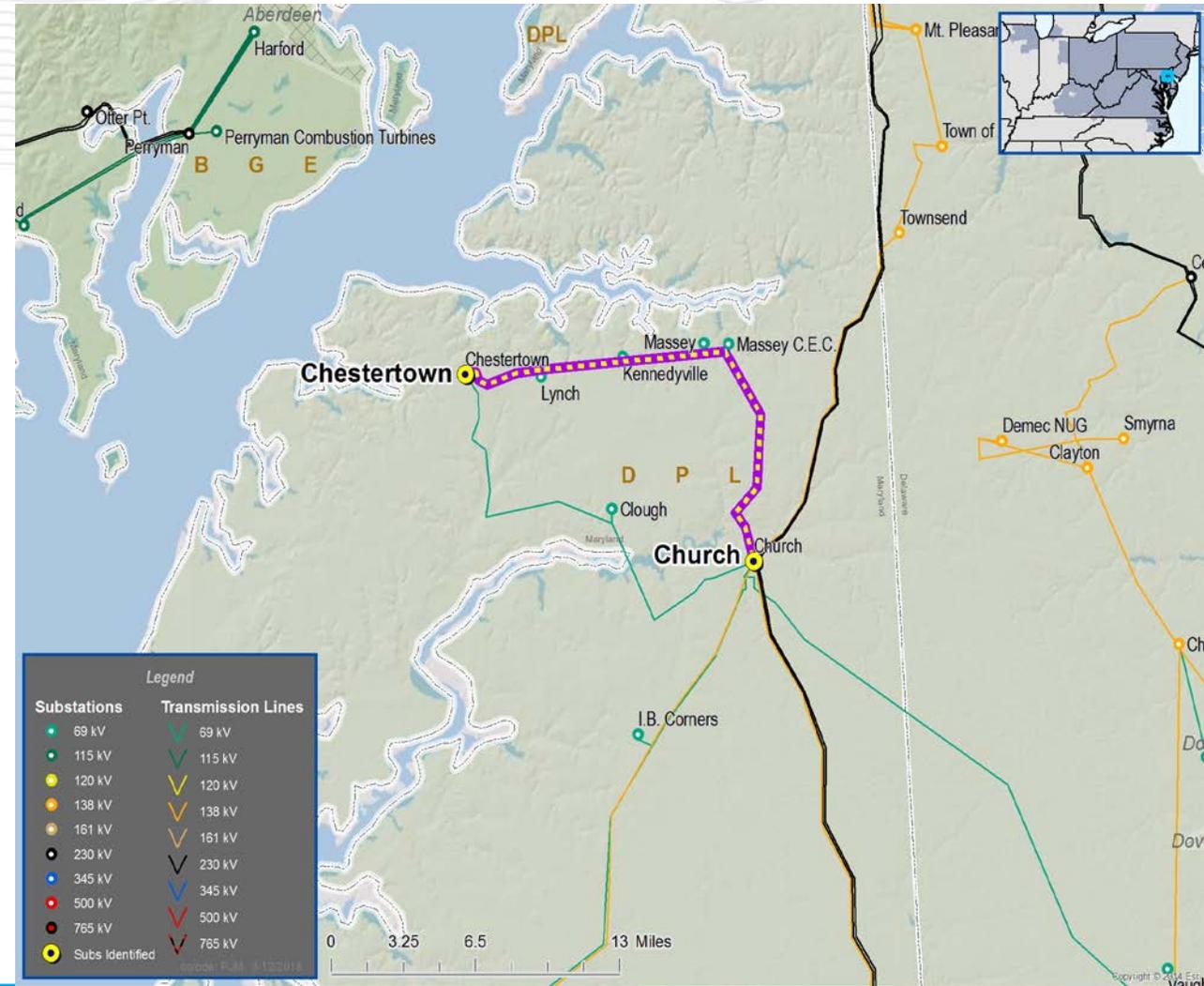
This project is needed to mitigate performance risk associated with the current equipment material and condition. Specifically, based on inspection data, deteriorated, cracked, and weathered crossarms and deteriorated poles were identified, which places this line in the top quartile of the DPL age and condition ranking.

### Potential/ Alternative Solution:

- Rebuild line 6727 between Church and Chestertown substations. The work would be split into three construction stages: Church – Massey REA, Massey REA – Lynch, and Lynch – Chestertown. All structures, conductor, and static wire will be replaced with new steel poles and conductor.
- Obtain new ROW to install a new line on an alternate route.

**Preliminary In-Service:** 12/31/2022 (Final Stage of construction completed)

**Status:** Conceptual



**Problem Statement:**

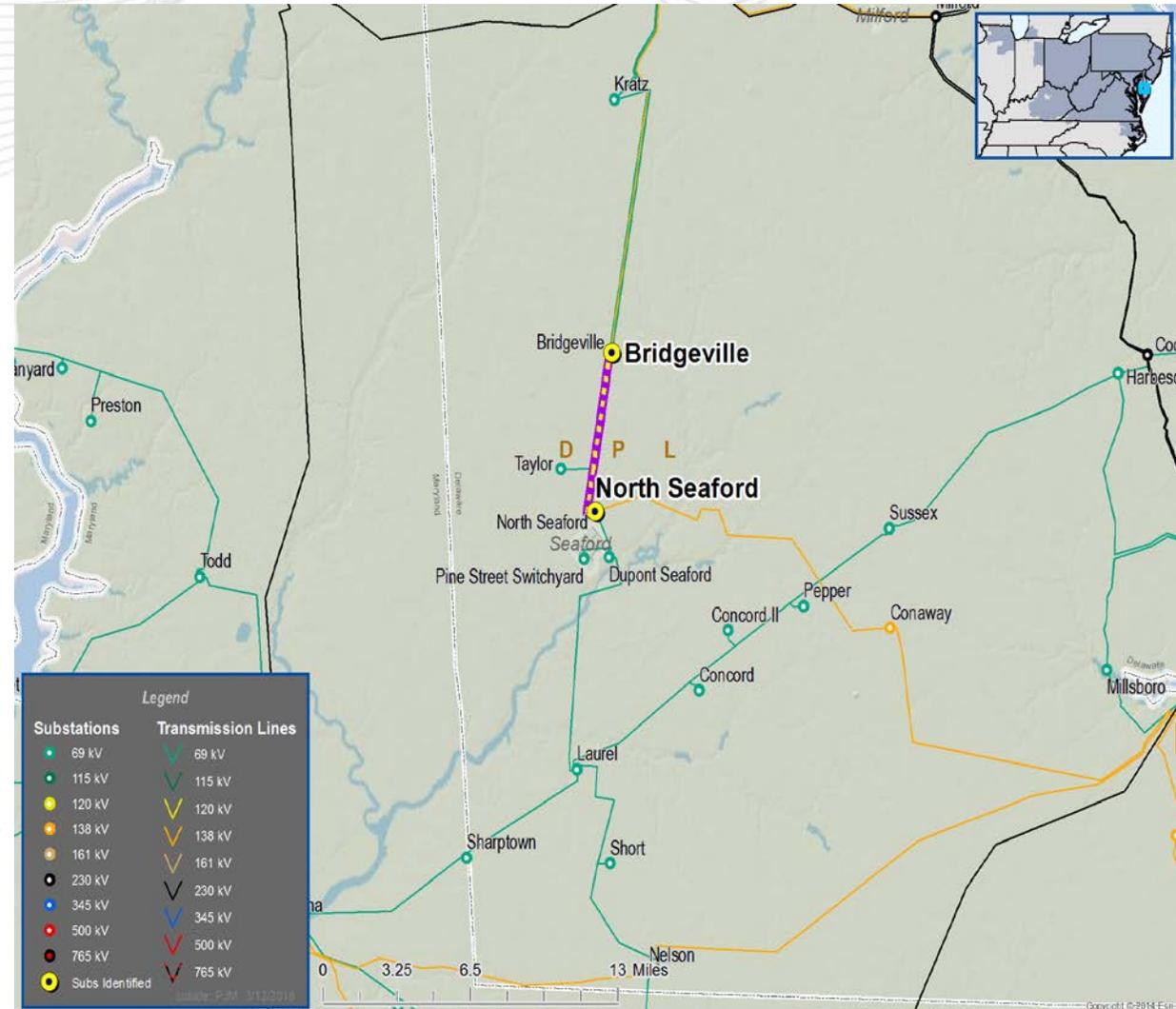
This project is needed to mitigate performance risk associated with the current equipment material and condition. Specifically, based on inspection data, deteriorated, cracked, and weathered crossarms and deteriorated poles were identified, which places this line in the top quartile of the DPL age and condition ranking.

**Potential/ Alternative Solution:**

- Rebuild line 6737 between North Seaford and Bridgeville substations. All structures, conductor, and static wire will be replaced with new steel poles and conductor.
- Obtain new ROW to install a new line on an alternate route.

**Preliminary In-Service:** 12/31/2020

**Status:** Conceptual



## Problem Statement:

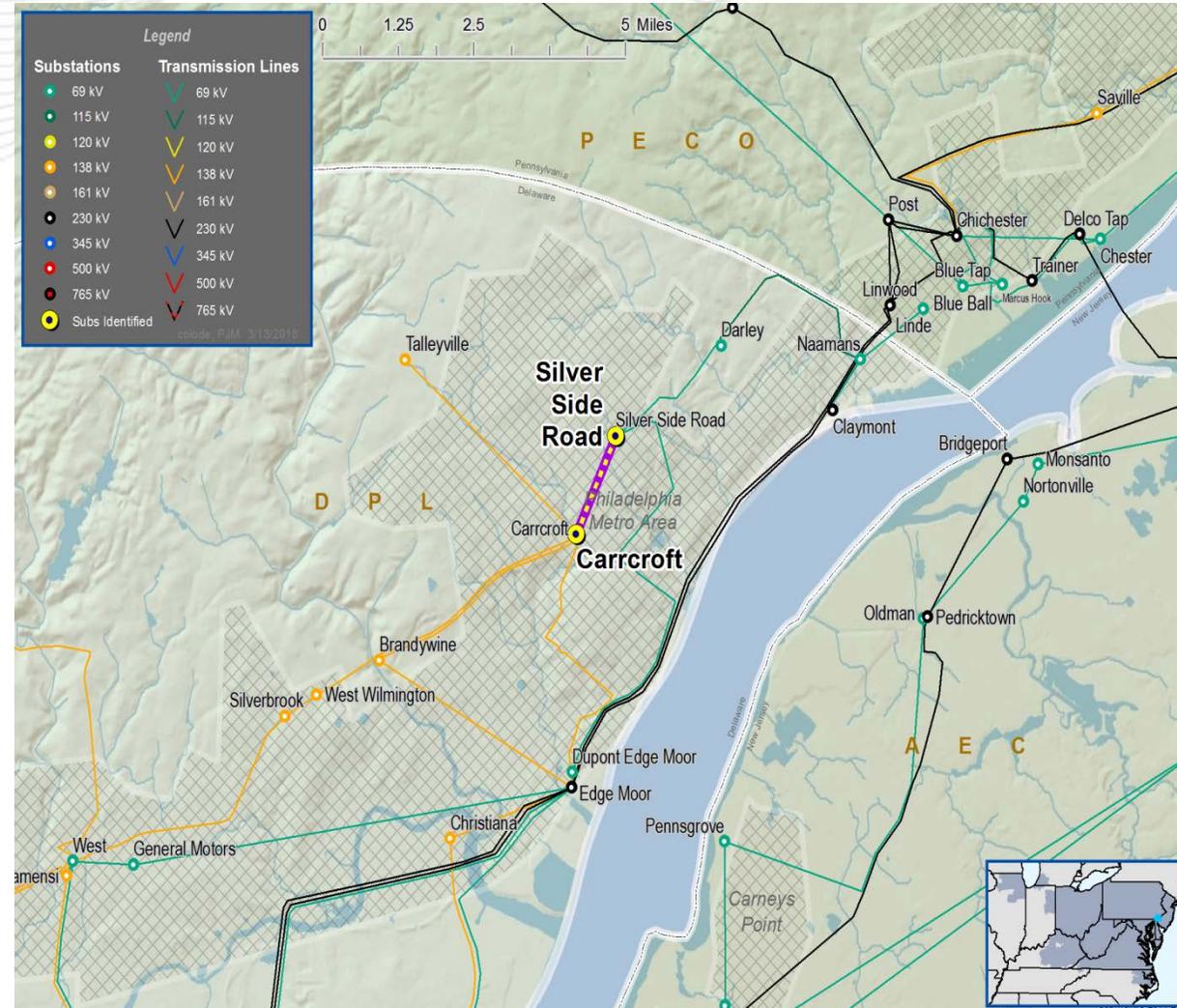
This project is needed to mitigate performance risk associated with the current equipment material and condition. Specifically, based on inspection data, deteriorated, cracked, and weathered crossarms and deteriorated poles were identified, which places this line in the top quartile of the DPL age and condition ranking.

## Potential/ Alternative Solution:

- Rebuild line 6831 between Carrcroft and Silverside substations. All structures, conductor, and static wire will be replaced with new poles, conductor, and OPGW.
- Obtain new ROW to install a new line on an alternate route.

**Preliminary In-Service:** 12/31/2020

**Status:** Conceptual



## Problem Statement:

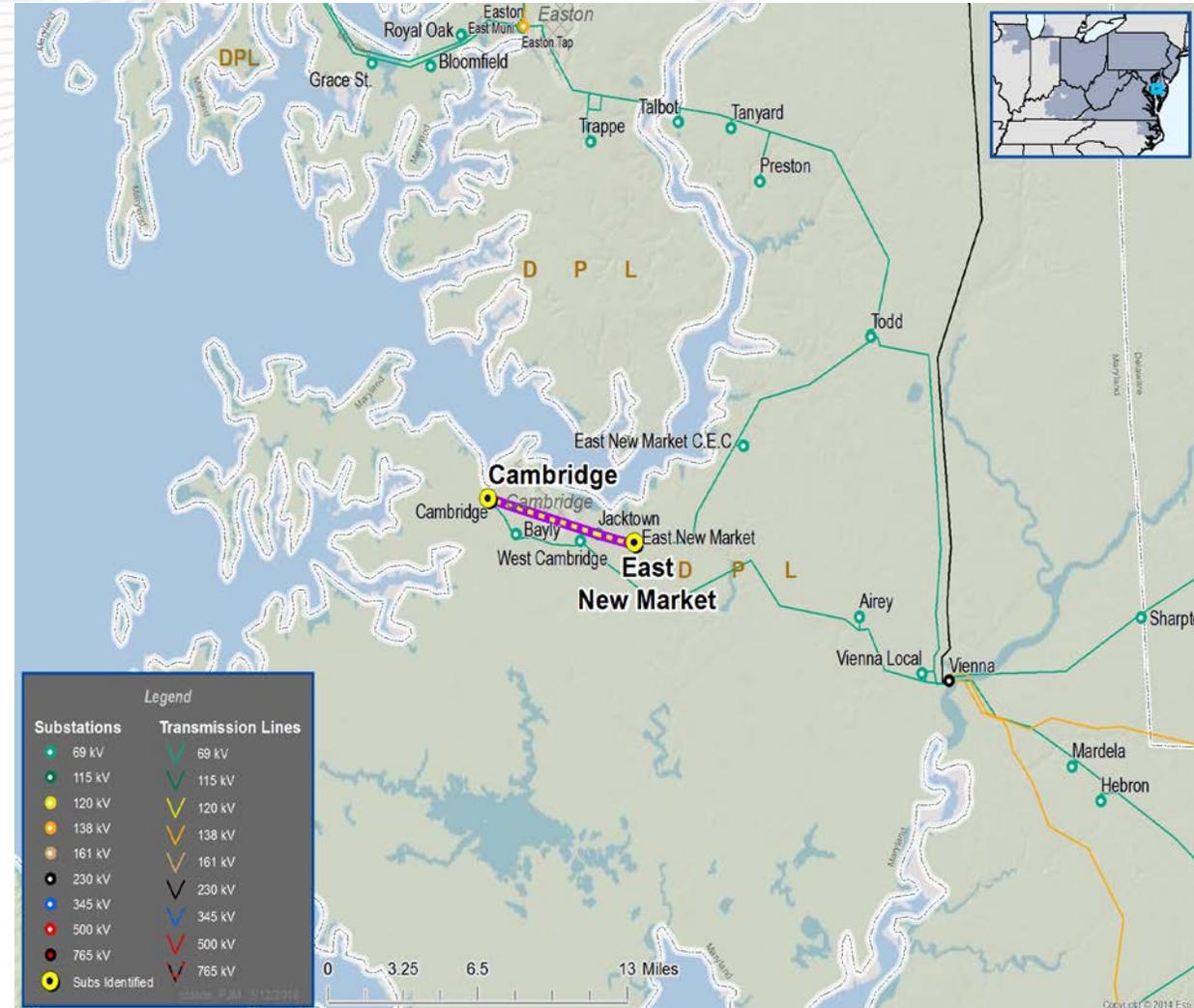
This project is needed to mitigate performance risk associated with the current equipment material and condition. Specifically, based on inspection data, deteriorated, cracked, and weathered crossarms and deteriorated poles were identified as being in critical condition, which places this line in the top quartile of the DPL age and condition ranking.

## Potential/ Alternative Solution:

- Rebuild line 6719 between East New Market and Cambridge substations. All structures, conductor, and static wire will be replaced with new poles, conductor, and OPGW.
- Obtain new ROW to install a new line on an alternate route.

**Preliminary In-Service:** 5/31/2021

**Status:** Conceptual



**Problem Statement:**

Operational Flexibility and Efficiency

- Improve operational flexibility during maintenance and restoration efforts.
- Eliminate the simultaneous outages to three or more system elements.

**Potential Solution:**

Middletown Junction Substation

- Install eleven (11) 230 kV Circuit Breakers to complete the double bus configuration including replacement of the #2 (75 MVA) & #5 (75/84 MVA) 230/115 kV transformers with 180/240/300 MVA units, and removal of the #1 (75 MVA) 230/115 kV transformer.

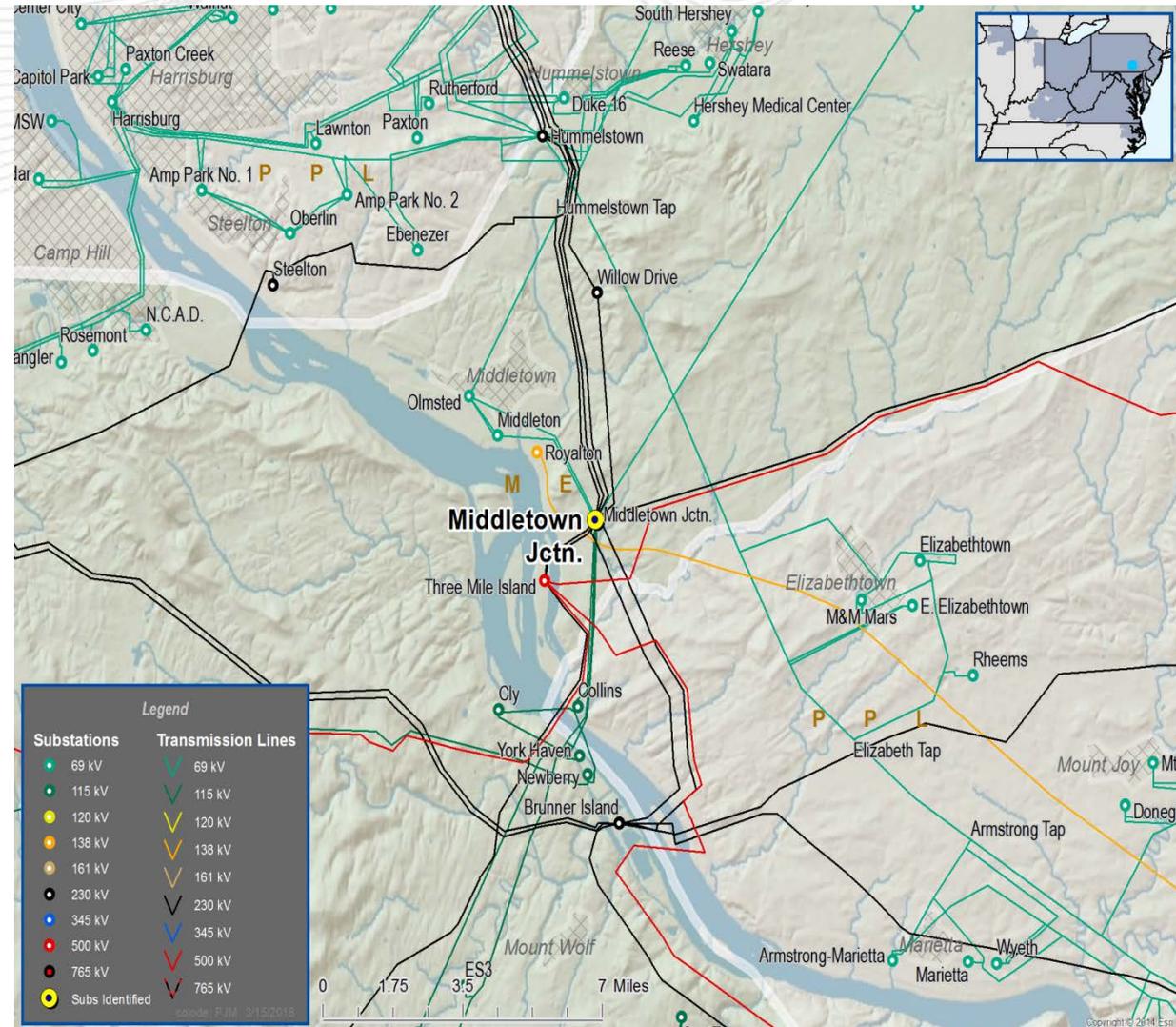
**Alternatives Considered:**

None

Estimated Project Cost: \$13.5 M

Projected IS date: 6/1/2023

Status: Engineering



**Problem Statement:**

Operational Flexibility and Efficiency

- Reduces customer outage exposure.
- Mitigates loss of Tolna substation for a fault on the 115 kV line to the generator.

**Potential Solution:**

Tolna Substation

- Install new 115 kV circuit breakers at Tolna on the generator terminal and in the bus tie position.

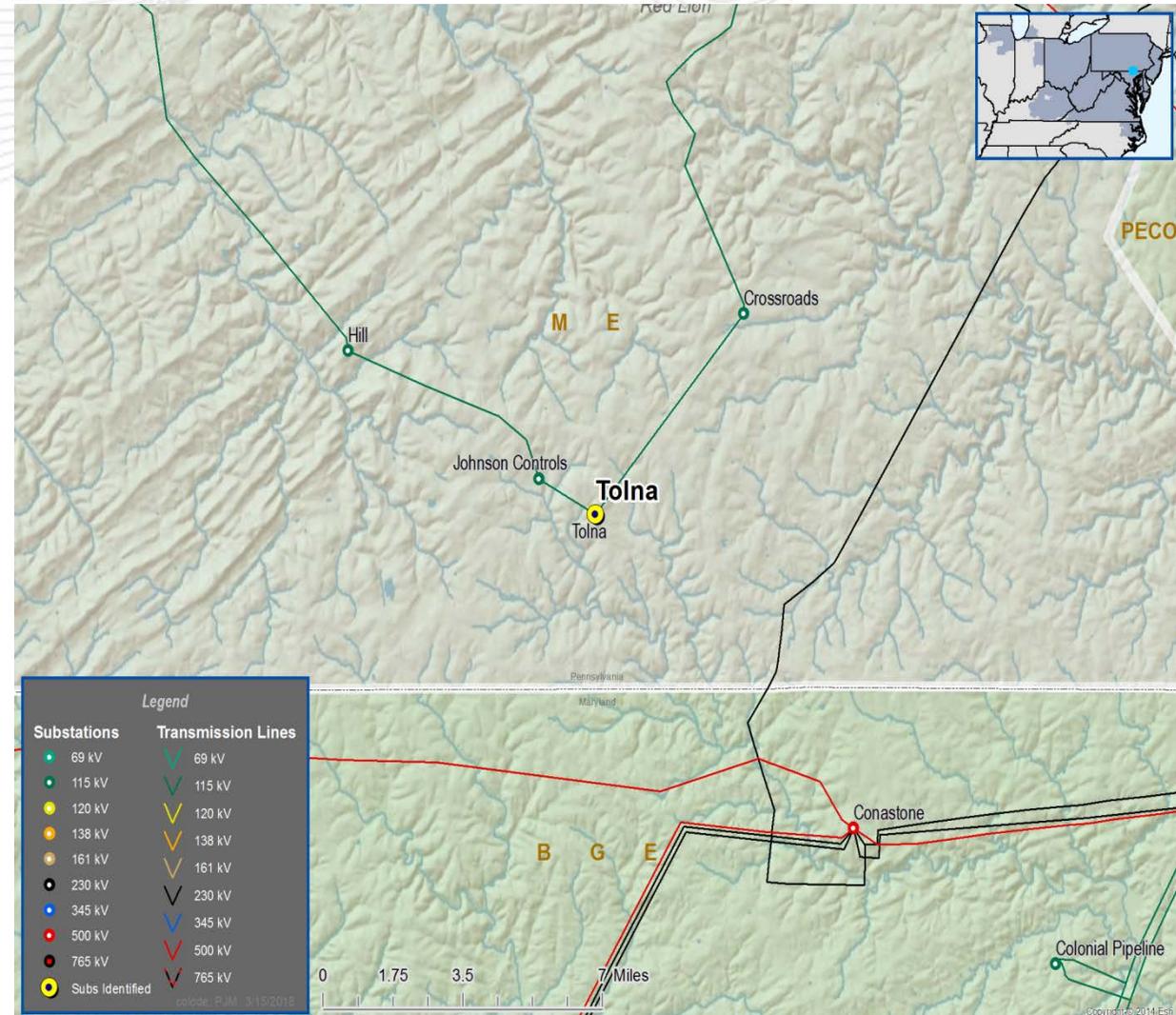
**Alternatives Considered:**

None

**Estimated Project Cost:** \$2.4M

**Projected IS date:** 12/31/2018

**Status:** Engineering



**Problem Statement:**

Equipment Material Condition, Performance and Risk

- Improve system reliability and performance
- Remove obsolete & deteriorated equipment.

**Potential Solution:**

Jackson Road Substation

- Replace the existing 25 and 28/37.3 MVA 115/46 kV transformers with 45/60/75 MVA units.
- Install a 115 kV breaker on the high side of each transformer.

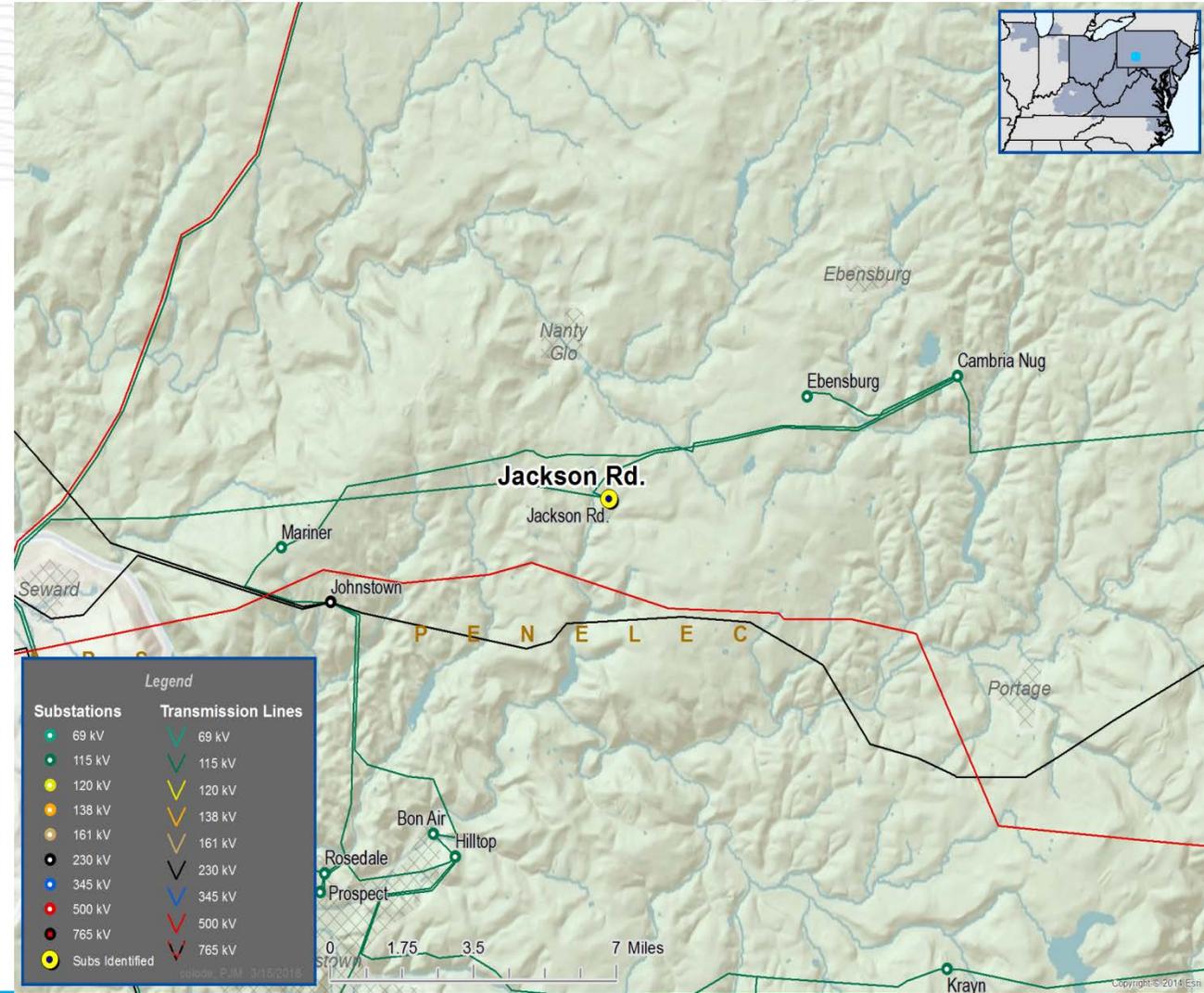
**Alternatives Considered:**

None

**Estimated Project Cost:** \$3.7 M

**Projected IS date:** 11/30/2018

**Status:** Engineering



**Problem Statement:**

Equipment Material Condition, Performance and Risk

- Improve system reliability and performance
- Remove obsolete & deteriorated equipment.
- Upgrade to current FE Standards
- Eliminate the simultaneous outages to three or more system elements

**Potential Solution:**

Roxbury Substation

- Replace the existing 100 MVA 138/115 kV transformer with a 224 MVA unit.
- Convert Roxbury 115 kV substation into a four (4) breaker ring bus.

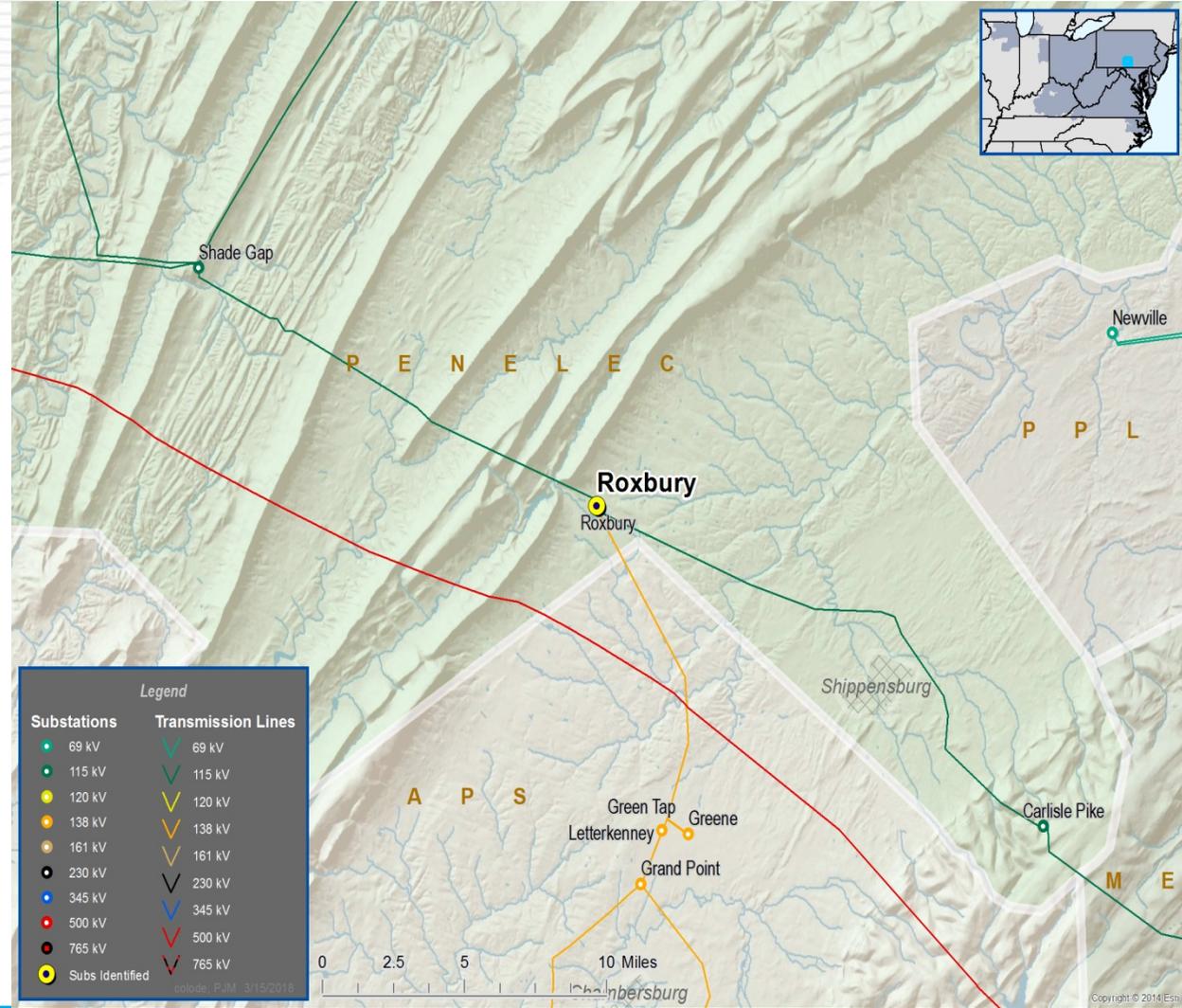
**Alternatives Considered:**

None

**Estimated Project Cost:** \$4.2 M

**Projected IS date:** 12/31/2019

**Status:** Engineering



**Problem Statement:**

Operational Flexibility and Efficiency

- Improve operational flexibility during maintenance and restoration efforts.
- Reduce amount of potential local load loss under contingency conditions.
- Eliminate the simultaneous outages to three or more system elements.

**Potential Solution:**

Hilltop Substation

- Expand the existing 115 kV substation to a six (6) breaker ring bus.

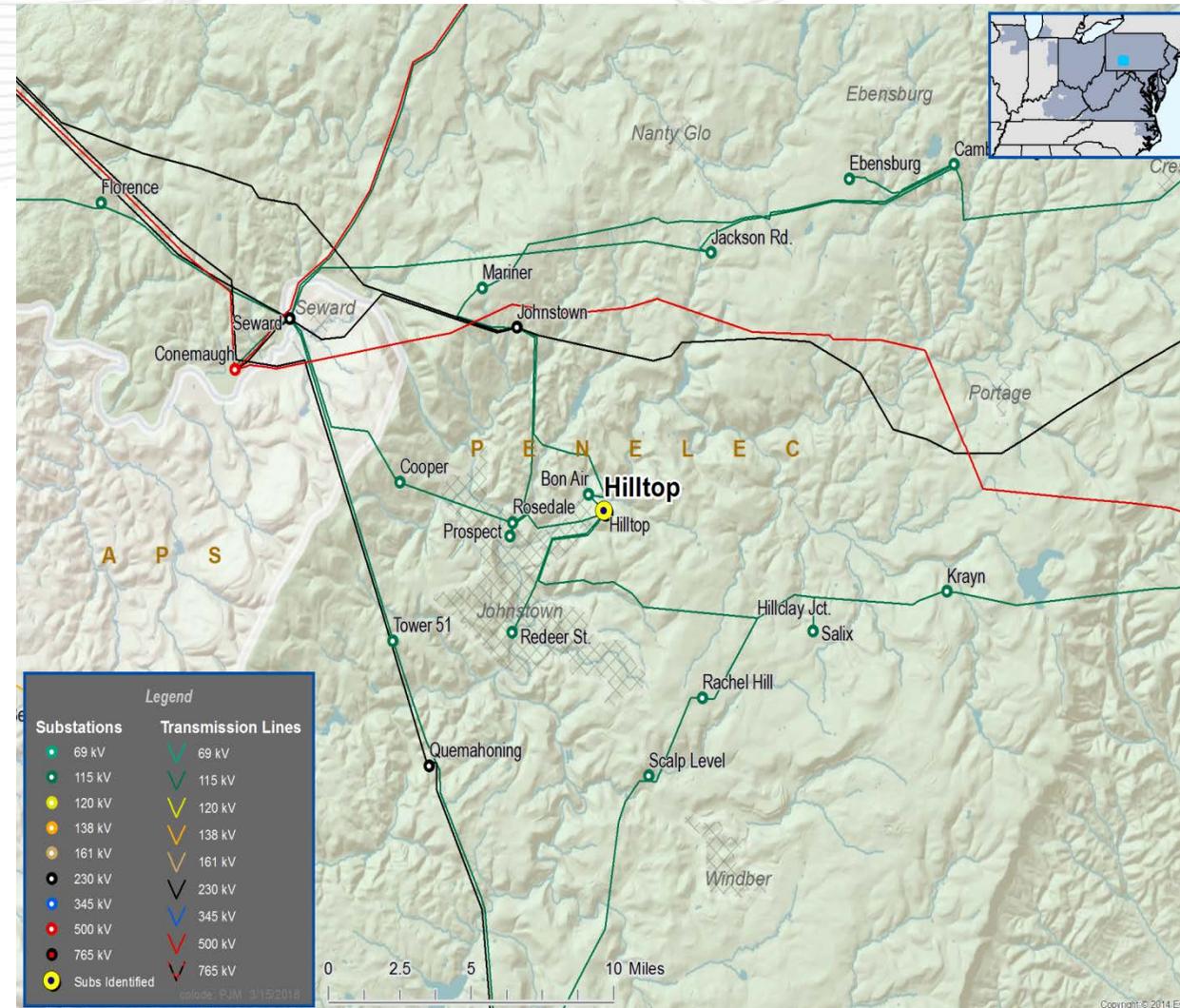
**Alternatives Considered:**

None

Estimated Project Cost: \$9.3 M

Projected IS date: 12/31/2018

Status: Engineering



**Problem Statement:**

Operational Flexibility and Efficiency

- Improve operational flexibility during maintenance and restoration efforts.
- Eliminate the simultaneous outages to three or more system elements.

**Potential Solution:**

Cambria Slope Substation

- Expand the existing 115 kV substation to a six (6) breaker ring bus

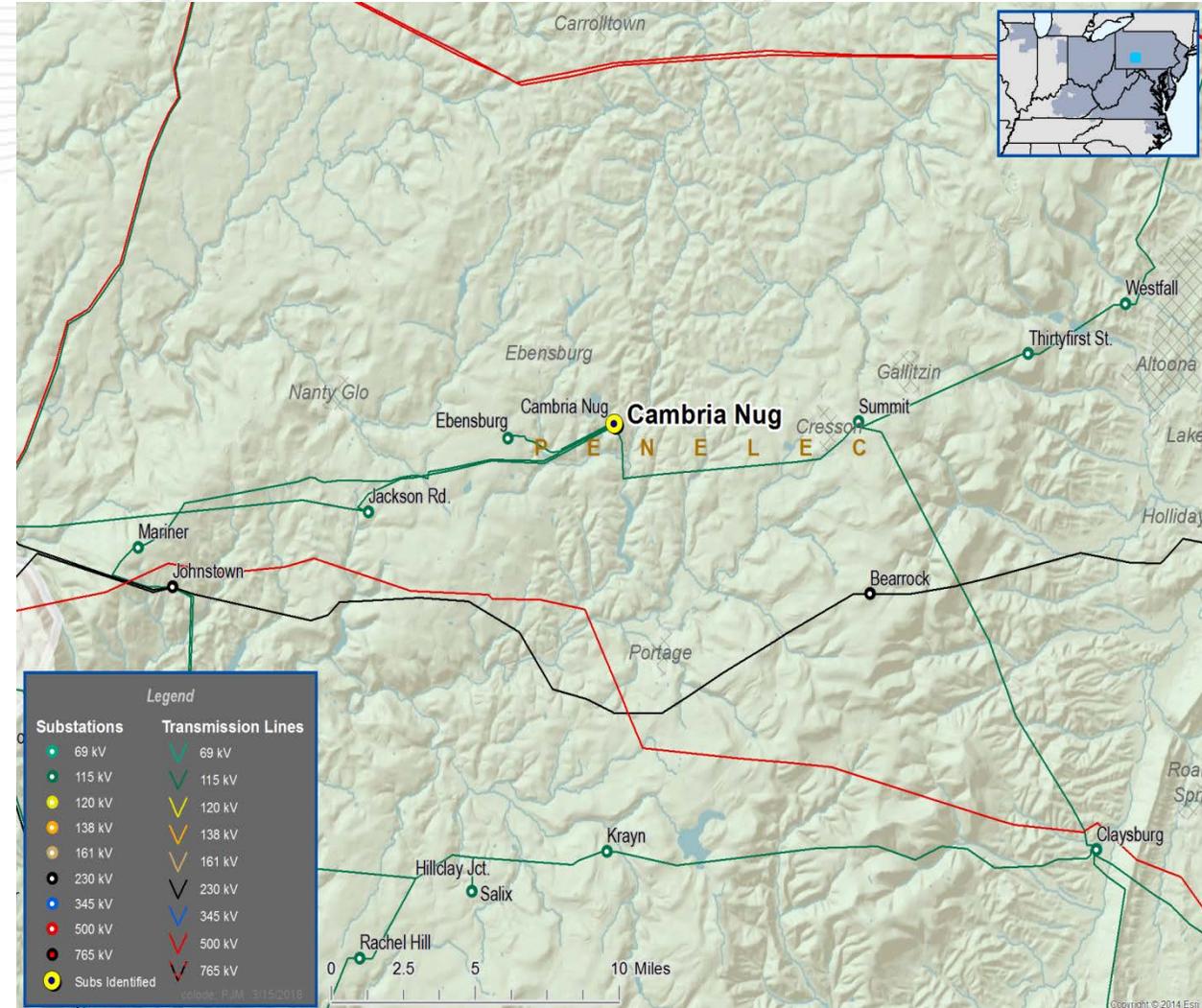
**Alternatives Considered:**

None

Estimated Project Cost: \$8.7 M

Projected IS date: 6/1/2019

Status: Engineering



## Problem Statement:

### Operational Flexibility and Efficiency

- Planning analysis identifies concerns related to loss of an existing transformer at a specific voltage level.
- Loss of substation bus adversely impact transmission system performance
- Improve operational flexibility during maintenance and restoration efforts.
- Eliminate the simultaneous outages to three or more system elements.

## Potential Solution:

### Wayne Substation

- Install a second 345/115 kV 168/224 MVA transformer. Convert the 115 kV yard to a 4 breaker ring bus.

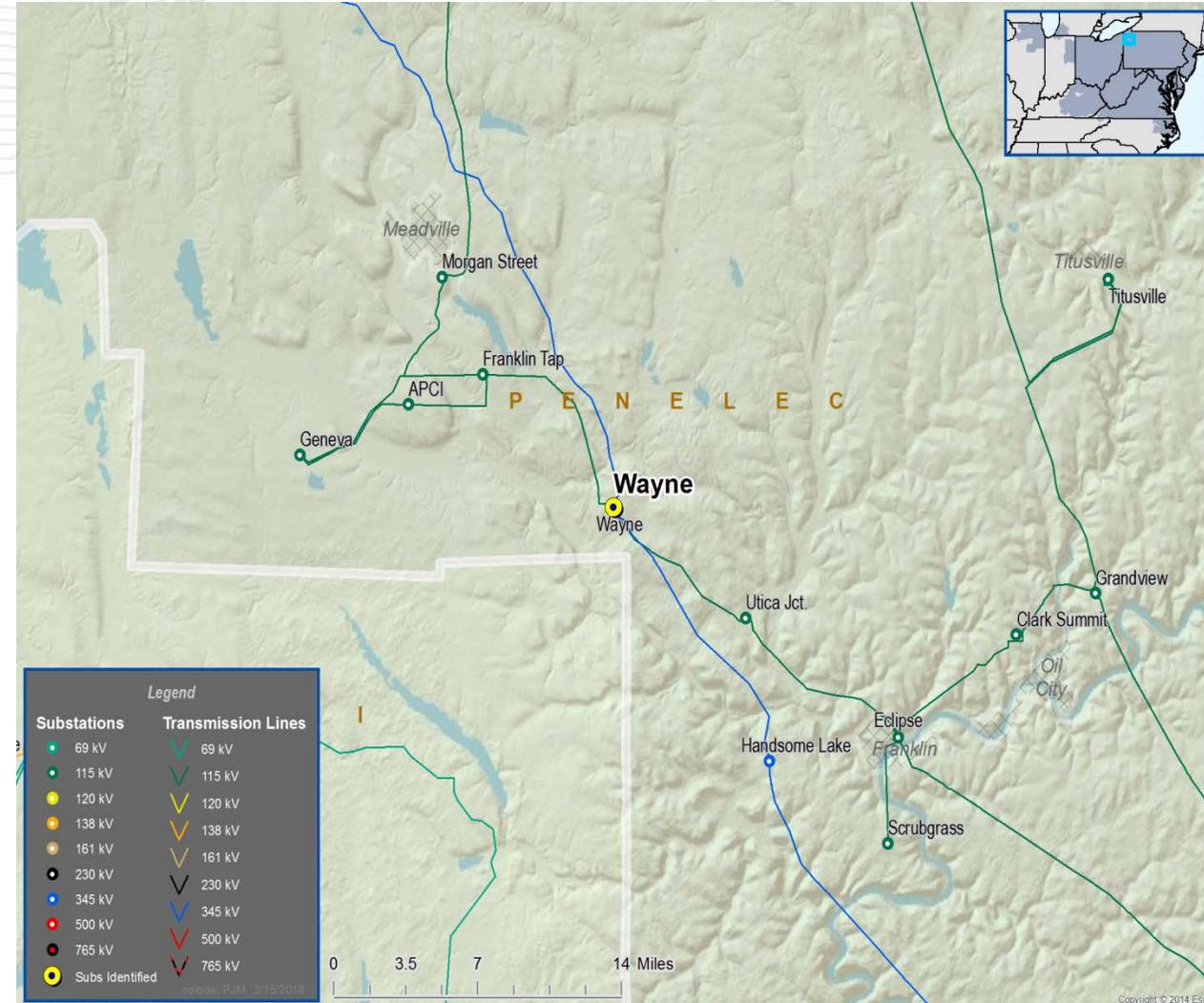
## Alternatives Considered:

None

Estimated Project Cost: \$5.8 M

Projected IS date: 6/1/2019

Status: Engineering



## Problem Statement:

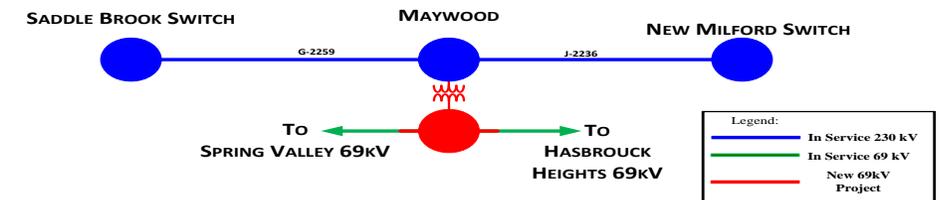
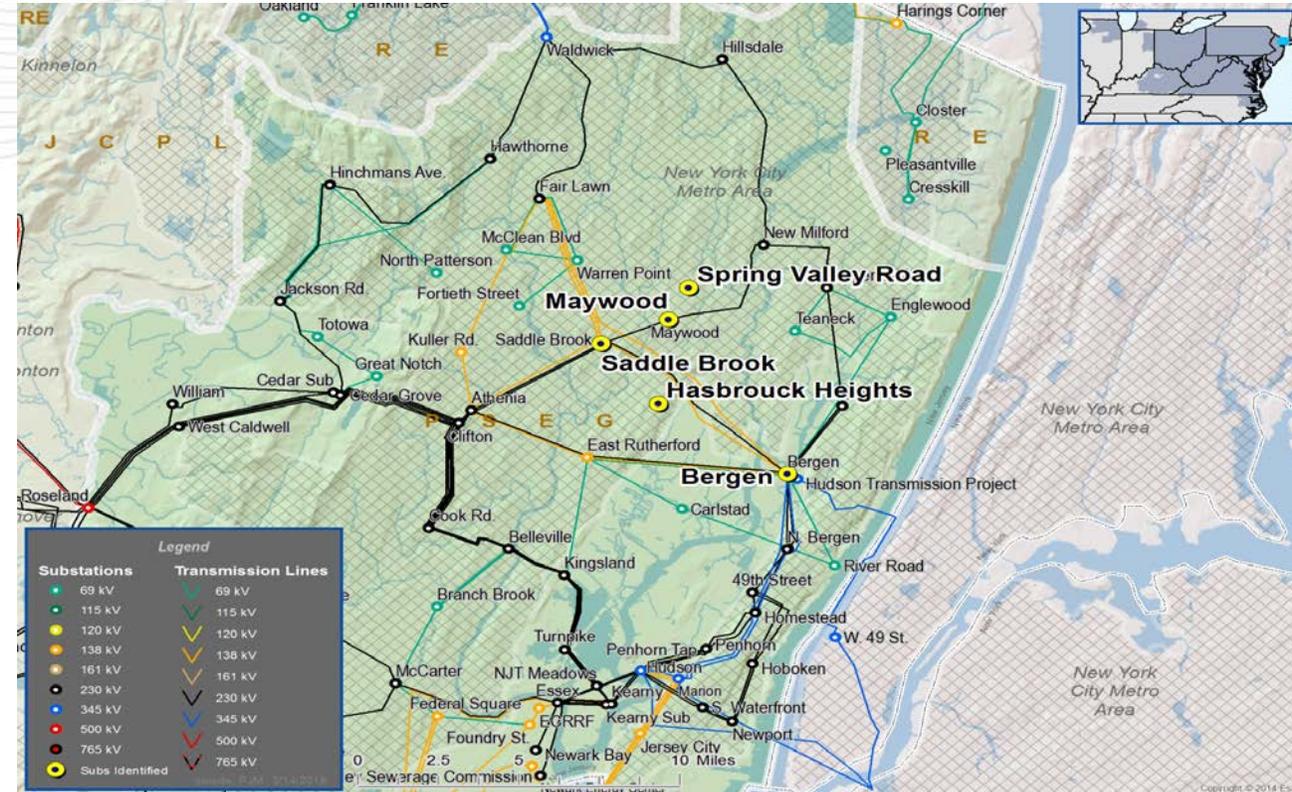
### FERC Form 715:

Maywood Substation is supplied by two underground 230kV cables. Maywood supplies more than 25,000 customers with load in excess of 130 MVA. An N-1-1 event would result in a complete loss of electric supply to the station for more than 24 hrs.

## Potential/ Alternative Solution:

- Construct a 230/69kV station at Maywood.
  - Purchase properties at Maywood to accommodate new construction.
  - Extend 230kV bus and install one (1) 230kV breaker.
  - Install one (1) 230/69kV transformer.
  - Install a 69kV ring bus.
  - Construct a 69kV network between Spring Valley Road, Hasbrouck Heights, and Maywood.
  - Estimated Project Cost: \$87M
- Loop Saddle Brook to Bergen 230kV cable into Maywood.
  - Purchase properties in addition to properties required for 69kV alternative at Maywood to accommodate new construction.
  - Reconfigure Maywood 230kV bus to provide additional line positions.
  - Estimated Project Cost: \$124M

Status: Conceptual





# PSEG Transmission Zone: Baseline Project South Trenton Network N-1-1 Reliability, Trenton Area Load Growth

## Problem Statement:

### FERC Form 715:

The South Trenton 69kV network is supplied by a 230/69kV transformer at Trenton Switching Station and an underground 69kV circuit between Lawrence Switching Station and Ewing. The South Trenton 69kV network, which consists of Clinton Ave, Ewing, Hamilton, and Liberty St, supplies over 15,000 customers with load in excess of 40 MVA. An N-1-1 event would result in a complete loss of electric supply to the network for more than 24 hrs.

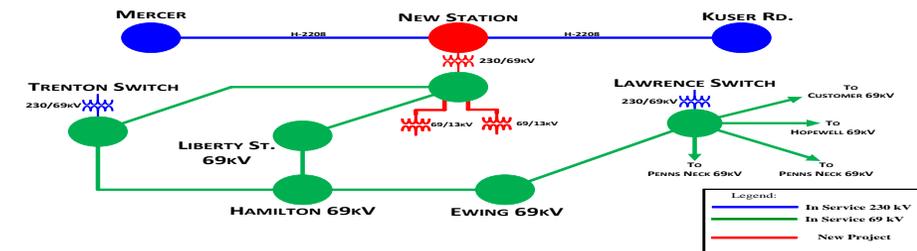
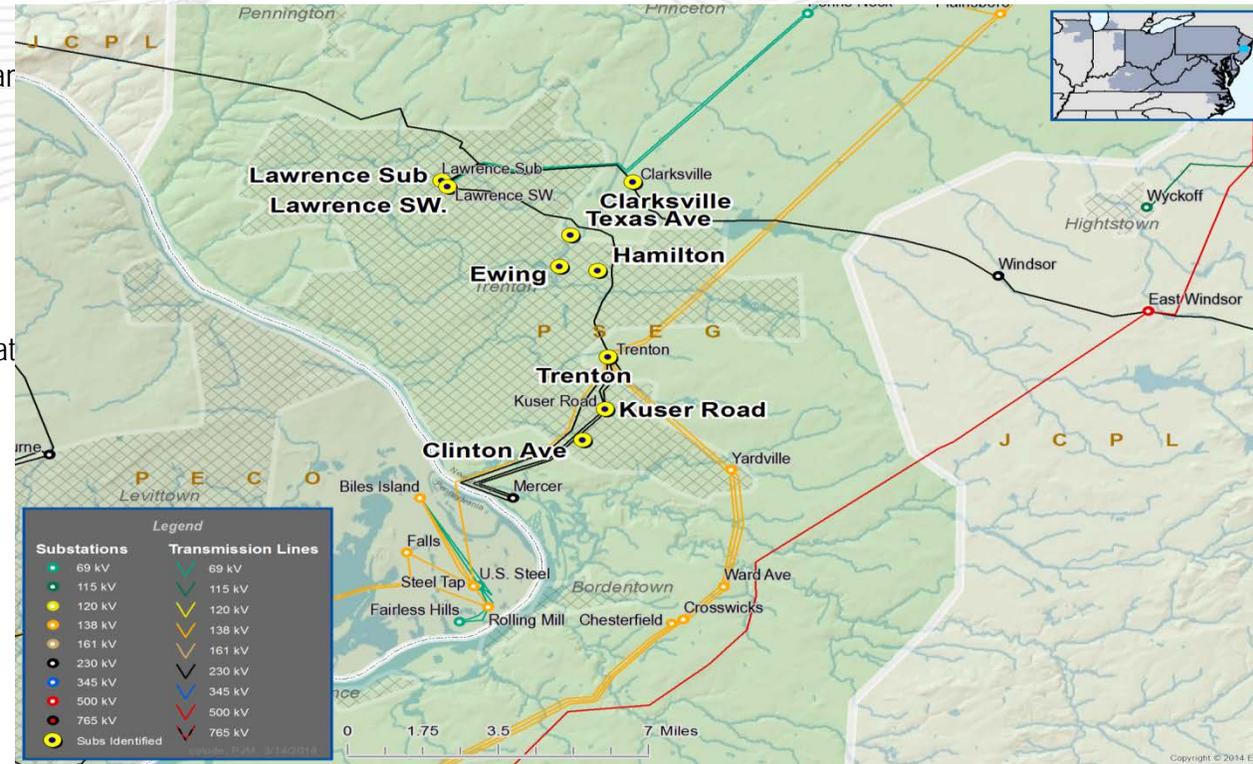
### Load Growth:

Kuser Road currently supplies over 42,000 customers in the Trenton area. The load supplied exceeded 150 MVA during summer 2017 and is expected to grow in the local area. During the loss of a transformer at Kuser Road, there will be a -9% overload on the remaining transformers.

### Potential/ Alternative Solution:

- Construct a 230/69/13kV station on existing 230kV ROW.
  - Install 230kV ring bus with one (1) 230/69kV transformer at existing Clinton Ave location.
  - Expand existing 69kV ring bus at Clinton Ave with two (2) additional 69kV breakers.
  - Install two (2) 69/13kV transformers.
  - Install 18 MVAR capacitor bank.
  - Estimated Project Cost: \$62M
- Construct a new 69kV Lawrence -Trenton line and a new 230/13kV station on existing 230kV ROW.
  - Install new 69kV circuit between Lawrence Switching Station and Trenton Switching Station.
  - Install two (2) 230/13kV transformers at new station on ROW.
  - Estimated Project Cost: \$119M
- Install a new 230/69kV transformer at Trenton, construct a new 230/13kV station on existing 230kV ROW.
  - Install one (1) new 230/69kV transformer at Trenton Switching Station.
  - Install two (2) 230/13kV transformers at new station on ROW.
  - Estimated Project Cost: \$89M

Status: Conceptual



**Problem Statement:**

Load Growth:

The Cranbury area is currently served by long 13kV circuits from Plainsboro and Devils Brook. Of the eight Plainsboro and Devils Brook 13kV circuits feeding this area, five experienced overloads in 2016, while the remaining three were loaded at over 75%. PSE&G continues to receive new business requests in the area.

Network Availability:

The Cranbury area is at the edge of PSE&G territory and does not have a transmission supply source to feed a new station.

Operational Flexibility and Efficiency, Customer Service:

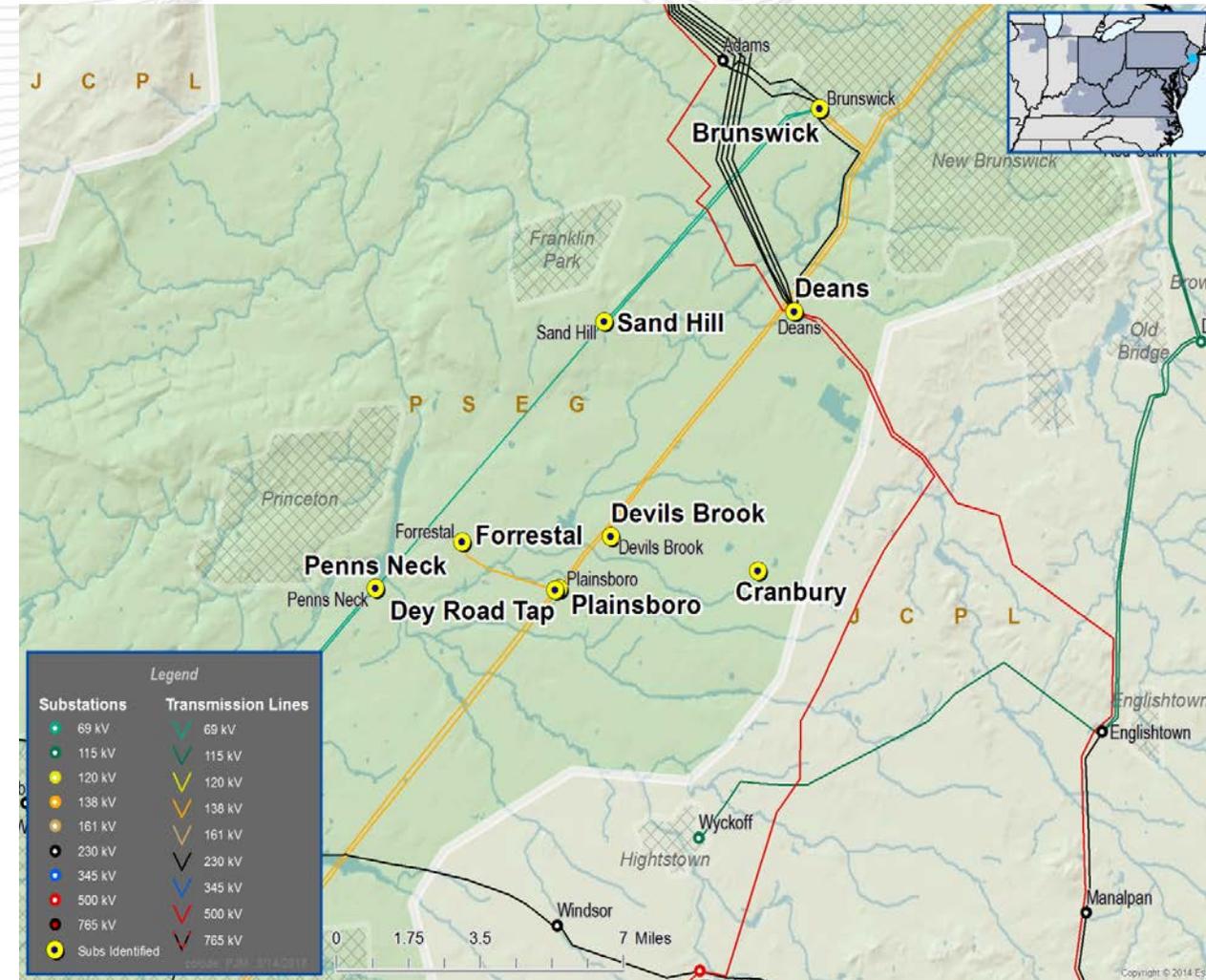
Sand Hills is a 69/13kV station that serves around 20,000 customers with load of around 80MVA. A stuck breaker event on the 69kV bus would cause the loss of two lines and a capacitor bank. This would cause the voltage on the 69kV bus to drop by roughly 10%, resulting in a voltage below 0.95 pu.

**Potential/ Alternative Solution:**

Construct a new 69/13kV station in Cranbury, construct a 230/69kV station at Plainsboro (Hunters Glen), and reconfigure 69kV bus at Harts Lane and Sand Hills.

- Install a 69kV ring bus, two (2) 69/13kV transformers, and 18 MVAR capacitor bank at new Cranbury station.
- Reconfigure 230kV bus, install a 69kV ring bus, and install one (1) 230/69kV transformer at Hunters Glen.
- Convert 69kV straight bus to 69kV ring bus at Harts Lane to provide a new line position.
- Convert 69kV straight bus to 69kV breaker-and-a-half bus at Sand Hills to resolve voltage issues and provide a line position.
- Construct a 69kV network between Cranbury, Harts Lane, Hunters Glen, Penns Neck, and Sand Hills.
- Estimated Project Cost: \$307M

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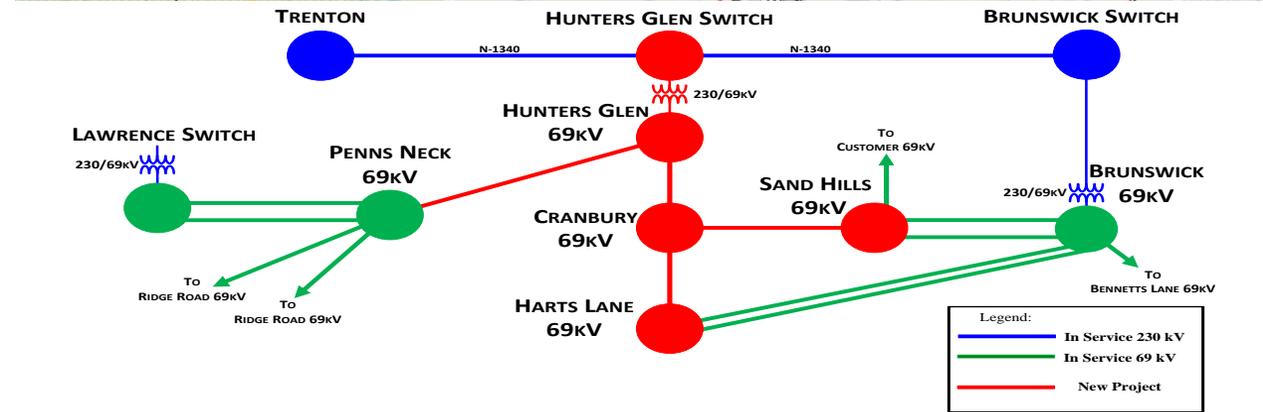


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### Potential/ Alternative Solution:

- Construct a new 69/13kV station in Cranbury, construct a 230/69kV station at Plainsboro (Hunters Glen), and reconfigure 69kV Construct a new 69/13kV station in Cranbury, reconfigure 69kV bus at Harts Lane and Sand Hills, and provide 69kV supplies from Brunswick and Trenton.
  - Install a 69kV ring bus, two (2) 69/13kV transformers, and 18 MVAR capacitor bank at new Cranbury station.
  - Convert 69kV straight bus to 69kV ring bus at Harts Lane to provide a new line position.
  - Convert 69kV straight bus to 69kV breaker-and-a-half bus at Sand Hills to resolve voltage issues and provide a line position.
  - Construct a 69kV network between Brunswick, Cranbury, Harts Lane, Sand Hills, and Trenton.
  - Estimated Project Cost: \$324M
- Construct a new 230/13kV station in Cranbury and reconfigure 69kV bus at Sand Hills.
  - Convert 69kV straight bus to 69kV breaker-and-a-half bus at Sand Hills to resolve voltage issues
  - Install a 230kV ring bus and two (2) 230/13kV transformers at new Cranbury station.
  - Install 230kV XLPE cable from Deans, Devils Brook, and Plainsboro to new Cranbury Station.
  - Estimated Project Cost: \$836M

Status: Conceptual



**Problem Statement:**

Distribution load growth requires the construction of a double circuit 66kV transmission line serving a two-transformer (Type II) substation. The installed and under construction load served by UGI's HIP Substation (Type II) exceeds current substation capacity for loss of a single transformer reducing reliability. In addition, proposed expansion of industrial and commercial load further magnifies the capacity limitation.

**Potential Solution:**

Construct 0.6 mile double circuit 66kV transmission line serving new two-transformer (Type II) substation with six (6) overhead feeders.

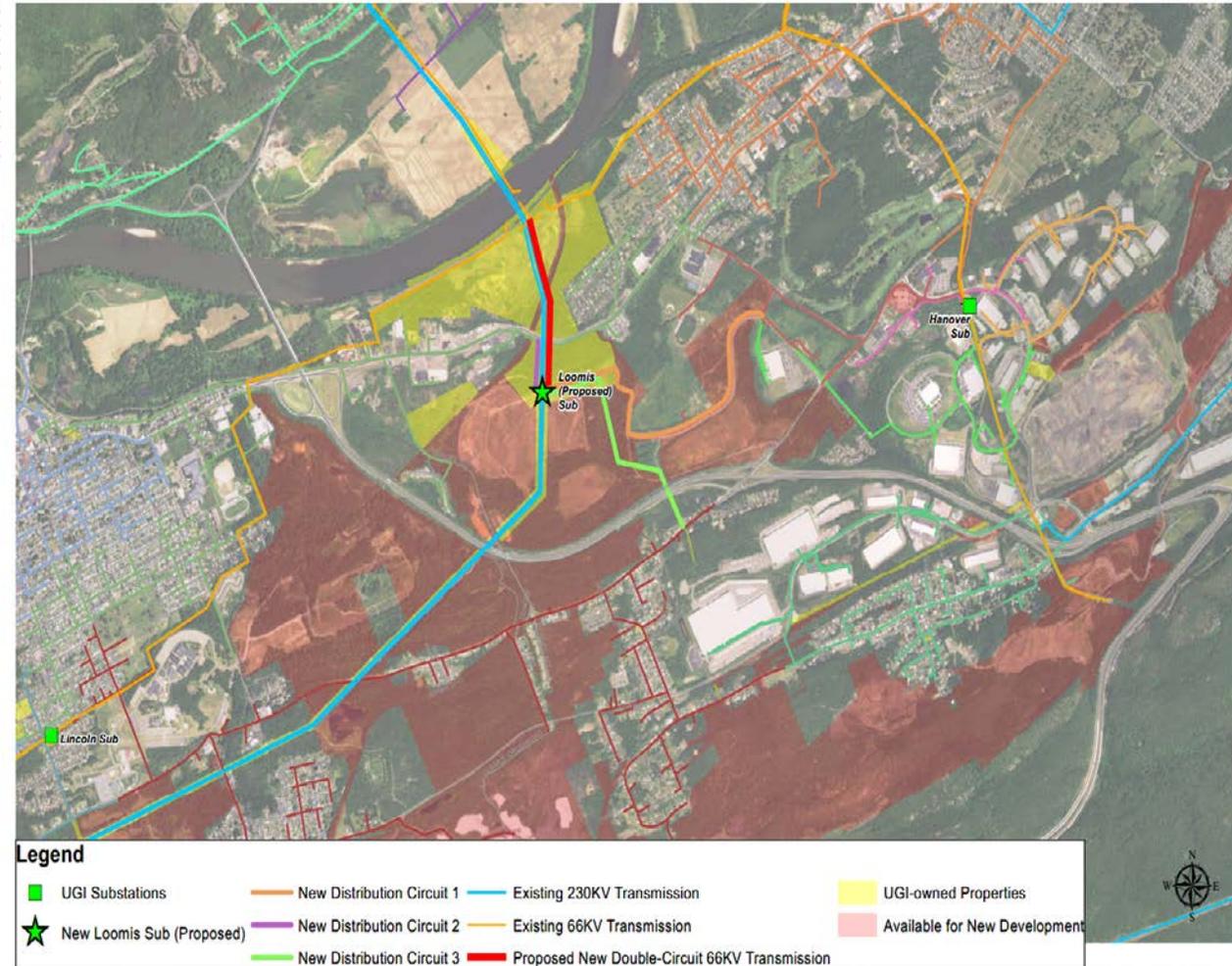
**Alternative Solution:**

Additional capacity does not exist at networked substations

**Estimated Cost:** Transmission → \$1 M, Substation → \$8 M

**Expected IS Date:** 9/30/2019

**Status:** Planning and Engineering



# Second Review

## Baseline Reliability and Supplemental Projects

**Previously Presented:** 01/26/2018

**Problem Statement:**

- Five 115 kV oil circuit breakers at Northeast and two 115 kV oil circuit breakers at Pumphrey are at risk of poor performance, environmental concerns, and parts availability issues

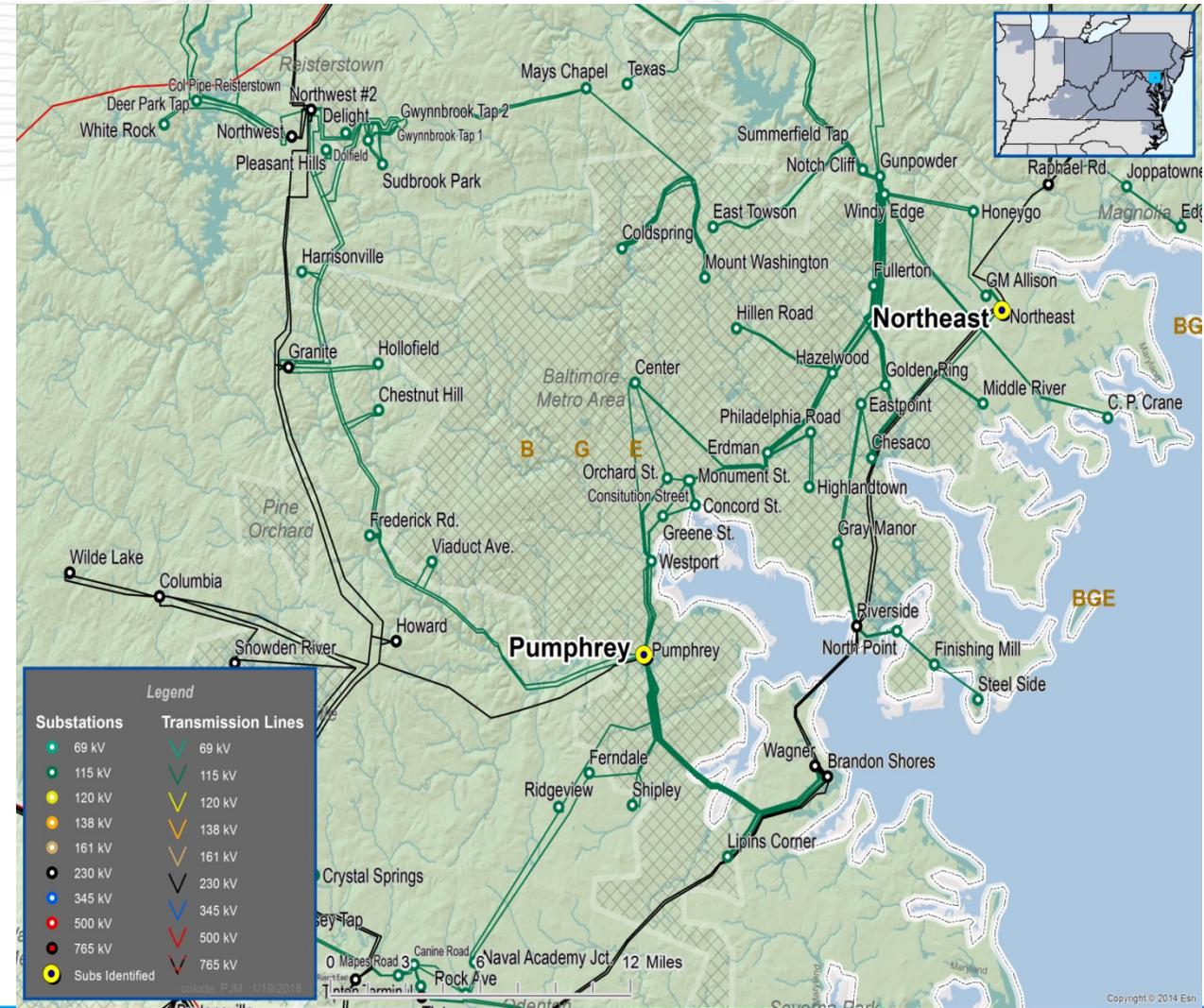
**Selected Solution:**

- Replace five breakers at Northeast with new 63 kA rated gas circuit breakers. (S1574.1)
- Replace two breakers at Pumphrey with new 80 kA rated gas circuit breakers. (S1574.2)

**Estimated Cost:** \$2.389 M

**Expected In-Service:** 12/1/2018

**Status:** Engineering





# PSEG Transmission Zone: Supplemental Project Harvey Switching Station

Previously Presented: 12/19/2017

## Problem Statement:

### Equipment Material Condition, Performance and Risk:

As discussed during the 8/31/2017 SRTEP Mid Atlantic meeting, there are several 26kV and 13kV substations in the Clifton area with equipment in poor condition. The majority of equipment at Allwood, Nutley, and Van Houten Substations is over 60 years of age and must be addressed.

## Selected Solution:

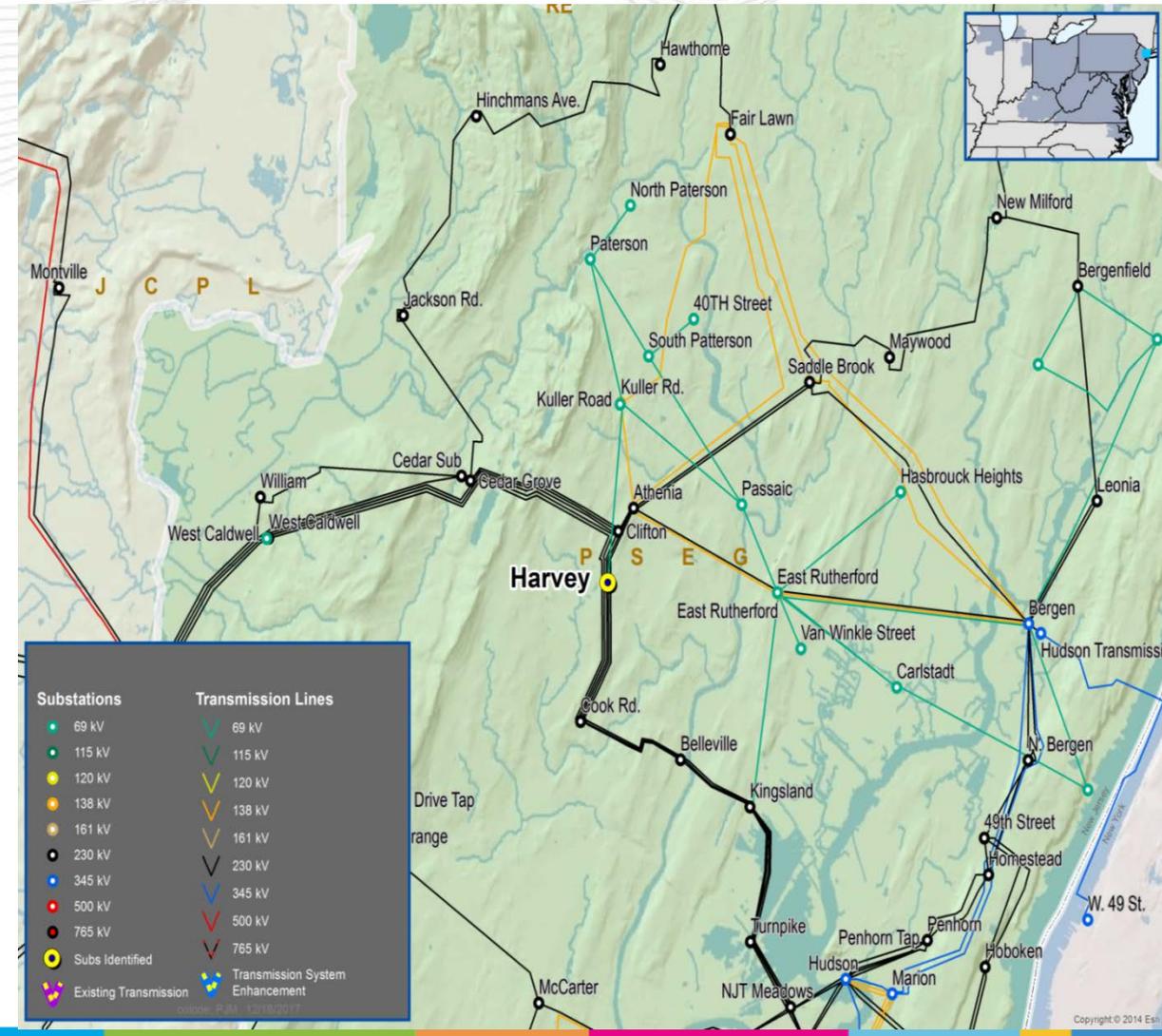
Construct a new 230/69kV and a new 69/13kV station in the Clifton area on the existing ROW. (S1575)

- Construct a new 230/69kV (Harvey) station in the Clifton area.
- Install 230kV ring bus with two (2) 230/69kV transformers and 69kV ring bus at Harvey Switching Station.
- Loop in overhead 230kV (Athenia – Cook Rd.) line to Harvey Switching Station.
- Install two (2) 69/13kV transformers fed from Harvey 69kV ring bus.
- Provides a source for a third supply to Kuller Road from Harvey 69 kV.

Estimated Cost: \$195 M

Expected In-Service: 12/30/2022

Status: Engineering



# Next Steps

Mid-Atlantic	Start	End
5/25/2018	8:30	12:30
7/20/2018	8:30	12:30
9/21/2018	8:30	12:30
11/28/2018	8:30	12:30

Questions?



Asset Management process employed by Exelon companies was described in detail at a meeting of the Transmission Replacement Processes Senior Task Force (TRPSTF). The presentation is posted on the PJM website and can be accessed here:

<http://www.pjm.com/~media/committees-groups/task-forces/trpstf/20160523/20160523-item-03-education-module-3-transmission-owner-asset-management.ashx>

## Revision History

5/11/2018 – V3 – Slide 34: Changed attribution of linked material to correctly identify owner as Exelon

3/23/2018 – V2 – Added Appendix A

Slide 24: Corrected formatting error

Slide 29: Removed “Howard” from title, corrected spelling of “Pumphrey”

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