Reliability Analysis Update

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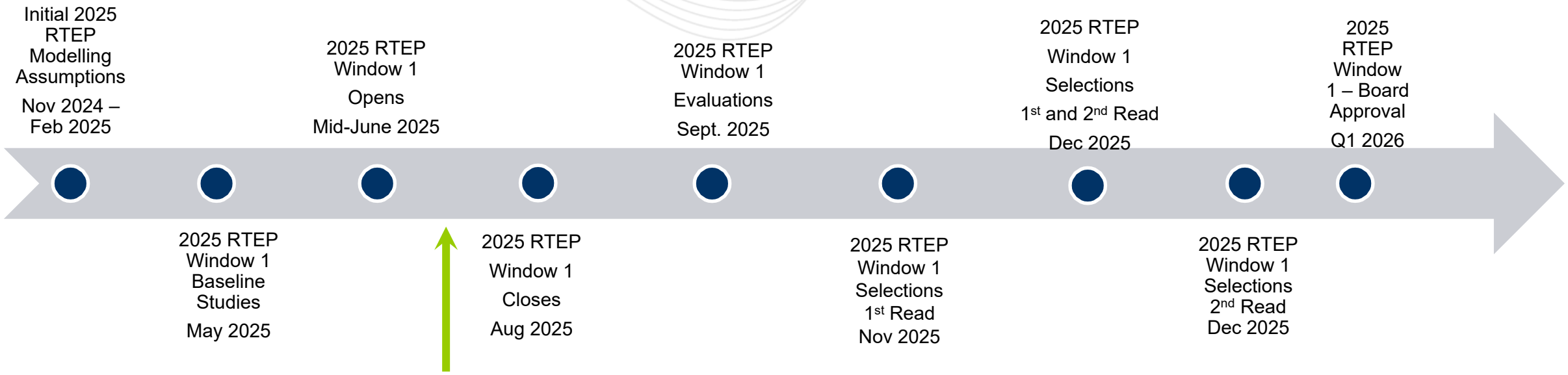
Transmission Expansion Advisory Committee
July 8, 2025

2025 RTEP Window 1 Update

2025 RTEP Window 1 – Timeline



2025 Window 1 - Timeline

- Current schedule
  - 2024 RTEP proposal Window 1 opened on June 18th, 2025, and will close on August 18th , 2025
  - First addendum posted on July 2nd
    - The Scenario 4 (2032 with NJ/DL OSW removed) study files and updated problem statement
    - 2030/2032 Study file updates
    - Updated result changes
  - 60 day window
  - Window summary and solutions to be brought forward to the TEAC starting in Oct. 2025 and through Jan. 2026
  - Board approvals in Feb. 2026

Problem Statement

PJM doesn't currently see major regional transfer issues in the 2030 analysis. In the 2032 analysis, there are several clusters showing EHV backbone overloads primarily along the extremities of the upgraded bulk, backbone transmission network that was reinforced as part of the PJM 2022 RTEP W3 and 2024 RTEP W1 competitive transmission windows. The following provides a brief rationale on whether a specific cluster is considered or not as part of the 2025 RTEP W1 window:

- ComEd/AEP 765KV transfer path: Wilton Center – Dumont – Sorenson – Marysville
  - Not considered in the window
  - The majority of this path is terminal equipment limited. For the Sorenson - Marysville line overload, the contingency, which causes the thermal violations is a line with stuck breaker contingency, which can be potentially addressed by local substation upgrade measures in the longer term (7 year horizon).

- AG1-125 – Marysville 765KV line
  - Not considered in the window
  - The line is terminal equipment limited.

- AEP Columbus area, there are two major backbone (765/345 kV) EHV sources that currently serve the load pocket. Multiple thermal overloads are showing in the area. In N-1-1 test, various contingency pairs cause the wide-spread local system voltage issues which are expected to worsen with forecasted load increase through 2032 and beyond. All the related thermal and voltage issues in 2030 are posted and open to competition. Solutions need to consider the longer term needs to ensure efficient and cost effective mitigation.

Problem Statement

- MAAC 500 kV system:
  - In 2032, multiple 500 kV facilities are overloaded due to terminal equipment constraints. However, the violations can be mitigated without long lead-time solutions.
  - Due to NJ offshore wind, the Rock Springs–Bramah 500 kV line exceeds its conductor rating. Scenario 4 study results confirm that without NJ OSW, this line is not overloaded, therefore PJM is not currently seeking proposals for the violations on the line.

- ATSI 138 & 115 kV area (2030 RTEP): East Springfield – Melissa – London path
  - PJM is experiencing load growth in Central Ohio, part of ATSI territory causing multiple thermal and voltage violations under various contingencies. These violations spread through several reliability analyses affecting neighboring TOs such as AEP and Dayton. PJM anticipates a holistic proposal to address the need, preferably an EHV solution.
  - PJM is seeking proposals to address these violations holistically and for the longer-term.

- ATSI 345 kV overloads (2032 RTEP): North to South & West to East
  - PJM has been experiencing increased loadings on the 345 kV backbone in the northern Ohio ATSI territory. As part of the 2024 RTEP W1, PJM selected a 138 kV rebuild solution for several facilities. PJM performed sensitivity analysis by upgrading the 138 kV lines to 345 kV and conducted additional studies incorporating both the 345 kV upgrade and the 2024 RTEP W1 138 kV selected solution and determined that the overloads remain, even if the line is upgraded to 345 kV.
  - The 2032 Summer RTEP shows additional flow from north to south (Lallendorf, Lemoyne and into Foster (AEP)) and west to east (Bayshore, Davis Besse and Beaver). These flows are more regional transfer-based and do not conflict with the rebuild of the existing 138 kV scope assigned by PJM in 2024 RTEP W1.
  - PJM is not currently seeking proposals to resolve the EHV violations but will continue to monitor the area closely moving forward.

Problem Statement

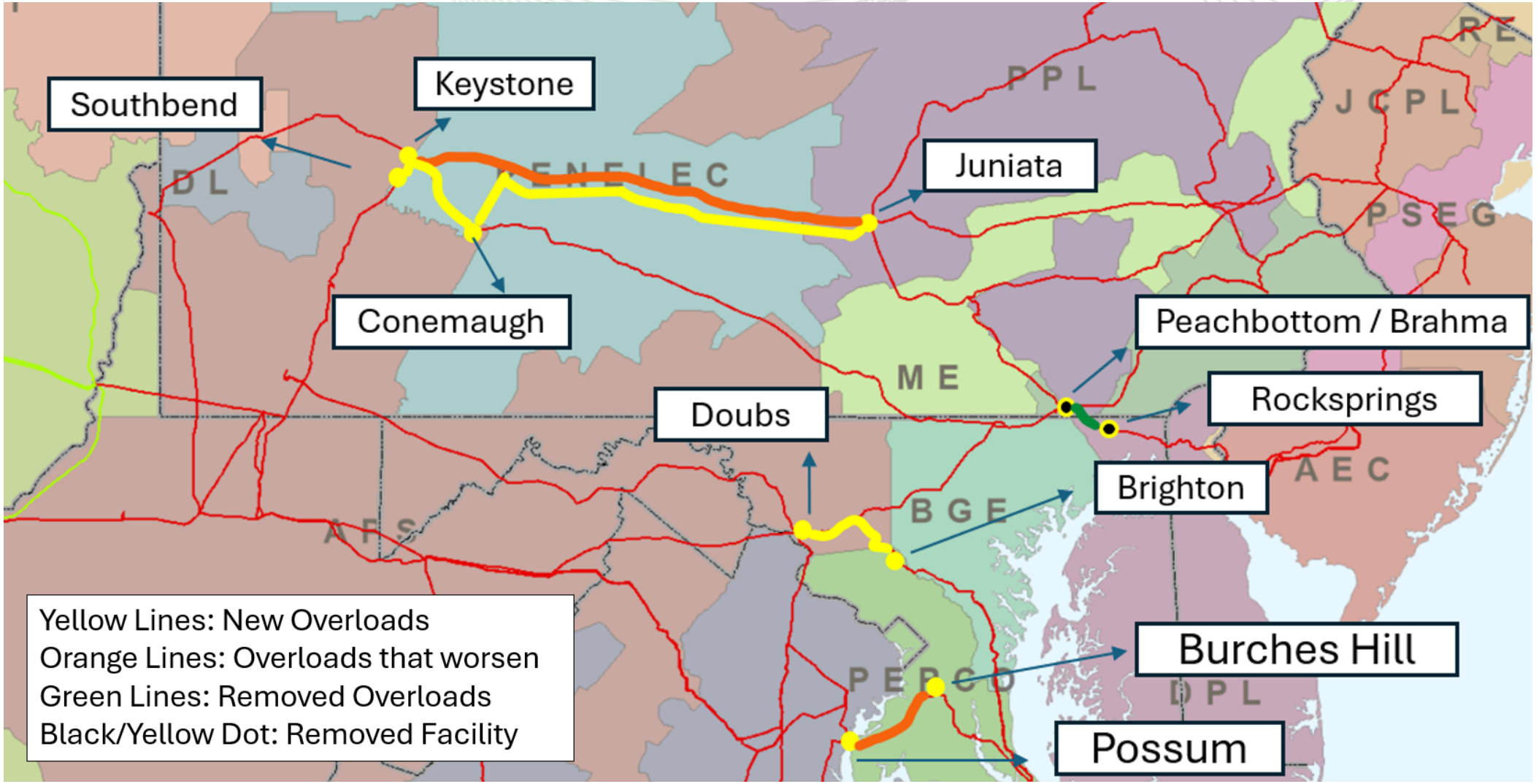
- Dominion / PJM South:
  - PJM will be addressing the 2032 needs to reinforce the southern 500 kV backbone. This 500kV corridor includes multiple North-South 500kV elements.
  - Violations associated with and/or impacted by CVOW (Coastal Virginia Offshore Wind) will be deferred until the network upgrades associated with the project are finalized.
  - 230kV Lines Chesterfield – Basin & Chesterfield – Hopewell will be addressed as part of the 2030 set of violations.

- PPL Zone:
  - Several 230kV facilities overloaded in PPL zone in 2030, and these issues worsened in the 2032 analysis.
  - Additional overloads are identified in 2032 as the load continue to grow.
  - PJM expects that solutions proposed for the PPL area will address both the 2032 violations and account for potential future load growth (and resource mix evolution) in the region.

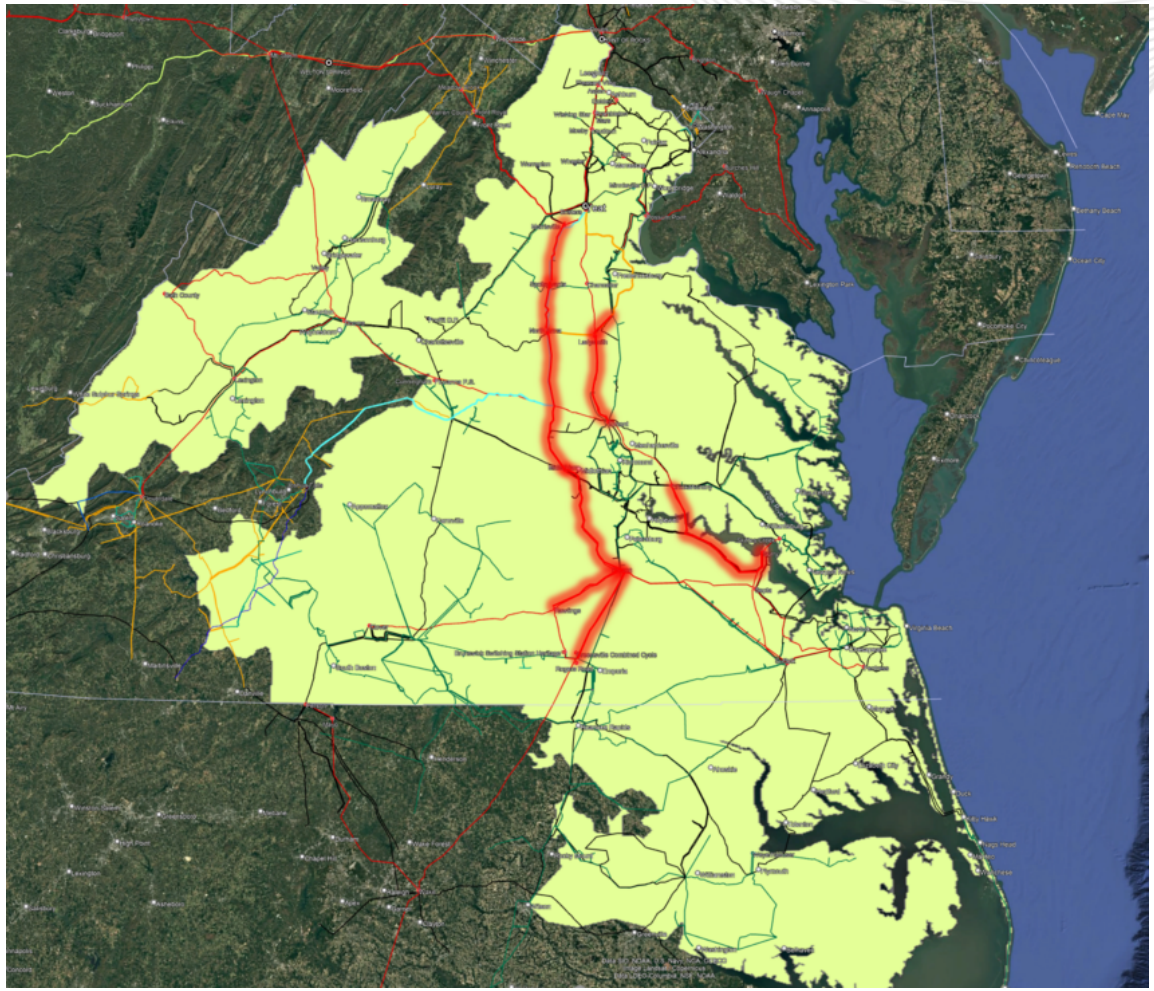
- With the NJ/DE OSW, the flow is from East to West resulting in overloads on the 500 kV circuits in Peach Bottom area
  - Rock Springs – Bramah 500 kV – no longer overloaded with S4 scenario
  - Peach Bottom 500 kV bus – no longer overloaded with S4 scenario
- Removing the NJ/DE OSW results in MAAC requiring additional source from west and south. This results in additional overloads on the West to East and South to North 500 kV lines, see below.
  - South Bend – Keystone 500 kV – new overload, terminal limit
  - Keystone – Conemaugh 500 kV – new overload, terminal limit
  - Conemaugh – Juniata 500 kV – new overload, terminal limit
  - Brighton – Doubs 500 kV - new overload, terminal limit
  - Keystone – Juniata 500 kV overload increased, terminal limit
  - Burches Hill – Possum Point 500 kV overload increased above the conductor rating

Scenario 4: 2032 Base case + Removing NJ/DE OSW

MAAC Region



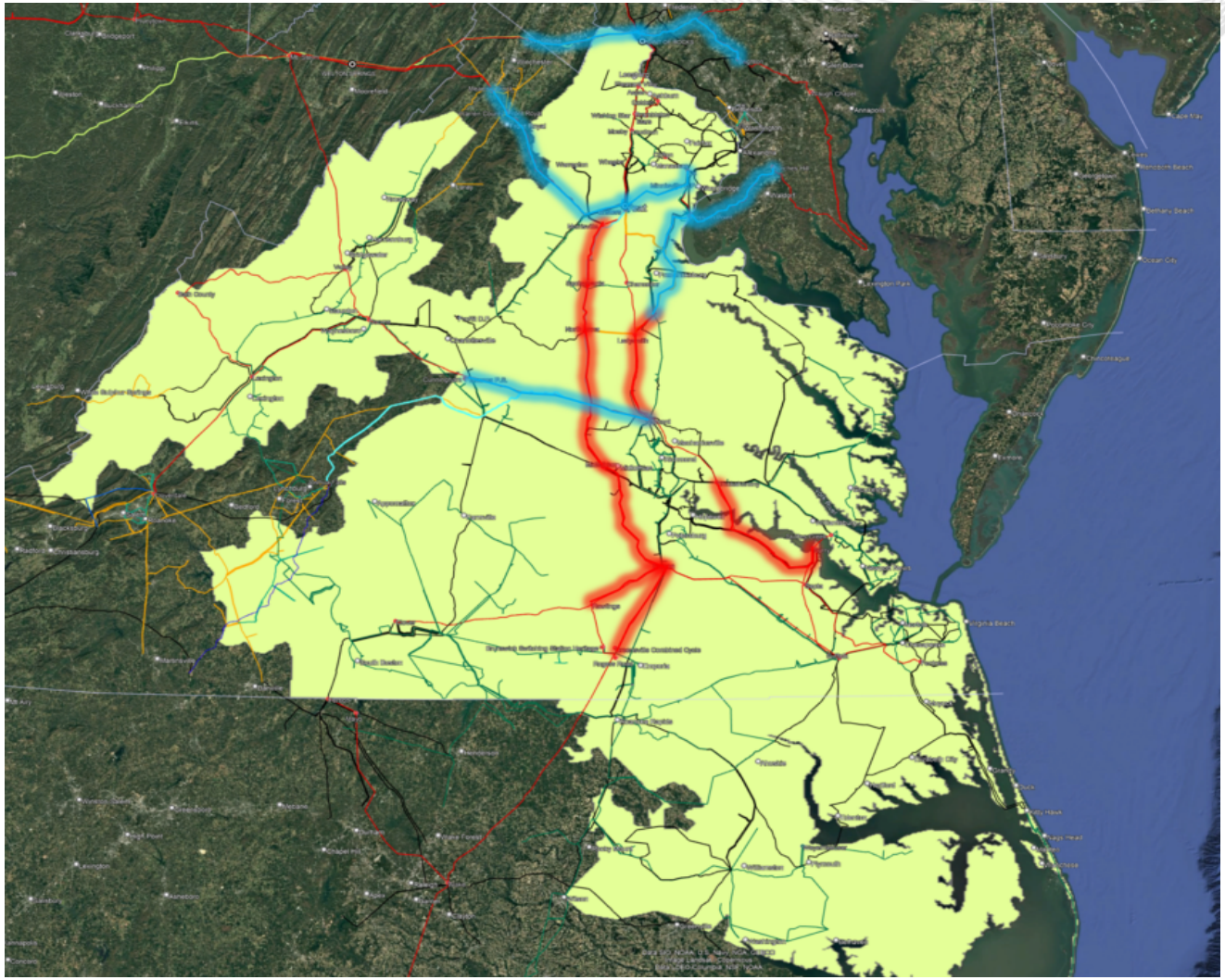
Scenario 4: 2032 Base case + Removing NJ/DE OSW West and South



2032 Base Case Dominion 500kV Overloads

Monitored Facility					
314908 8ELMONT	500	314911 8LADYSMITH	500	1
314914 8MDLTHAN	500	314918 8NO ANNA	500	1
314902 8CARSON	500	314914 8MDLTHAN	500	1
314924 8SURRY	500	314903 8CHCKAHM	500	1
314911 8LADYSMITH	500	313483 8KRAKEN	500	1
314934 8SPOTSYL	500	314916 8MORRSVL	500	1
314918 8NO ANNA	500	314934 8SPOTSYL	500	1
314936 8RAWLINGS	500	314902 8CARSON	500	1
970672 AG2-436 TP	500	941030 AE2-094 TAP	500	1
314940 8ROGERS RD	500	970672 AG2-436 TP	500	1

Scenario 4: 2032 Base case + Removing NJ/DE OSW West and South



2032 Scenario 4 Dominion 500kV Overloads

Monitored Facility - New Overloads Under Scenario 4						
314929	8FRONT ROYAL	500	314916	8MORRSVL	500	1
235110	01MDWBRK	500	289543	05YEAT	500	1
314910	8CUNINGHAM	500	314908	8ELMONT	500	1
313483	8KRAKEN	500	314922	8POSSUM	500	1
289543	05YEAT	500	314919	8OX	500	1
314922	8POSSUM	500	200019	BURCHES	500	1
235098	WOODSIDE	500	235105	01DOUBS	500	1
235105	01DOUBS	500	200003	BRIGHTON	500	1

Scenario 4:Scenario 4: 2032 Base case + Removing NJ/DE OSW

- There are loading changes (decrease/increase) compared to 2032 base case.
  - Some MAAC overloads are removed due to the removal of the NJ/DE OSW. PJM will continue to monitor the NJ/DE OSW development and make necessary adjustment to needed upgrades.
  - Some significant loading increases for some DOM/APS facilities are due to the aggravated low voltage issues. (Increased transfer to East due to NJ/DE OSW removal)
  - The increase West to East and South to North (Central/Southern Dominion) flows will need to be considered part of the robustness evaluation of the proposed 2025W1 proposals.

2025 W1 Assumptions Update: PPL Future Load Information

- In late June, PPL informed PJM that more load is anticipated to show up in PPL in 2030-2032 time frame.
- The following future loads in PPL have Signed Agreements (SA). These loads are NOT included in 2025 load forecast, therefore not included in 2025 RTEP W1 posted cases. PPL will incorporate these loads in the 2026 load forecast.
- The additional loads are expected to have a material impact on 2025 W1 posted violations/solutions. PJM would encourage proposing entities to consider these additional loads part of their robustness test while developing their solutions.
- For the transparency purpose, the idvs to model these loads are included in the 7/2 window addendum

Need #	Solution Date	2032 Load Capacity (MW)	2032 Load Demand (MW)
PPL-2025-0003	May TEAC	1440	1008
PPL-2025-0005	June TEAC	500	350
PPL-2025-0006	June TEAC	1000	700
PPL-2025-0007	June TEAC	450	315
PPL-2025-0008	TBD	600	420
PPL-2025-0009	June TEAC	500	350
PPL-2025-0010	TBD	1000	700

Baseline Reliability Projects Cancellations

PSEG Transmission Zone: Baseline Farragut – Hudson Area

Cancellation of b2436.90

Previously Presented: 12/15/2016

Original Proposed Scope:

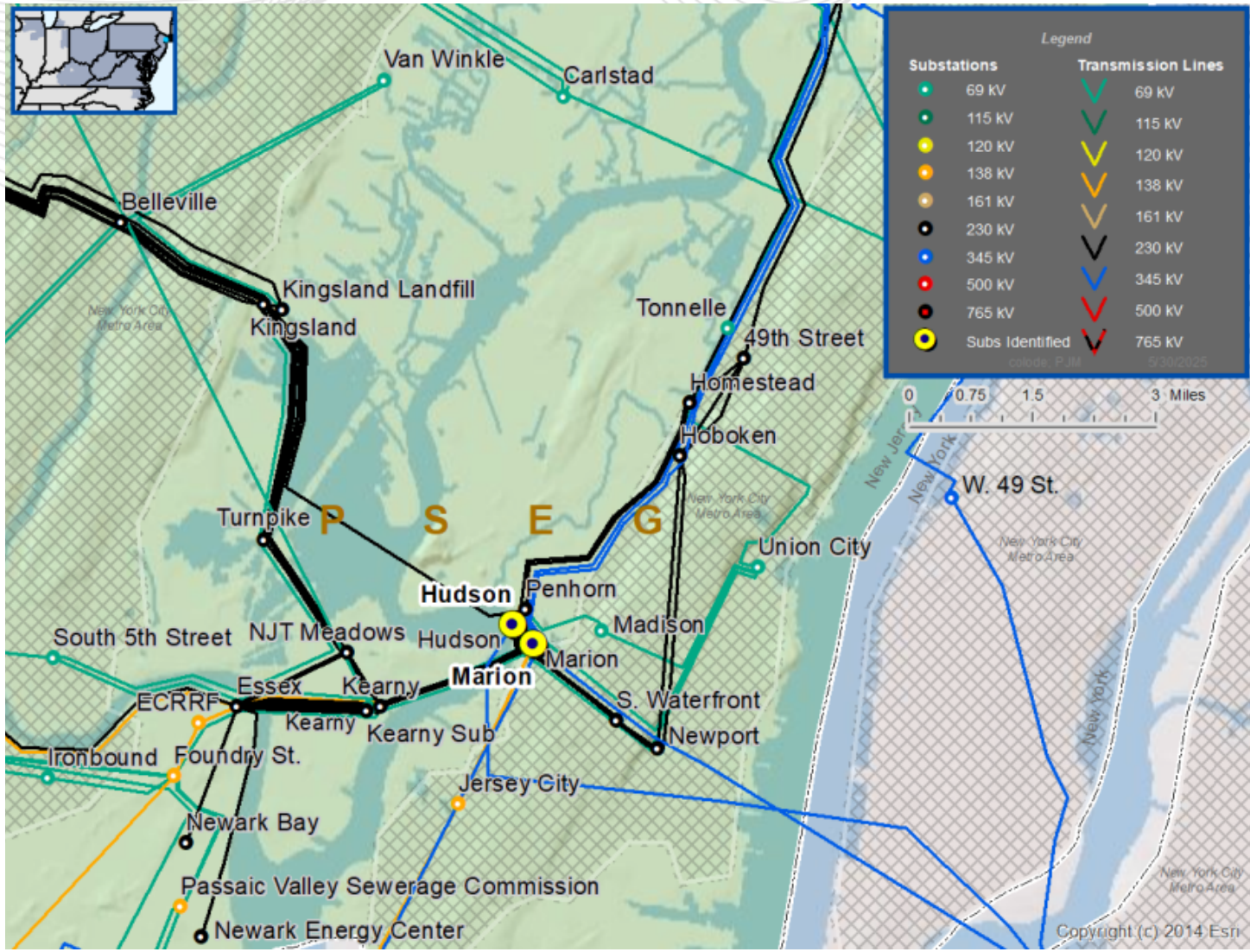
Relocate Farragut - Hudson "B" and "C" 345 kV circuits to Marion 345 kV and any associated substation upgrades (b2436.90)

Reason for Cancellation:

The "B" and "C" lines have been out of service since 2018.

These circuits served as part of a firm transmission service agreement which is no longer in effect. This project is no longer necessary.

Cost Estimate: $38.25M



BGE Transmission Zone: Baseline Conastone Breaker

Cancellation of b3737.52

Previously Presented: 11/04/2022

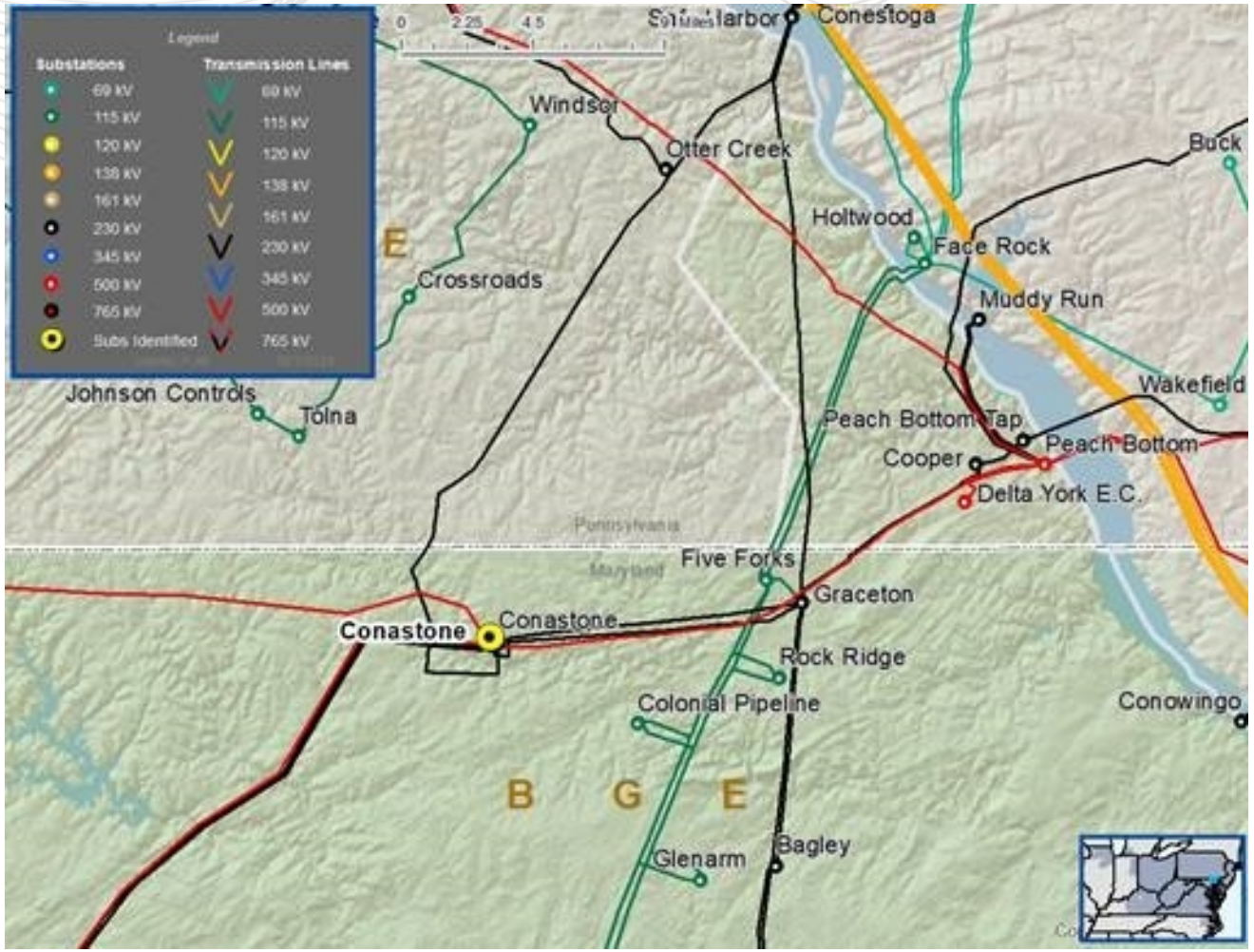
Original Proposed Scope:

Replace one 63 kA circuit breaker "B4" at Conastone 230 kV with 80 kA. (b3737.52)

Reason for Cancellation:

As of the 2030 RTEP, fault duties no longer exceed the breaker capabilities. This is due to modifications to the NJ SAA project and the removal of 9A from the PJM cases.

Cost Estimate: $1.3M



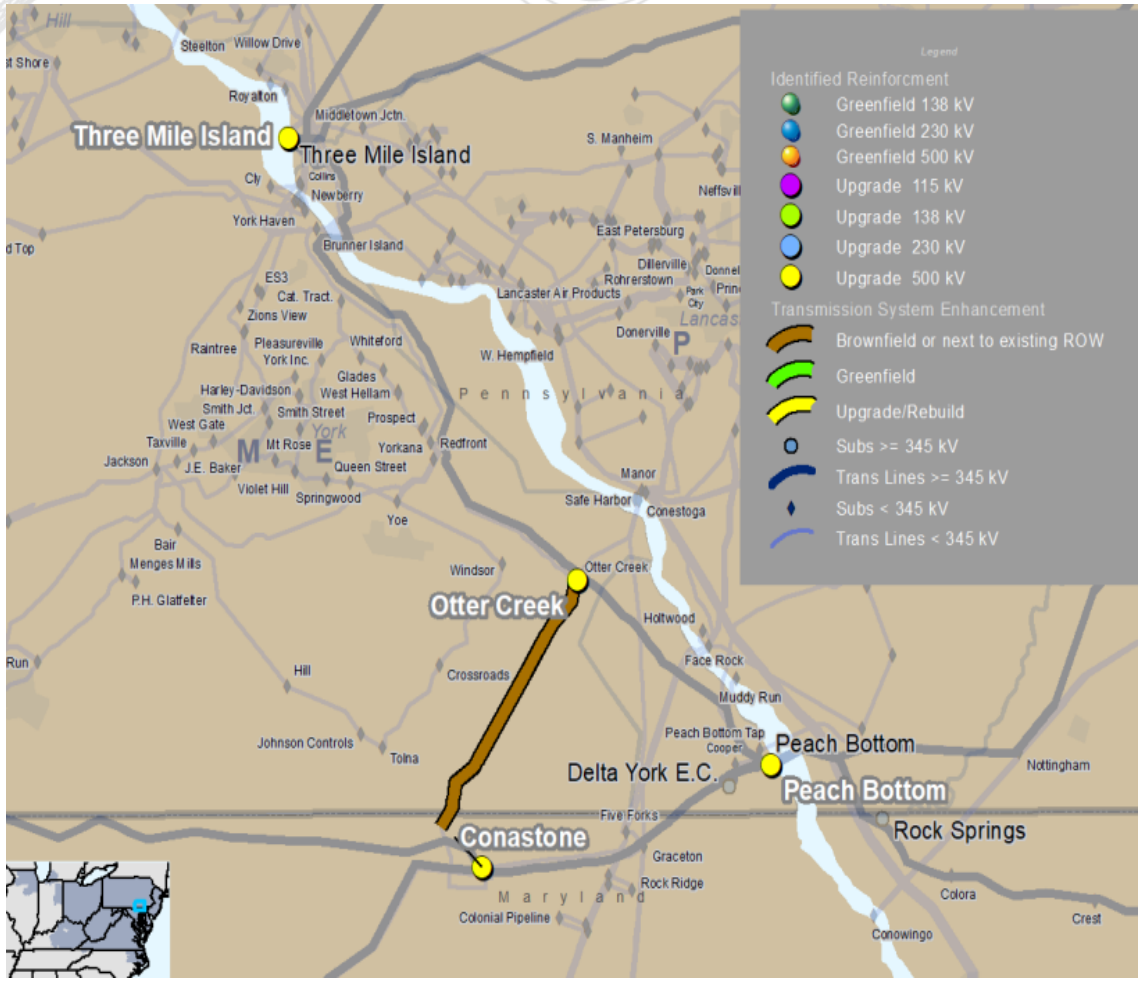
Baseline Reliability Projects
Changes to Previously Approved Projects

2022 W3 Chanceford-Doubs Project Update
PPL Baseline Projects b3800.1, b3800.3, b3800.53

Current Project Description – 2022 Window 3 Approved Projects (PPL)

- Build new Otter Creek 500 kV (Chanceford) Switching Station -Two bay three breaker configuration. **$32.76M (b3800.1)**
- Build New 500kV AC line from the new Chanceford (near Otter Creek) 500 kV switchyard – towards PA/MD border ~12.5 miles. Rebuild the existing Otter Creek - Conastone 230 kV line to become a double-circuit 500 kV line, operate Conastone circuit at 230 kV initially. **$102.8M (b3800.3)**
- Construct a double-circuit 500 kV line from the existing TMI-Peach Bottom 500 kV right-of-way to the proposed Chanceford Switchyard approximately 1.0 miles in length. **$12.59M (b3800.53)**

Required IS Date : 6/1/2027
Total Estimated Cost : $148.15M



2022 W3 Chanceford-Doubs Project Update
PPL Baseline Projects b3800.1, b3800.3, b3800.53

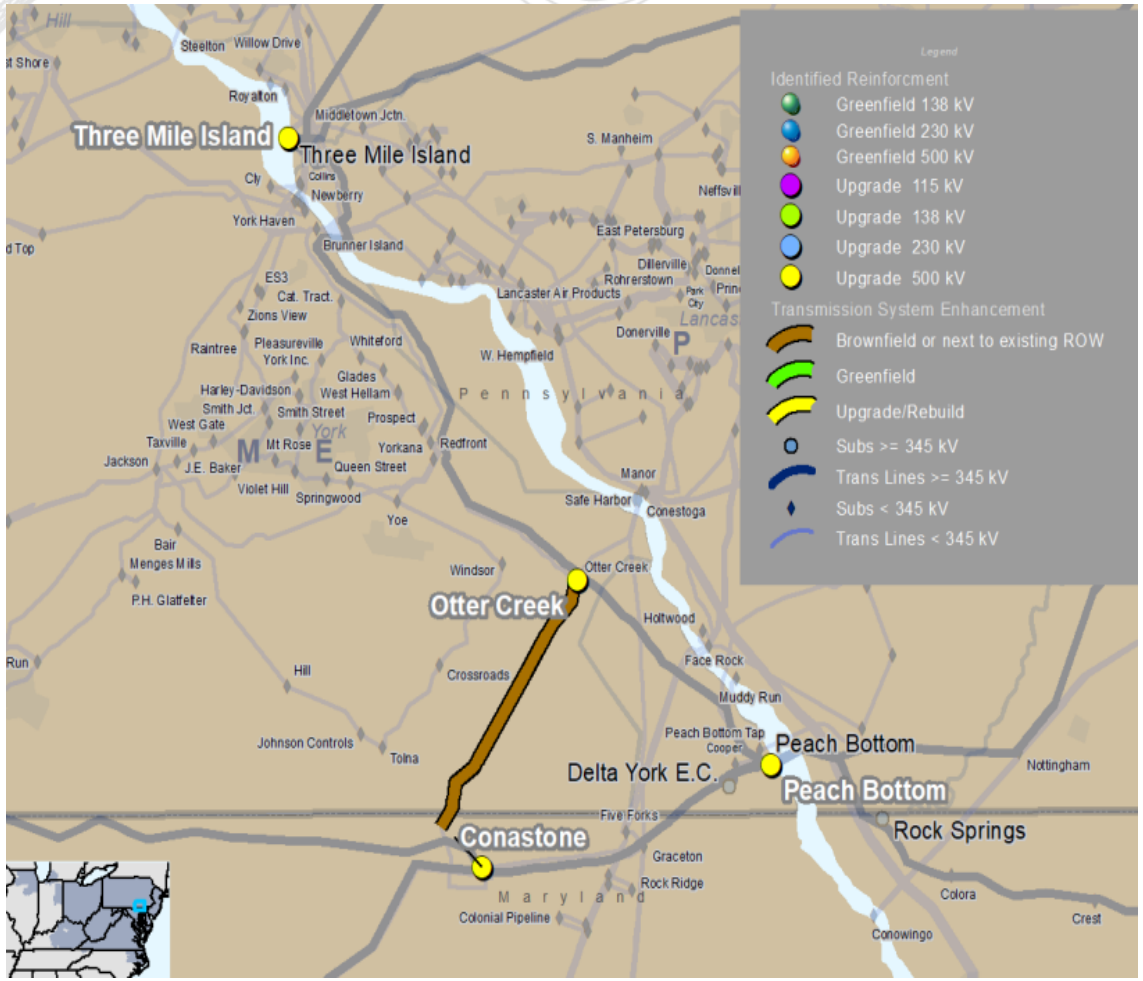
Updated Project Description

- Build new Otter Creek 500 kV (Chanceford) Switching Station -Two bay three breaker configuration. **$32.76M (b3800.1)**
- Build New 500kV AC line from the new Chanceford (near Otter Creek) 500 kV switchyard – towards PA/MD border ~12.5 miles. Rebuild the existing Otter Creek - Conastone 230 kV line to become a double-circuit 500 kV line, operate Conastone circuit at 230 kV initially. ~~**$102.8M**~~ **$102.6M (b3800.3)**
- Construct a double-circuit 500 kV line from the existing TMI-Peach Bottom 500 kV right-of-way to the proposed Chanceford Switchyard approximately 1.0 miles in length. **$12.59M (b3800.53)**
- **(New)** Perform final tie-ins and commissioning for Chanceford-Doubs 500kV line energization, upon completion of all transmission owner segments within PA & MD **$0.2M (b3800.54)**

Required IS Date : 6/1/2027 (Unchanged)
Total Estimated Cost : $148.15 M (Unchanged)

Reason for Project Update:

PPL's baseline projects b3800.1, b3800.3 and b3800.3 are components of the 2022W3 Solution, to build the new Chanceford switchyard, and the segment of the new Chanceford – Doubs 500 kV line in PA. A new sub-project b3800.54 is being split out of PPL's existing project representing their scope to tie-in and commission the Chanceford – Doubs 500 kV line upon completion of the overall project. This change is intended to improve project-on-project coordination, and accommodate a potentially earlier completion of PPL's line segment, in advance of other segments of the Chanceford – Doubs line.

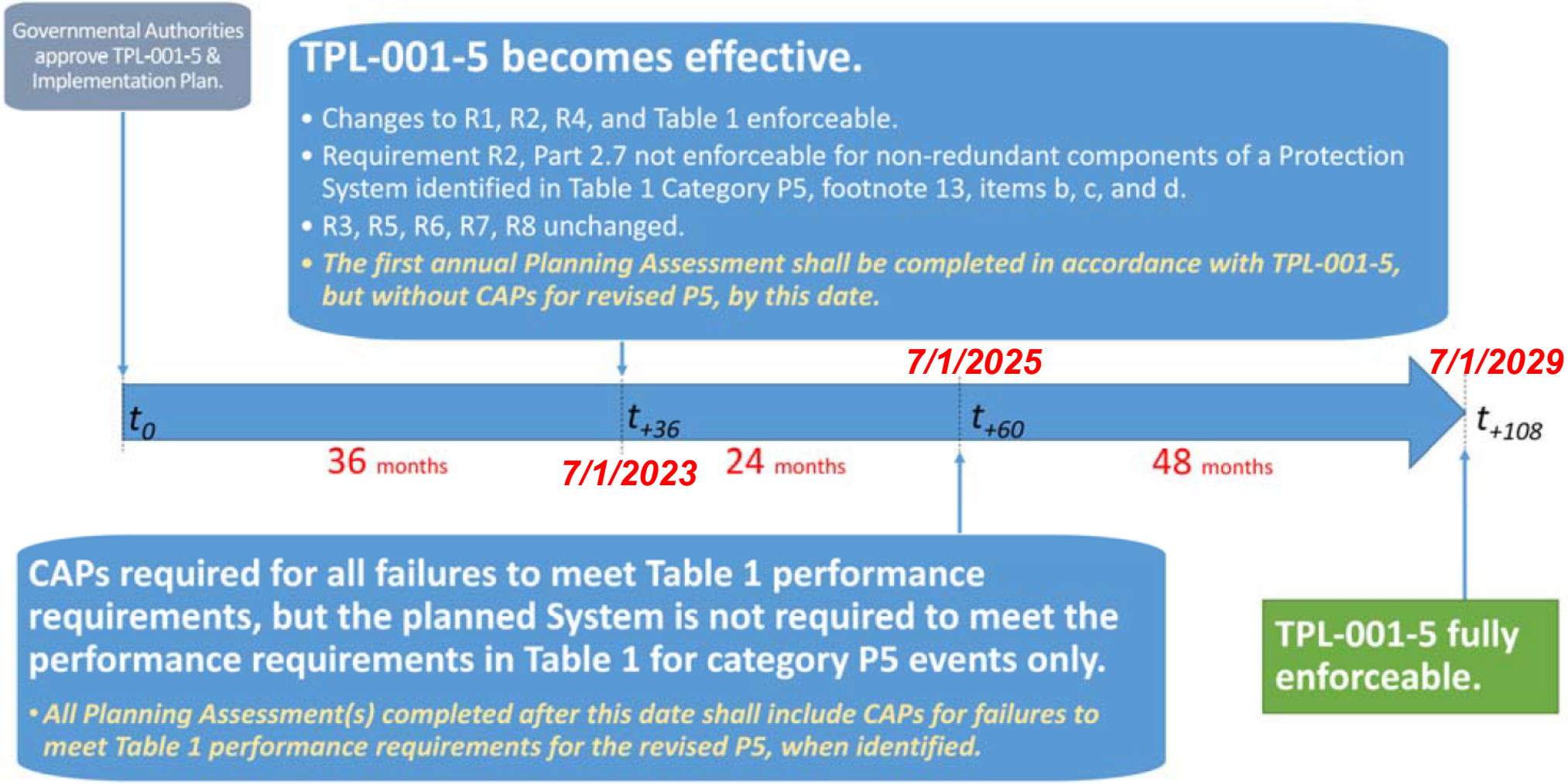


TPL-001.5 P5: Submitted CAPs Second Read

TPL-001-5.1 P5 Contingencies

- As previously presented during the August 2024 TEAC, PJM has determined that the P5 CAPs will be exempted as reliability violations on transmission substation equipment (OA, Schedule 6, section 1.5.8(p)). The construction responsibility for and ownership of each project shall be designated to the respective incumbent Transmission Owner.
- The solution to the violations resulting from lack of redundancy, lack of alarming, or DC supply issues including monitoring and alarming, is to incorporate local redundancy or implement needed alarms/protection/DC supply enhancements within existing substation equipment.
- PJM is presenting here a summary of P5 CAPs which were identified by TOs to mitigate violations from the 2024 Series RTEP (2029 SUM/WIN/LL cases).
    - PJM does not intend to post detailed contingency regarding the violations and CAPs due to CEII/CIP-014 considerations.
- All expected P5 CAPs have been submitted by PJM Transmission Owners by the July 1st deadline. PJM is currently working with the second batch of Transmission Owners to present the CAPs by the fall of 2025.
    - The NERC Implementation Plan involving the development of CAPs for Category P5 planning events is provided on the following slide.

TPL-001-5.1 Implementation Plan Timeline



DVP/AEP/PSEG
Transmission Zone: Baseline

Process Stage: First Review Solution

Criteria: Baseline Analysis

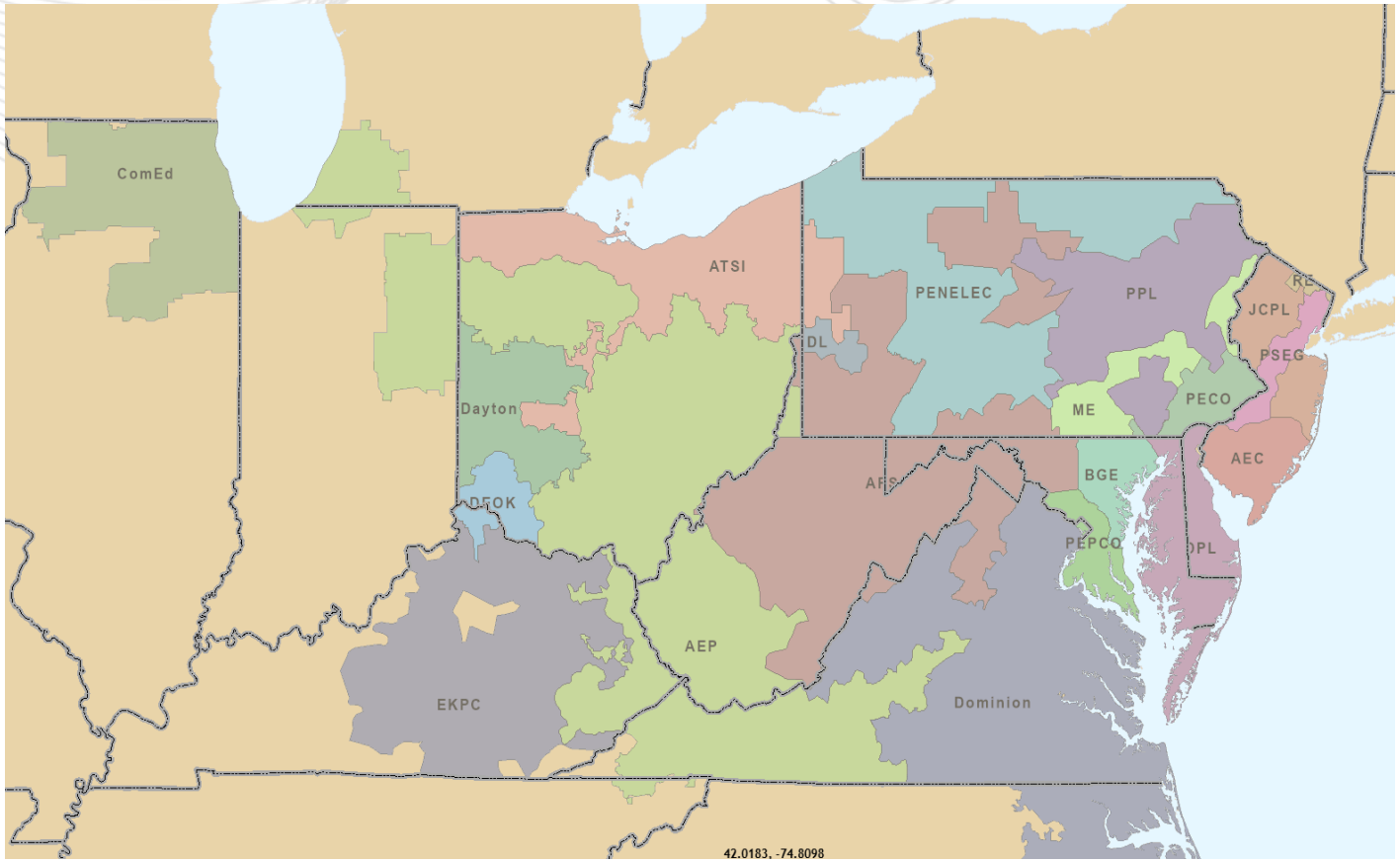
Assumption Reference: 2029 RTEP assumption

Model Used for Analysis: 2029 Summer, Winter & LL RTEP case

Proposal Window Exclusion: Substation Exclusion

Problem Statement:

In 2029 RTEP Summer, Winter & LL cases, multiple thermal and voltage violations are observed due to multiple P5 contingencies.



DVP/AEP/PSEG
Transmission Zone: Baseline

Proposed Solution:

- TOs have submitted P5 mitigation projects that include upgrades listed below designed to eliminate the P5 contingency:
    - Battery Monitoring
    - Relay Upgrades

Transmission Estimated Cost: $3.35M

Ancillary Benefits: Installation of redundant equipment will prevent outage scenarios and improve reliability of the transmission system.

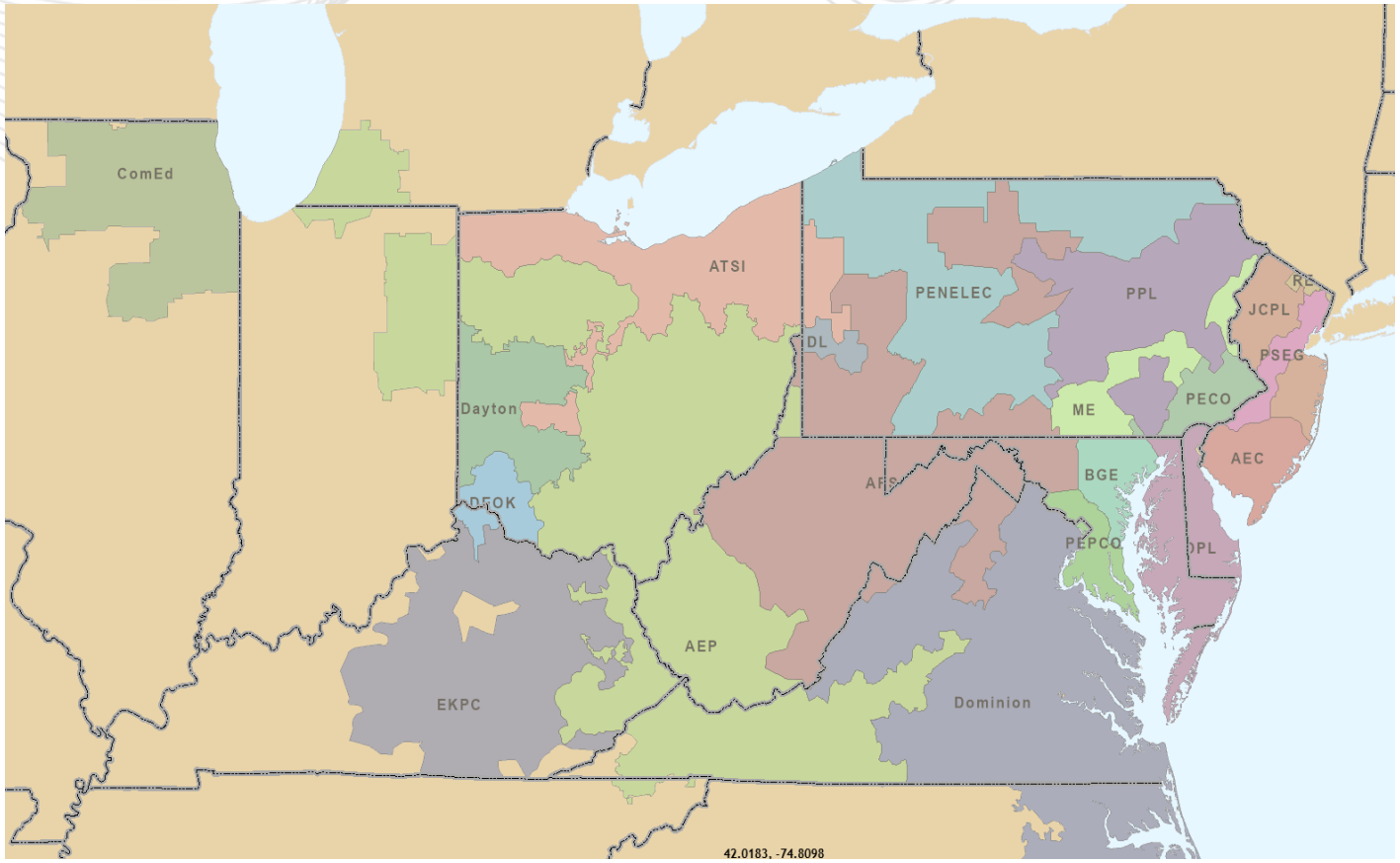
Alternatives: None

Preliminary Facility Rating: N/A

Required in-service date: 6/1/2029

Projected in-service date: 6/1/2029

Upgrade ID Numbers: **b3936** (AEP/OVEC), **b3937** (DVP), **b3938** (DVP), **b3929** (PSEG)



DVP/AEP/PSEG
Transmission Zone: Baseline

Designated Entity	Total Cost ($M)	kV							Total Substations	Upgrade #
		69	**115**	**138**	**230**	**345**	**500**	**765**		
AEP	0.62			3		3			6	b3936.1-.5, .7
Dominion	1.77	1			13		25		39	b3937.1-.39, b3938.1-.8
OVEC	0.58					1			1	b3936.6
PSEG	0.38				5				5	b3939.1-.5
TOTAL	3.35	1	0	10	28	6	31	0	76	

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Revision History

Version No.	Date	Description
1	7/2/2025	• Initial slides posted