Sub Regional RTEP Committee
Mid-Atlantic

November 20, 2015

Reliability Analysis Update

PSEG Transmission Zone

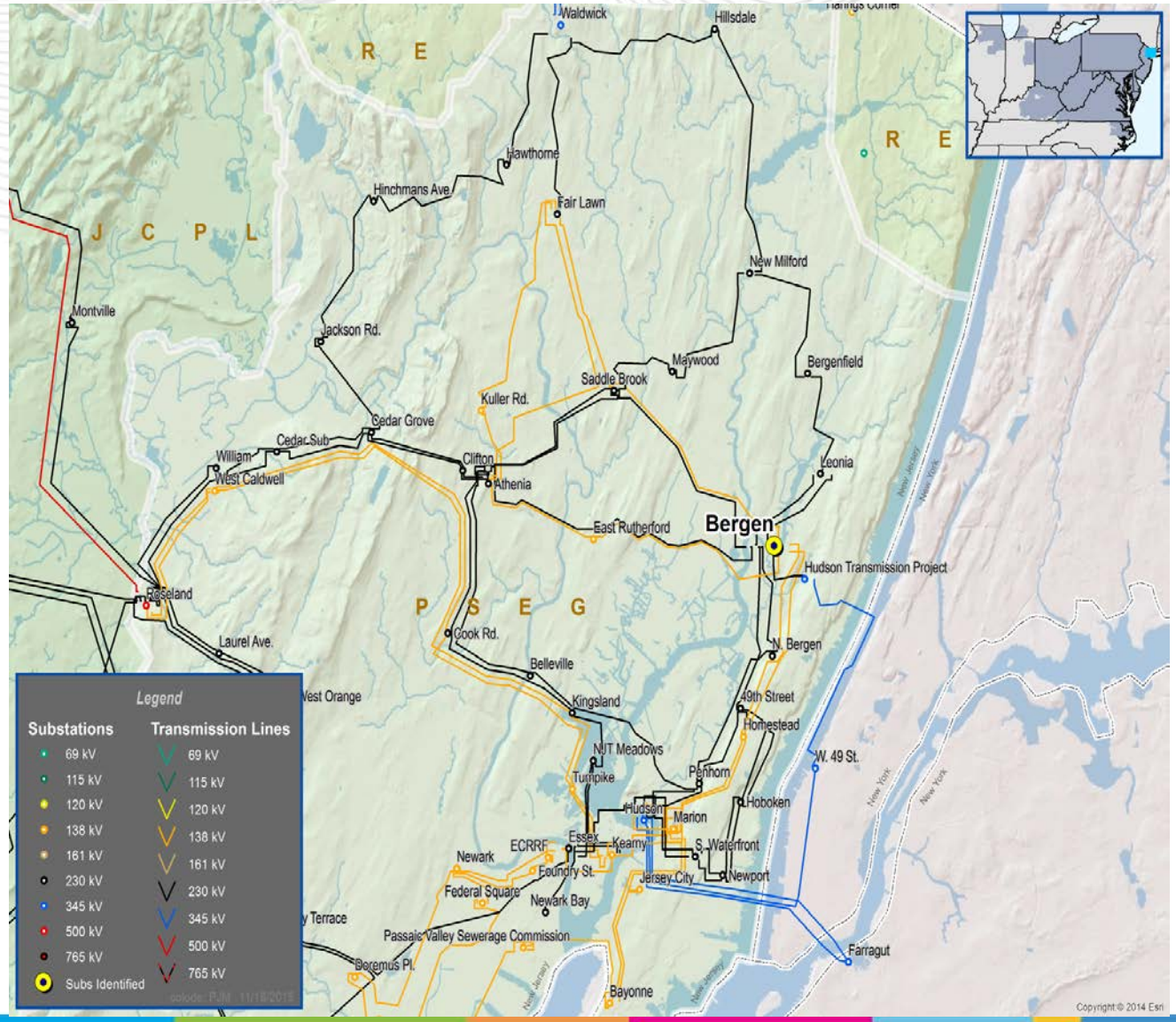
- Operation Performance:
- The Bergen – Bergen GT 138 kV circuit (B-1302) is overloaded for pre-contingency condition during the Bergen GT generator full output.
- Proposed Solution:

  Due to the time – sensitive nature and current issue this problem presents, PSEG (Local TO) will be the Designated Entity

  Reconductor the 1 mile Bergen – Bergen GT 138 kV circuit (B-1302).
- Estimated Project Cost:

  $ 6.5 M
- Expected IS Date:

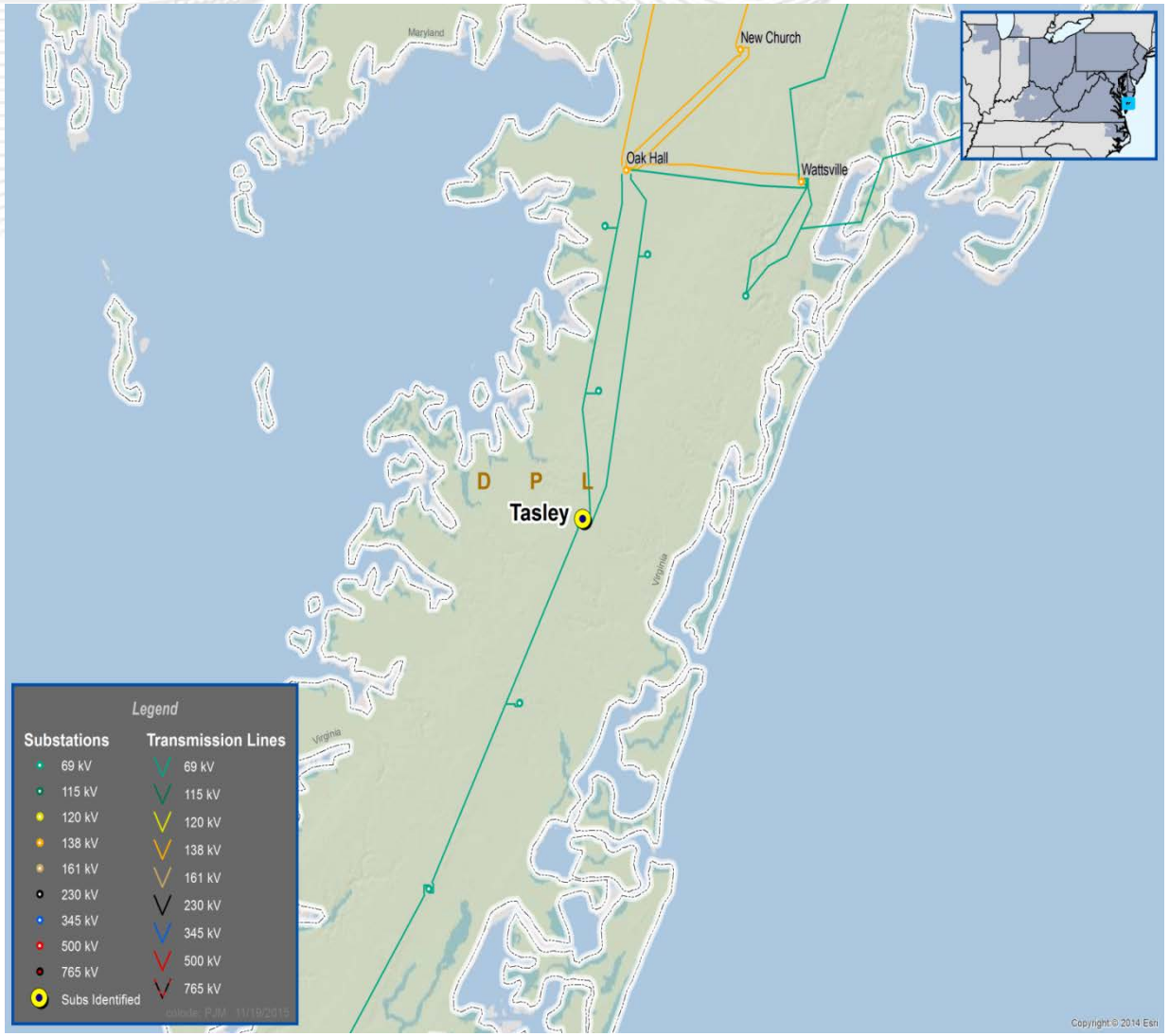
  10/30/2016



Supplemental

ODEC Transmission Zone

- Supplemental Upgrade :
  - Failure of a single breaker at Tasley Substation will result in an outage to Tasley substation and all facilities to the south.
  - Electromechanical relays are near the end of their life.
- Proposed Solution:
  - Replace two 69 kV breakers and reconfigure the Tasley Substation
  - Tasley station - Remove 600 Amp switch and Install microprocessor relaying for incoming lines and capacitor bank . (S1090)
- Estimated Project Cost:
  - $ 0.9 M
- Projected IS Date:
  - 5/31/2017



MetEd Transmission Zone

- Supplemental Upgrade :

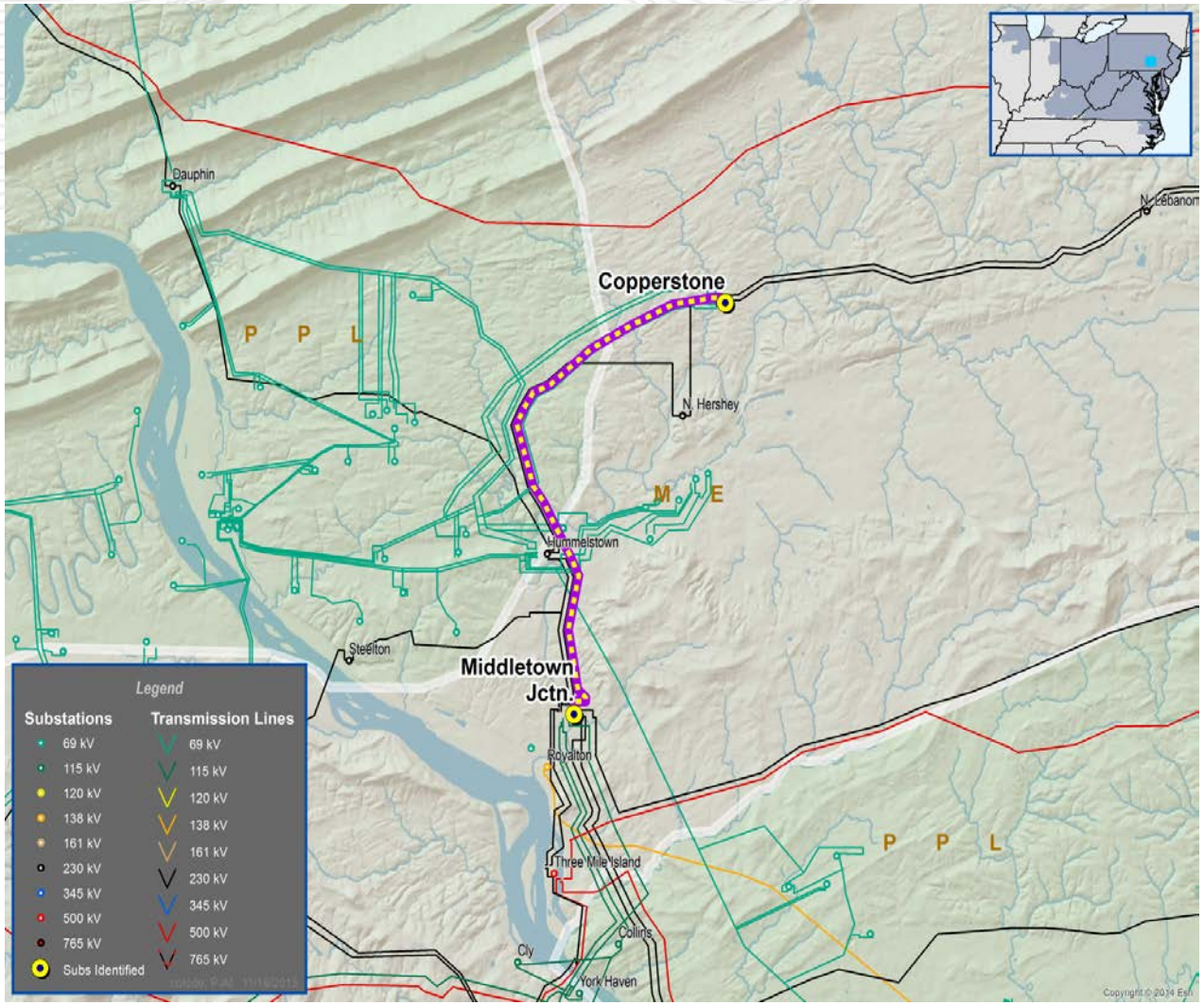
  Loop the Middletown Jc. – Copperstone 230 kV line into a new 230 kV switching station and provide 230 kV service to a new customer. (S1024)

- Estimated Project Cost:

  $ 3.5 M

- Projected IS Date:

  10/1/2016



PenElec Transmission Zone

- Supplemental Upgrade :

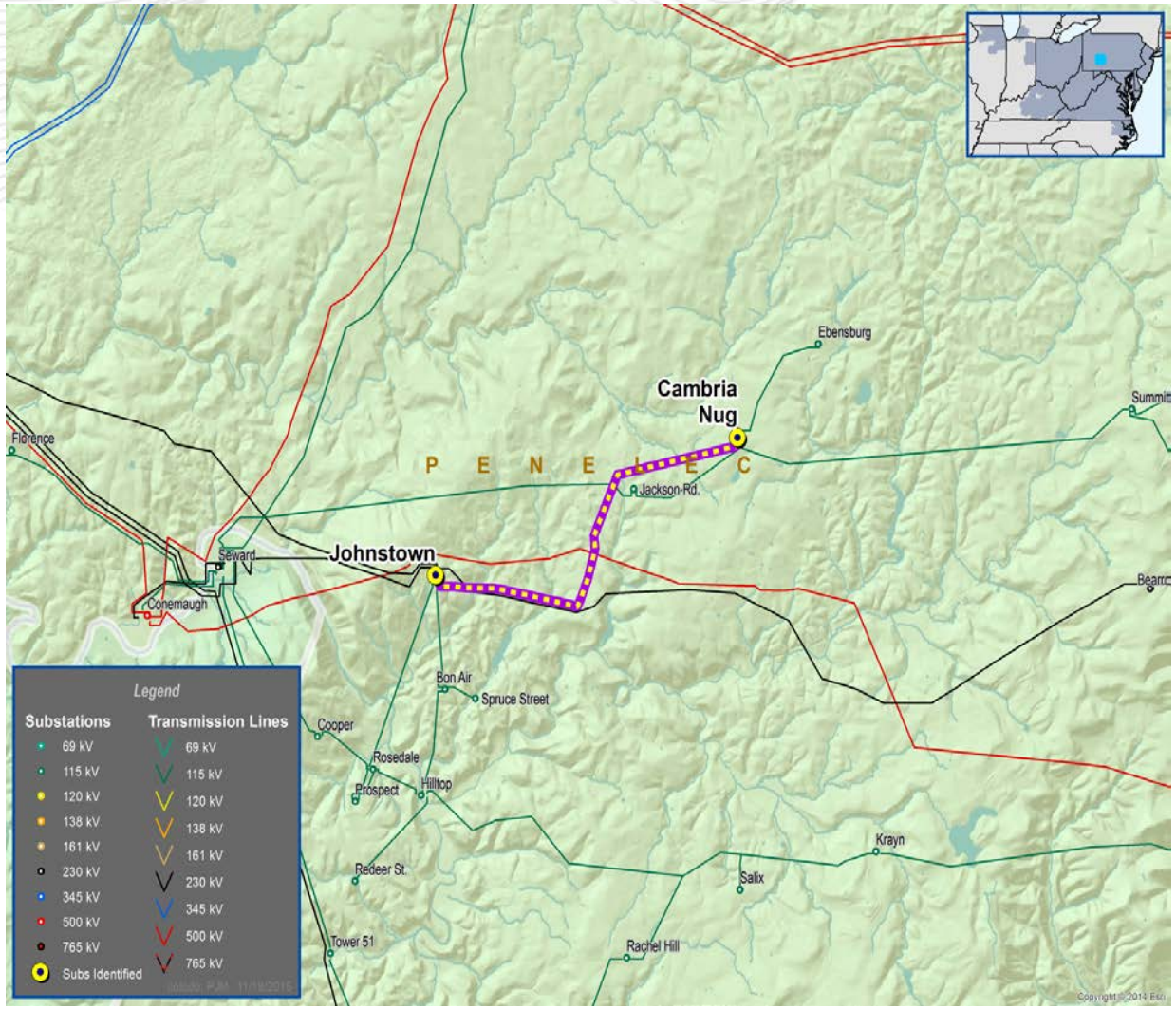
  Tap the Cambria Slope - Johnstown 115 kV line and provide 115 kV service to a new customer. (S1025)

- Estimated Project Cost:

  $ 1.1 M

- Projected IS Date:

  9/1/2016



PEPCO Supplemental projects Change

- PEPCO is updating the S0838, S0839 and S0840 supplemental upgrades to address the following:
  - Meet load growth by providing increased distribution capacity to relieve predicted substation overloads in the Washington DC area
  - Address aging infrastructure; and
  - Enhance reliability to critical load by transforming the existing radial supply system to a networked configuration.

PEPCO Transmission Zone

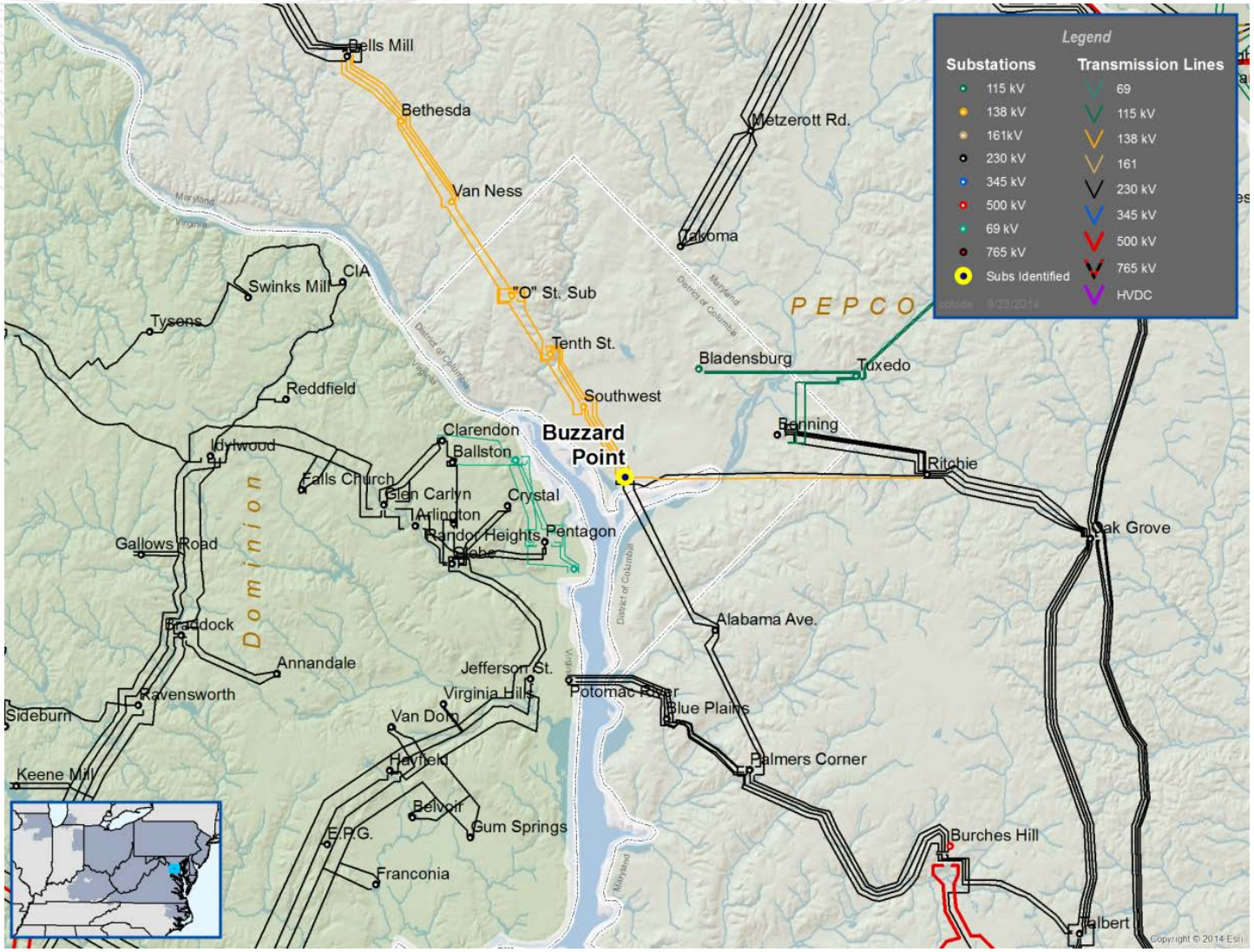
- S0838 Project Scope Change:
- OLD Scope:
  - Install a new Waterfront 138/13kV Sub. 223 and build four new 138kV circuits from Buzzard Point to supply the station. (S0838)
- New Scope:
  - Install a new Waterfront 230/13kV Sub. 223 and build three new 230 kV circuits from Buzzard Point to supply the station. The high side of station and the lines will operate at 138 kV and will be converted to 230 in future.
- Estimated Project Cost:

  Old → $ 76 M

  New →$ 156 M
- Projected IS Date:

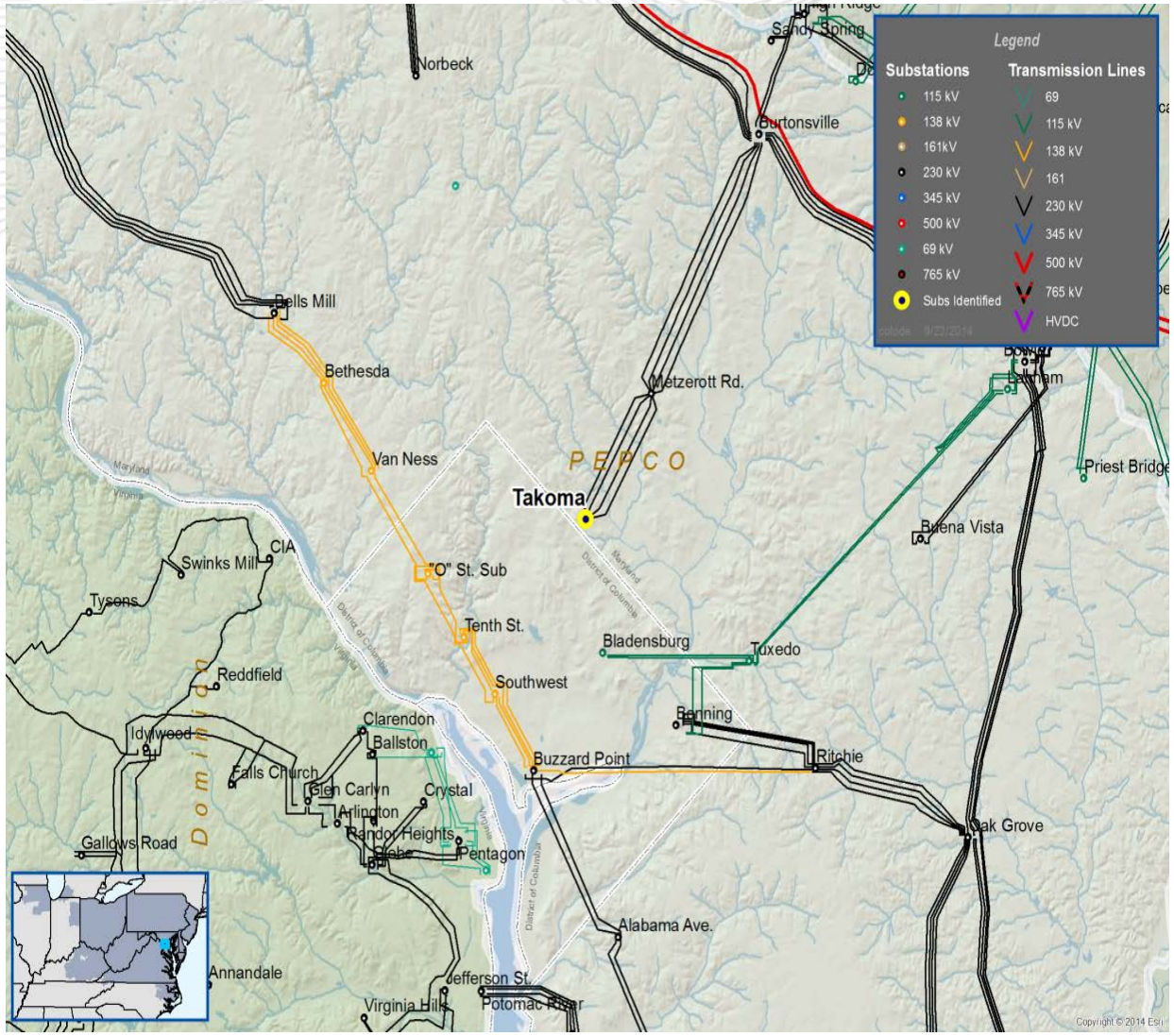
  Old →12/31/2016

  New → 6/1/2017



PEPCO Transmission Zone

- S0839 Project Scope Change:
- Old Scope:
  - Install Mt. Vernon 230/13kV Sub and 230kV High-Side-Bus at Takoma Sub. 27. Extend four new 230kV U.G. circuits from the new Takoma HSB to the Mt. Vernon substation on two separate rights-of-way. (S0839)
- New Scope:
  - Construct the Mt. Vernon 230/13kV, 210 MVA Substation with a 4-Bay, 14 Breaker 230kV GIS insulated High-Side-Bus
  - Construct a 230kV High-Side-Bus at Takoma with 8-Bays and 26 Breakers
  - Install 2 - 230kV feeders from Takoma to Mt. Vernon
  - Install 2 – 230kV feeders from Mt. Vernon to Waterfront
  - Convert Waterfront to 230kV: Install 2 – 400 MVA Phase Shifters and 2 – 100 MVAR Shunt Reactors at Waterfront
- Estimated Project Cost:
  Old → $ 345 M
  New → $ 337 M
- Projected IS Date:
  Old → 12/31/2021
  New → 6/31/2021



PEPCO Transmission Zone

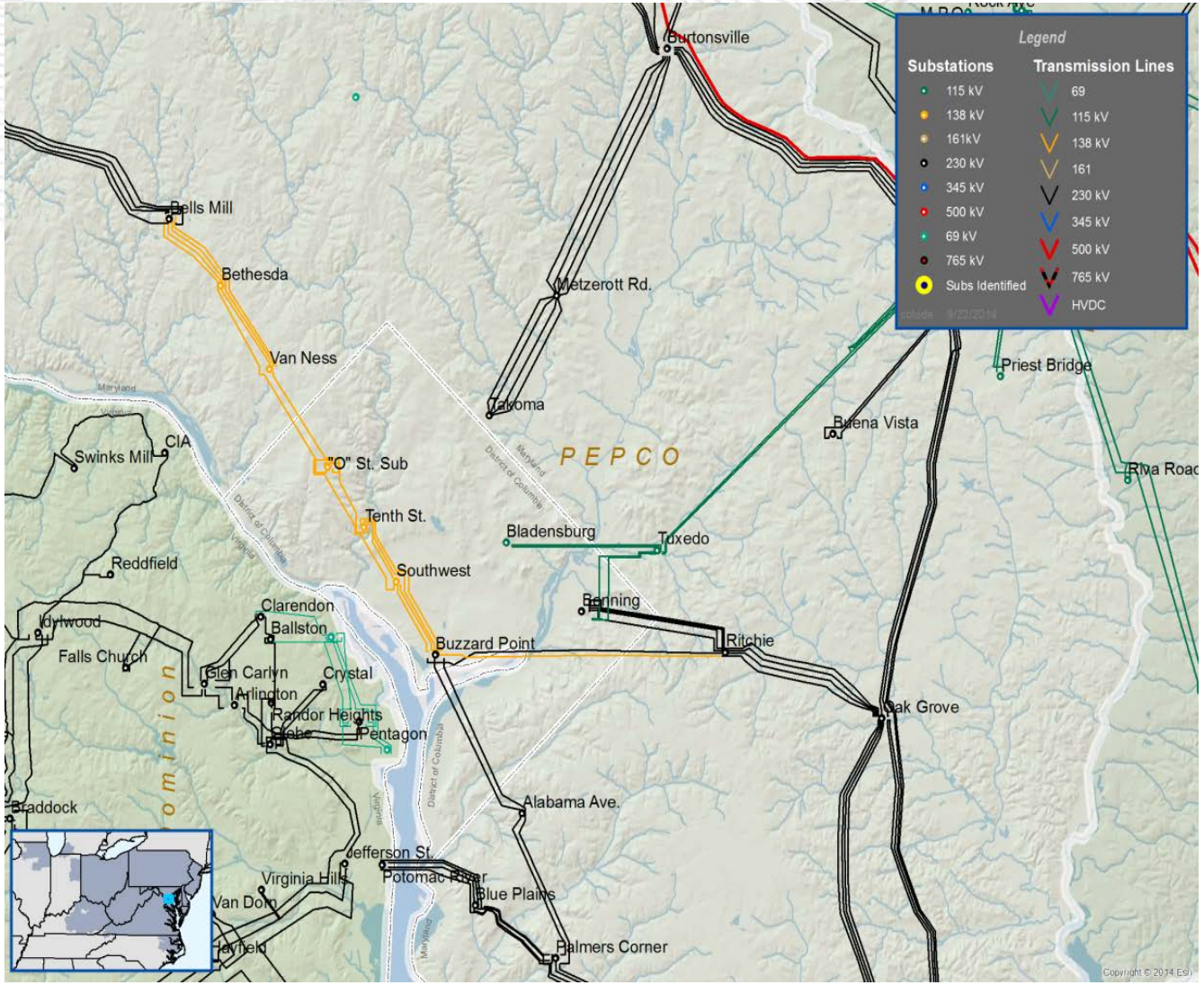
- S0840 Project Cost Change:
  - Install New Harvard 230/13kV Sub and supply the station by tapping two of the extend circuits to serve Mt. Vernon. (S0840)
- Estimated Project Cost:

  Old → $ 110 M

  New → $ 79 M
- Projected IS Date:

  Old → 12/31/2020

  New → 6/1/2022



PPL Supplemental projects

- Development of the PPL Electric Utility 10 year plan: 2015-2024
- Aging Infrastructure
  - A majority of PPL EU's transmission system was installed during expansion periods and it is now approaching the time where structures should be replaced to maintain integrity.
- Increase system reliability
  - Using latest PPL specifications in rebuilds will decrease the frequency and duration of outages due to failed components, lightning, and other weather-related events.
  - Rebuilding facilities to current standard designs will eliminate line tapped transformers at regional substations.
- Reduction in Maintenance Costs
- Combat specific line failure concerns
  - Particular assets though the industry standard at the time, such as cellon treated poles, wood upswept arms, conductor splices, were prone to increase in degradation.

PPL Supplemental projects

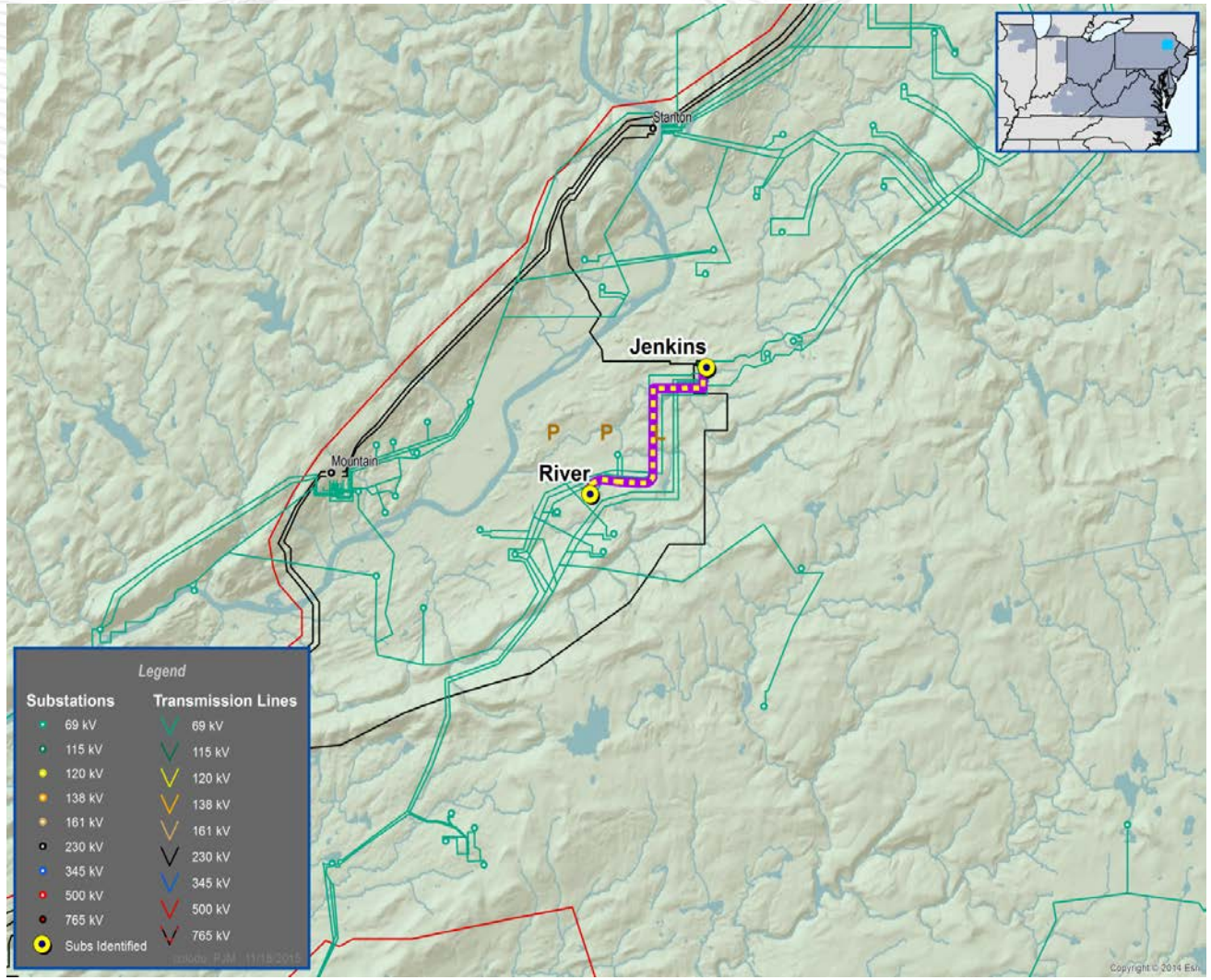
- Address Worst Performing Circuits
  - PPL has identified worst performing circuits which increase customer outages. Improvement on these lines will improve quality of service
- Increase in capabilities of equipment
  - Rebuilds utilizing new technology will provide better communication, analytics and operations that will restore customers in shorter periods of time.
- Work Efficiency
  - Bundling of work together will reduce outage impact to customers
- Relays and Control Houses
  - Reduced maintenance, remote monitoring, improved data recording, supports PPL EU fiber, upgrades, and upgraded battery systems.

PPL Transmission Zone

- Supplemental Upgrade :
  - Reconfigure the Harwood 69 kV Yard
  - Rebuild Jenkins - River 1 & 2 69 kV Line (3.5 mi). (S1026)
- Estimated Project Cost:

  $ 12.3 M
- Projected IS Date:

  12/31/2020

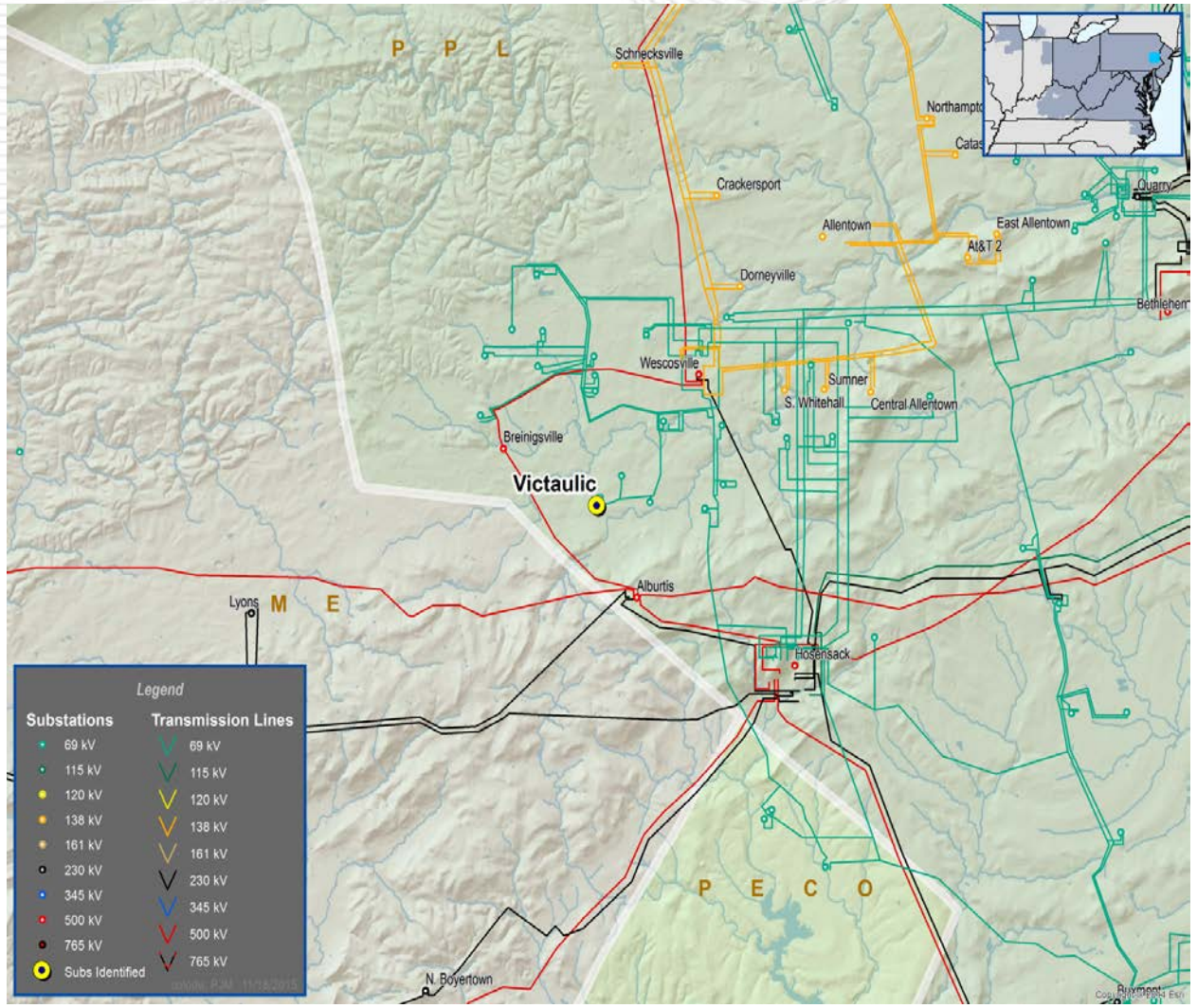


PPL Transmission Zone

- Supplemental Upgrade :
  - Install second 69 kV circuit on existing Victaulic Tap (1.2 mi). (S1027)
- Estimated Project Cost:

  $ 1.1 M
- Projected IS Date:

  11/30/2016

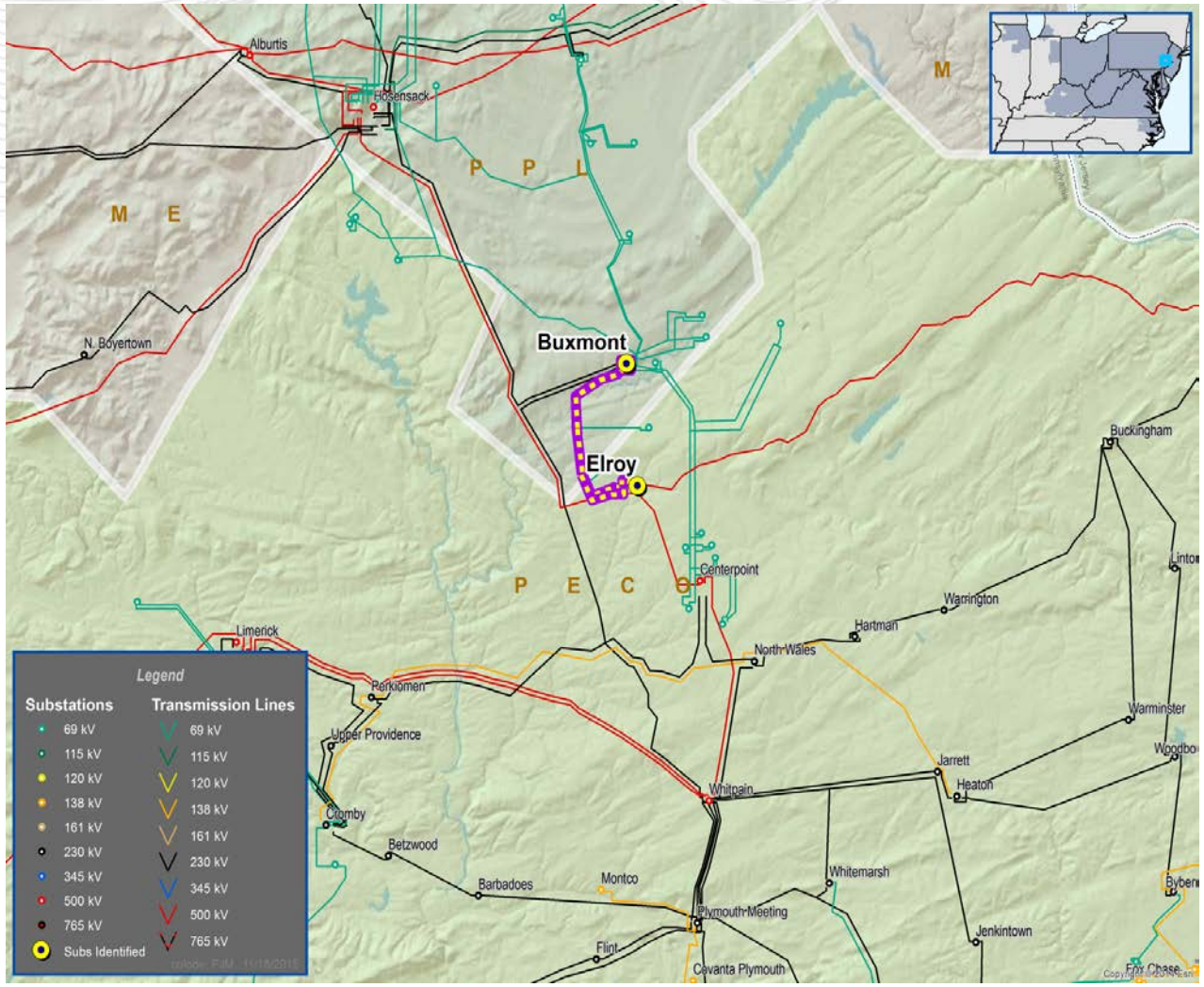


PPL Transmission Zone

- Supplemental Upgrade :
  - Rebuild the Buxmont-Elroy 1 & 2 69 kV Lines (6 mi)
  - Rebuild the Elroy-Hatfield 1 & 2 69 kV Lines (0.25 mi). (S1028)
- Estimated Project Cost:

  $ 13.3 M
- Projected IS Date:

  12/31/2018

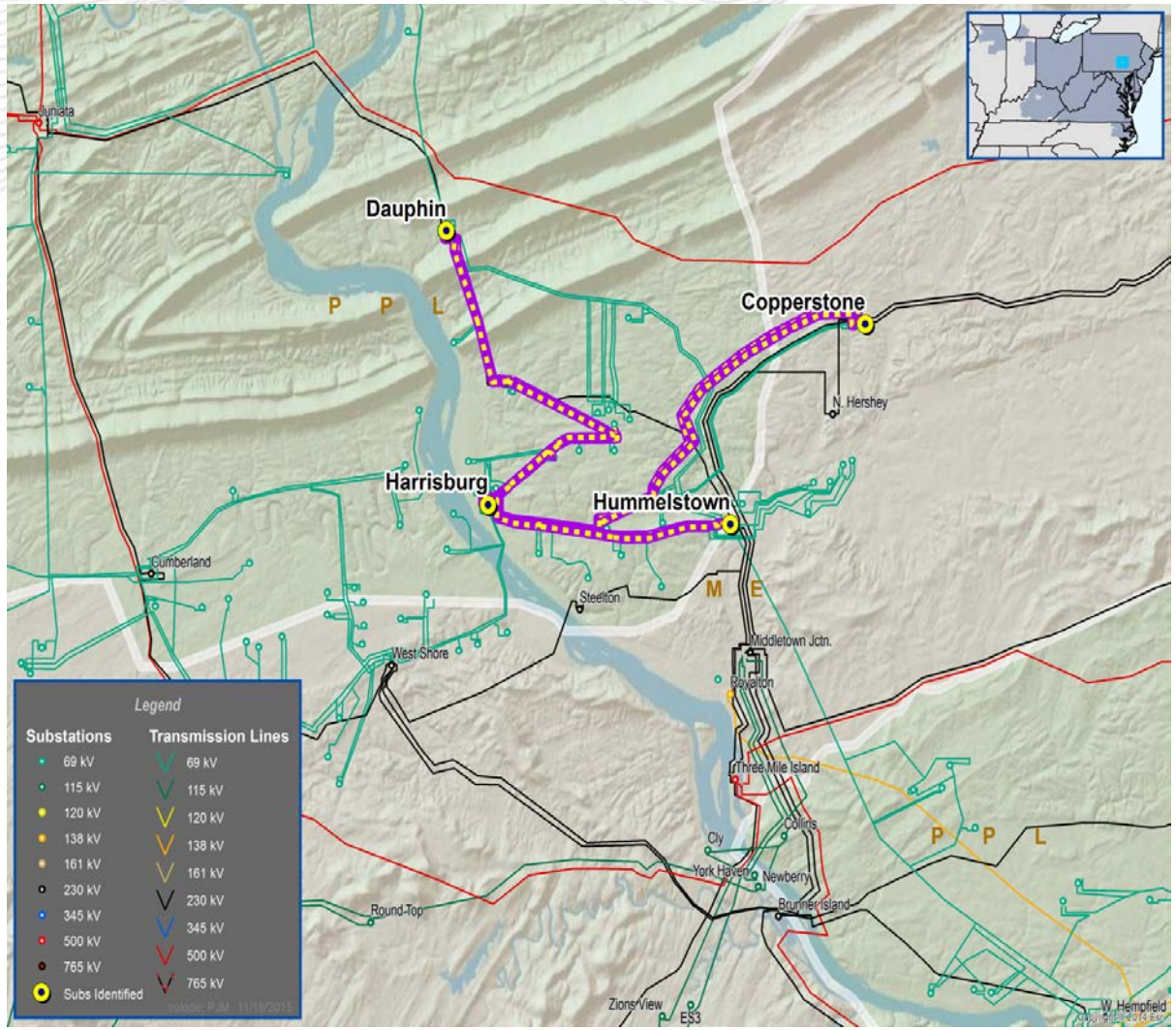


PPL Transmission Zone

- Supplemental Upgrade :
  - Upgrade Relaying on Hummelstown - Harrisburg 1 & 2 69 kV lines
  - Upgrade Relaying on Copperstone - Harrisburg 1 & 2 69 kV lines
  - Upgrade Relaying on Dauphin- Harrisburg 1 & 2 69 kV lines. (S1029)
- Estimated Project Cost:

  $ 1.62 M
- Projected IS Date:

  11/30/2016

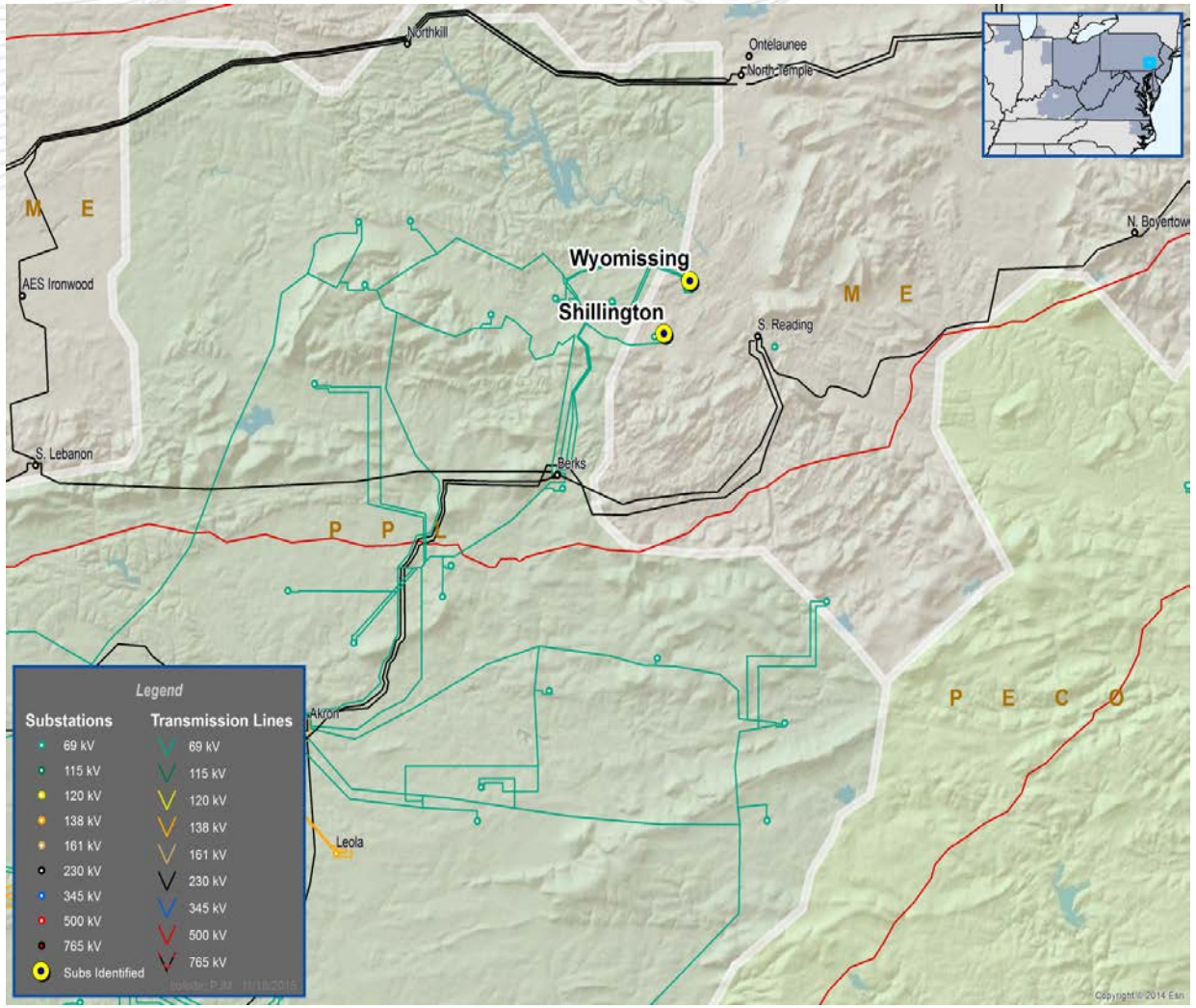


PPL Transmission Zone

- Supplemental Upgrade :
  - Build new D/C tap to Shillington from the new Lauschtown -Wyomissing #1 & #2 69kV lines (Approximately 2 Miles). (S1030)
- Estimated Project Cost:

  $ 4.9 M
- Projected IS Date:

  5/31/2019

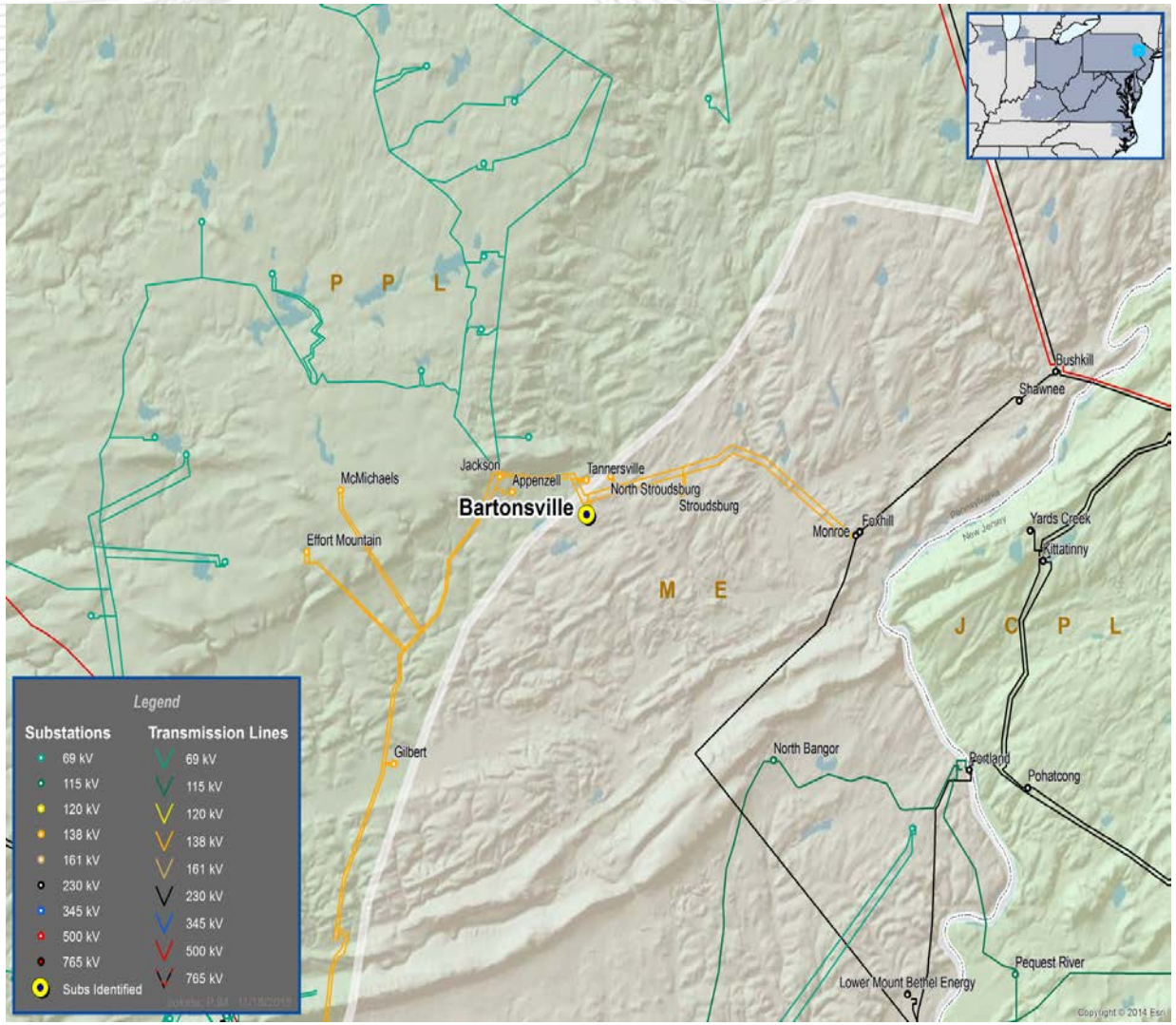


PPL Transmission Zone

- Supplemental Upgrade :
  - Rebuild approximately 3.2 miles of Bartonsville 69 kV tap to double circuit. (S1031)
- Estimated Project Cost:

  $ 5.3 M
- Projected IS Date:

  5/31/2019

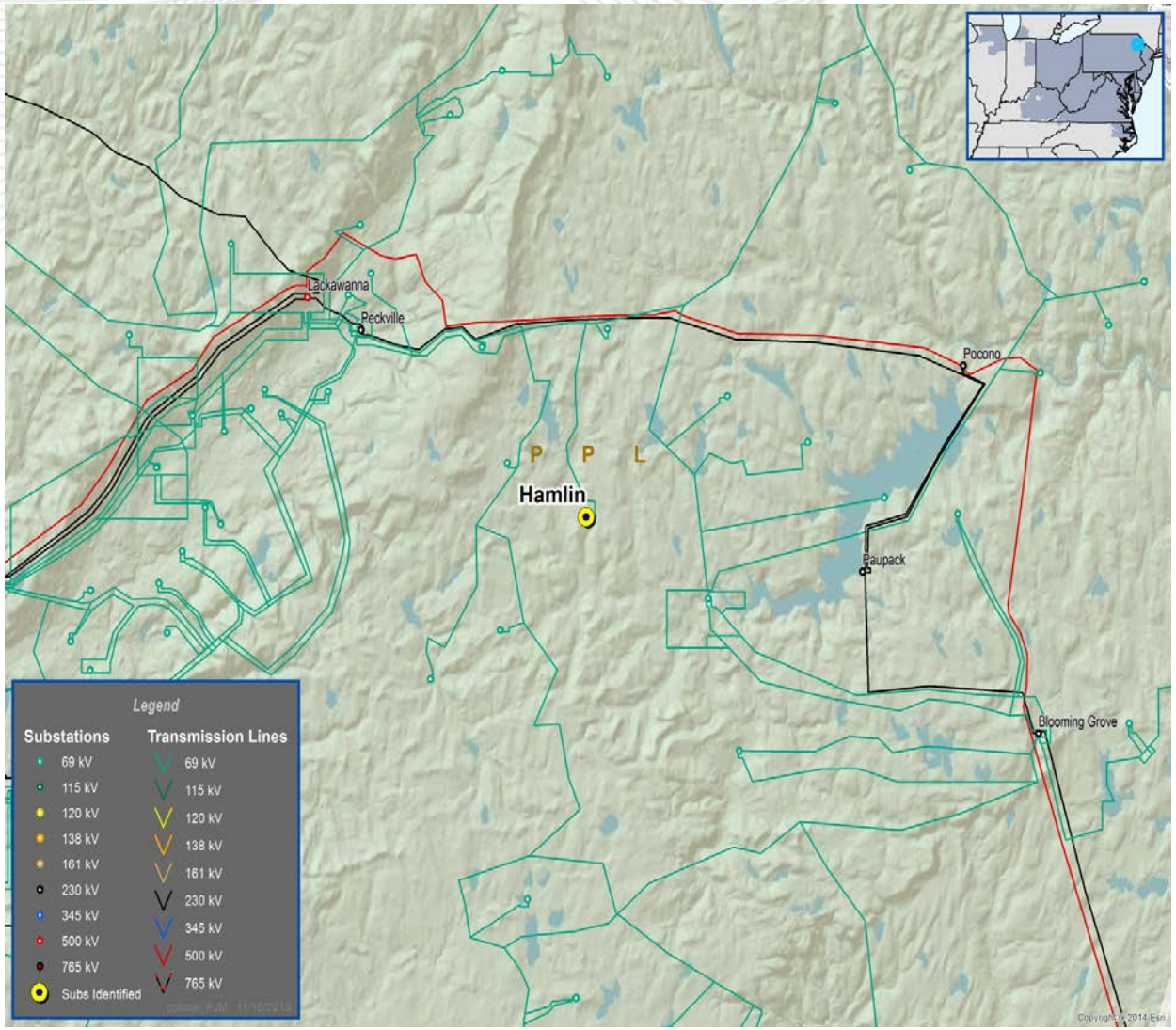


PPL Transmission Zone

- Supplemental Upgrade :
  - Rebuild approximately 6.6 miles of Hamlin 69 kV tap to double circuit. (S1032)
- Estimated Project Cost:

  $ 14.5 M
- Projected IS Date:

  12/31/2019

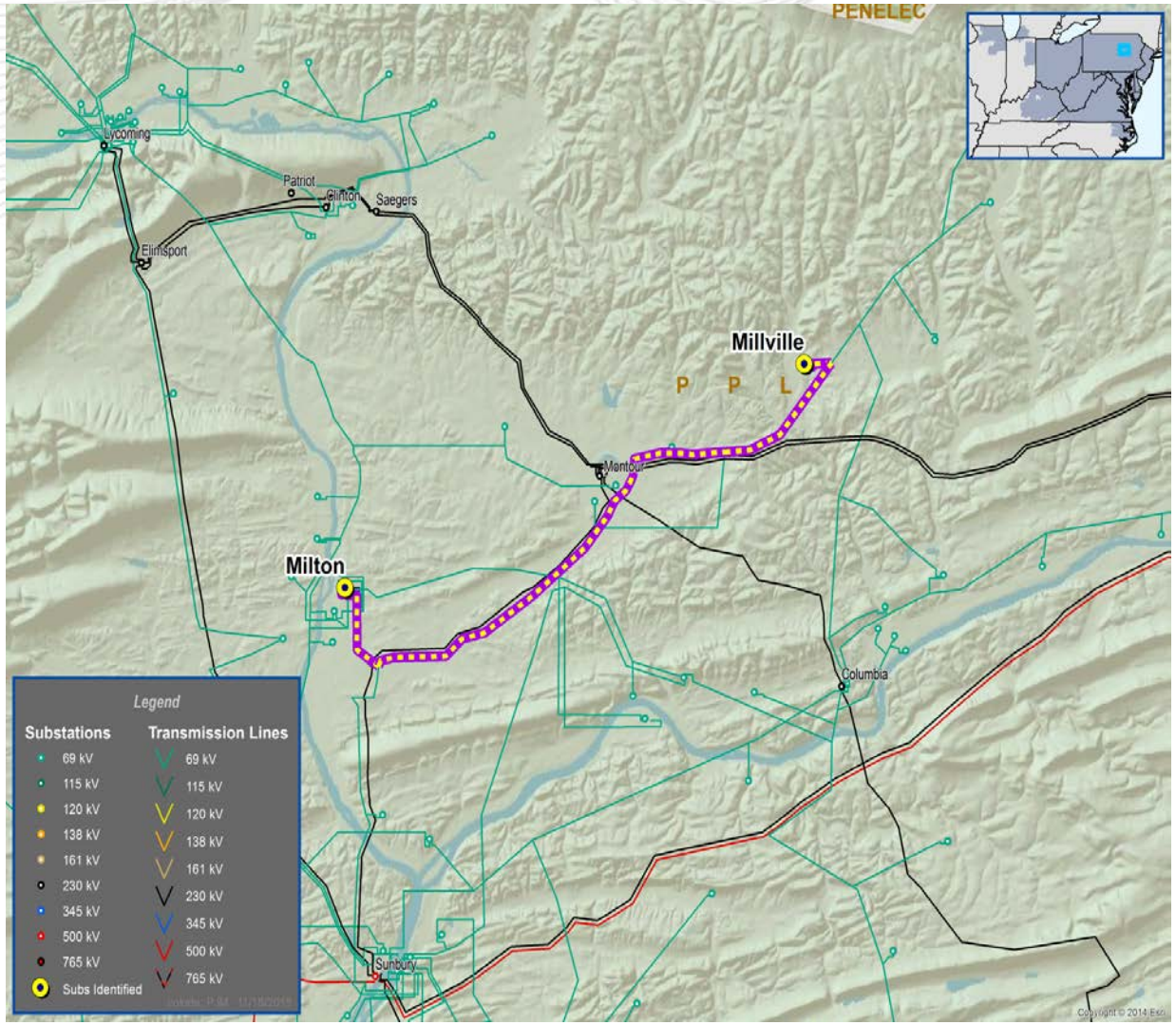


PPL Transmission Zone

- Supplemental Upgrade :
  - Rebuild approximately 9.8 miles of Milton-Millville 69 kV line. (S1033)
- Estimated Project Cost:

  $ 17 M
- Projected IS Date:

  1/31/2021

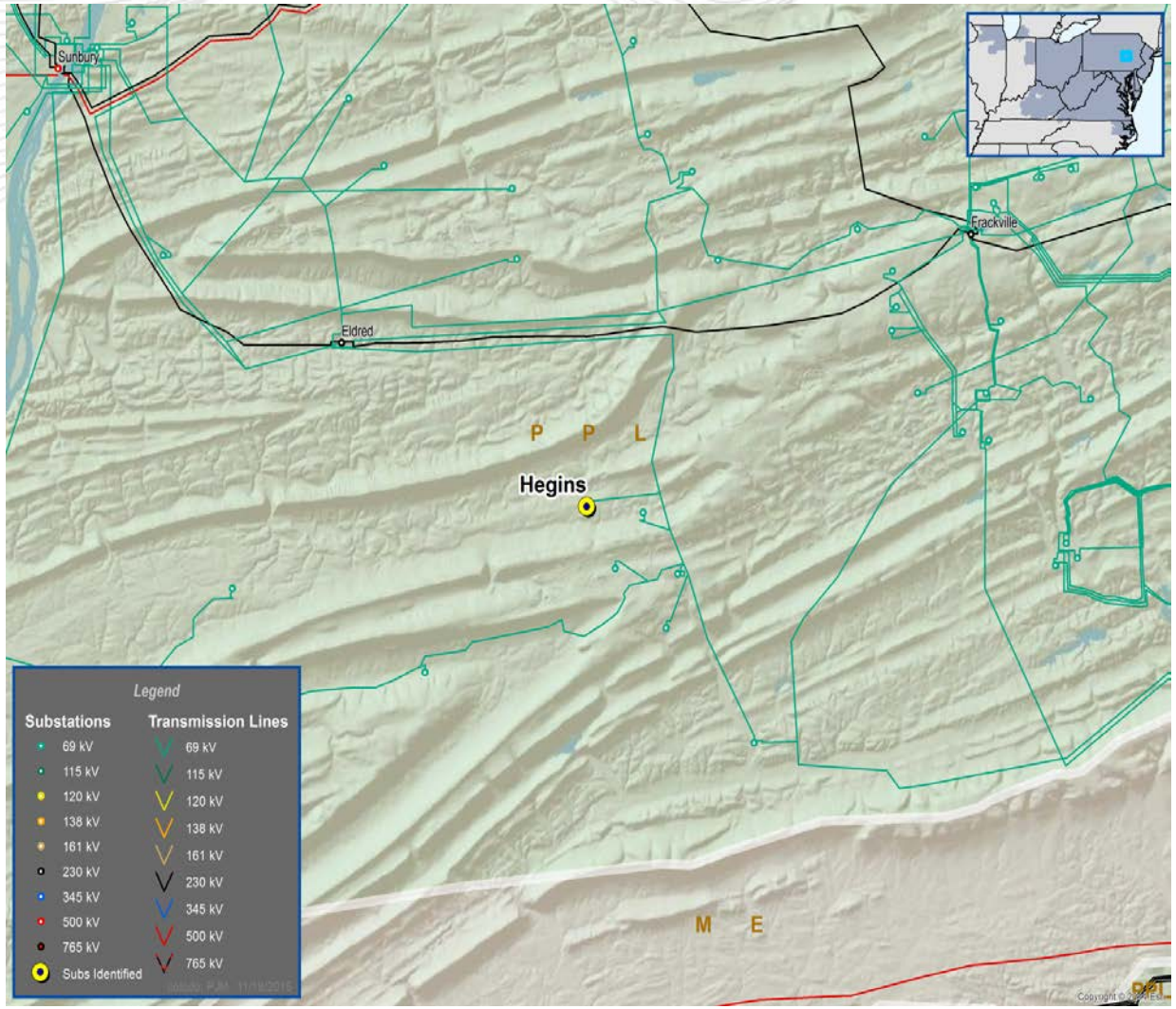


PPL Transmission Zone

- Supplemental Upgrade :
  - Rebuild approximately 3.2 miles of Hegins 69 kV tap. (S1034)
- Estimated Project Cost:

  $ 4.5 M
- Projected IS Date:

  4/30/2017

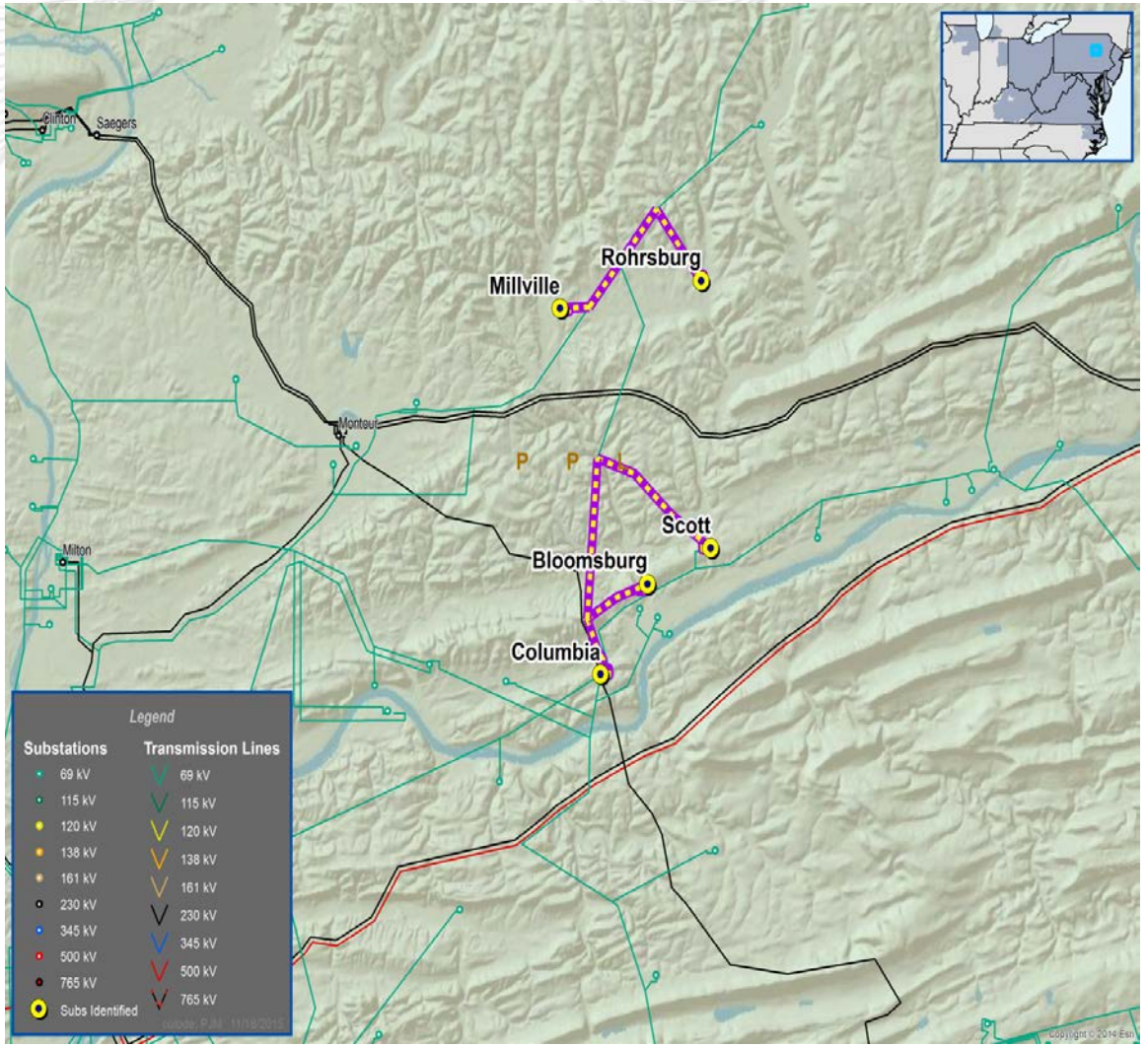


PPL Transmission Zone

- Supplemental Upgrade :
  - Rebuild the existing Columbia - Scot 69 kV line from Columbia sub to Bloomsburg sub to single circuit (Approximately 2.5 Miles)
  - Rebuild the existing Columbia-Scot 69 kV line from Bloomsburg sub to Scott sub to double circuit (Approximately 3.3 Miles)
  - Rebuild the existing Rohrsburg - Millville 69 kV tap (Approximately 5.9 Miles). (S1035)
- Estimated Project Cost:

  $ 24 M
- Projected IS Date:

  2/28/2017, 12/31/2014, 5/31/2019

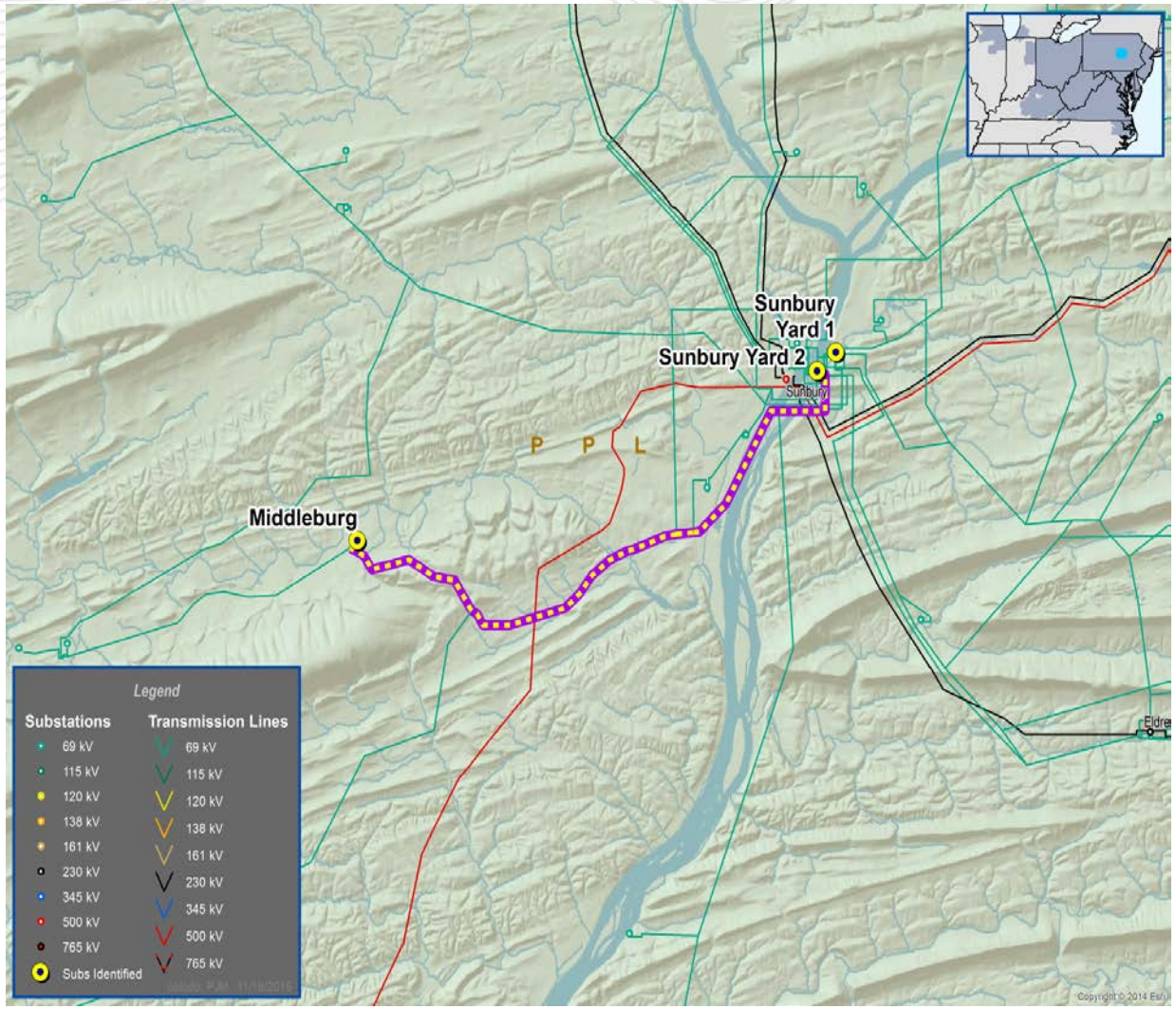


PPL Transmission Zone

- Supplemental Upgrade :
  - Expand and upgrade the Sunbury 69 kV Yard #1 substation
  - Expand and upgrade the Sunbury 69 kV Yard #2 substation
  - Rebuild the Sunbury - Middleburg 69 kV circuit (Approximately 23.7 Miles). (S1036)
- Estimated Project Cost:

  $ 42.5 M
- Projected IS Date:

  4/30/2018, 6/30/2018, 3/31/2022

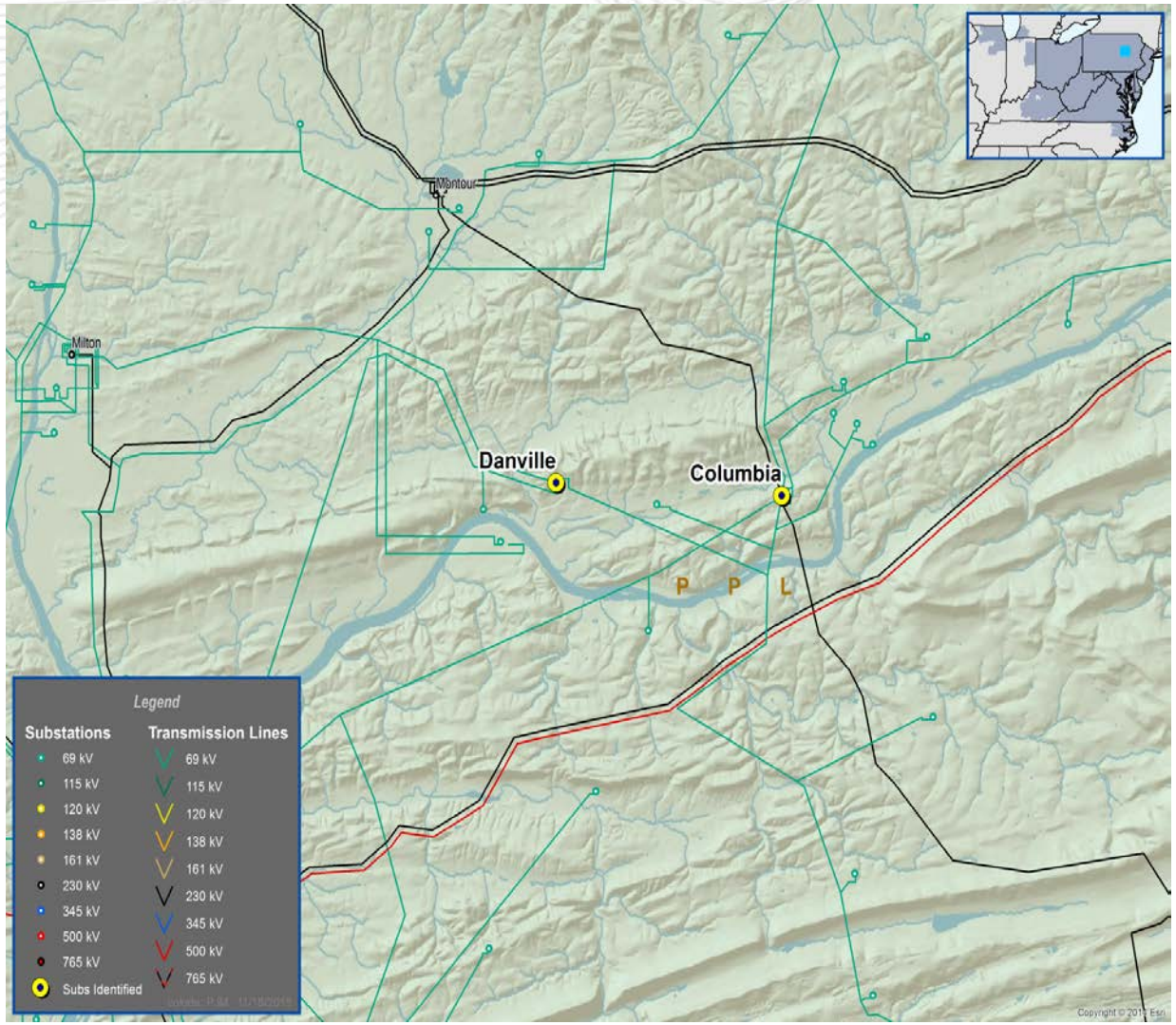


PPL Transmission Zone

- Supplemental Upgrade :
  - Expand the Columbia 69kv Yard
  - Reconfigure the Danville Switchyard to a distribution substation. (S1037)
- Estimated Project Cost:

  $ 1.7 M
- Projected IS Date:

  4/30/2018, 6/30/2020

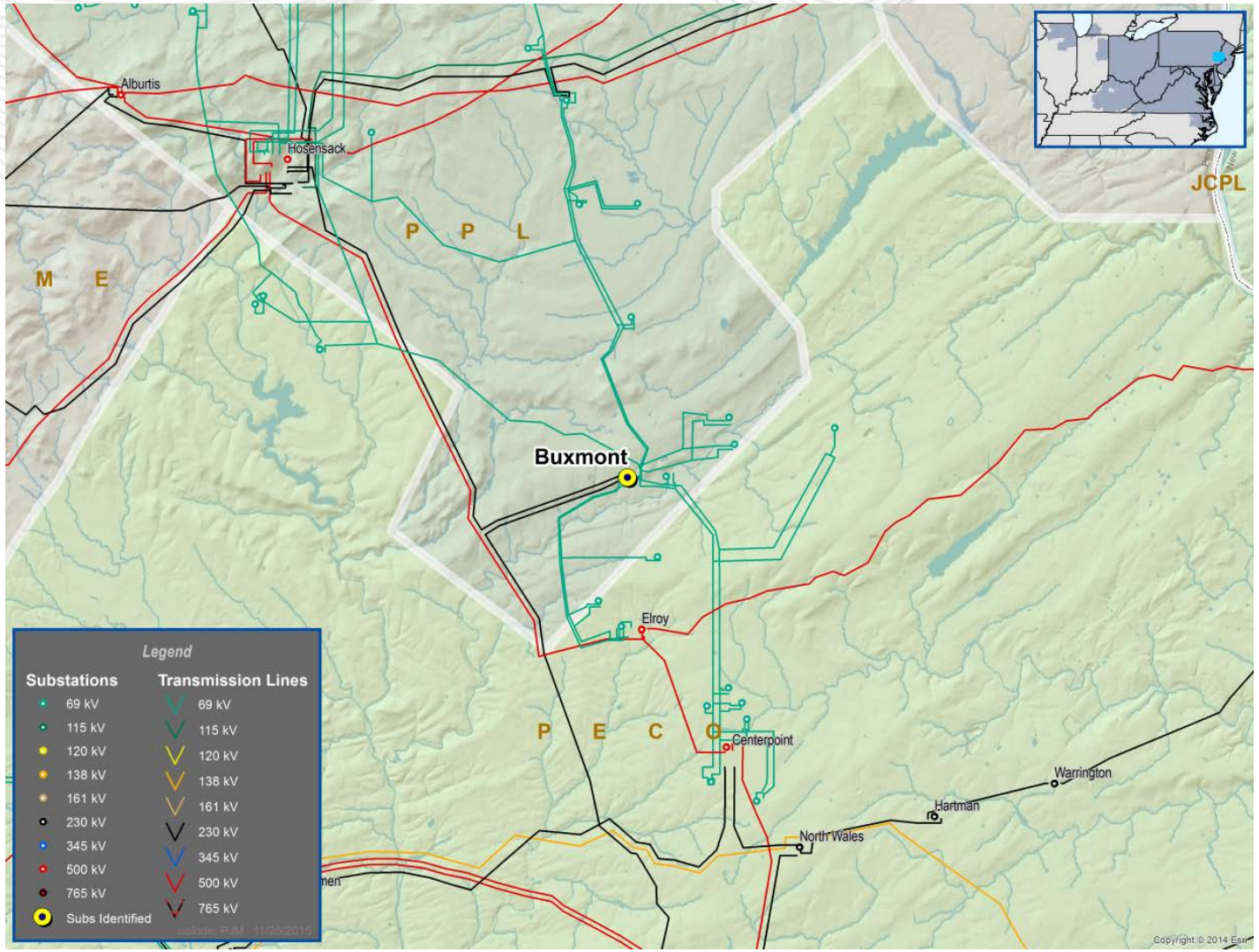


PPL Transmission Zone

- Supplemental Upgrade:
- To improve reliability due to aging infrustructure
- Proposed Solution:
  - Upgrade Buxmont 230-69 kV Substation. (S1092)
- Estimated Project Cost:

  $ 5.1 M
- Projected IS Date:

  12/31/2018

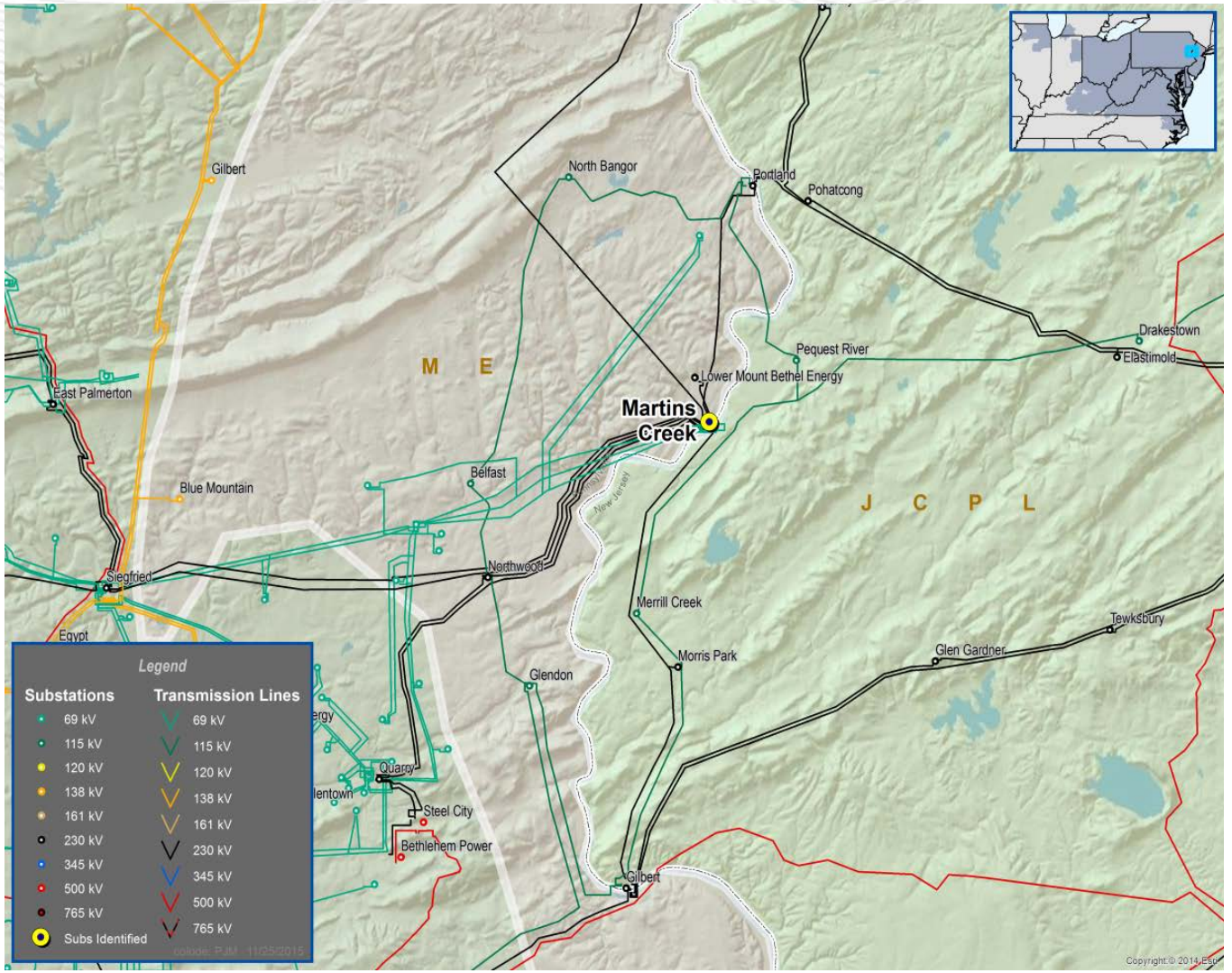


PPL Transmission Zone

- Supplemental Upgrade:
- To improve reliability due to aging infrastructure.
- Proposed Solution:
  - Upgrade Martins Creek 230-69 kV substation. (S1093)
- Estimated Project Cost:

  $ 35 M
- Projected IS Date:

  5/31/2023

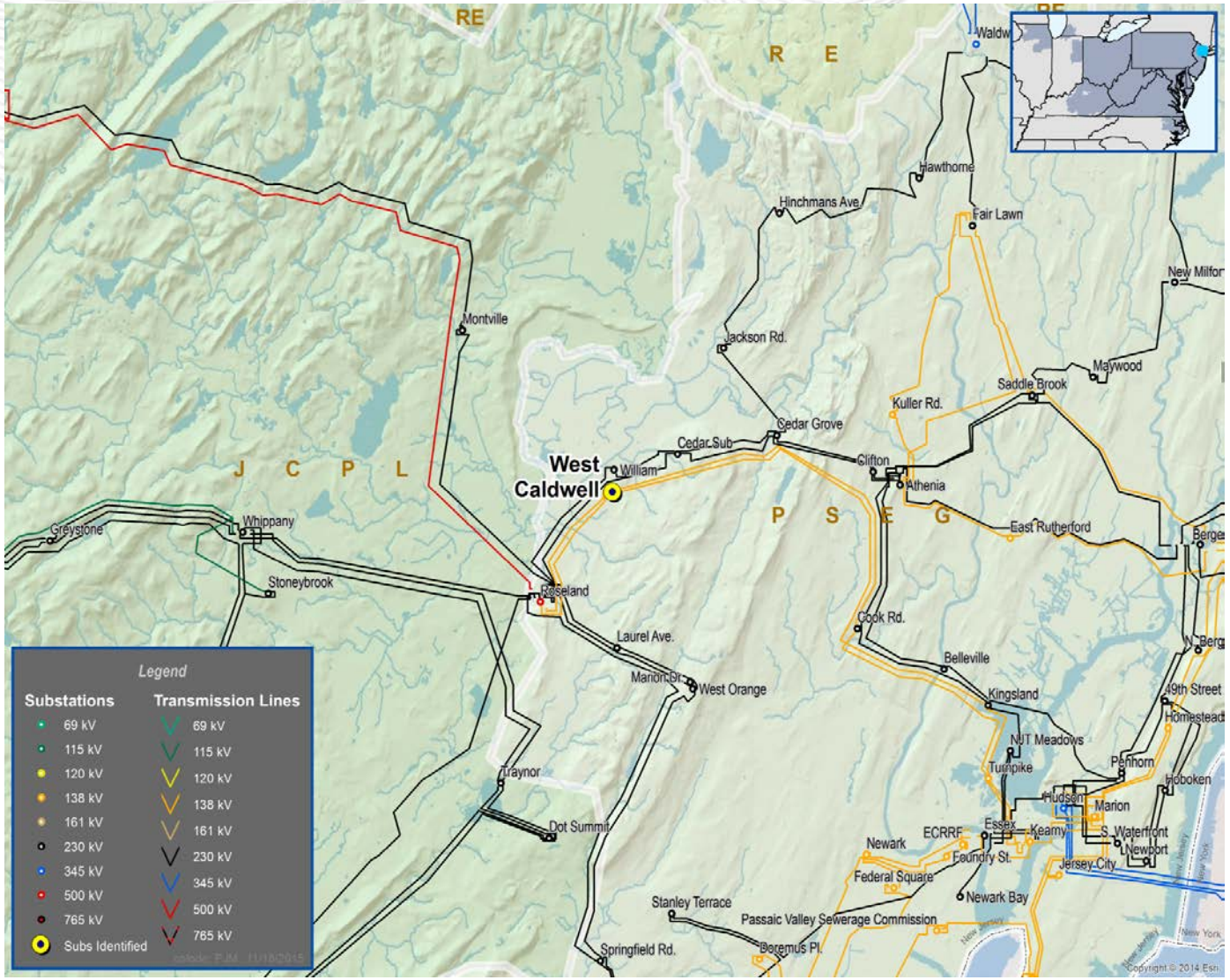


PSEG Transmission Zone

- Supplemental Upgrade :
- To improve reliability due to aging infrastructure.
- Proposed Solution:
  - Replace West Caldwell T1 138/13 kV transformer.
  - Replace West Caldwell T3 138/13 kV transformer. (S1007)
- Estimated Project Cost:

  $ 9.8 M
- Projected IS Date:

  12/31/2017

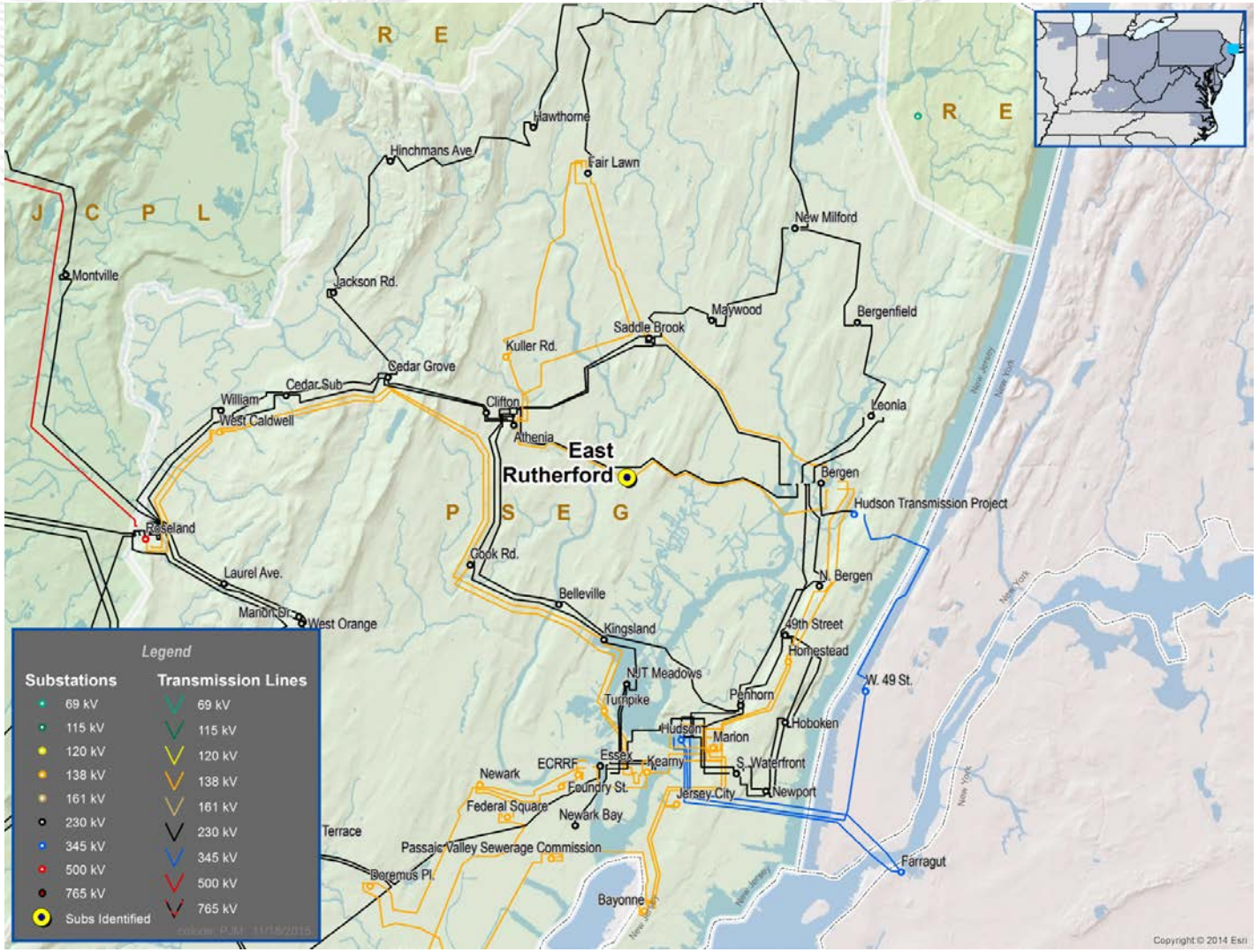


PSEG Transmission Zone

- Supplemental Upgrade :
- To improve reliability due to aging infrastructure.
- Proposed Solution:
  - Replace East Rutherford T-10 138/13 kV transformer.
  - Replace East Rutherford T-20 138/13 kV transformer. (S1008)
- Estimated Project Cost:

  $ 9.8 M
- Projected IS Date:

  12/31/2017

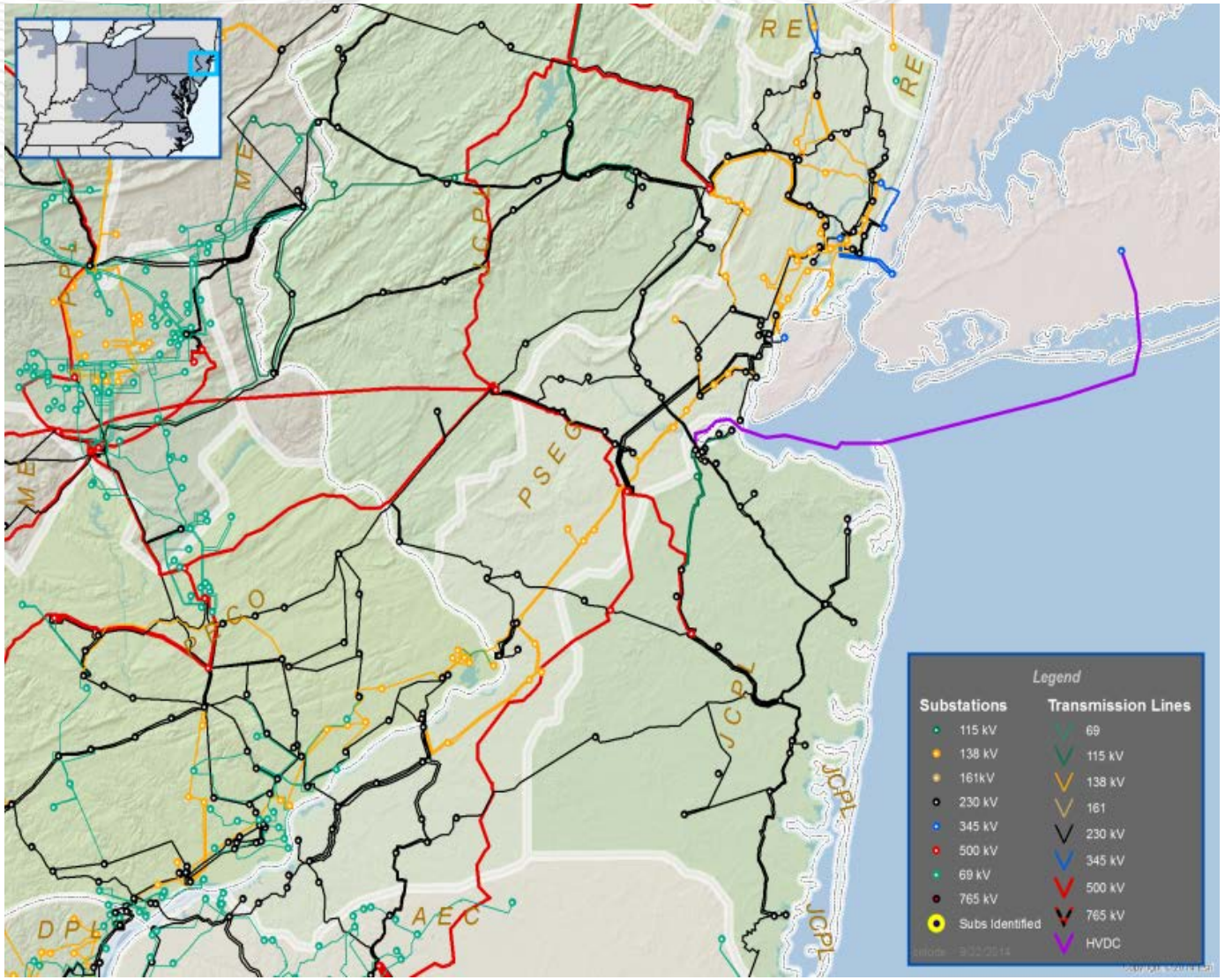


PSEG Transmission Zone

- Supplemental Project:
- To improve reliability and transformer availability during contingency/failure
- Proposed Solution:
  - Purchase 750 MVA 345/138 kV autotransformer (Special Divided or Dissociated Phases) . (S1010.3)
  - Purchase 750 MVA, 345/138 kV autotransformer (Conventional 3-Phase). (S1010.4)
- Estimated Project Cost:

  $ 22 M
- Projected IS Date:

  6/1/2016-6/1/2018

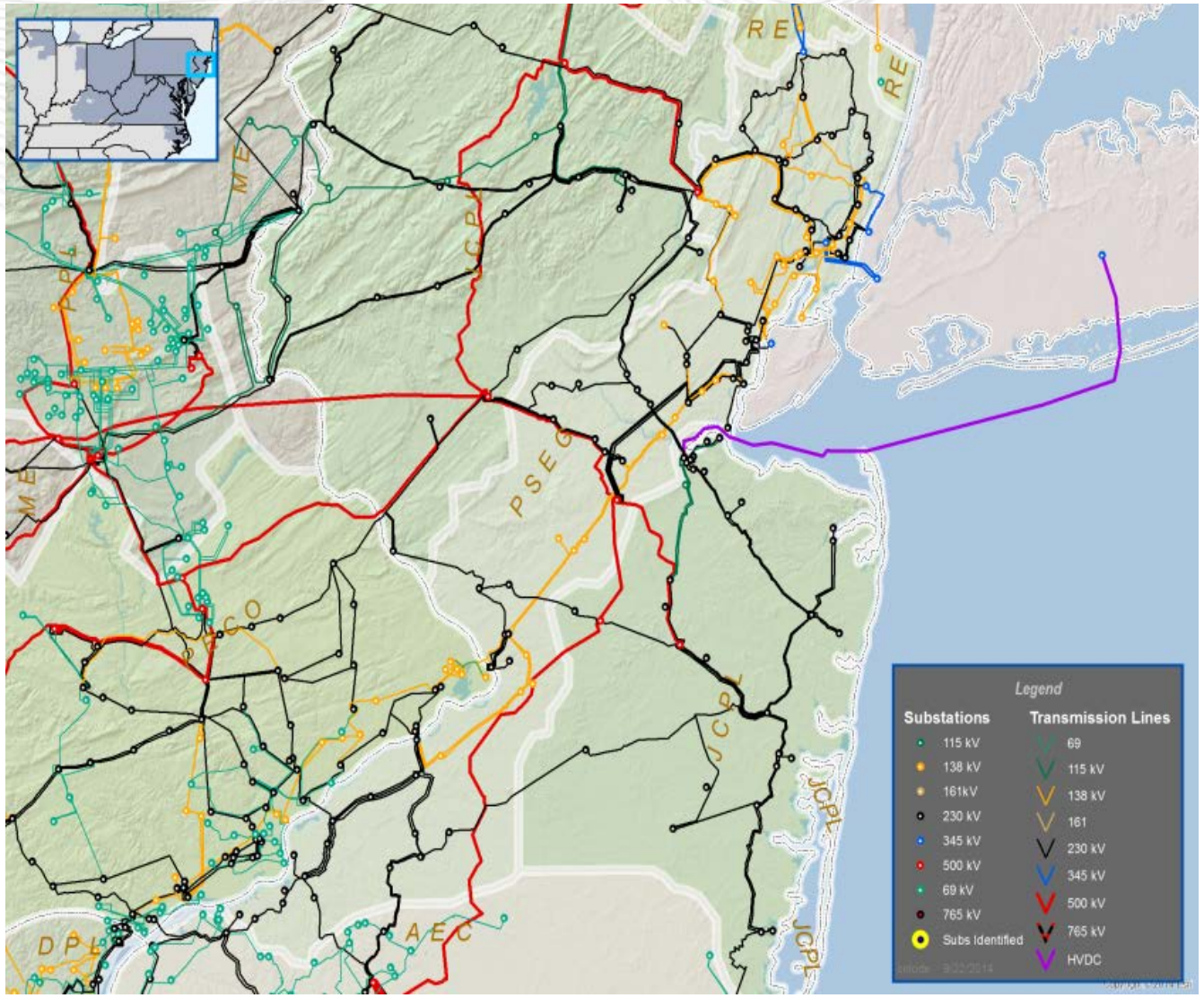


PSEG Transmission Zone

- Supplemental Project:
- To improve reliability and transformer availability during contingency/failure
- Proposed Solution:
  - Purchase 300 MVA 345/69 kV autotransformer. (S1010.5)
  - Purchase 150 MVA, 345/27.72/13.8 kV transformer. (S1010.6)
  - Purchase 45 MVA, 345/13.8 kV transformer. (S1010.7)
- Estimated Project Cost:

  $ 19.9 M
- Projected IS Date:

  6/1/2016-6/1/2018

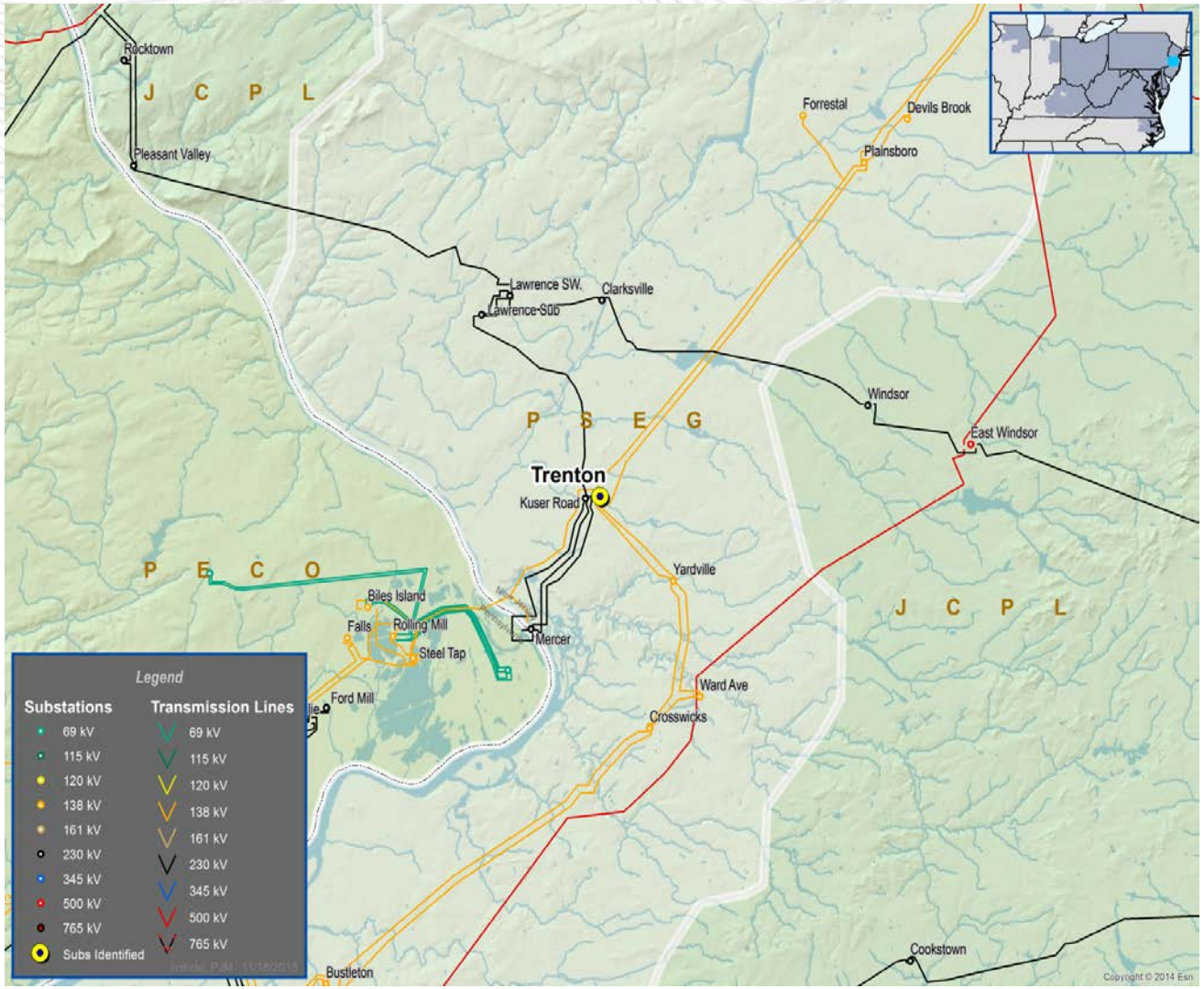


PSEG Transmission Zone

- Supplemental Upgrade :
- To improve reliability due to aging infrastructure.
- Proposed Solution:
  - Decommission the Trenton Switch 440V Bus System. Retire 26/0.44 kV SL&P transformers and transfer remaining 208V load to new control house supply (Two new 1000kVA transformers).
  - Trenton: Replace 440V and 220V AC Panels and install step up 208/440 V transformers for the 440 V loads. (S1014)
- Estimated Project Cost:

  $ 2.2 M
- Projected IS Date:

  12/31/2016

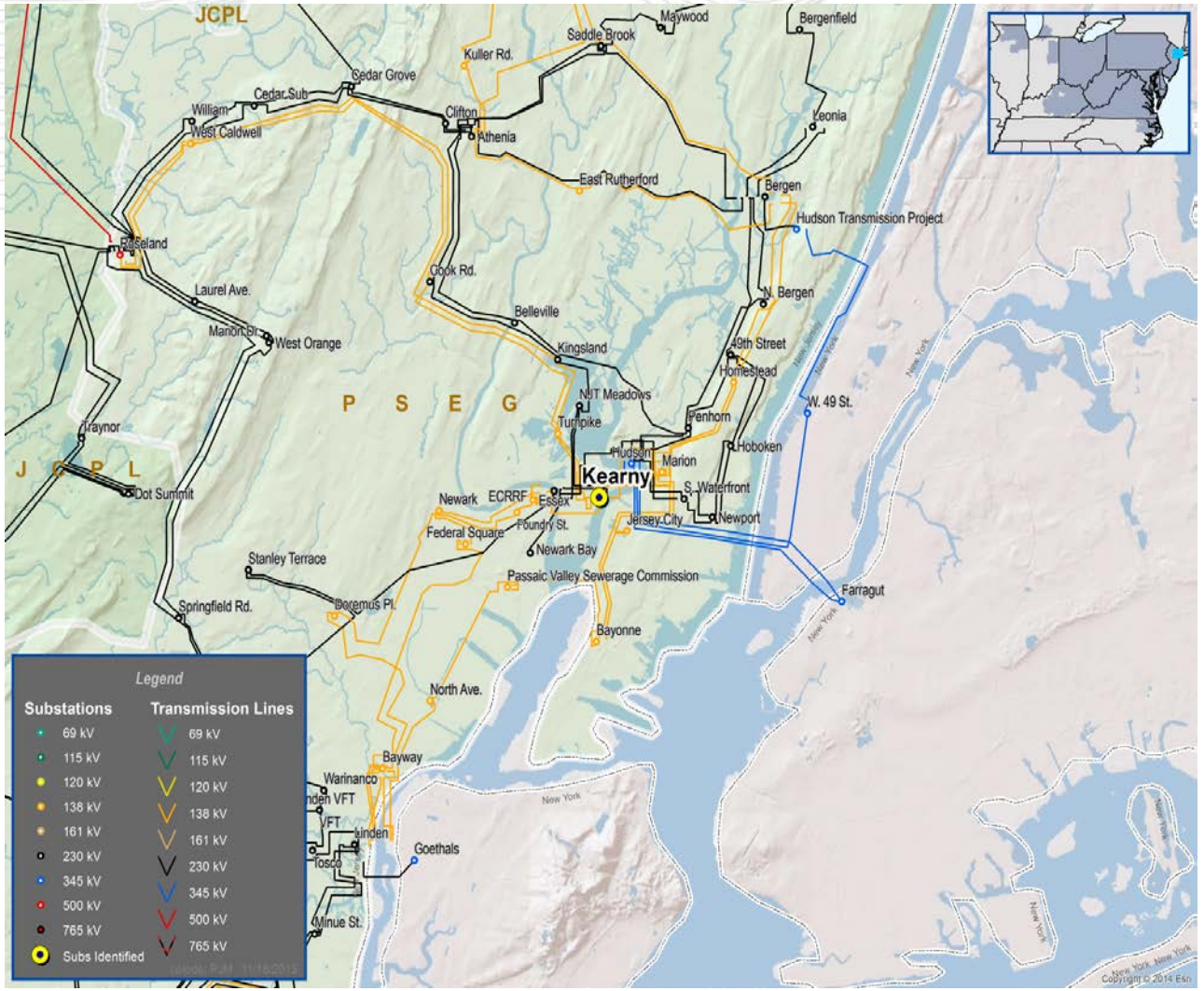


PSEG Transmission Zone

- Supplemental Upgrade :
- This project will provide capacity for future load growth in the area.
- Proposed Solution:
  - Build a new Kearney breaker and a half design 69kV switching station consisting of three (3) bays with nine (9) circuit breakers, and space for a future fourth (4th) bay.
  - Install two Kearney 230/69 kV transformers.
  - Install a new bay at the Kearney 230 kV station for the new Kearney 230/69 kV transformers. (S1015)
- Estimated Project Cost:

  $ 125.1 M
- Projected IS Date:

  12/31/2018

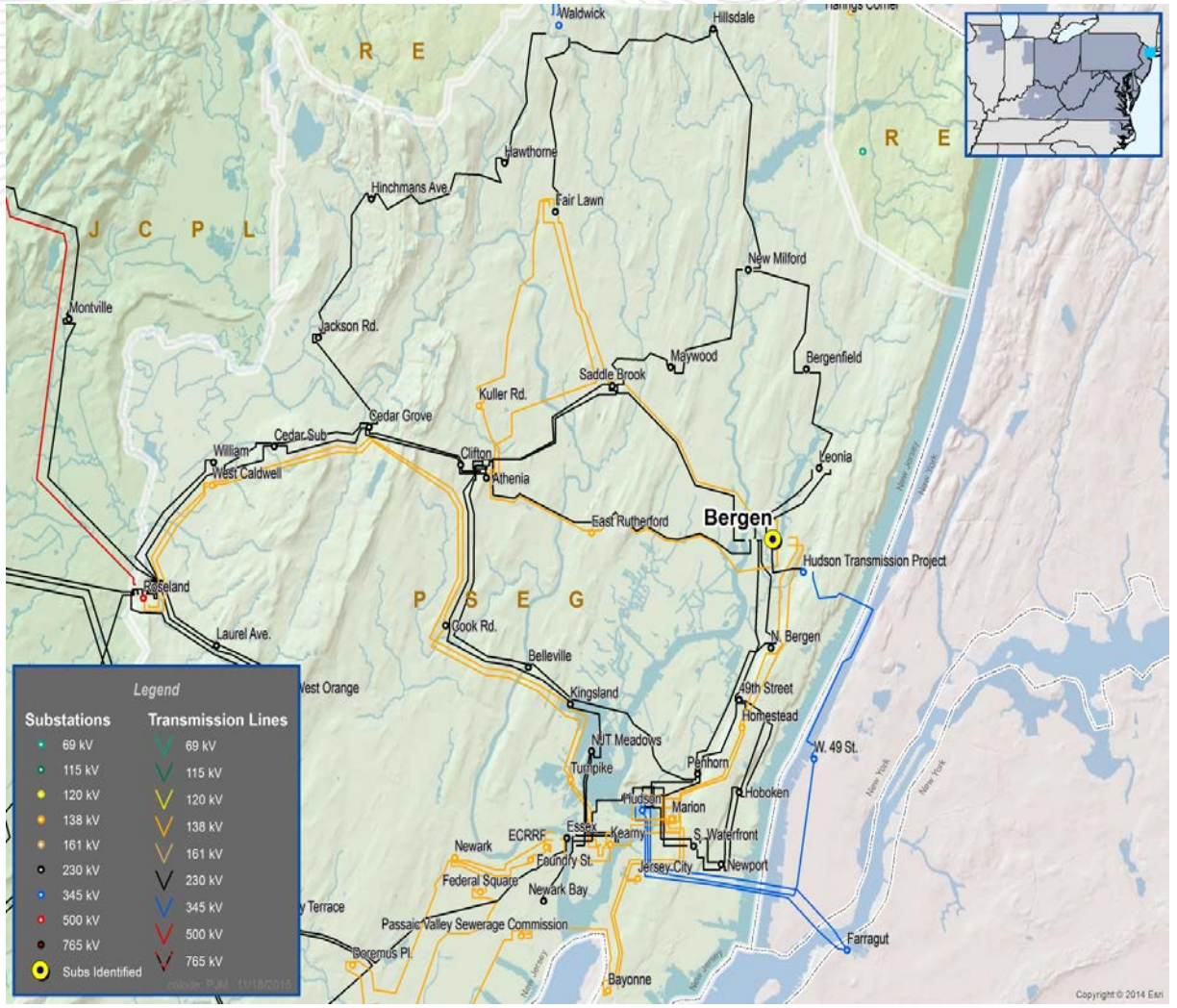


PSEG Transmission Zone

- Supplemental Upgrade :
- This project will provide capacity for future load growth in the area and to retire Marshall Street 26/4kV Substation.
- Proposed Solution:
  - Build a new Madison 230 kV substation with 3 breaker ring bus configuration by looping the R-2270 230 kV circuit
  - Build a new Madison 69 kV substation with 8 breaker ring bus configuration and install one 230/69 kV auto-transformer.
  - Install four69/4 kV transformers at the new Madison station. (S1016)
- Estimated Project Cost:

  $ 124.627 M
- Projected IS Date:

  12/31/2018

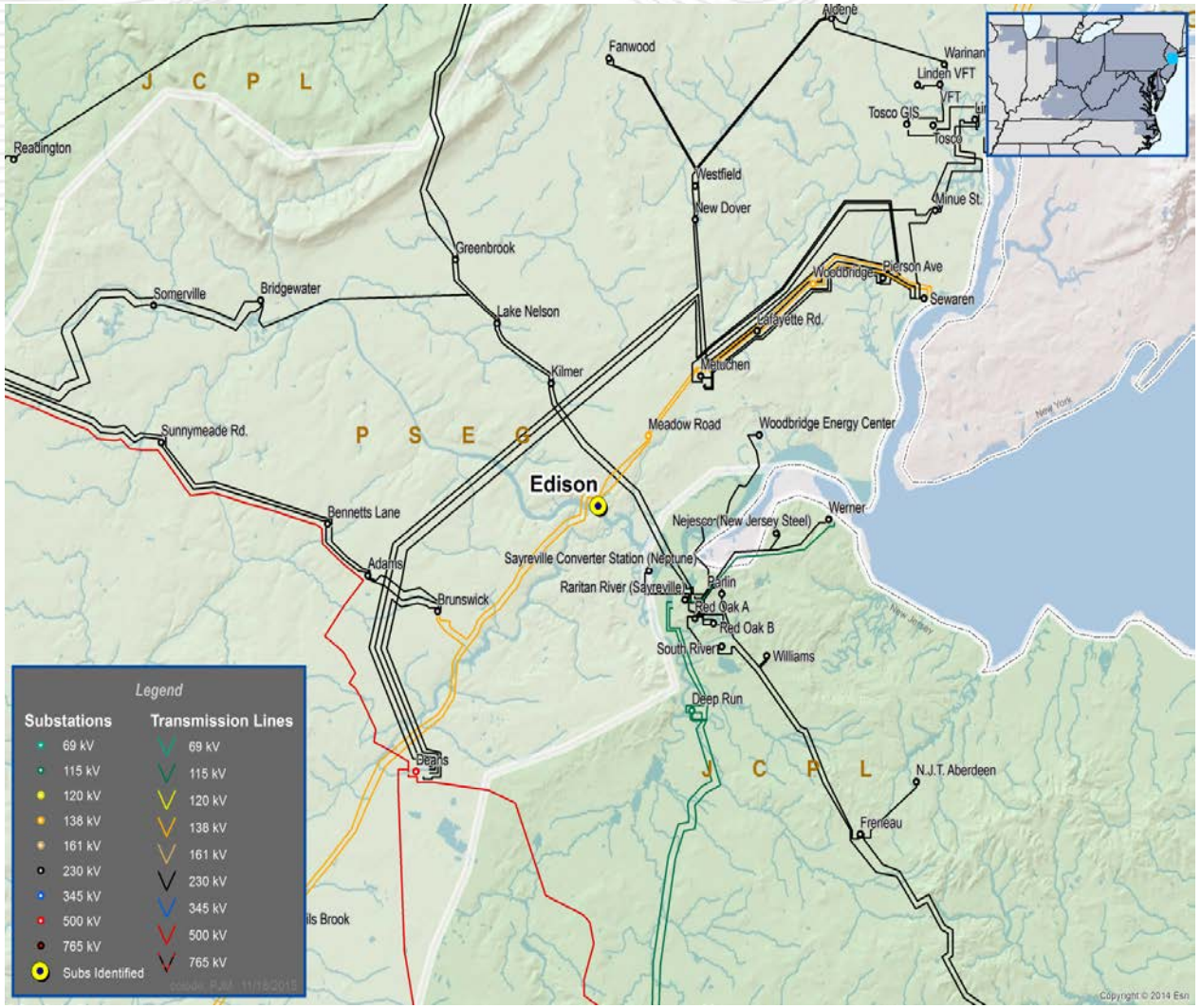


PSEG Transmission Zone

- Supplemental Upgrade :
- During Hurricane Sandy there was a lack of support for critical aux power and batteries that were abandoned from certain generating stations. This project will modify and update the protective relaying at Edison substation and will provide an opportunity for improving other aspects of the high voltage electric system at Edison substation by isolating lines from generators on different bus sections within the 138kV yard. The project will include replacing old, one dimensional electromechanical relays with new microprocessor relays, SCADA and alarm panels and more
- Proposed Solution:
  - Install Edison Control House. (S1018)
- Estimated Project Cost:

  $ 10 M
- Projected IS Date:

  1/31/2017

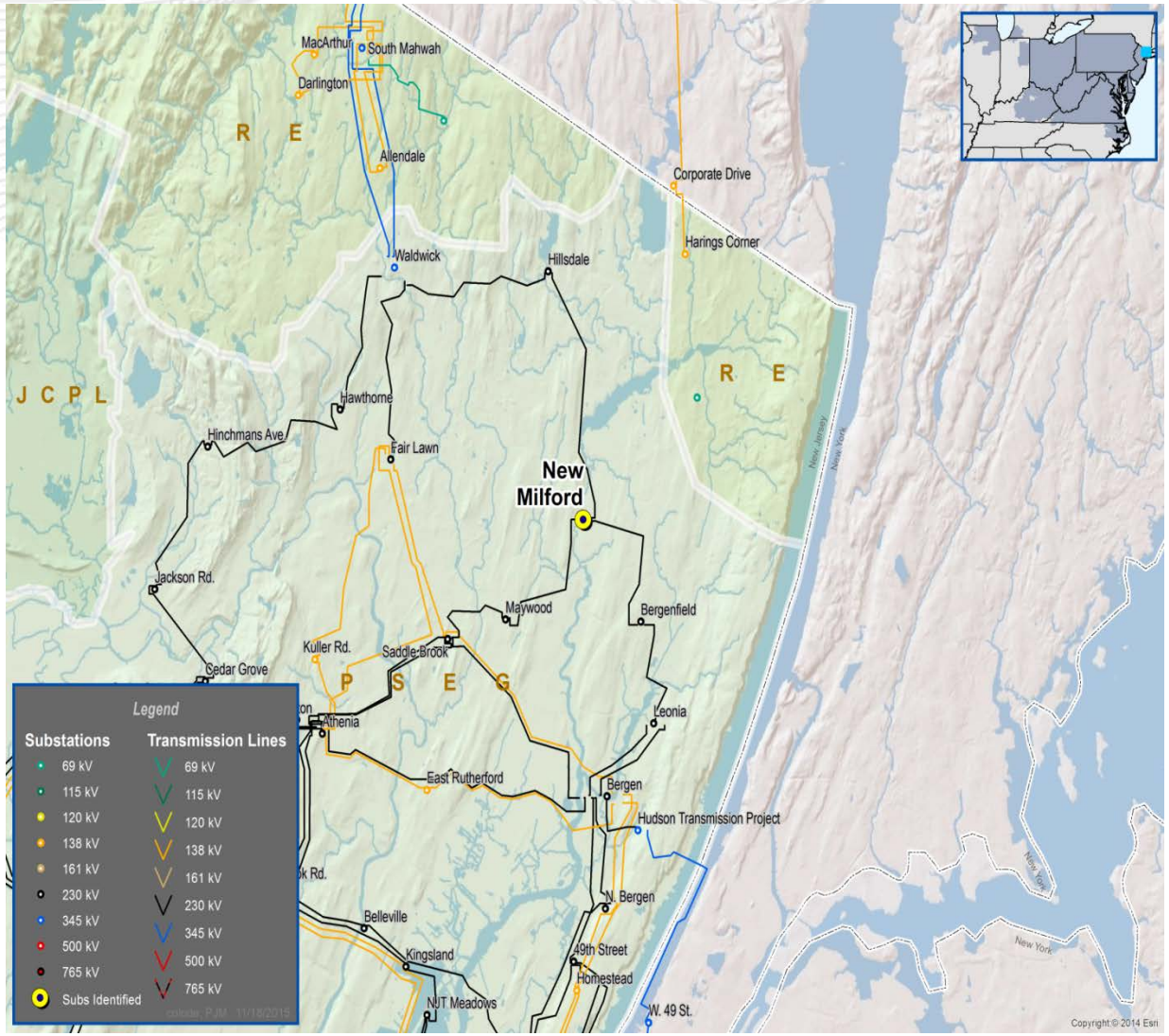


PSEG Transmission Zone

- Supplemental Upgrade :
- To improve reliability and operational flexibility. This project will improve voltage in the area by adding 69 kV sources.
- Proposed Solution:
  - Build a new New Milford 69 kV substation with ring bus configuration
  - Install 230/69 kV transformer at New Milford substation
  - Build a new 69 kV circuit from New Milford to Dumont and install 18 MVAR capacitor at Dumont 69 kV station
  - Build a new 69 kV circuit from New Milford to Teaneck substation (S1019)
- Estimated Project Cost:

  $ 79.7 M
- Projected IS Date:

  6/1/2019

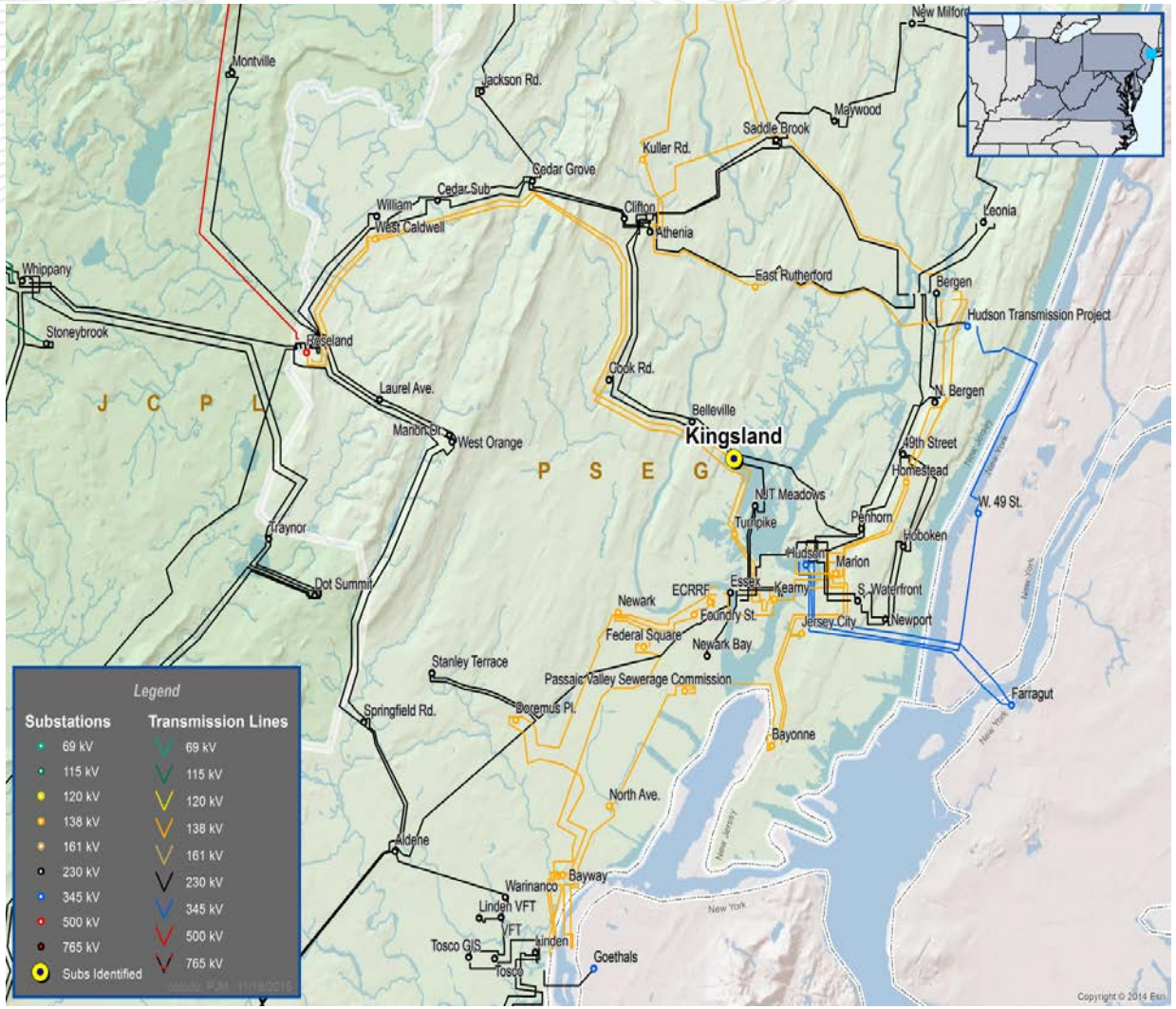


PSEG Transmission Zone

- Supplemental Upgrade :
- Improves reliability of Kingsland, Harrison and Van Winkle station by adding 69 kV source. To relief the heavily loaded E. Rutherford 26 kV which currently sources the Van Winkle load.
- Proposed Solution:
  - Build a new Kingsland 69 kV substation and install 230/69 kV transformer . Build a new Van Winkle 69 kV substation with breaker and half configuration and install three 69/4 kV transformers
  - Build a new 69 kV circuit from Kingsland to Harrison station. Build a new 69 kV circuit from Kingsland to Van Winkle.
  - Build a new 69 kV circuit from Van Winkle to Belleville Switch. Build a new 69 kV circuit from Van Winkle to E. Rutherford switch (S1021)
- Estimated Project Cost:

  $ 138.5 M
- Projected IS Date:

  6/1/2019

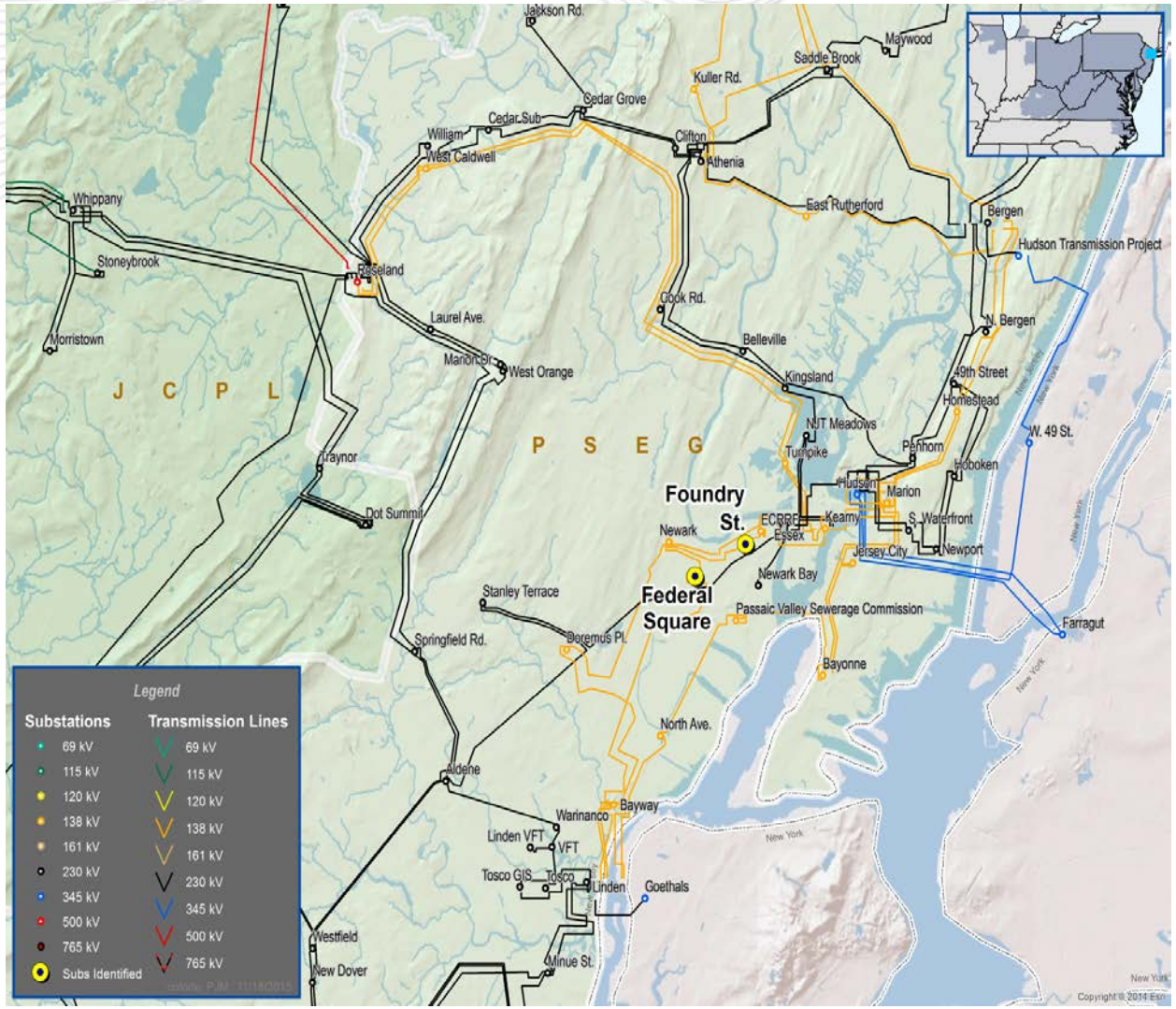


PSEG Transmission Zone

- Supplemental Upgrade :
- To improve reliability of the Existing Ironwood 26 kV do to aging. The Ironwood 26 kV station have been in-service since 1931. This project will also improve the reliability in the area by networking the 69 kV system.
- Proposed Solution:
  - Build a new Ironbound 69kV Substation
  - Build a new 69 kV circuit from Ironbound to Federal Square.
  - Build a new 69 kV circuit from Ironbound to Foundry Street (S1022)
- Estimated Project Cost:

  $ 75 M
- Projected IS Date:

  6/1/2019

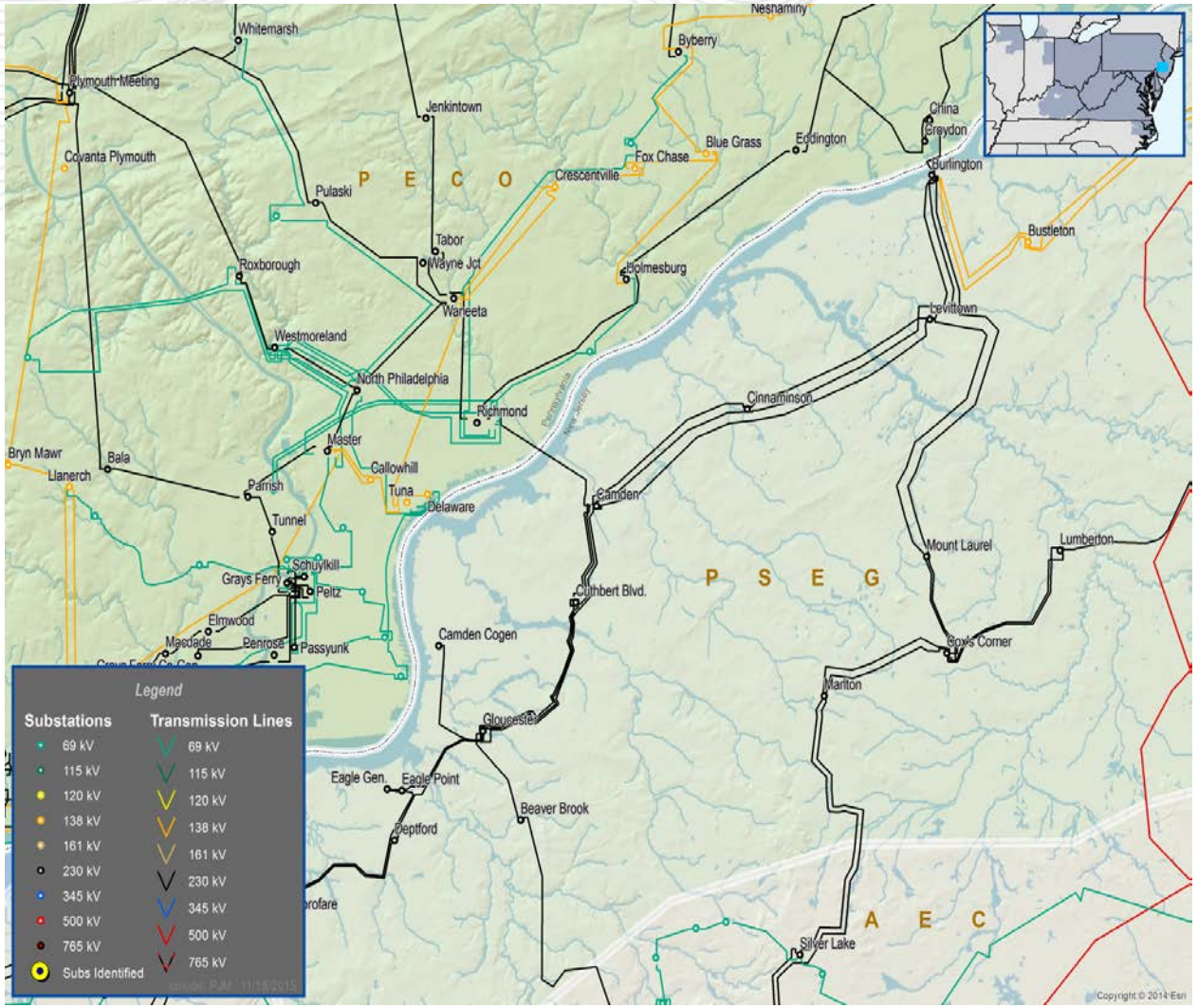


PSEG Transmission Zone

- Supplemental Upgrade :
- To improve reliability due to load growth in the Camden area.
- Proposed Solution:
  - Replace the existing limiting Locust Street two 69/4 kV and three 69/13 kV unit transformers with two 45/60 MVA 69/13 kV transformers. (S1023)
- Estimated Project Cost:

  $ 14.82 M
- Projected IS Date:

  12/31/2017



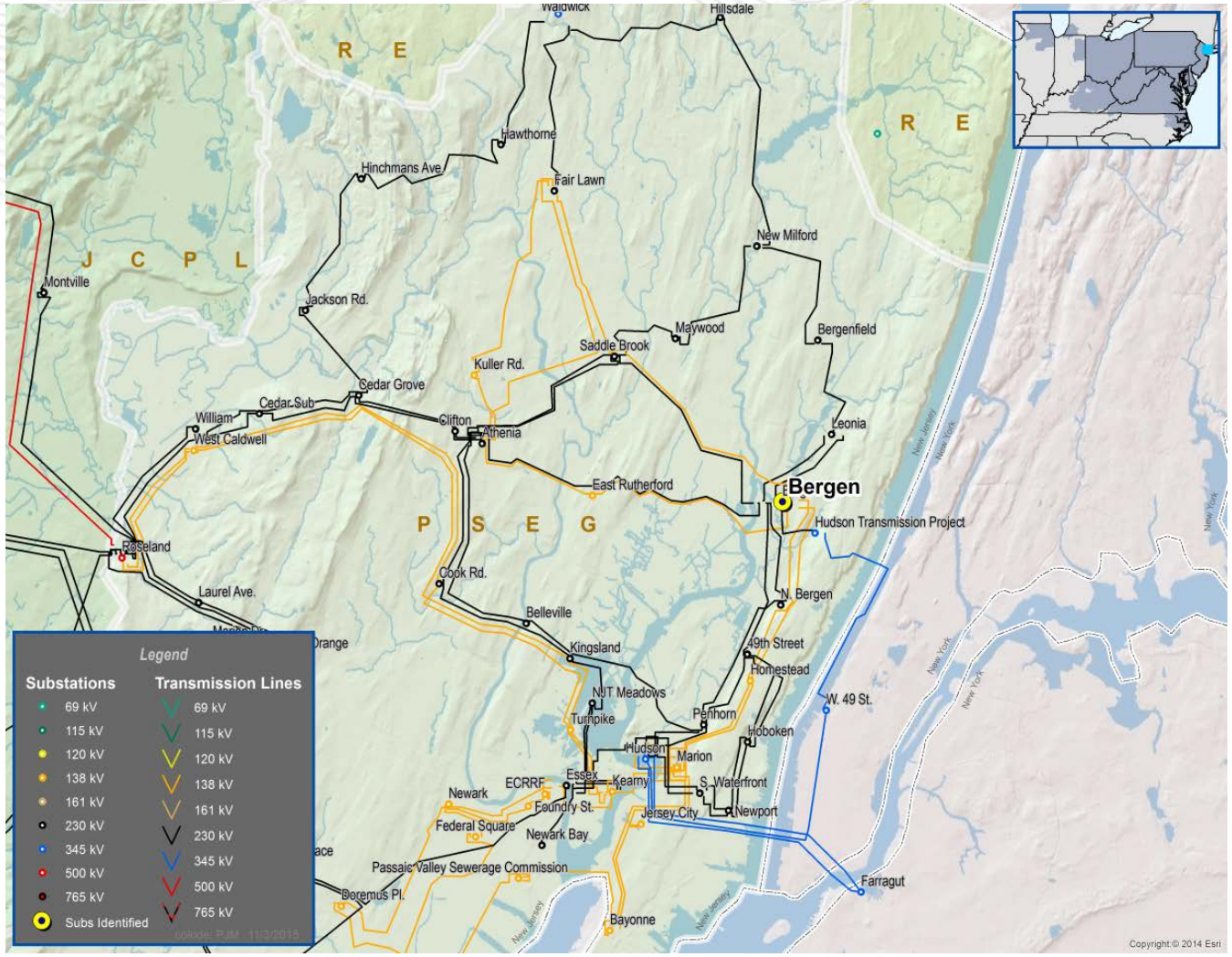
Short Circuit Upgrades

PSEG Transmission Zone

- **Short Circuit Violation:**
  - The Bergen 138kV ’40P’ and ’90P breakers are overstressed
- **Proposed Solution:**
  - Replace the Bergen 138kV ’40P’ and ’90P breakers with 80kA breakers (b2712-b2713)
- **Estimated Project Cost:**

  $6.545 M
- **Required In Service Date**:

  6/1/2020



Questions?

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