Reliability Analysis Update

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Sub Regional RTEP Committee - PJM West

November 18, 2022

Changes to Existing Projects

Baseline Reliability Projects

APS Transmission Zone: Baseline
B3710 Scope Change: AA2-161 to Yukon ckt 1 and 2 138 kV

B3710: Previously presented on 04/22/2022 SRRTEP-W

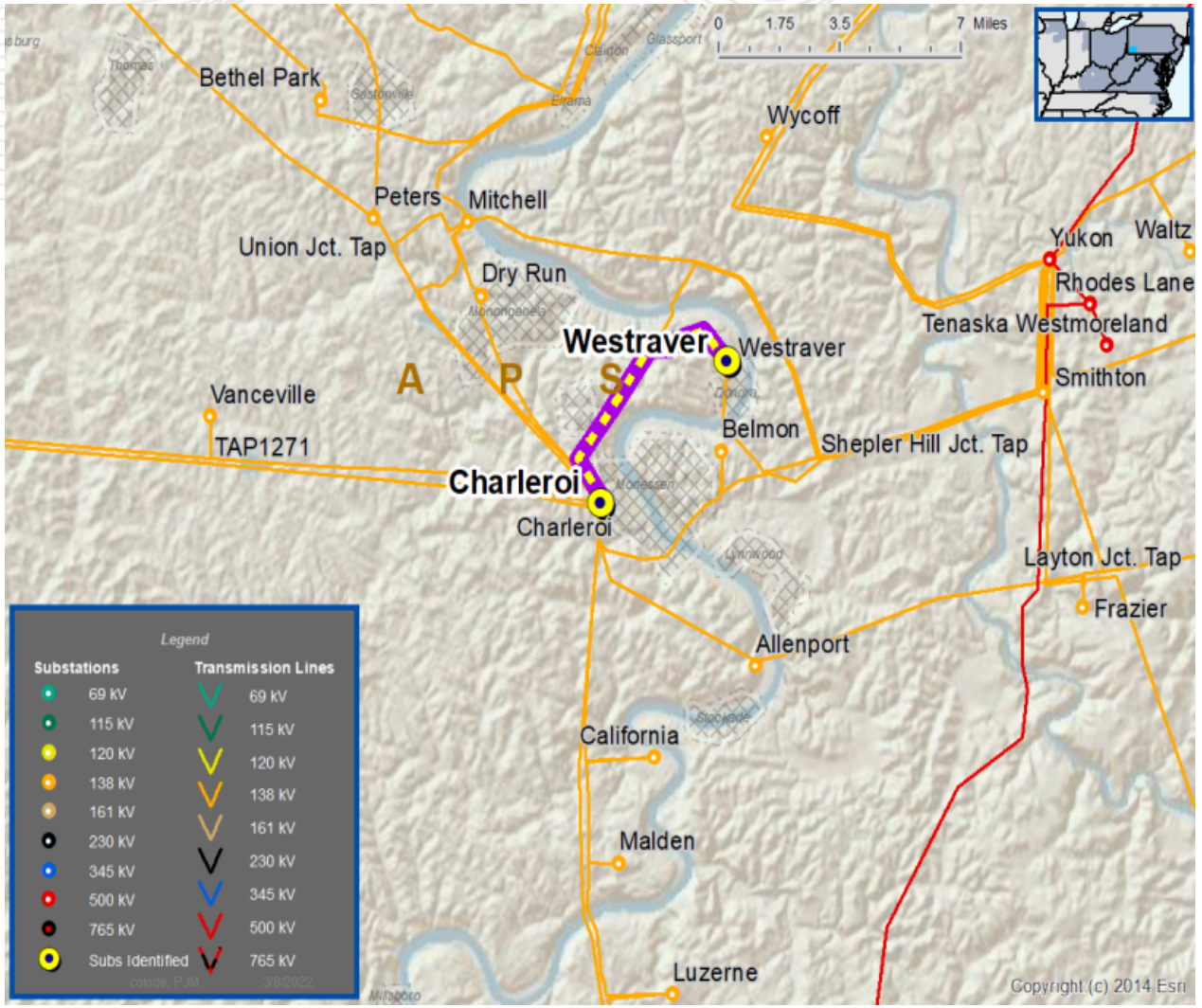
Problem Statement:

In 2026 RTEP Summer case, Yukon to AA2-161 Tap 138 kV lines are overloaded due to single contingencies.

Original Proposed Solution:

Expand the future AA2-161 138 kV six (6) breaker ring bus into an eleven (11) breaker substation with a breaker-and-a-half layout by constructing five (5) additional breakers and expanding the bus. Loop the Yukon - Charleroi #2 138 kV line into the future AA2-161 substation. Relocate terminals as necessary at AA2-161. Upgrade terminal equipment (wavetrap, substation conductor) and relays at Yukon, Huntingdon, Springdale, Charleroi, and the AA2-161 substation.

Transmission Estimated Cost: $14.37M

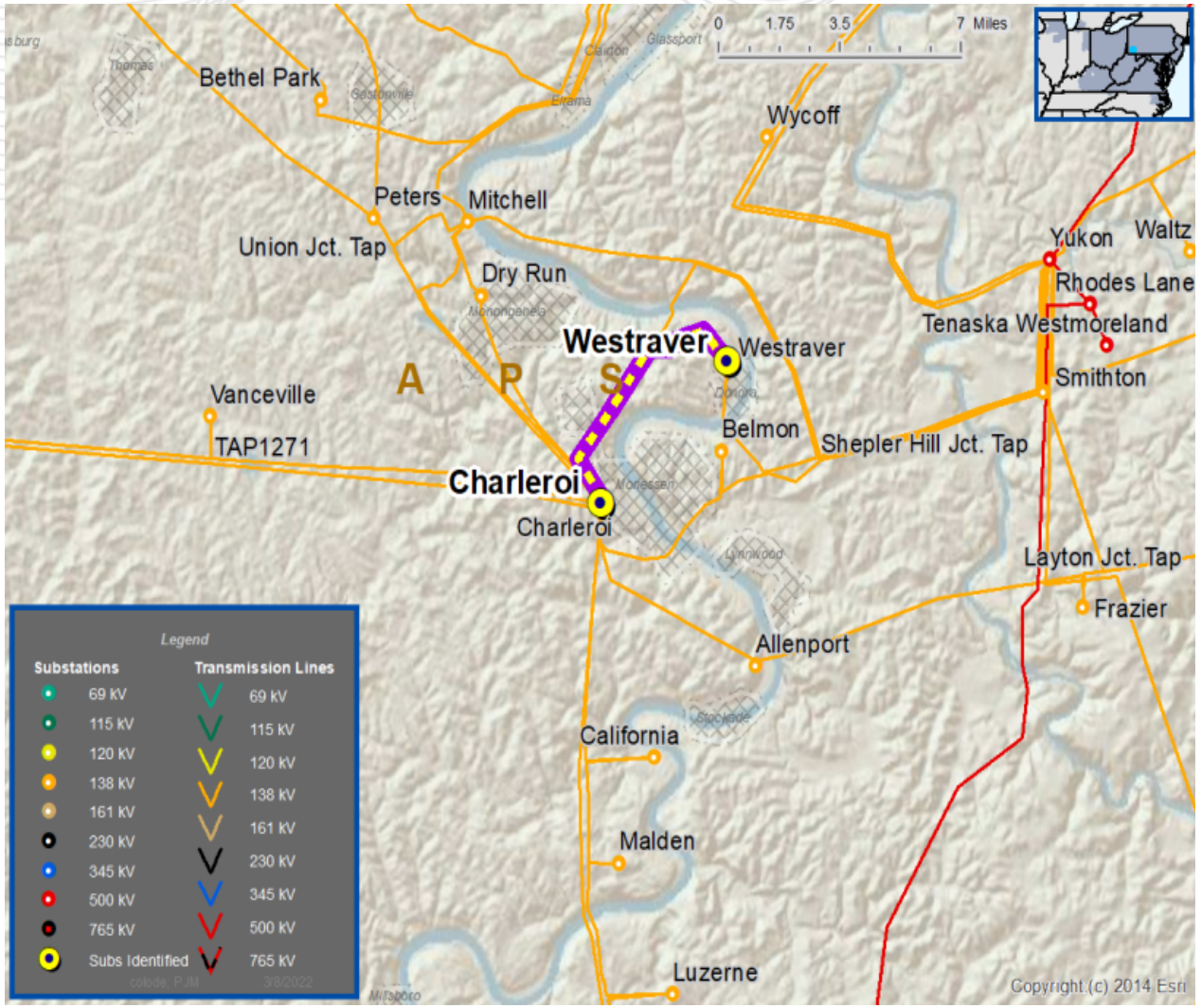


APS Transmission Zone: Baseline
B3710 Scope Change: AA2-161 to Yukon ckt 1 and 2 138 kV

During 2027 RTEP analysis, it was determined that the topology change caused the new AA2-161 to Charleroi line to be overloaded. The new overload is conductor limited and the cost to upgrade 12.8 miles is $32 M.

As a result, the cost-effective solution is to alternatively reconductor Yukon to AA2-161 ckt 1 & 2 while maintaining the existing topology. The cost to upgrade is $10.64 M.

	Scope	Cost (M)
B3710 (original)	b3710 (Expand AA2-161 & Loop Yukon – Charleroi #2 138 kV Line into Station)	$14.37
B3710 (original)	Reconductor 12.8 miles from AA2-161 to Charleroi	$32.01
B3710 (Scope change)	Reconductor both Yukon – AA2-161 138 kV Lines	$10.64



APS Transmission Zone: Baseline
B3710 Scope Change: AA2-161 to Yukon ckt 1 and 2 138 kV

Recommended Solution:

Reconductor AA2-161 to Yukon 138 kV lines ckt 1 and 2 with 954 ACSS conductor.

Total Estimated Transmission Cost: $10.64M

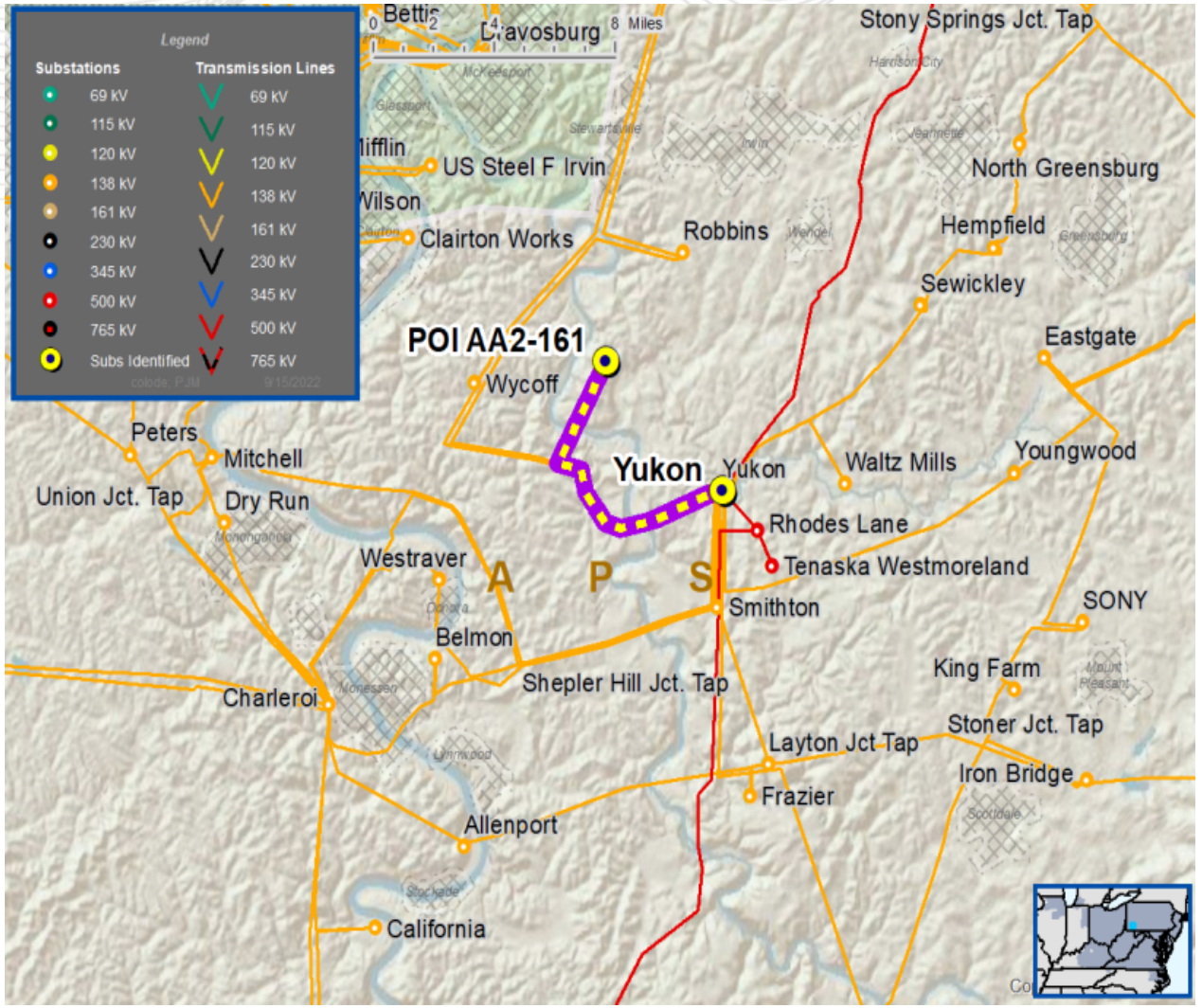
Ancillary Benefits: None

Preliminary Facility Rating:

Branch	SN/SE/WN/WE (MVA)
AA2-161 – Yukon Ckt 1 and 2	501/577/501/607

Required IS Date: 06/01/2026

Projected IS Date: 06/01/2026



ComEd Transmission Zone: Baseline
B3317 Cancellation: Waukegan 138kV Substation

B3317: Previously presented on 5/21/2021 SRRTEP-W meeting

Problem Statement:

Waukegan 138kV Substation: Mitigate existing instabilities at 138kV STA16 Waukegan for close-in three-phase faults with breaker failure. ComEd has been using out-of-step-relay as a temporary solution. A permanent solution is needed.

B3317 Scope:

Modify backup relay clearing times at the 138kV STA16 Waukegan station.

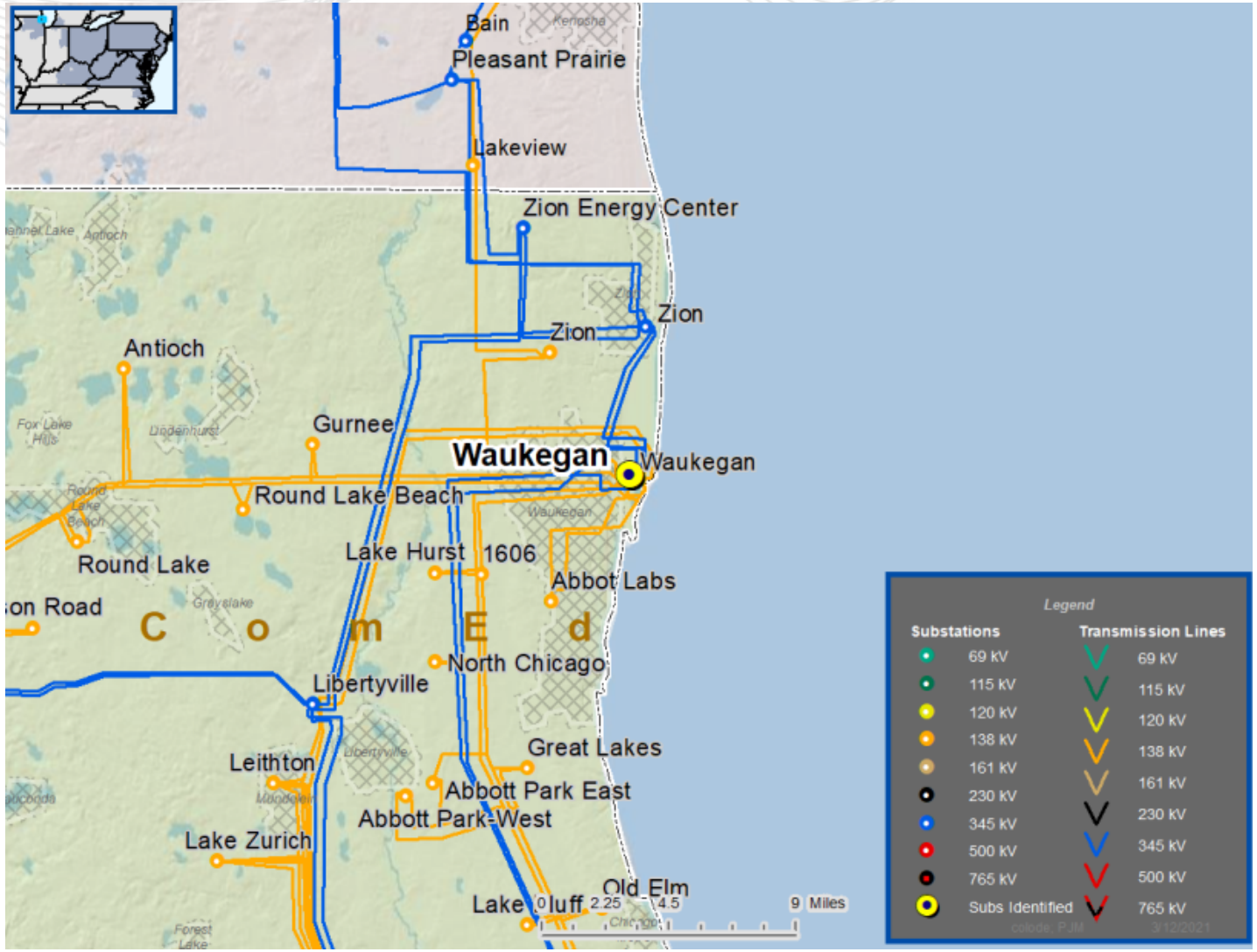
Estimated Cost: $0.255 M

Required In-Service: 6/1/2023

Projected In-Service: 6/1/2023

Reason for Cancellation:

The Waukegan generation retired on May 31, 2022, and the baseline is no longer needed as it was a stability related project for these generators.



Recommended Solution

Baseline Reliability Projects

AEP Transmission Zone: Baseline McComb 40kV Breaker J Replacement

Process Stage: Recommended Solution

Criteria: AEP 715 Criteria

Assumption Reference: 2027 RTEP assumption

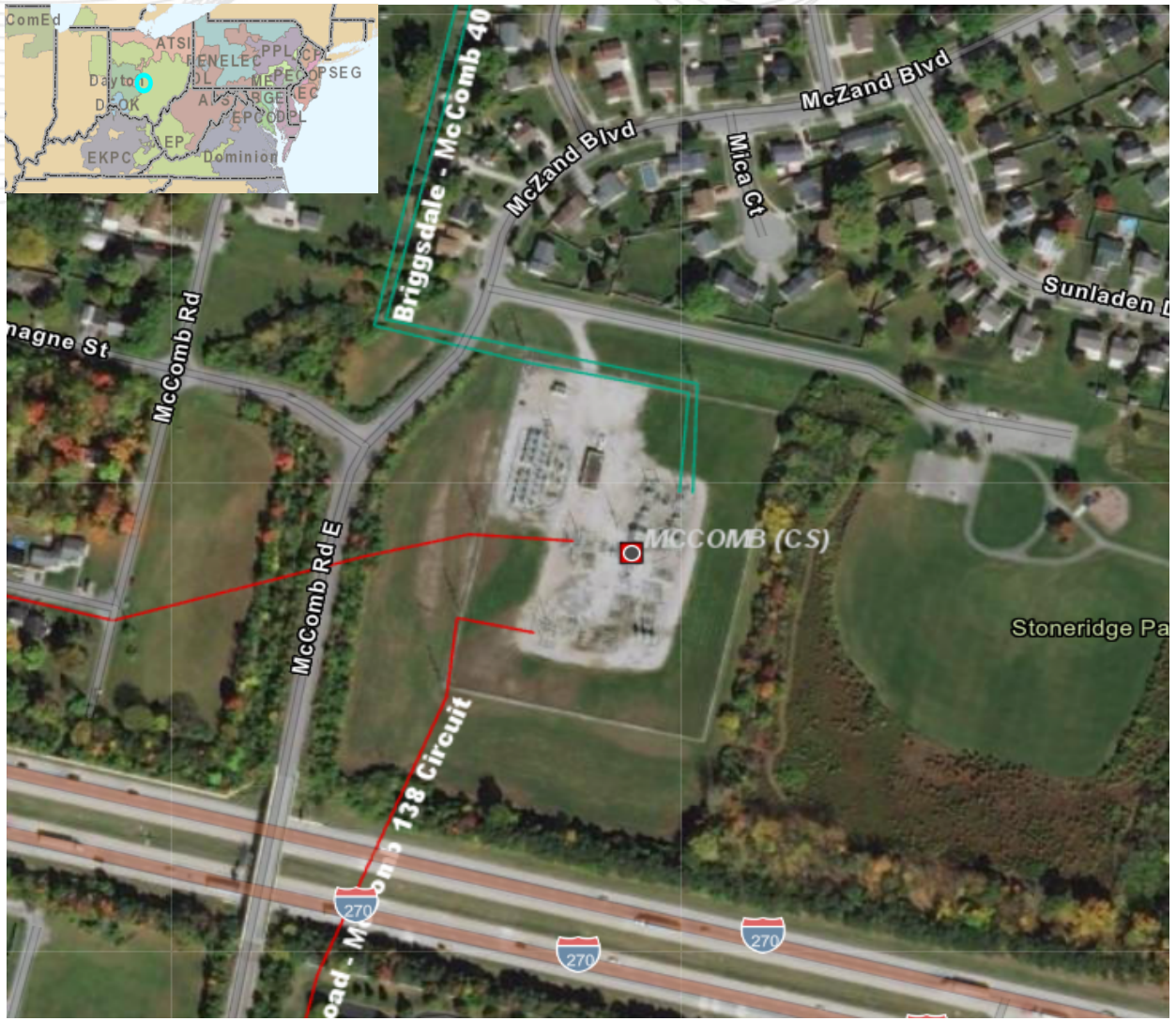
Model Used for Analysis: 2027 RTEP short circuit case

Proposal Window Exclusion: Below 200 kV Exclusion

Problem Statement: 2022W1-AEP-SC1

In 2027 RTEP short circuit case, 40 kV circuit breaker 'J' at McComb station was identified as being overdutied.

Existing Facility Rating: 18kA



AEP Transmission Zone: Baseline McComb 40kV Breaker J Replacement

Recommended Solution:

Replace 40kV breaker J at McComb station with a new 3000A 40kA breaker (**B3731**)

Transmission Estimated Cost: $0.5M

Ancillary Benefits: Breaker J was identified as part of the need under AEP-2019-OH020.

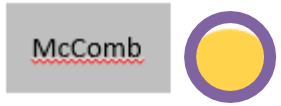
Preliminary Facility Rating: 40kA

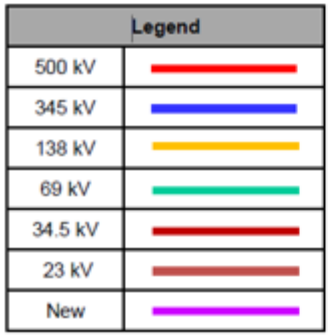
Required in-service date: 6/1/2027

Projected in-service date: 6/1/2025

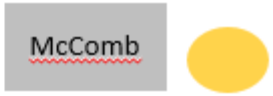
Previously Presented: 10/14/2022

Existing:





Proposed:



AEP Transmission Zone: Baseline Morgan Run 34.5kV Cap Bank

Process Stage: Recommended Solution

Criteria: AEP 715 Criteria

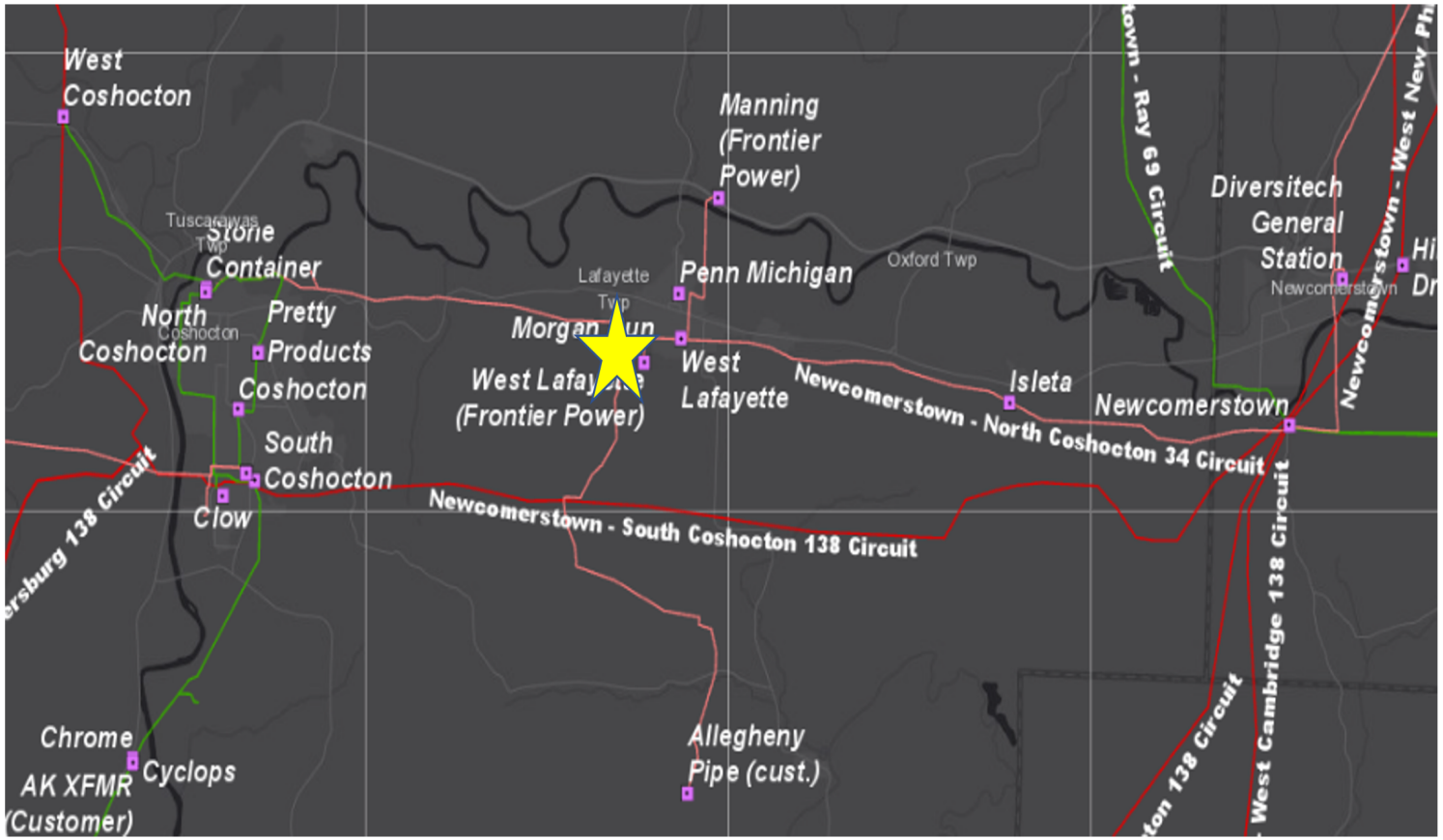
Assumption Reference: 2027 RTEP assumption

Model Used for Analysis: 2027 RTEP summer case

Proposal Window Exclusion: Below 200 kV Exclusion

Problem Statement: 2022W1-AEP-VM22 through 2022W1-AEP-VM39. 2022W1-AEP-VD25 through 2022W1-AEP-VD33; 2022W1-AEP-VD38 through 2022W1-AEP-VD47.

In 2027 RTEP summer case, low voltage and voltage-drop violations on the 34.5kV system between North Coshocton, Newcomerstown, and West New Philly stations, including Allegheny Pipe, East Coshocton, Gen Tire, Isleta, Morgan Run, North Coshocton, Newcomerstown, W Lafayette, Copper head 34.5kV buses, under multiple N-1-1 contingency scenarios.



AEP Transmission Zone: Baseline Morgan Run 34.5kV Cap Bank

Recommended Solution:

Install a 6 MVAR, 34.5kV cap bank at Morgan Run station. (**B3732**)

Transmission Estimated Cost: $0.37M

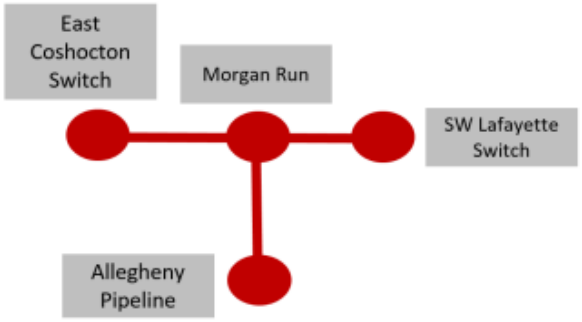
Ancillary Benefits: Improved year-round operating voltages on the 34.5kV system; increased SCADA voltage data for AEP Operations personnel, increasing the accuracy of state-estimation, etc.

Required in-service date: 6/1/2027

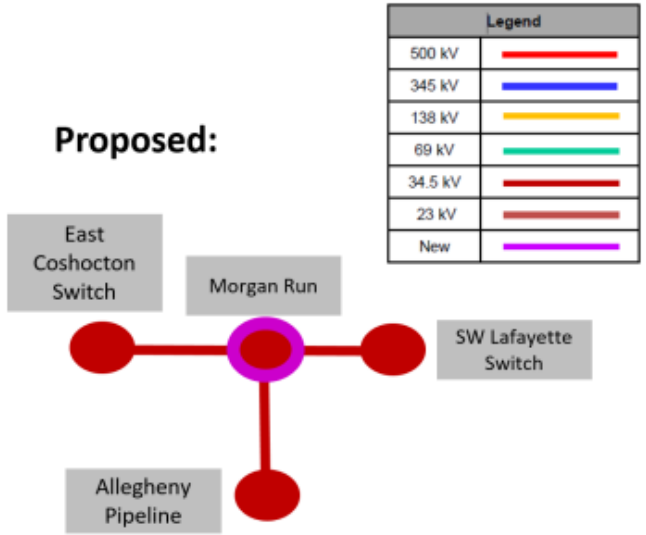
Projected in-service date: 6/1/2027

Previously Presented: 10/14/2022

Existing:



Proposed:



AEP Transmission Zone: Baseline Summerhill-Willow Grove 69kV Line Rebuild

Process Stage: Recommended Solution

Criteria: AEP 715 Criteria

Assumption Reference: 2027 RTEP assumption

Model Used for Analysis: 2027 RTEP summer case

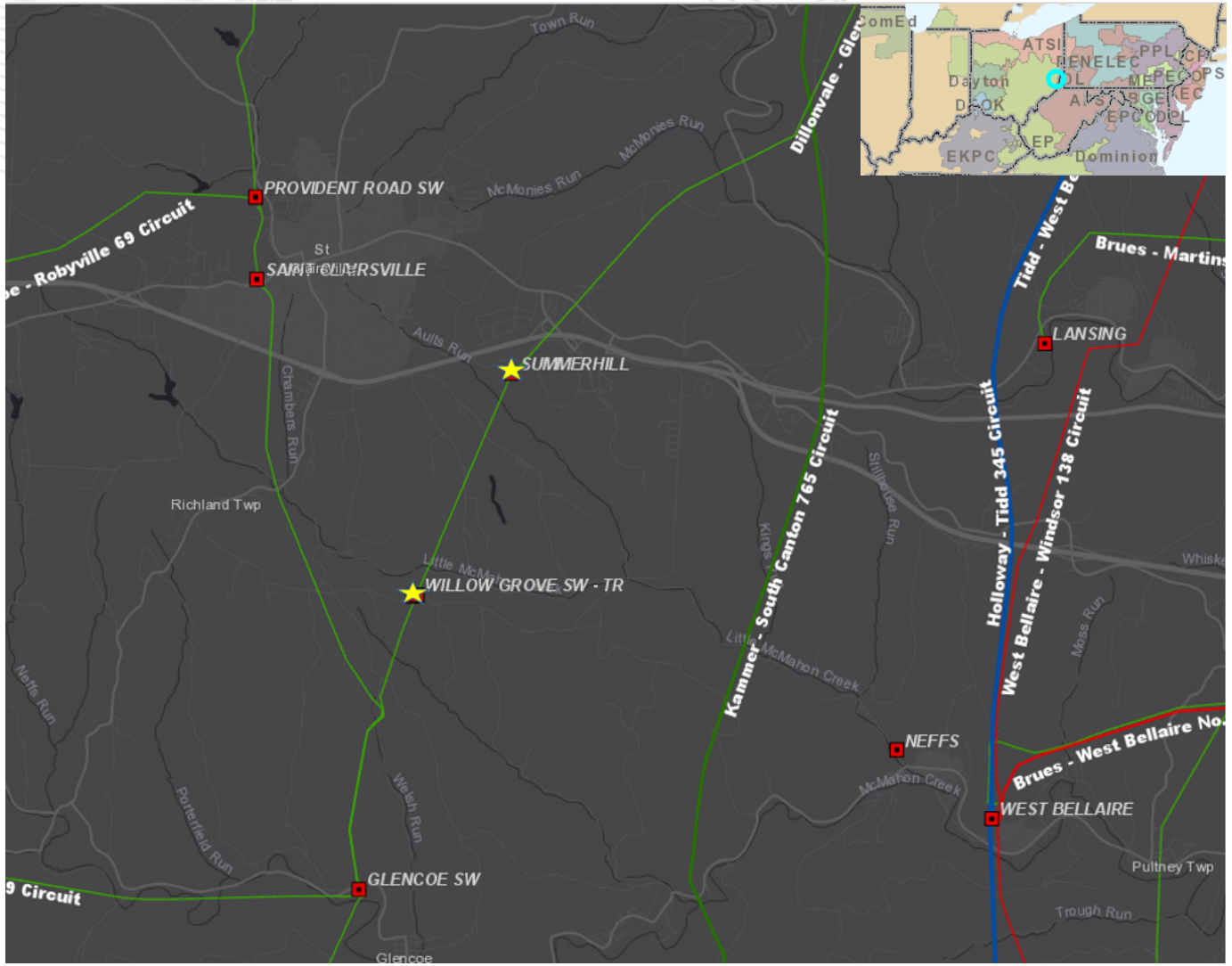
Proposal Window Exclusion: Below 200 kV Exclusion

Problem Statement: 2022W1-AEP-T10

In 2027 RTEP summer case, The Summerhill-Willow Grove Switch 69kV line segment is overloaded for an N-1-1 contingency pair.

Existing Facility Rating:

Branch	SN/SE/WN/WE (MVA)
05SUMMERHI -05WILLGRSS 69kV	50/50/63/63



AEP Transmission Zone: Baseline Summerhill-Willow Grove 69kV Line Rebuild

Recommended Solution:

Rebuild the 1.8 mile 69kV T-line between Summerhill and Willow Grove Switch. Replace 4/0 ACSR conductor with 556 ACSR. (**B3733**)

Transmission Estimated Cost: $5.1M

Preliminary Facility Rating:

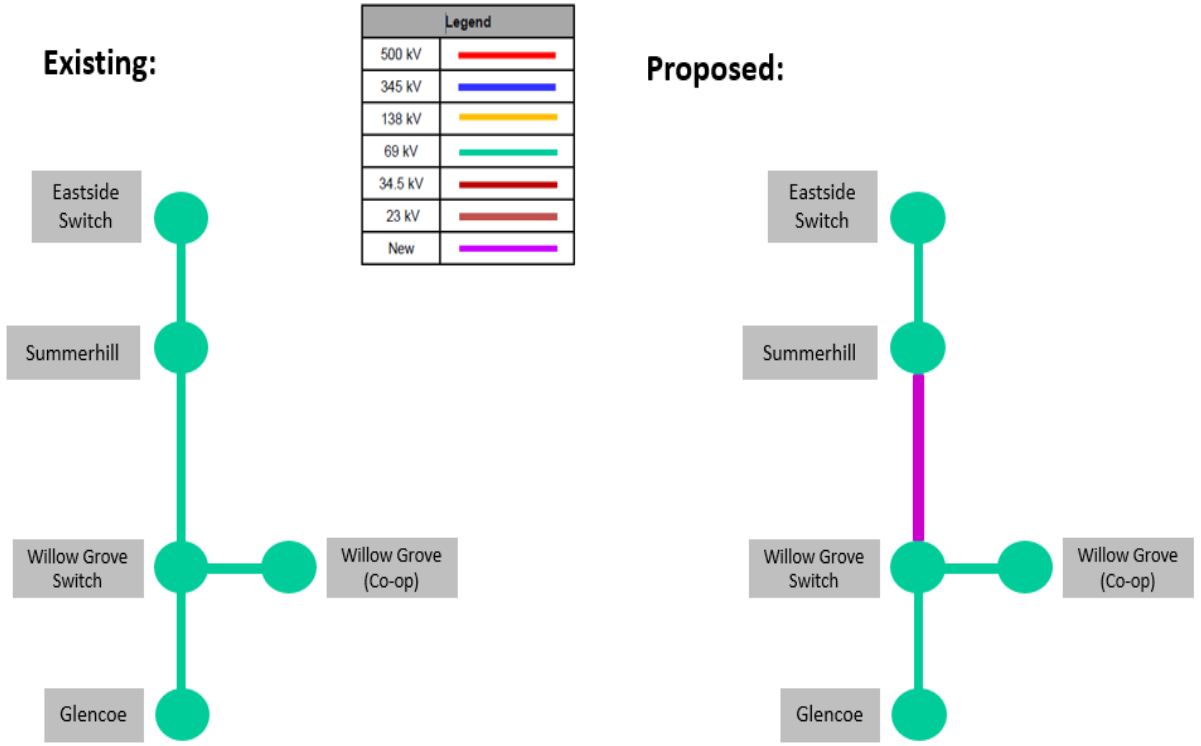
Branch	SN/SE/WN/WE (MVA)
05SUMMERHI -05WILLGRSS 69kV	82/90/107/113

Ancillary Benefits: Addresses potential M-3 facility condition needs, as documented by field personnel and AEP Asset Renewal groups. Existing structure conditions include broken down leads, broken molding, and cracked cross-bracing. This portion of line was originally constructed in 1946, primarily with wooden H-frame structures. The line has experienced over 680k CMI between 2015-2021 with 8 momentary and 2 permanent outages. There are 37 structures (46% of the line) with at least one open condition. There are 67 open conditions along the line.

Required in-service date: 6/1/2027

Projected in-service date: 6/1/2027

Previously Presented: 10/14/2022



AEP Transmission Zone: Baseline Rarden-Rosemount Cap Banks

Process Stage: Recommended Solution

Criteria: AEP 715 Criteria

Assumption Reference: 2027 RTEP assumption

Model Used for Analysis: 2027 RTEP summer case

Proposal Window Exclusion: Below 200 kV Exclusion

Problem Statement: 2022W1-AEP-VD34 through 2022W1-AEP-VD37

In 2027 RTEP summer case, voltage-drop violations at Rarden switch, Otway station, Tick Ridge station, and Rarden station 69kV buses under a N-1-1 contingency scenario.

AEP Transmission Zone: Baseline Rarden-Rosemount Cap Banks

Recommended Solution:

Install a 7.7 MVAR, 69kV cap bank at both Otway station and Rosemount station to resolve N-1-1 voltage-drop violations (**B3734)**

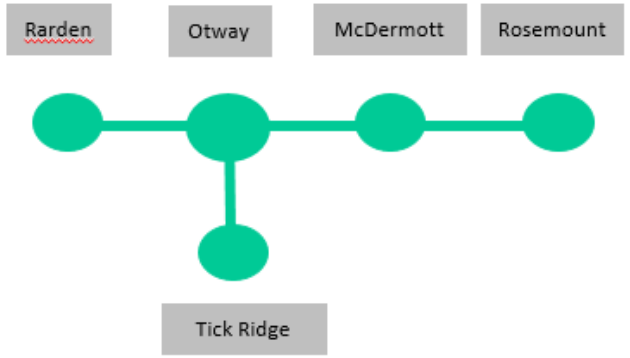
Transmission Estimated Cost: $1.73M

Required in-service date: 6/1/2027

Projected in-service date: 6/15/2026

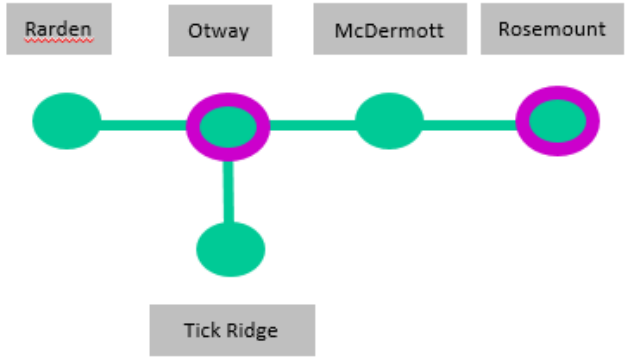
Previously Presented: 10/14/2022

Existing:



Legend	
500 kV	
345 kV	
138 kV	
69 kV	
34.5 kV	
23 kV	
New	

Proposed:



AEP Transmission Zone: Baseline Abingdon Station Upgrades

Process Stage: Recommended Solution

Criteria: AEP 715 Criteria

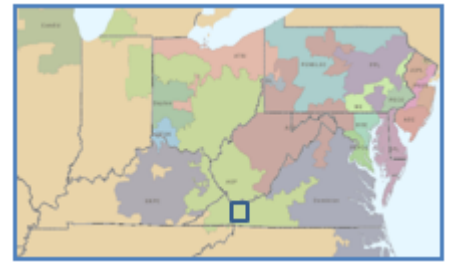
Assumption Reference: 2027 RTEP assumption

Model Used for Analysis: 2027 RTEP summer/winter cases

Proposal Window Exclusion: Below 200 kV Exclusion

Problem Statement: 2022W1-AEP-T3, 2022W1-AEP-T4, 2022W1-AEP-VM1 through 2022W1-AEP-VM3, 2022W1-AEP-VD1 through 2022W1-AEP-VD4

In 2027 RTEP summer/winter case, Thermal overload on the Arrowhead - Hillman Highway 69 kV line under multiple N-1-1 contingency pairs. In 2027 RTEP winter case, Voltage Mag. and Voltage Drop Violations at Arrowhead, Damascus, Hillman and South Abington 69kV buses under a N-1-1 contingency pair.



AEP Transmission Zone: Baseline Abingdon Station Upgrades

Recommended Solution:

- Terminate the existing Broadford – Wolf Hills #1 138 kV line into Abingdon 138 kV Station. This line currently bypasses the existing Abingdon 138 kV Station.
- Install two new 138 kV circuit breakers on each new line exit towards Broadford and towards Wolf Hills #1
- Install one new 138 kV circuit breaker on line exit towards South Abingdon for standard bus sectionalizing (**B3735**)

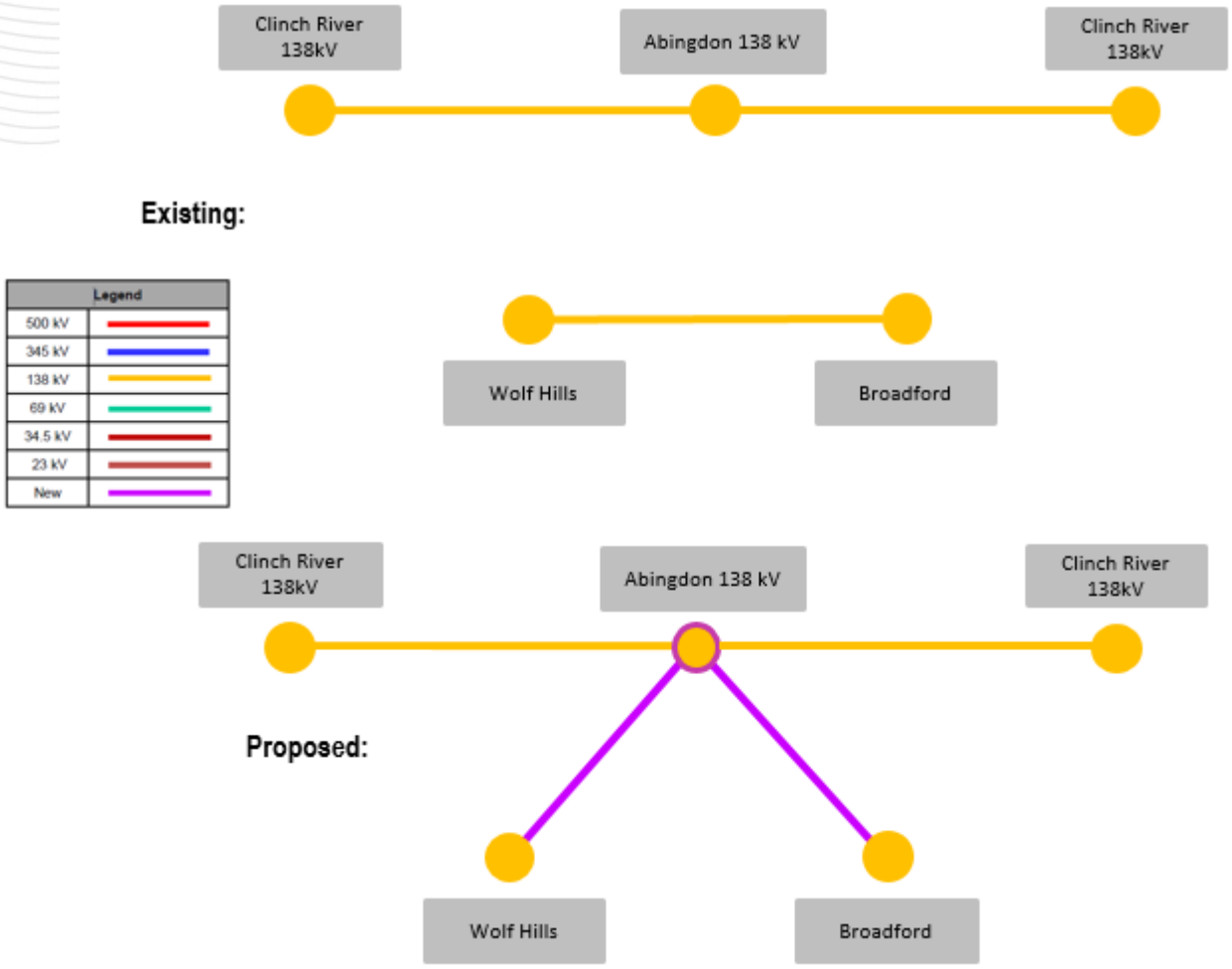
Transmission Estimated Cost: $8.48M

Ancillary Benefits: Operational flexibility is improved with the additional sources into Abingdon

Required in-service date: 6/1/2027

Projected in-service date: 6/1/2027

Previously Presented: 10/14/2022



AEP Transmission Zone: Baseline Breaks - Dorton 69kV Conversion

Process Stage: Recommended Solution

Criteria: AEP 715 Criteria

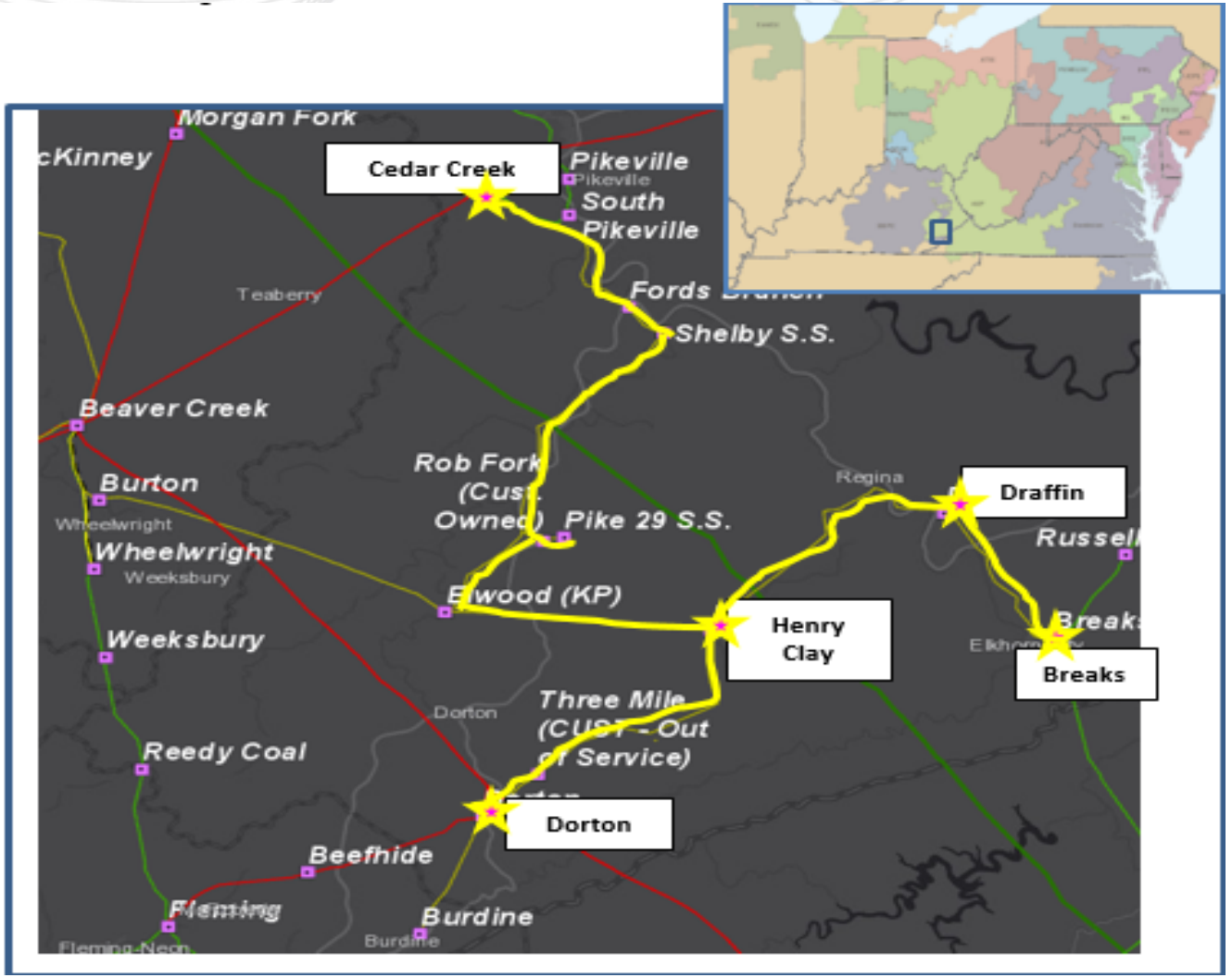
Assumption Reference: 2027 RTEP assumption

Model Used for Analysis: 2027 RTEP Winter case

Proposal Window Exclusion: Below 200 kV Exclusion

Problem Statement: 2022W1-AEP-VM4 through 2022W1-AEP-VM21, 2022W1-AEP-VD5 through 2022W1-AEP-VD24

In 2027 Winter RTEP case, Dorton, Pike 29, Rob Fork, Burdine, Henry Clay, Draffin 46KV buses (along the Cedar Creek - Elwood and Breaks - Dorton – Elwood 46KV circuits) experience voltage magnitude and drop violations under multiple N-1-1 contingency scenarios.



AEP Transmission Zone: Baseline Breaks - Dorton 69kV Conversion

Recommended Solution:

Transmission Components:

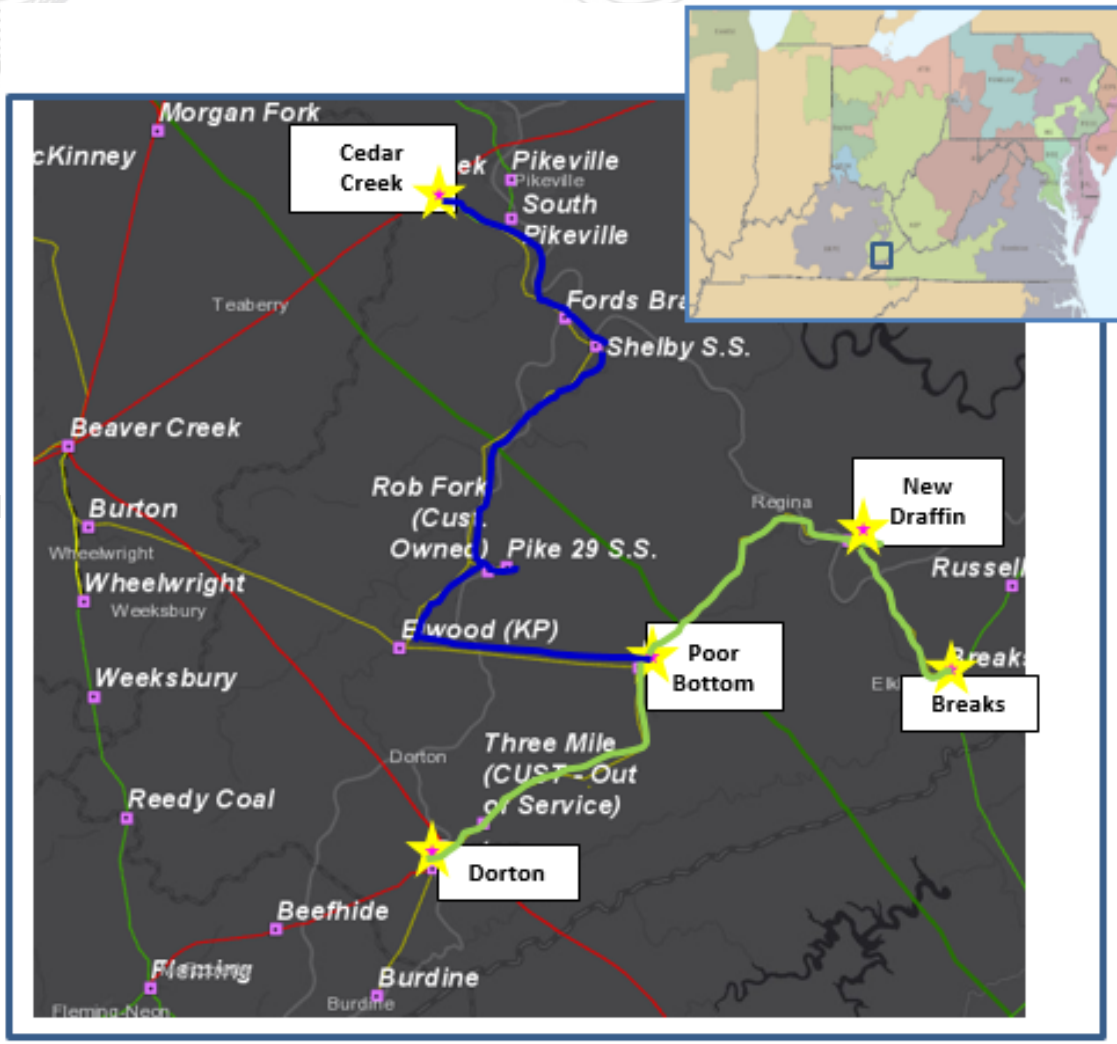
- Establish 69kV bus and new 69 kV line CB at Dorton substation. (**B3736.1**) $1.13 M
- At Breaks substation, reuse 72kV breaker A as the new 69kV line breaker. (**B3736.2**) $0.71 M
- Rebuild ~16.7 mi Dorton – Breaks 46kV line to 69kV. (**B3736.3**) $58.52
- Retire ~17.2 mi Cedar Creek – Elwood 46kV circuit. (**B3736.4**) $11.15 M
- Retire ~ 6.2 mi Henry Clay – Elwood 46kV line section. (**B3736.5**) $4.3 M
- Retire Henry Clay 46 kV substation and replace with Poor Bottom 69 kV station. Install a new 0.7 mi double circuit extension to Poor Bottom 69kV. (**B3736.6**) $3.42 M
- Retire Draffin substation and replace with a new substation. Install a new 0.25 mi double circuit extension to New Draffin substation. (**B3736.7**) $2.01M
- Remote End work at Jenkins substation. (**B3736.8**) $0.03 M
- Provide Transition fiber to Dorton, Breaks, Poor Bottom, Jenkins and New Draffin substations. (**B3736.9**) $0.41M
- Henry Clay S.S Retirement: . (**B3736.10**) $ 0.3 M
- Cedar Creek substation work: . (**B3736.11**) $0.44 M
- Breaks substation retire 46kV equipment: (**B3736.12**) $0.25 M
- Retire Pike 29 SS and Rob Fork SS: . (**B3736.13**) $0.42 M

Total Transmission Estimated Cost: $83M

Distribution Components:

- Serve Pike 29 and Rob Fork customers from nearby 34kV Distribution sources. . (**B3736.14**) $ 2.23 M (D cost)
- Poor Bottom substation install: . (**B3736.15**) $8.46 M (D cost)
- Henry Clay 46kV substation retirement: . (**B3736.16**) $0.82 M (D cost)
- New Draffin 69kV substation install: . (**B3736.17**) $6.66 M (D cost)
- Draffin 46kV substation retirement: . (**B3736.18**) $0.68 M (D cost)

Total Distribution Estimated Cost: $18.9M



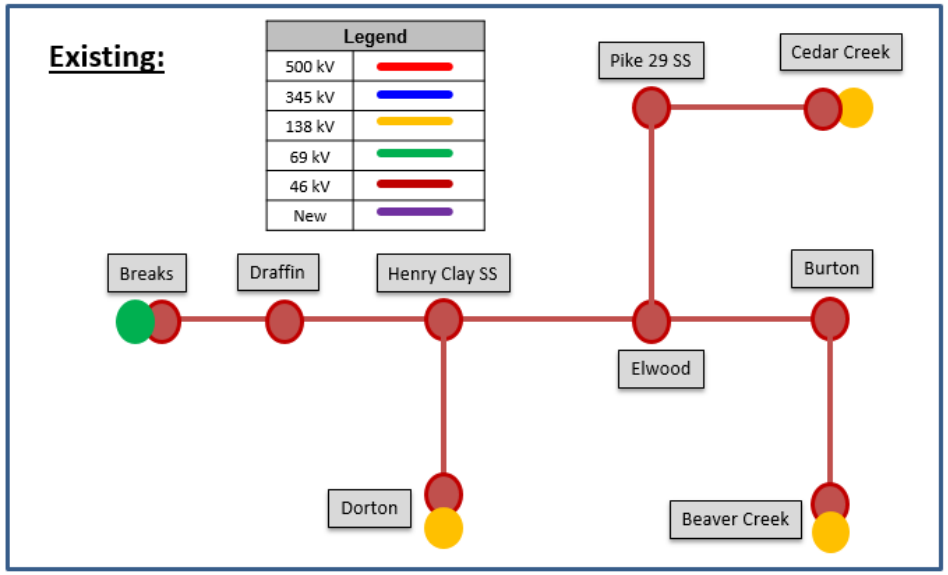
AEP Transmission Zone: Baseline Breaks - Dorton 69kV Conversion

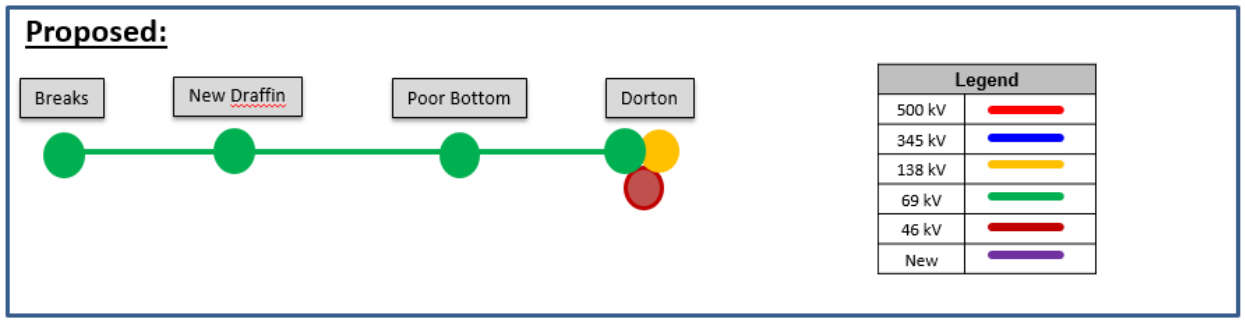
Ancillary Benefits: This proposal completely addresses identified supplemental needs on Cedar Creek – Elwood 46kV under Need AEP-2019-AP032 (presented 8/29/2019 W-SRRTEP), and Identified supplemental needs on Breaks – Dorton – Elwood 46kV circuit under AEP-2020-AP012 (presented 2/21/2020 W-SRRTEP). The proposal proposes retirement of roughly 23.4 mi of obsolete 46kV line.

Required in-service date: 12/1/2027

Projected in-service date: 7/31/2027

Previously Presented: 10/14/2022





APS Transmission Zone: Baseline
Charleroi - Dry Run 138 kV

Process Stage: Recommended Solution

Criteria: Generation Deliverability

Assumption Reference: 2027 RTEP assumption

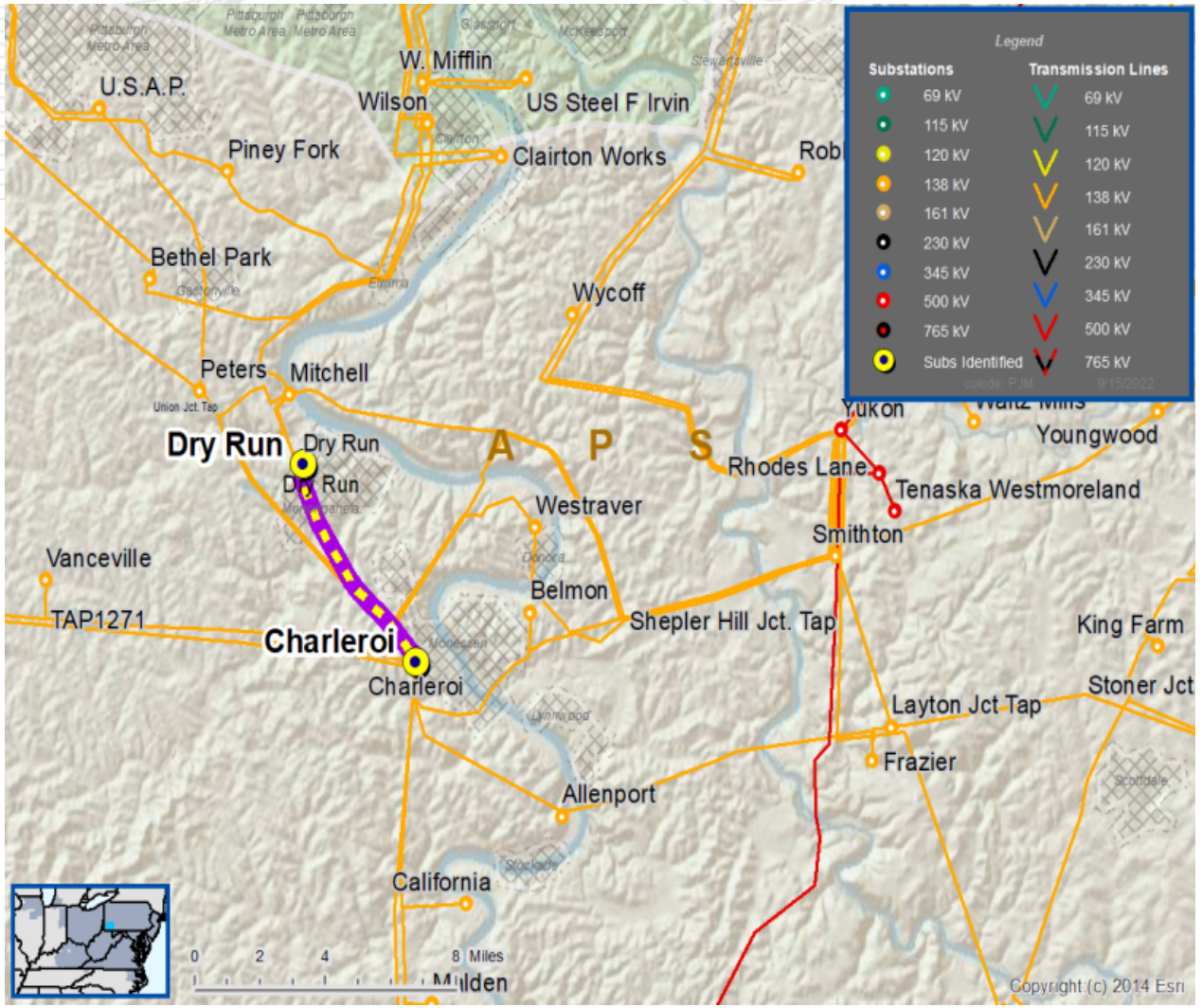
Model Used for Analysis: 2027 Summer RTEP case

Proposal Window Exclusion: Below 200 kV Exclusion

Problem Statement: 2022W1-GD-S601 and 2022W1-GD-S943

In 2027 RTEP Summer case, Charleroi to Dry Run 138 kV line is overloaded due to a breaker and bus contingency.

Branch	SN/SE/WN/WE (MVA)
Charleroi – Dry Run 138 kV	292/314/325/343



APS Transmission Zone: Baseline
Charleroi - Dry Run 138 kV

Recommended Solution:

Replace limiting terminal equipment. (**b3738)**

Transmission Estimated Cost: $0.38M

Ancillary Benefits: Upgrading the limiting terminal equipment will increase the ratings of the line.

Alternatives: None

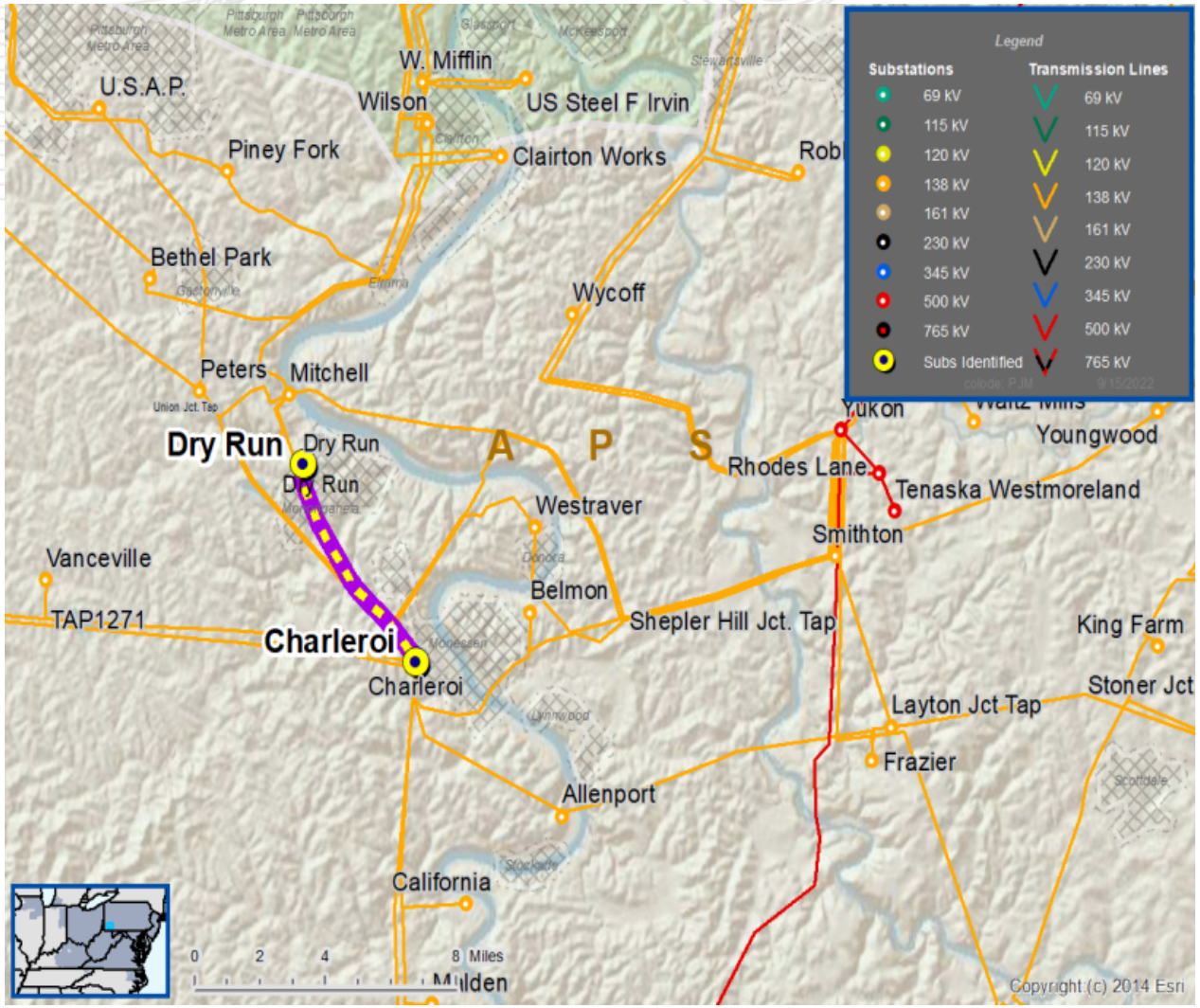
Preliminary Facility Rating:

Branch	SN/SE/WN/WE (MVA)
Charleroi – Dry Run 138 kV	308/376/349/445

Required in-service date: 6/1/2027

Projected in-service date: 6/1/2027

Previously Presented: 10/14/2022



APS Transmission Zone: Baseline
Dry Run – Mitchell 138 kV

Process Stage: Recommended Solution

Criteria: Generation Deliverability

Assumption Reference: 2027 RTEP assumption

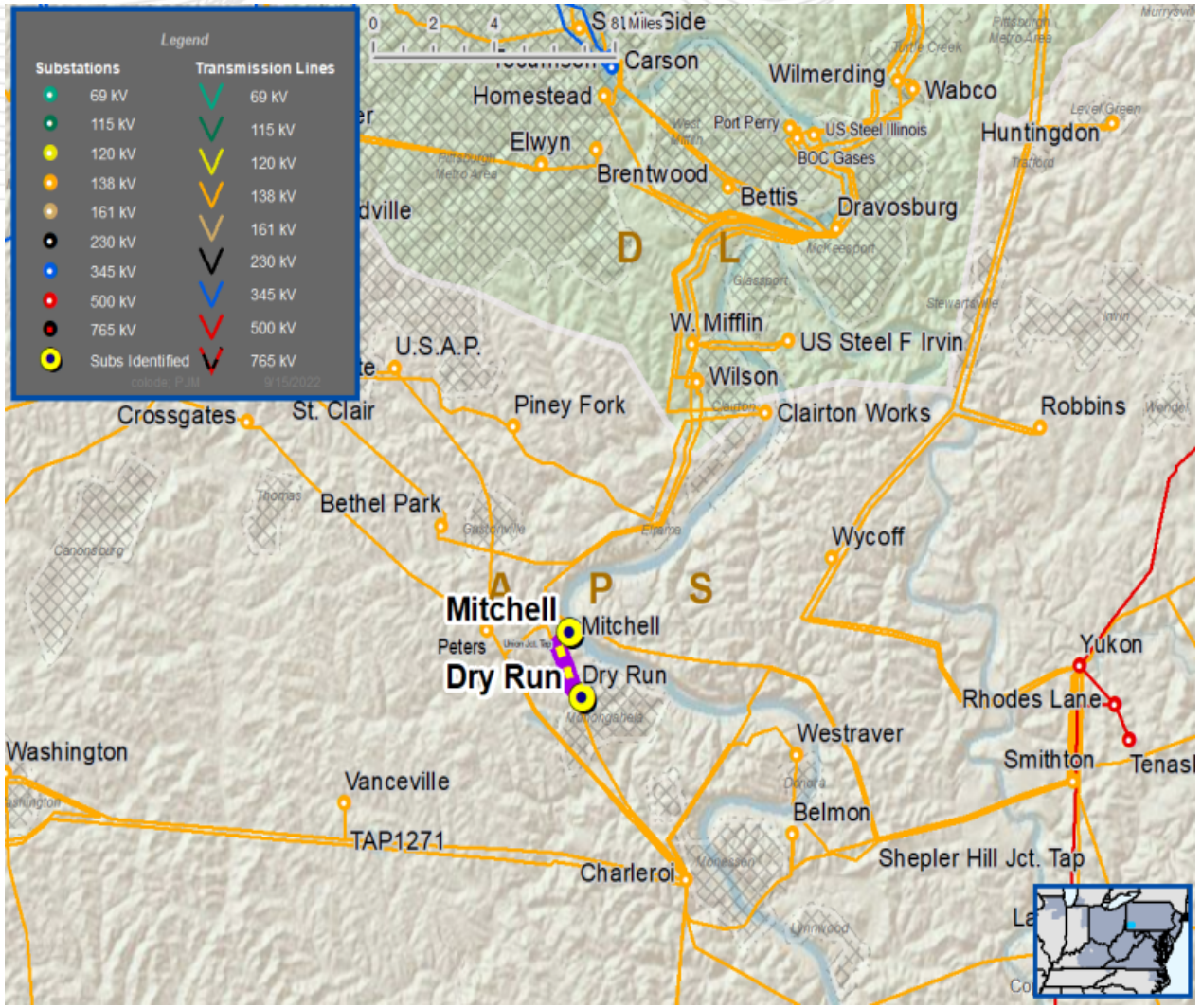
Model Used for Analysis: 2027 Summer RTEP case

Proposal Window Exclusion: Below 200 kV Exclusion

Problem Statement: 2022W1-GD-S633 and 2022W1-GD-S949

In 2027 RTEP Summer case, Dry Run to Mitchell 138 kV line is overloaded due to a breaker and bus contingency.

Branch	SN/SE/WN/WE (MVA)
Dry Run - Mitchell 138 kV	292/314/325/343



APS Transmission Zone: Baseline
Dry Run – Mitchell 138 kV

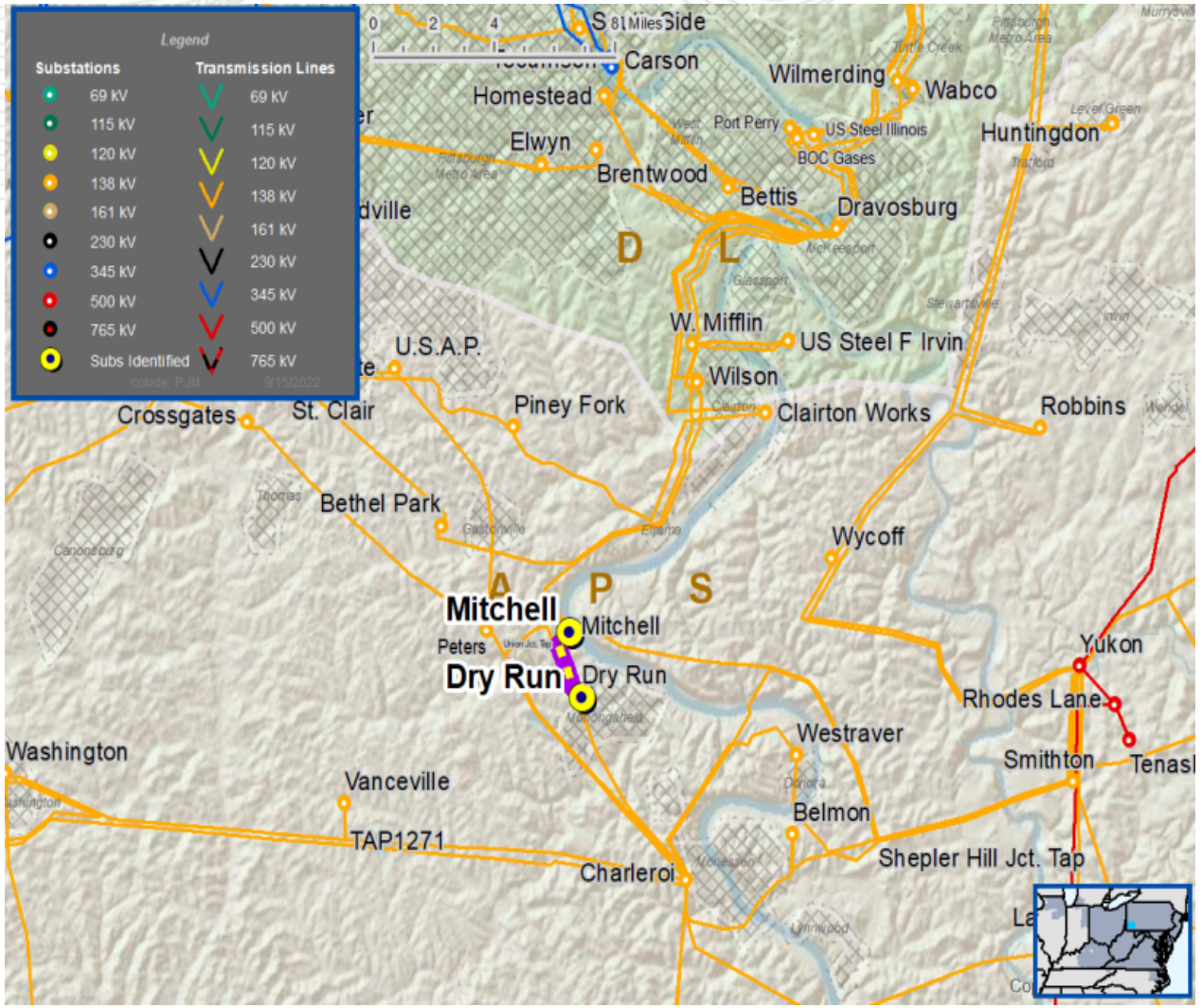
Recommended Solution:

Replace limiting terminal equipment. **(b3739)**

Transmission Estimated Cost: $0.40M

Ancillary Benefits: Upgrading the limiting terminal equipment will increase the ratings of the line.

Alternatives: None



Preliminary Facility Rating:

Branch	SN/SE/WN/WE (MVA)
Dry Run – Mitchell 138 kV	308/376/349/445

Required in-service date: 6/1/2027

Projected in-service date: 6/1/2027

Previously Presented: 10/14/2022

APS Transmission Zone: Baseline Glen Falls – Bridgeport Hill 138 kV

Process Stage: Recommended Solution

Criteria: Generation Deliverability

Assumption Reference: 2027 RTEP assumption

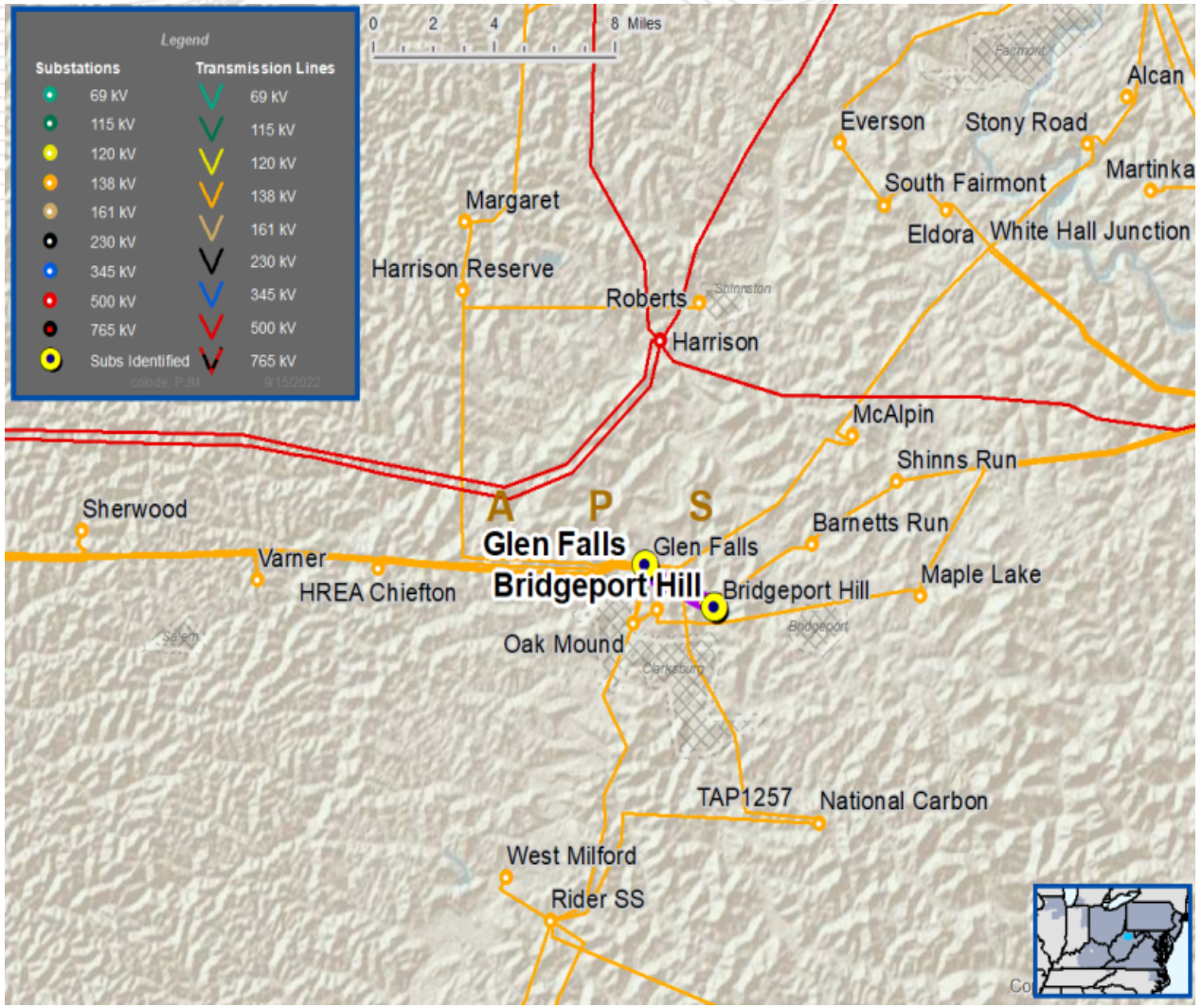
Model Used for Analysis: 2027 Summer RTEP case

Proposal Window Exclusion: Below 200 kV Exclusion

Problem Statement: 2022W1-GD-S608, 2022W1-GD-S945, 2022W1-GD-S615 and 2022W1-GD-S616.

In 2027 RTEP Summer case, Glen Falls – Bridgeport Hill 138 kV is overloaded due to three breaker and one bus contingency.

Branch	SN/SE/WN/WE (MVA)
Glen Falls – Bridgeport Hill 138 kV	176/209/217/229



APS Transmission Zone: Baseline Glen Falls – Bridgeport Hill 138 kV

Recommended Solution:

Replace limiting terminal equipment. **(b3740)**

Transmission Estimated Cost: $1.88M

Ancillary Benefits: Upgrading the limiting terminal equipment will increase the ratings of the line.

Alternatives: None

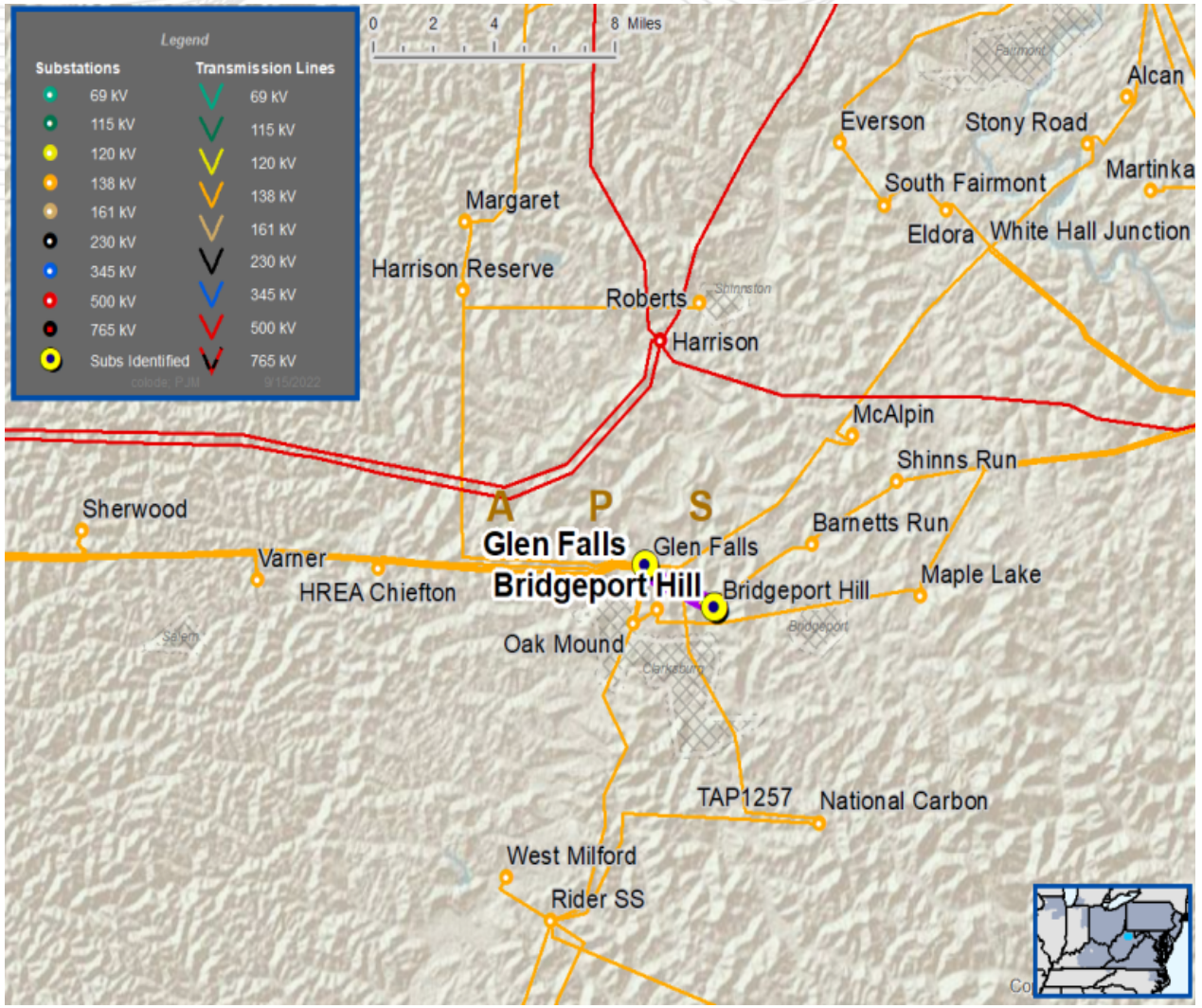
Preliminary Facility Rating:

Branch	SN/SE/WN/WE (MVA)
Glen Falls – Bridgeport Hill 138 kV	221/268/250/317

Required in-service date: 6/1/2027

Projected in-service date: 6/1/2027

Previously Presented: 10/14/2022



APS Transmission Zone: Baseline
Yukon - Charleroi No.1 138 kV

Process Stage: Recommended Solution

Criteria: Generation Deliverability

Assumption Reference: 2027 RTEP assumption

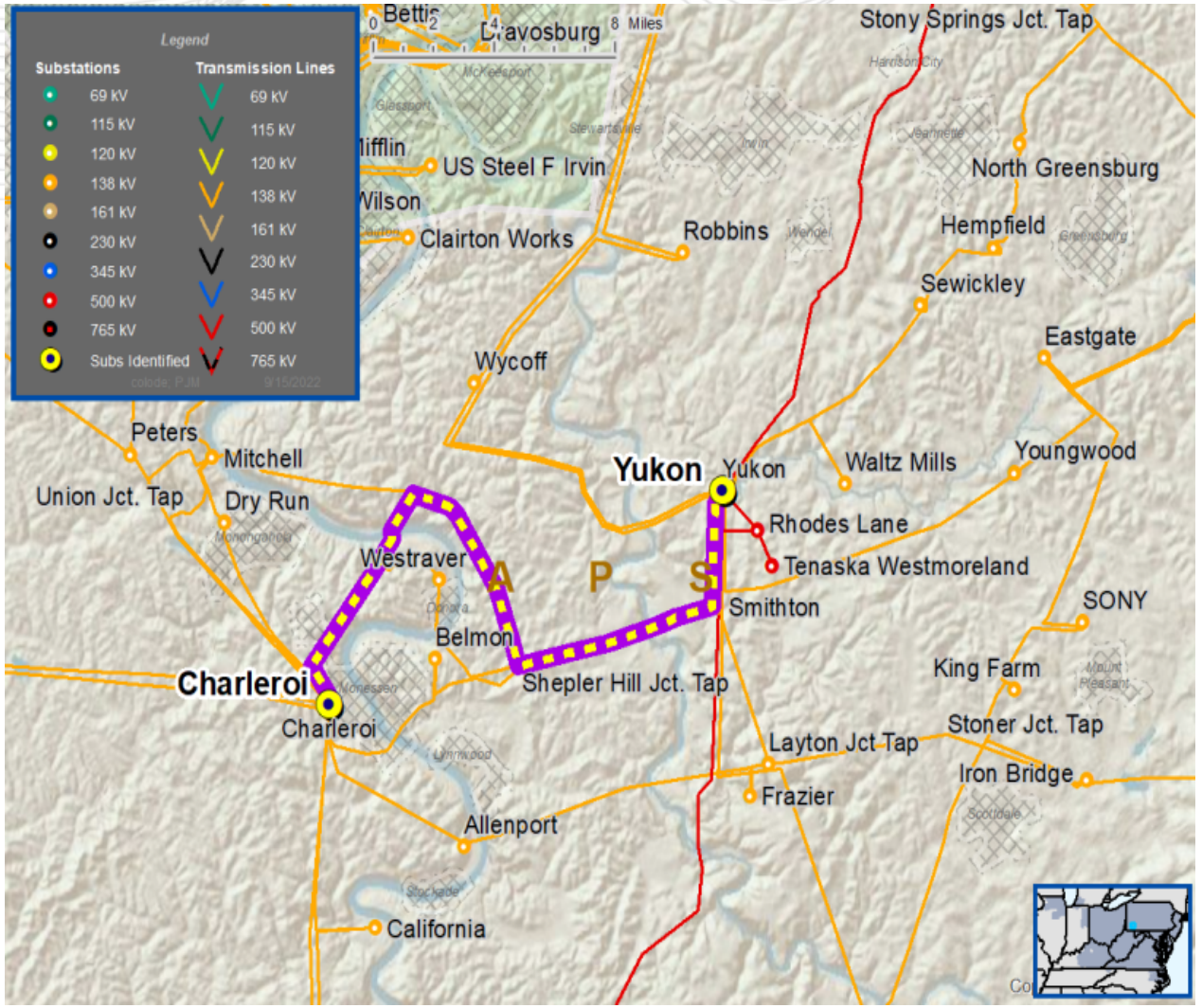
Model Used for Analysis: 2027 Summer RTEP case

Proposal Window Exclusion: Below 200 kV Exclusion

Problem Statement: 2022W1-GD-S1033

In 2027 RTEP Summer case, Yukon to Charleroi # 1 138 kV line is overloaded due to a tower contingency.

Branch	SN/SE/WN/WE (MVA)
Yukon - Charleroi No.1 138 kV	292/314/325/343



APS Transmission Zone: Baseline
Yukon - Charleroi No.1 138 kV

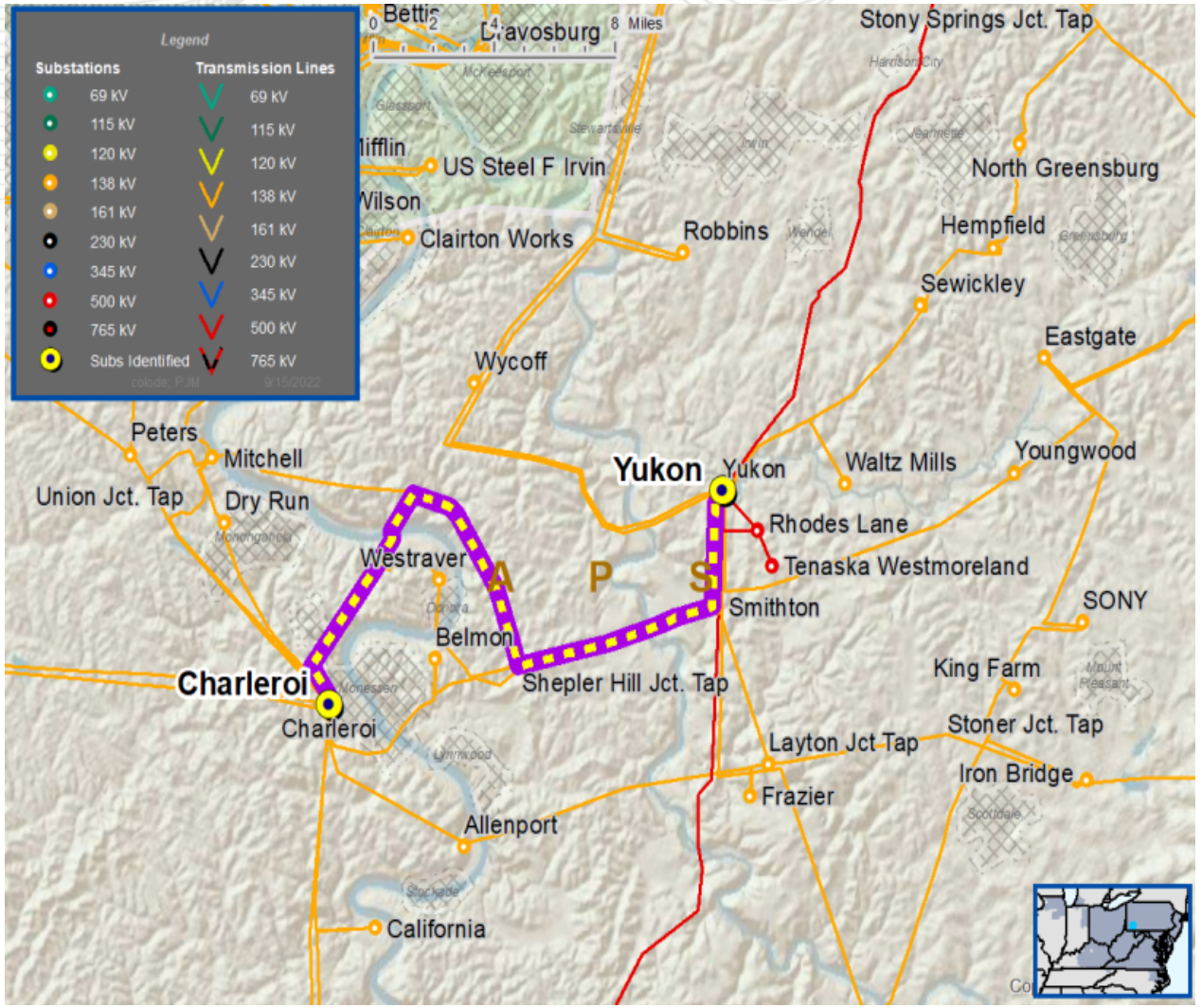
Recommended Solution:

Replace limiting terminal equipment. **(b3741)**

Transmission Estimated Cost: $0.7M

Ancillary Benefits: Upgrading the limiting terminal equipment will increase the ratings of the line.

Alternatives: None



Preliminary Facility Rating:

Branch	SN/SE/WN/WE (MVA)
Yukon - Charleroi No.1 138 kV	308/376/349/445

Required in-service date: 6/1/2027

Projected in-service date: 6/1/2027

Previously Presented: 10/14/2022

APS Transmission Zone: Baseline
Yukon - Charleroi No.2 138 kV

Process Stage: Recommended Solution

Criteria: Generation Deliverability

Assumption Reference: 2027 RTEP assumption

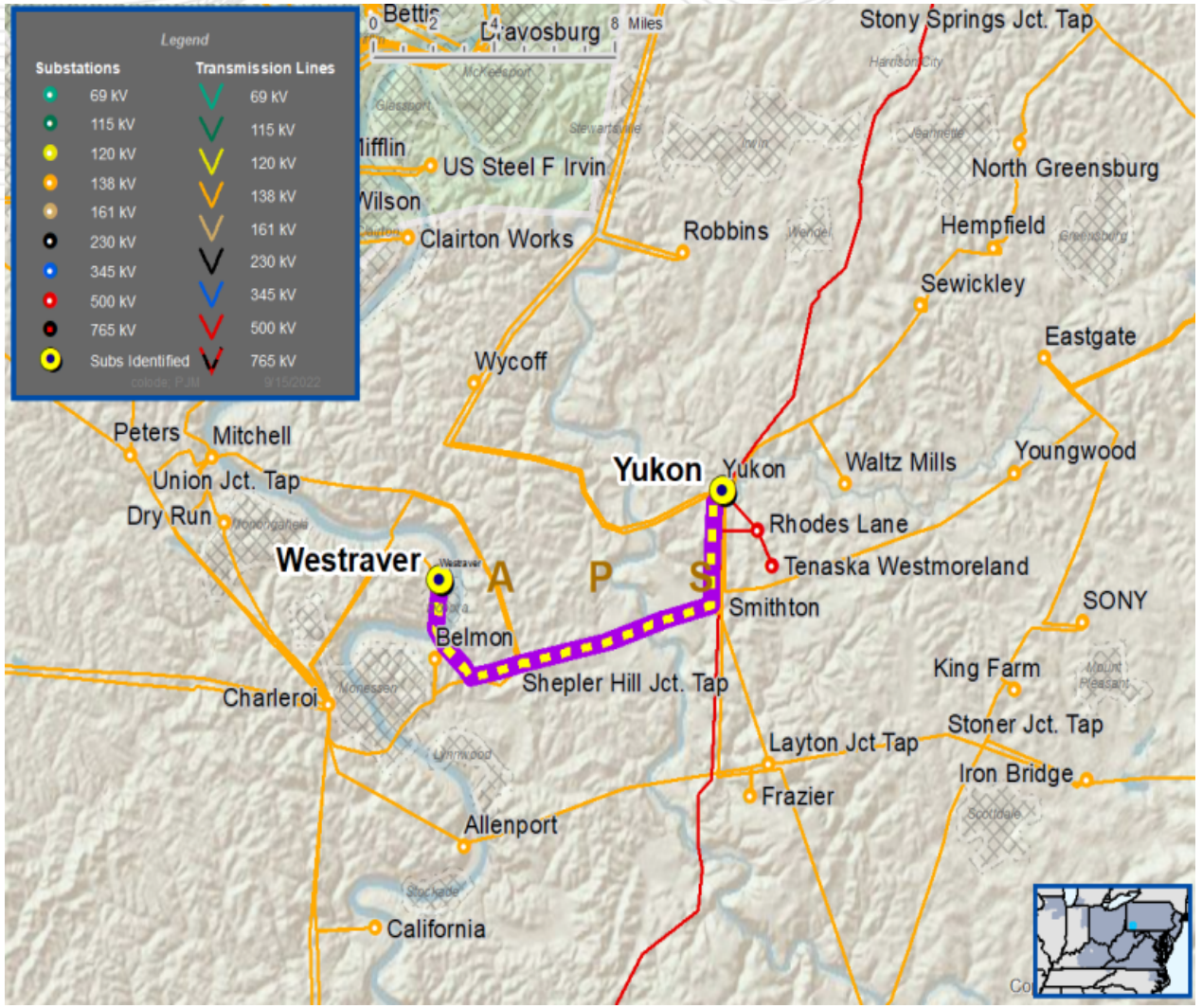
Model Used for Analysis: 2027 Summer RTEP case

Proposal Window Exclusion: Below 200 kV Exclusion

Problem Statement: 2022W1-GD-S1029

In 2027 RTEP Summer case, Yukon to Westraver 138 kV line is overloaded due to a tower contingency.

Branch	SN/SE/WN/WE (MVA)
Yukon - Westraver 138 kV	292/314/325/343
Westraver – Charleroi 138 kV	274/314/325/343



APS Transmission Zone: Baseline
Yukon - Charleroi No.2 138 kV

Recommended Solution:

Replace limiting terminal equipment. **(b3742)**

Transmission Estimated Cost: $0.45M

Ancillary Benefits: Upgrading the limiting terminal equipment will increase the ratings of the line.

Alternatives: None

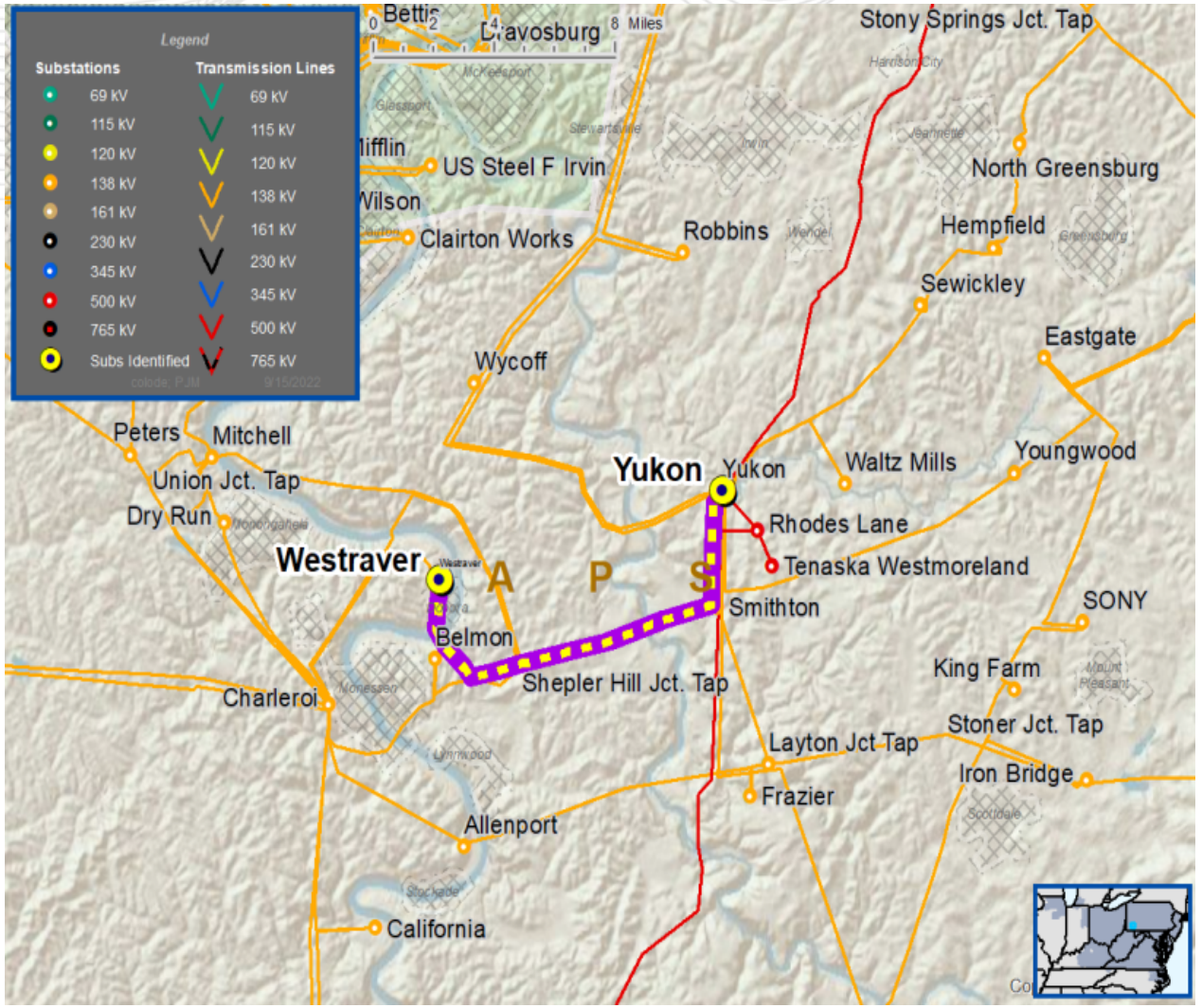
Preliminary Facility Rating:

Branch	SN/SE/WN/WE (MVA)
Yukon - Westraver138 kV	308/376/349/445
Westraver – Charleroi 138 kV	297/365/345/441

Required in-service date: 6/1/2027

Projected in-service date: 6/1/2027

Previously Presented: 10/14/2022



APS Transmission Zone: Baseline
Cherry Run - Harmony Jct tap 138 kV

Process Stage: Recommended Solution

Criteria: Generation Deliverability

Assumption Reference: 2027 RTEP assumption

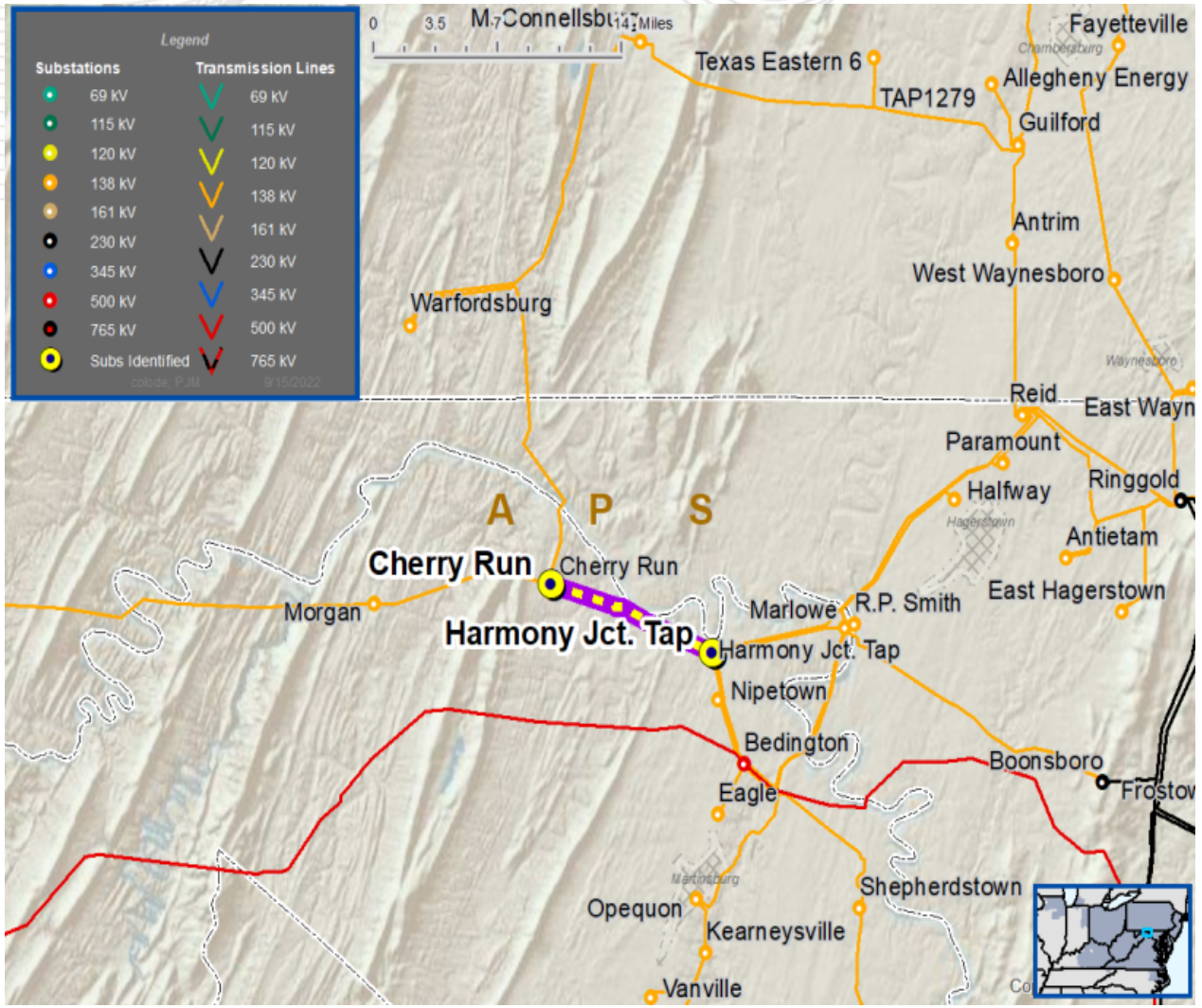
Model Used for Analysis: 2027 Summer and Winter RTEP case

Proposal Window Exclusion: Below 200 kV Exclusion

Problem Statement: 2022W1-GD-S565 and 2022W1-GD-S940

In 2027 RTEP Summer case, Cherry Run to Harmony Junction tap 138 kV line is overloaded due to one breaker and one bus contingency.

Branch	SN/SE/WN/WE (MVA)
Cherry Run - Harmony Jct tap 138 kV	210/229/229/229
Marlowe – Harmony Jct tap 138 kV	225/295/325/343
Bedington – Harmony Jct tap 138 kV	294/350/349/401



APS Transmission Zone: Baseline
Cherry Run - Harmony Jct tap 138 kV

Recommended Solution:

- At Bedington Substation: Replace substation conductor, wavetrap, CT's and upgrade relaying
- At Cherry Run Substation: Replace substation conductor, wavetrap, CT's, disconnect switches, circuit breaker and upgrade relaying
- At Marlowe: Replace substation conductor, wavetrap, CT's and upgrade relaying. **(b3743)**

Transmission Estimated Cost: $4.66M

Ancillary Benefits: Upgrading the limiting terminal equipment will increase the ratings of the line.

Alternatives: None

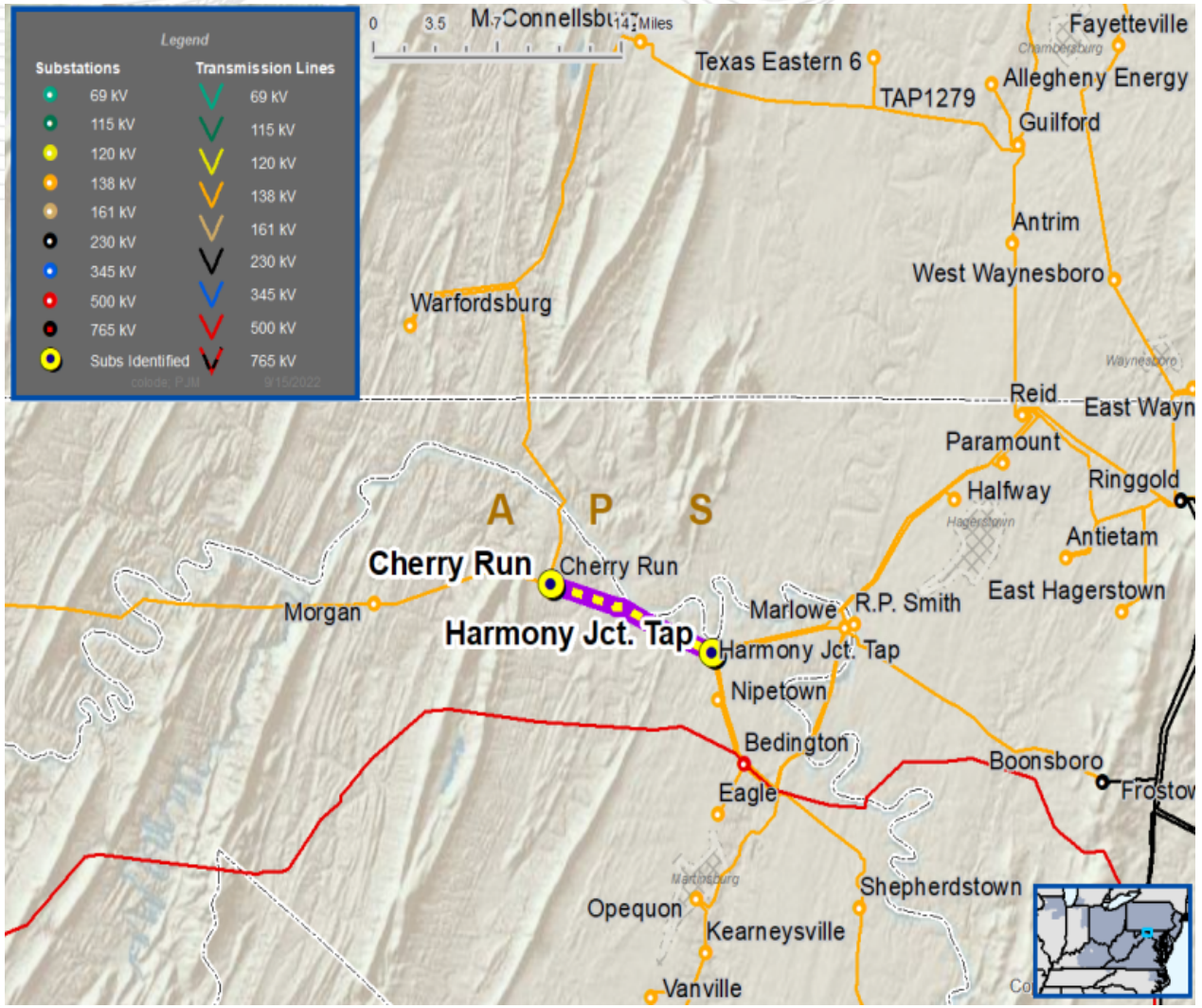
Preliminary Facility Rating:

Branch	SN/SE/WN/WE (MVA)
Cherry Run - Harmony Jct tap 138 Kv	221/268/250/317
Marlowe – Harmony Jct tap 138 kV	308/376/349/445
Bedington – Harmony Jct tap 138 kV	308/376/349/445

Required in-service date: 6/1/2027

Projected in-service date: 6/1/2027

Previously Presented: 10/14/2022



APS Transmission Zone: Baseline Shanor – Krendale 138 kV

Process Stage: Recommended Solution

Criteria: Generation Deliverability

Assumption Reference: 2027 RTEP assumption

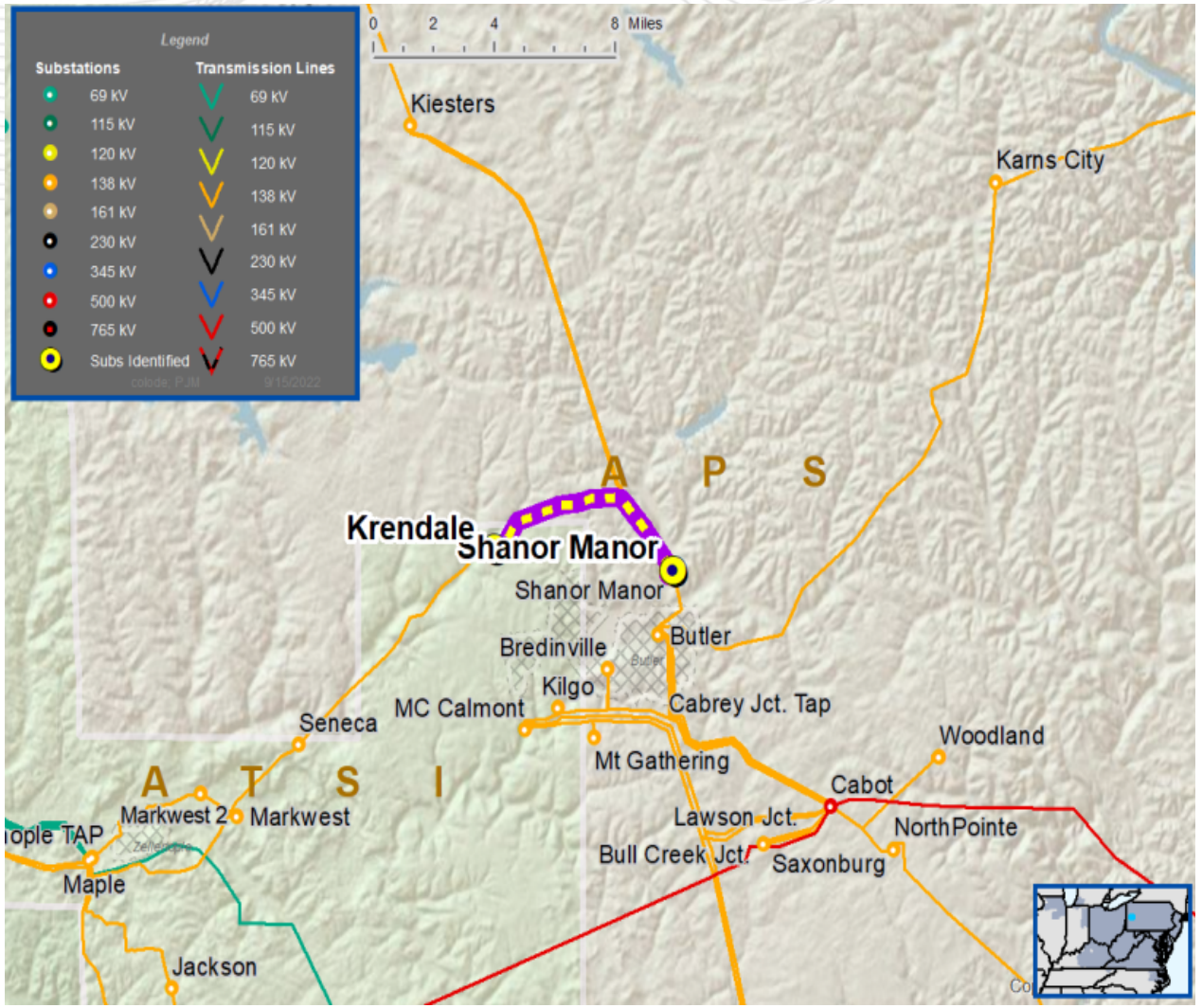
Model Used for Analysis: 2027 Summer RTEP case

Proposal Window Exclusion: Below 200 kV Exclusion

Problem Statement: 2022W1-GD-S28

In 2027 RTEP Summer case, Shanor to Krendale 138 kV line is overloaded due to single contingency.

Branch	SN/SE/WN/WE (MVA)
Shanor – Krendale 138 kV line	353/422/419/459



APS Transmission Zone: Baseline
Shanor – Krendale 138 kV

Recommended Solution:

- Replace one span of 1272 ACSR from Krendale substation to structure 35 (~630 ft)
- Replace one span of 1272 ACSR from Shanor Manor to structure 21 (~148 ft)
- Replace 1272 ACSR risers at Krendale & Shanor Manor Substations
- Replace 1272 ACSR Substation Conductor at Krendale Substation
- Replace relaying at Krendale Substation
- Revise Relay Settings at Butler & Shanor Manor Substations.**(b3744)**

Transmission Estimated Cost: $1.75M

Ancillary Benefits: Upgrading the limiting terminal equipment will increase the ratings of the line.

Alternatives: None

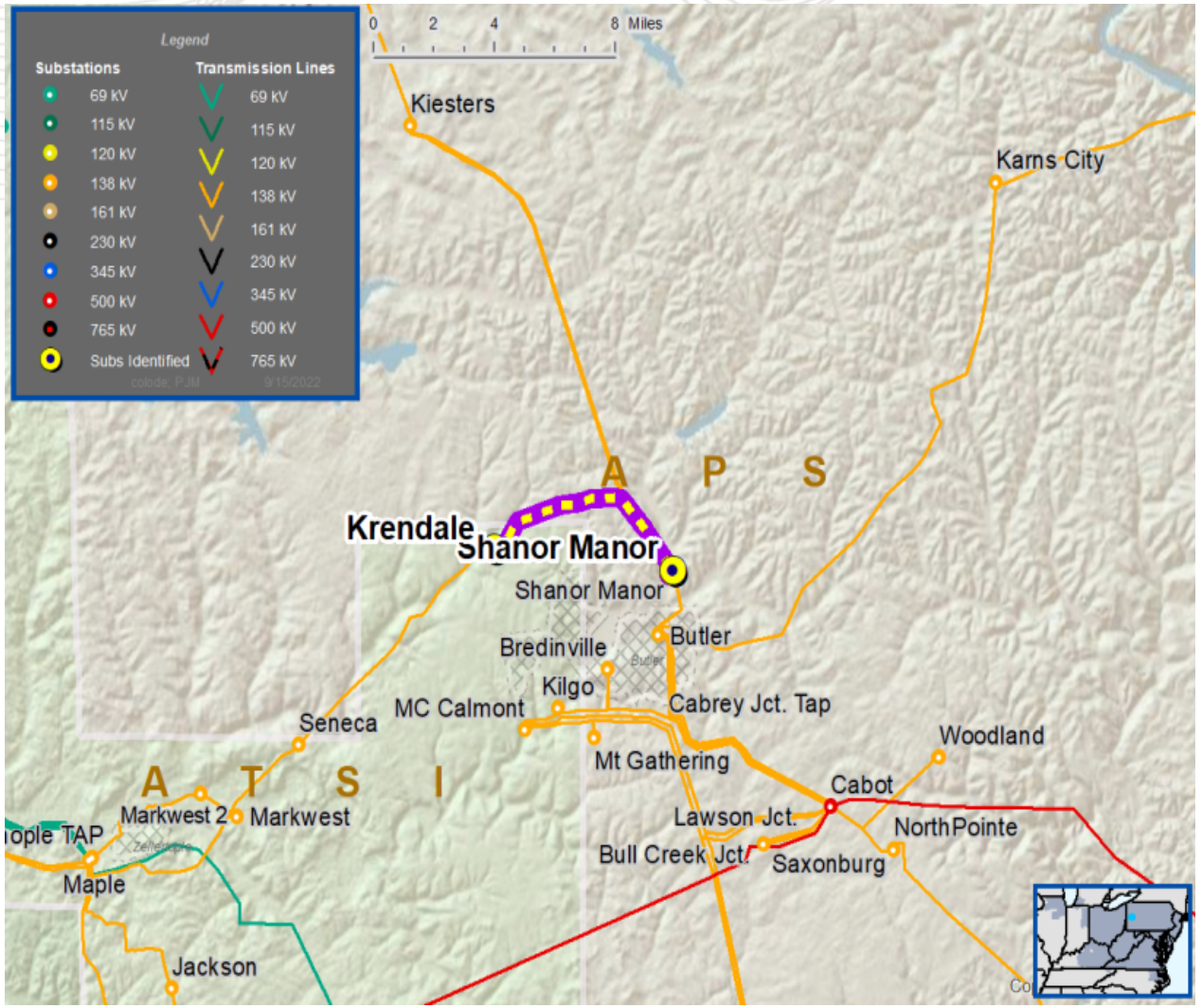
Preliminary Facility Rating:

Branch	SN/SE/WN/WE (MVA)
Shanor – Krendale 138 kV line	443/535/500/607

Required in-service date: 6/1/2027

Projected in-service date: 12/1/2023

Previously Presented: 10/14/2022



APS Transmission Zone: Baseline Carbon Center 230 kV Substation

Process Stage: Recommended Solution

Criteria: Baseline Analysis

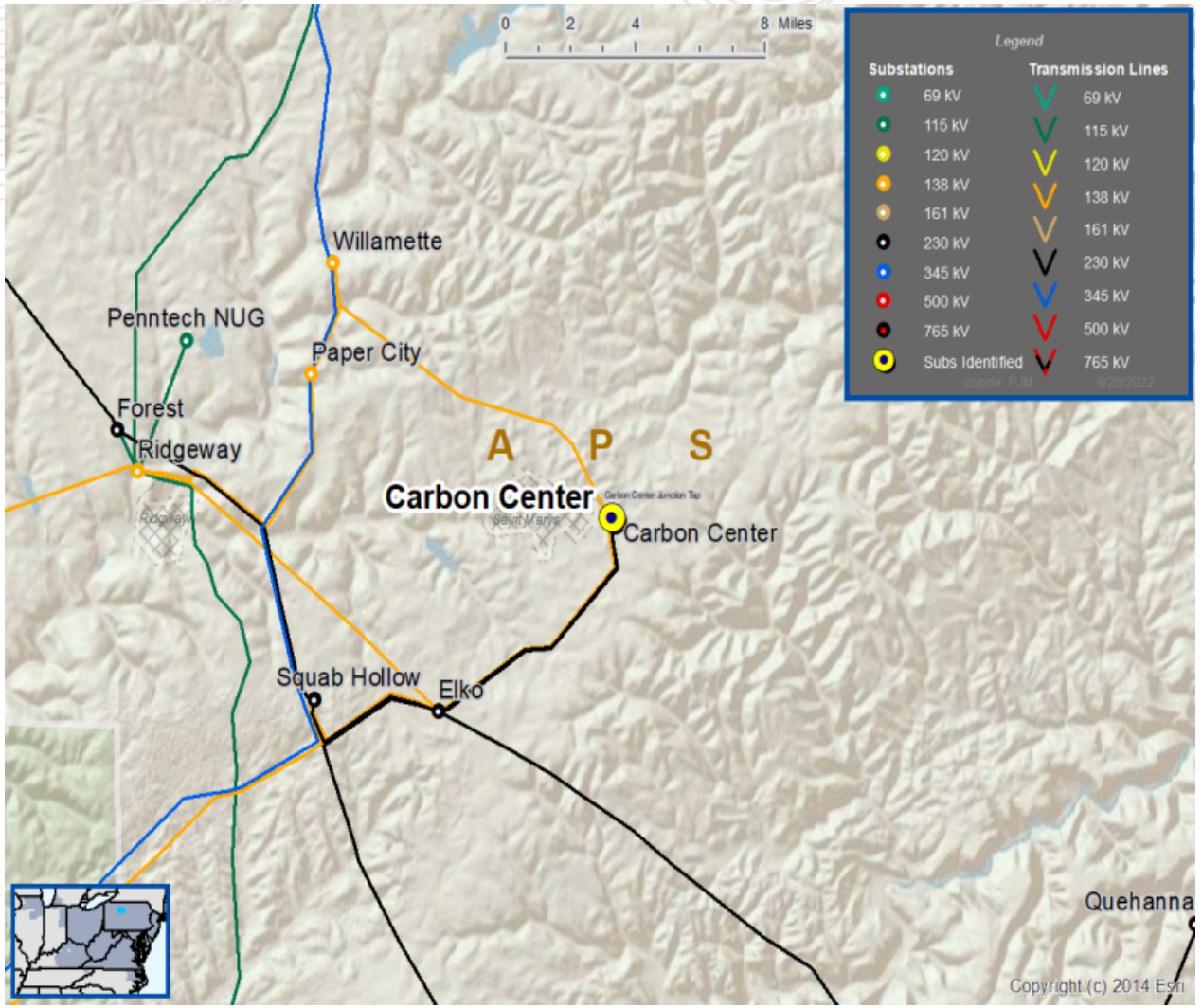
Assumption Reference: 2027 RTEP assumption

Model Used for Analysis: 2027 Summer and Winter RTEP case

Proposal Window Exclusion: Below 200 kV Exclusion

Problem Statement: 2022W1-N1-WT83 & 2022W1-N1-ST5

In 2027 RTEP Summer and winter case, Elko to Ridgeway 138 kV line is overloaded to P5 contingency.



APS Transmission Zone: Baseline Carbon Center 230 kV Substation

Recommended Solution:

- At Carbon Center Substation: Replace and add relaying to ensure there is redundancy for 230 kV and 138 kV bus & stuck breaker faults to avoid remote-end clearing. The new redundant relaying shall meet the TPL-001-4 non-redundant relays standard. **(b3745)**

Transmission Estimated Cost: $0.57M

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

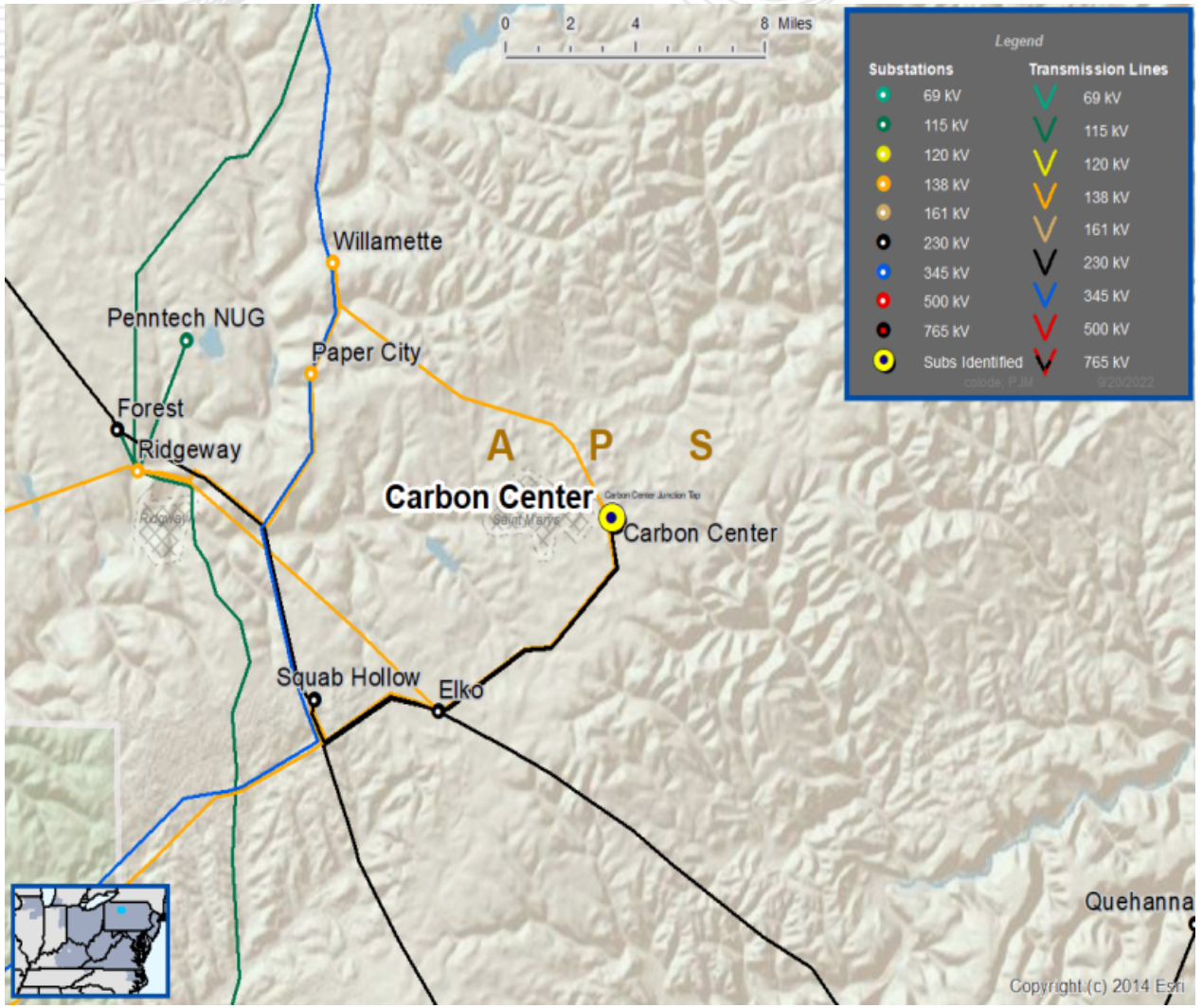
Alternatives: None

Preliminary Facility Rating: N/A

Required in-service date: 6/1/2027

Projected in-service date: 6/1/2027

Previously Presented: 10/14/2022



APS Transmission Zone: Baseline
Meadow Brook 500 kV Substation

Process Stage: Recommended Solution

Criteria: Baseline Analysis

Assumption Reference: 2027 RTEP assumption

Model Used for Analysis: 2027 Summer and Winter RTEP case

Proposal Window Exclusion: Below 200 kV Exclusion

Problem Statement: 2022W1-N1-ST3, 2022W1-N1-ST4, 2022W1-N1-ST14, 2022W1-N1-ST15, 2022W1-N1-SVM1, 2022W1-N1-SVM2, 2022W1-N1-SVM5 through 2022W1-N1-SVM10, 2022W1-N1-SVM13 through 2022W1-N1-SVM16, 2022W1-N1-SVD3, 2022W1-N1-SVD4, 2022W1-N1-SVD7 through 2022W1-N1-SV12, 2022W1-N1-SV15, 2022W1-N1-SV16, 2022W1-N1-SV19, 2022W1-N1-SV20, 2022W1-N1-WT20, 2022W1-N1-WT21, 2022W1-N1-WT67, 2022W1-N1-WT68, 2022W1-N1-WVM3, 2022W1-N1-WV4, 2022W1-N1-WV11, 2022W1-N1-WV12, 2022W1-N1-WV15 to 2022W1-N1-WV18. 2022W1-N1-WV21, 2022W1-N1-WV22, 2022W1-N1-WV29, 2022W1-N1-WV30, 2022W1-N1-WV33, 2022W1-N1-WV34, 2022W1-N1-WV39, 2022W1-N1-WV40, 2022W1-N1-WVD3, 2022W1-N1-WVD4, 2022W1-N1-WVD15, 2022W1-N1-WVD16, 2022W1-N1-WVD19, 2022W1-N1-WVD20, 2022W1-N1-WVD21, 2022W1-N1-WVD22, 2022W1-N1-WVD25, 2022W1-N1-WVD26, 2022W1-N1-WVD37, 2022W1-N1-WVD38, 2022W1-N1-WVD43 & 2022W1-N1-WVD44

In 2027 RTEP Summer and winter case, Thermal overloads voltage drop violations and voltage magnitude violations at multiple 138 kV buses due to two P5 contingencies.

APS Transmission Zone: Baseline Meadow Brook 500 kV Substation

Recommended Solution:

- At Meadow Brook Substation: Replace and add relaying to ensure there is redundancy for 500 kV and 138 kV bus & stuck breaker faults to avoid remote-end clearing. The new redundant relaying shall meet the TPL-001-4 non-redundant relays standard. **(b3746)**

Transmission Estimated Cost: $0.21M

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

Alternatives: None

Preliminary Facility Rating: N/A

Required in-service date: 6/1/2027

Projected in-service date: 6/1/2027

Previously Presented: 10/14/2022

APS Transmission Zone: Baseline Bedington 500 kV Substation

Process Stage: Recommended Solution

Criteria: Baseline Analysis

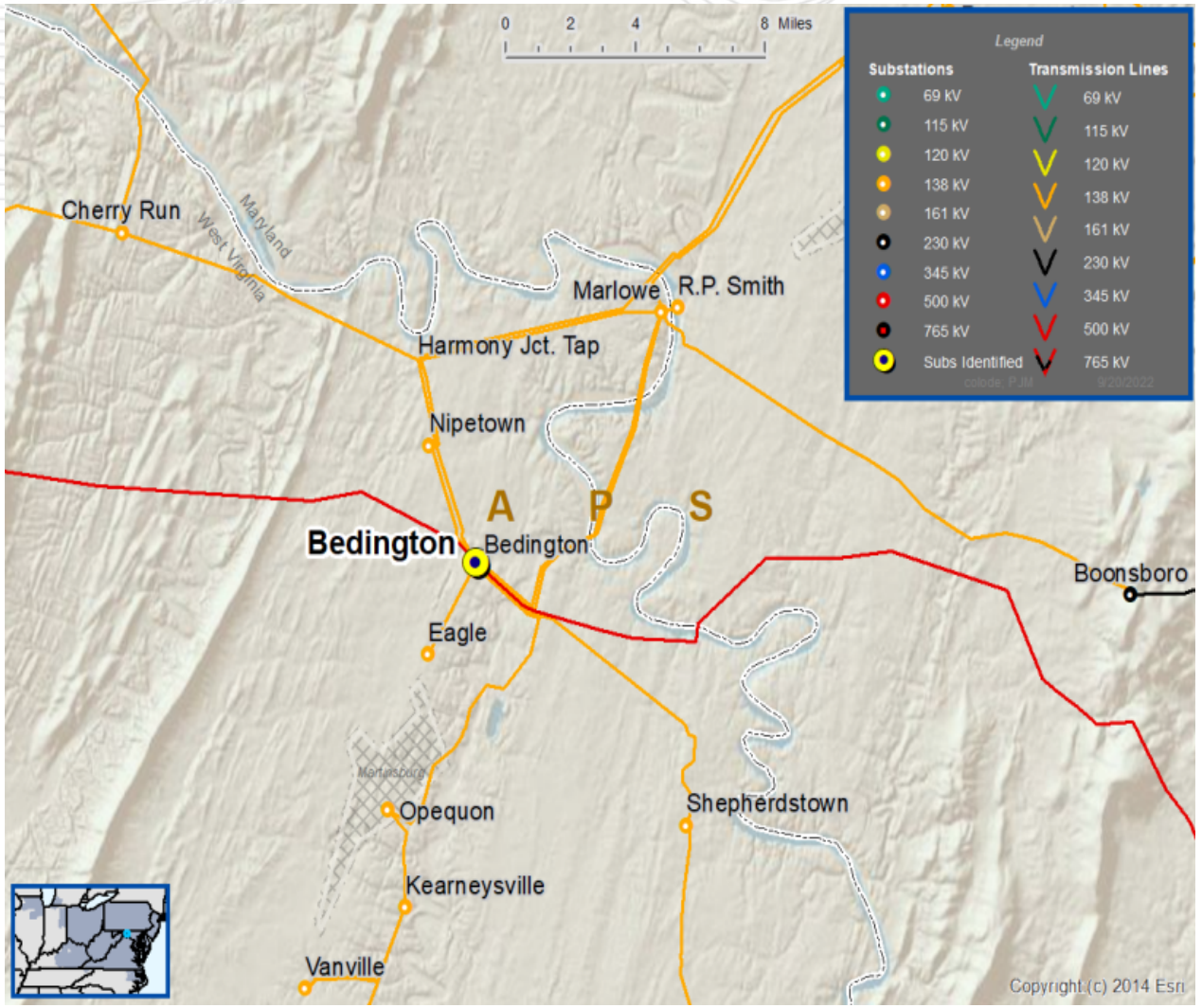
Assumption Reference: 2027 RTEP assumption

Model Used for Analysis: 2027 Summer and Winter RTEP case

Proposal Window Exclusion: Below 200 kV Exclusion

Problem Statement:. 2022W1-N1-SVM3, 2022W1-N1-SVM4, 2022W1-N1-SVM11, 2022W1-N1-SVM12, 2022W1-N1-SVD1, 2022W1-N1-SVD2, 2022W1-N1-SVD5, 2022W1-N1-SVD6, 2022W1-N1-SVD13, 2022W1-N1-SVD14, 2022W1-N1-SVD17, 2022W1-N1-SVD18, 2022W1-N1-WT88, 2022W1-N1-WT89, 2022W1-N1-WVM1, 2022W1-N1-WVM2, 2022W1-N1-WVM5 through 2022W1-N1-WVM10, 2022W1-N1-WVM13, 2022W1-N1-WVM14, 2022W1-N1-WVM19, 2022W1-N1-WVM20, 2022W1-N1-WVM23 through 2022W1-N1-WVM28, 2022W1-N1-WVM31, 2022W1-N1-WVM32, 2022W1-N1-WVM35 thorugh 2022W1-N1-WVM38, 2022W1-N1-WVD1, 2022W1-N1-WVD2, 2022W1-N1-WVD5 through 2022W1-N1-WVD14, 2022W1-N1-WVD17, 2022W1-N1-WVD18, 2022W1-N1-WVD23, 2022W1-N1-WVD24, 2022W1-N1-WVD27 through 2022W1-N1-WVD36, 2022W1-N1-WVD39 through 2022W1-N1-WVD42, 2022W1-N1-WVD45 & 2022W1-N1-WVD46

In 2027 RTEP Summer and winter case, Thermal overloads voltage drop violations and voltage magnitude violations at multiple 138 kV buses due to two P5 contingencies.



APS Transmission Zone: Baseline
Bedington 500 kV Substation

Recommended Solution:

- At Bedington Substation: Replace and add relaying to ensure there is redundancy for 500 kV and 138 kV bus & stuck breaker faults to avoid remote-end clearing. The new redundant relaying shall meet the TPL-001-4 non-redundant relays standard.**(b3747)**

Transmission Estimated Cost: $0.28M

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

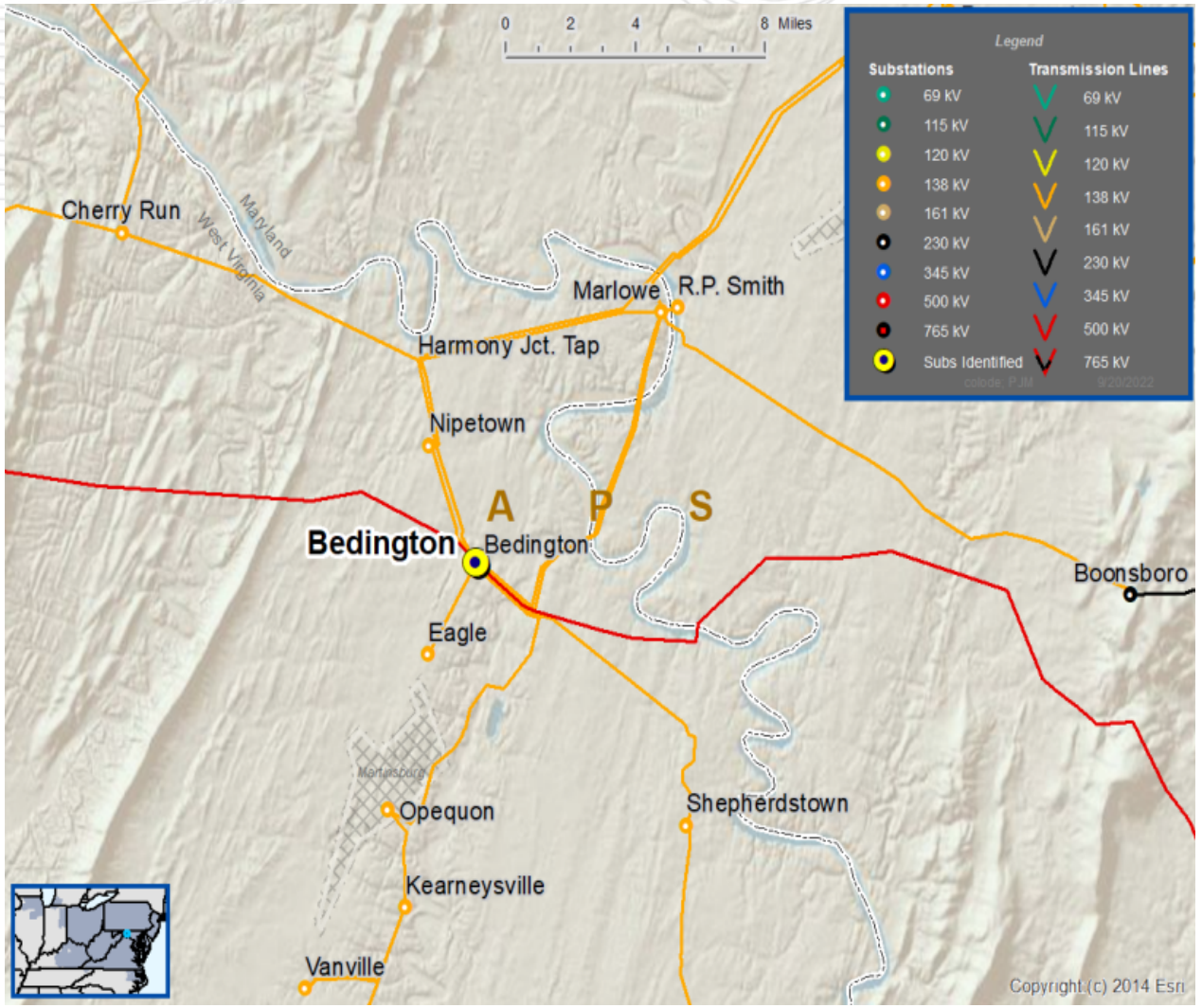
Alternatives: None

Preliminary Facility Rating: N/A

Required in-service date: 6/1/2027

Projected in-service date: 6/1/2027

Previously Presented: 10/14/2022



First Review

Baseline Reliability Projects

APS Transmission Zone: Baseline Ridgway 138/46 #2 Transformer

Process Stage: First Review Solution

Criteria: Baseline N-1-1 Analysis

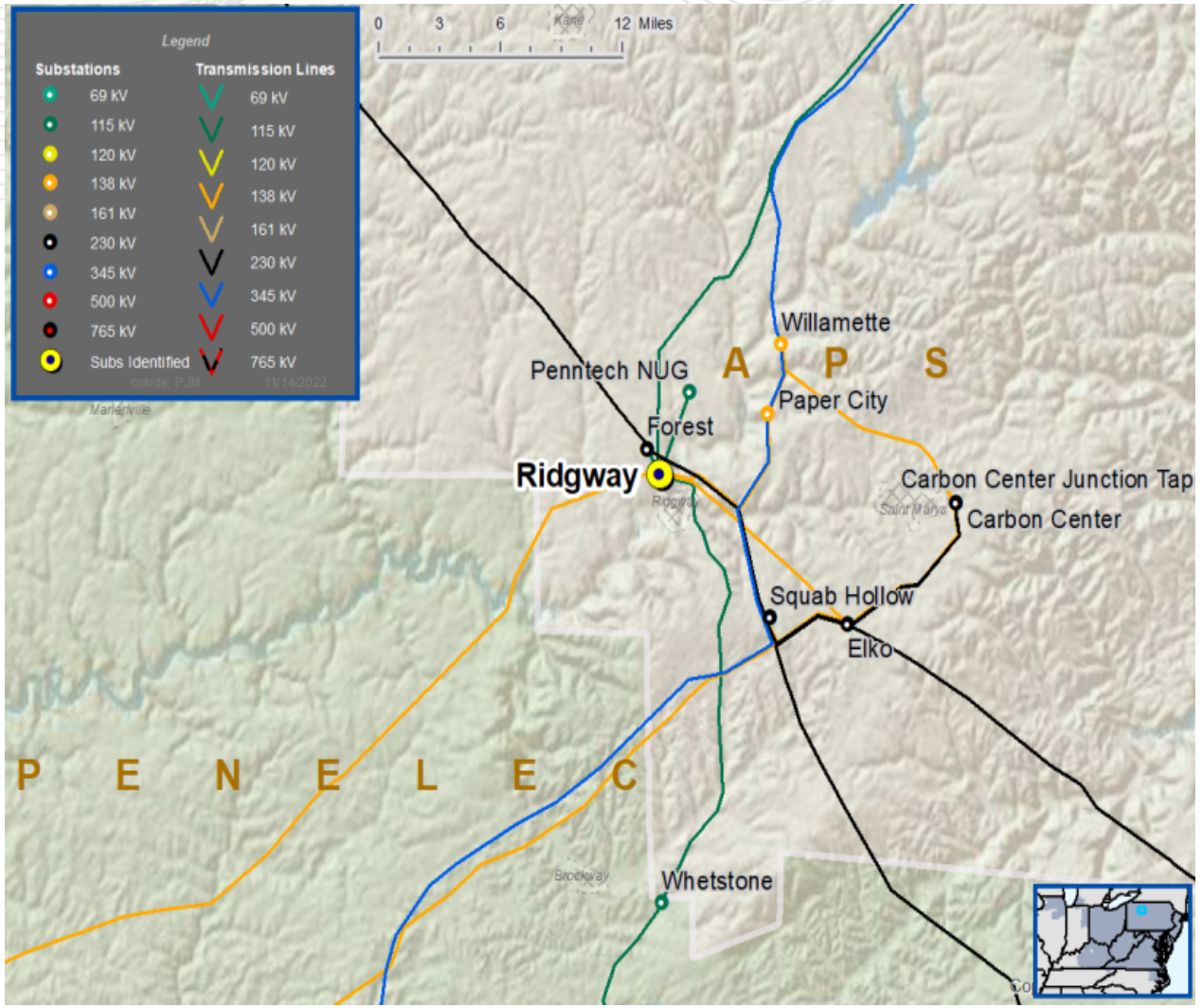
Assumption Reference: 2027 RTEP assumption

Model Used for Analysis: 2027 Summer RTEP case

Proposal Window Exclusion: Below 200 kV Exclusion

Problem Statement: 2022W1-N2-ST1

In 2027 RTEP Summer case, Carbon Center to Elko 138 kV line is overloaded due to N-1-1 contingencies.



APS Transmission Zone: Baseline Ridgway 138/46 #2 Transformer

Proposed Solution:

- Install 138 kV Breaker on the Ridgway 138/46 kV #2 Transformer

Transmission Estimated Cost: $1.1M

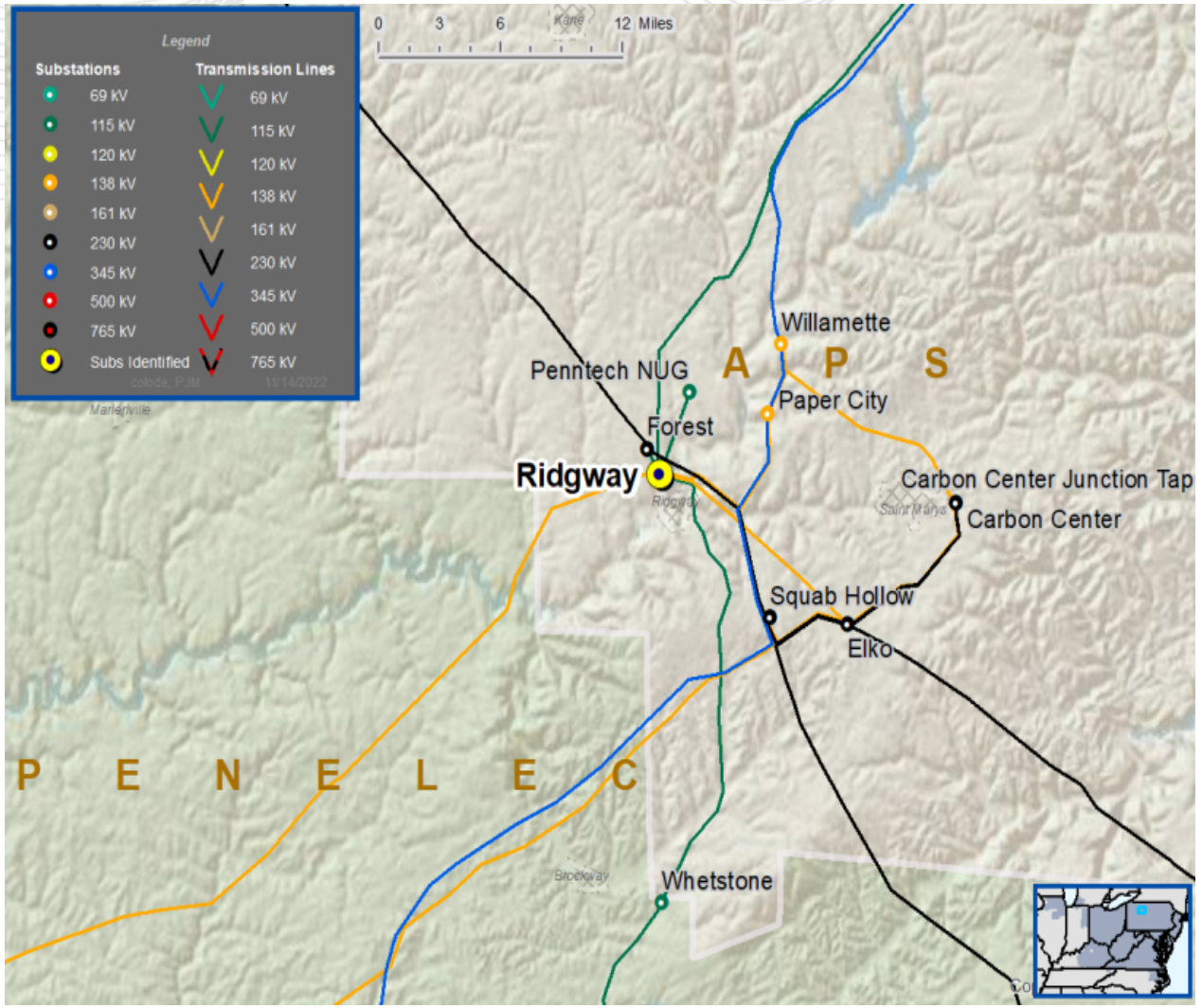
Ancillary Benefits: Adding a 138 kV breaker on the Ridgway #2 138/46 kV Transformer will prevent the 138 kV bus from being de-energized in the event of a transformer fault.

Alternatives: None

Preliminary Facility Rating: N/A

Required in-service date: 6/1/2027

Projected in-service date: 6/1/2027



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SRRTEP-W Reliability Analysis Update

Revision History

- V1 – 11/**/2022 – Original slides posted

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