Reliability Analysis Update

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Transmission Expansion Advisory Committee

October 6, 2020

Updates

Baseline Reliability Projects

DAYTON/AEP Transmission Zone

B1570.4 Scope change (B1570.4 was presented in 4/11/2019 TEAC)

Original Scope:

Add a 345kV breaker at Marysville 345kV station and a 0.1 mile 345kV line extension from Marysville to the new 345/69KV Dayton transformer

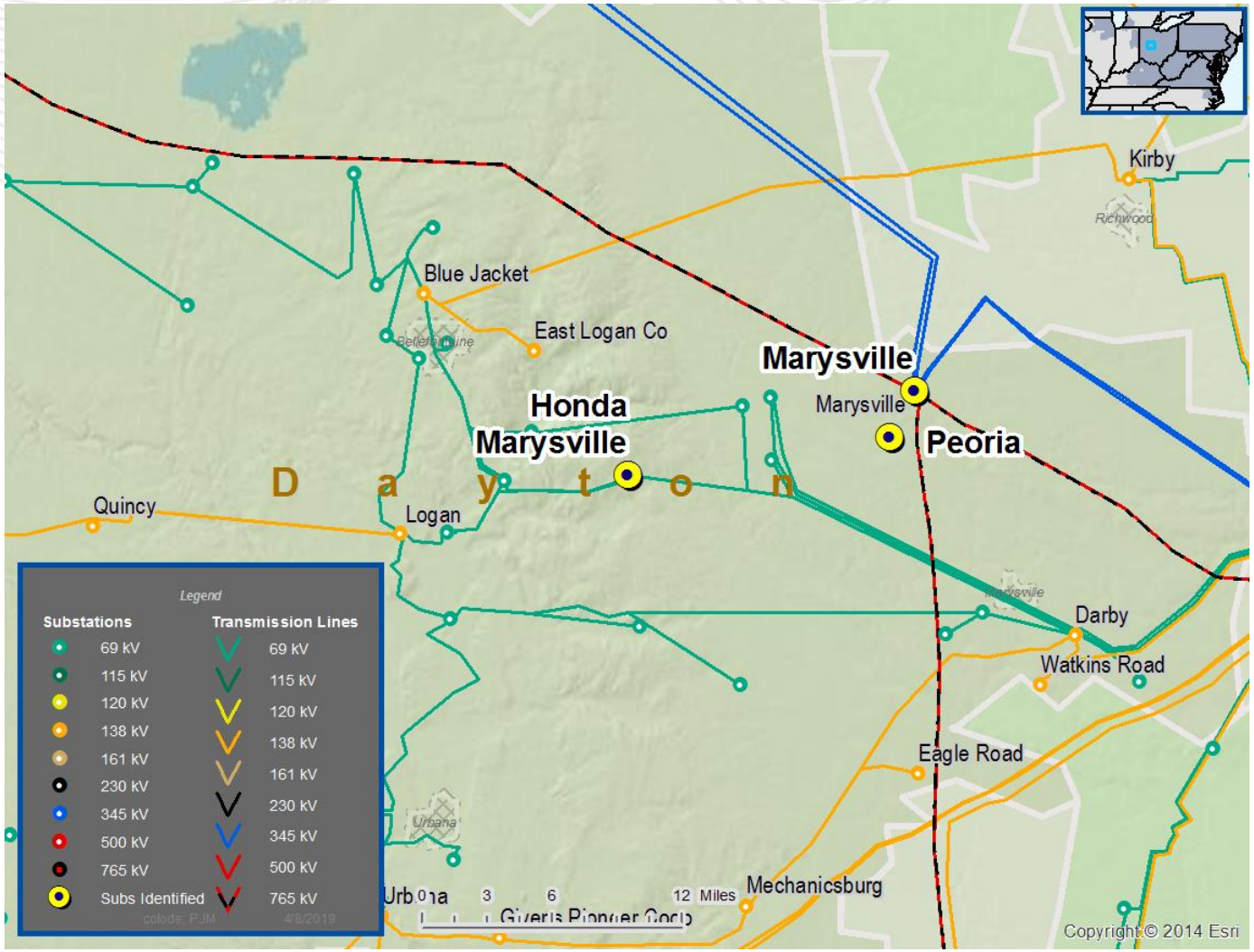
Original Estimated Cost: $4.1M

New Scope:

~~Add a 345kV breaker at Marysville 345kV station~~ Add a new 345 kV string with two new 5000A, 63 kV circuit breakers at AEP's Marysville 345 kV station and a 0.1 mile 345kV line extension from Marysville to the new 345/69KV Dayton transformer

New Estimated Cost: ~~$4.1M~~ $6.45M

Reason for the scope change: The Original scope to add a breaker to an existing string was found to be very complex and costly during the Detailed Scoping stage. In addition, outage durations would have increased, custom T-Line poles needed to be installed in the drive path, and 765/345 kV Transformer #2 would have to be relocated along with all the control cables.



First Review

Baseline Reliability Projects

AEP Transmission Zone: Baseline Muskingum-Waterford 345 kV Bus/Riser Upgrades

Process Stage: First Review

Criteria: Summer Generation Deliverability

Assumption Reference: 2025 RTEP assumption

Model Used for Analysis: 2025 Summer case and 2025 Winter case

Proposal Window Exclusion: Substation Equipment

Problem Statement:

FGs: GD-S2, GD-S3, GD-S4, GD-S5, GD-S8, GD-S14

The Muskingum –Waterford 345kV line is overloaded for base case and multiple contingencies.

Existing Facility Rating:

Branches	SN/SE (MVA)	WN/WE (MVA)
05WATERFORD – 05MUSKNG 345KV	1025/1318	1298/1522

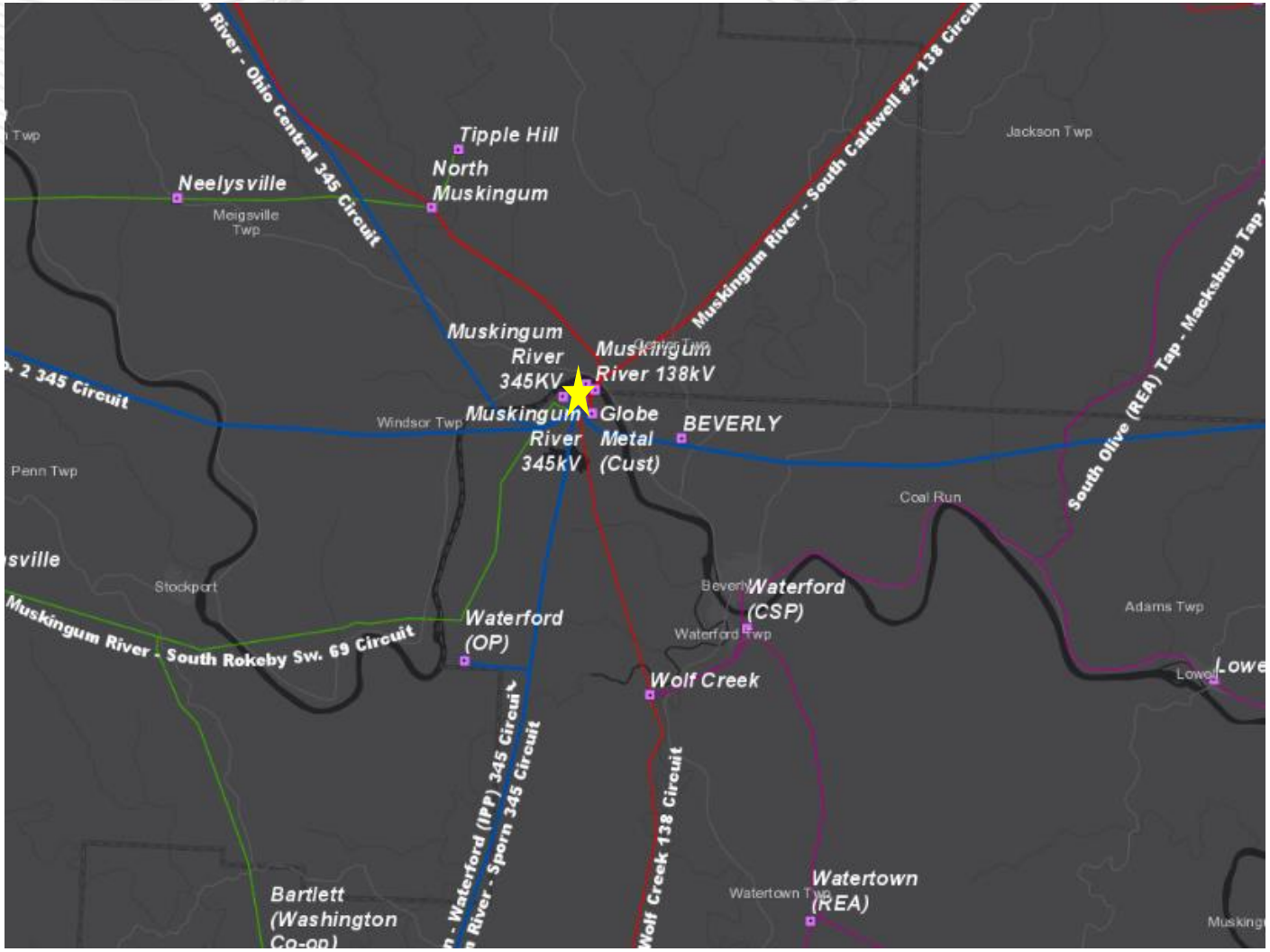
Proposed Solution:

Upgrade 2156 ACSR & 2874 ACSR bus and risers at Muskingum River 345 kV station to address loading issues on Muskingum - Waterford 345 kV line.

Estimated Cost: $0.58M

Alternatives: N/A

Required In-Service: 6/1/2025



AEP Transmission Zone: Baseline
West New Philadelphia station

Process Stage: First Review

Criteria: AEP FERC 715 Criteria

Assumption Reference: 2025 RTEP assumption

Model Used for Analysis: 2025 Summer case and 2025 Winter case

Proposal Window Exclusion: None

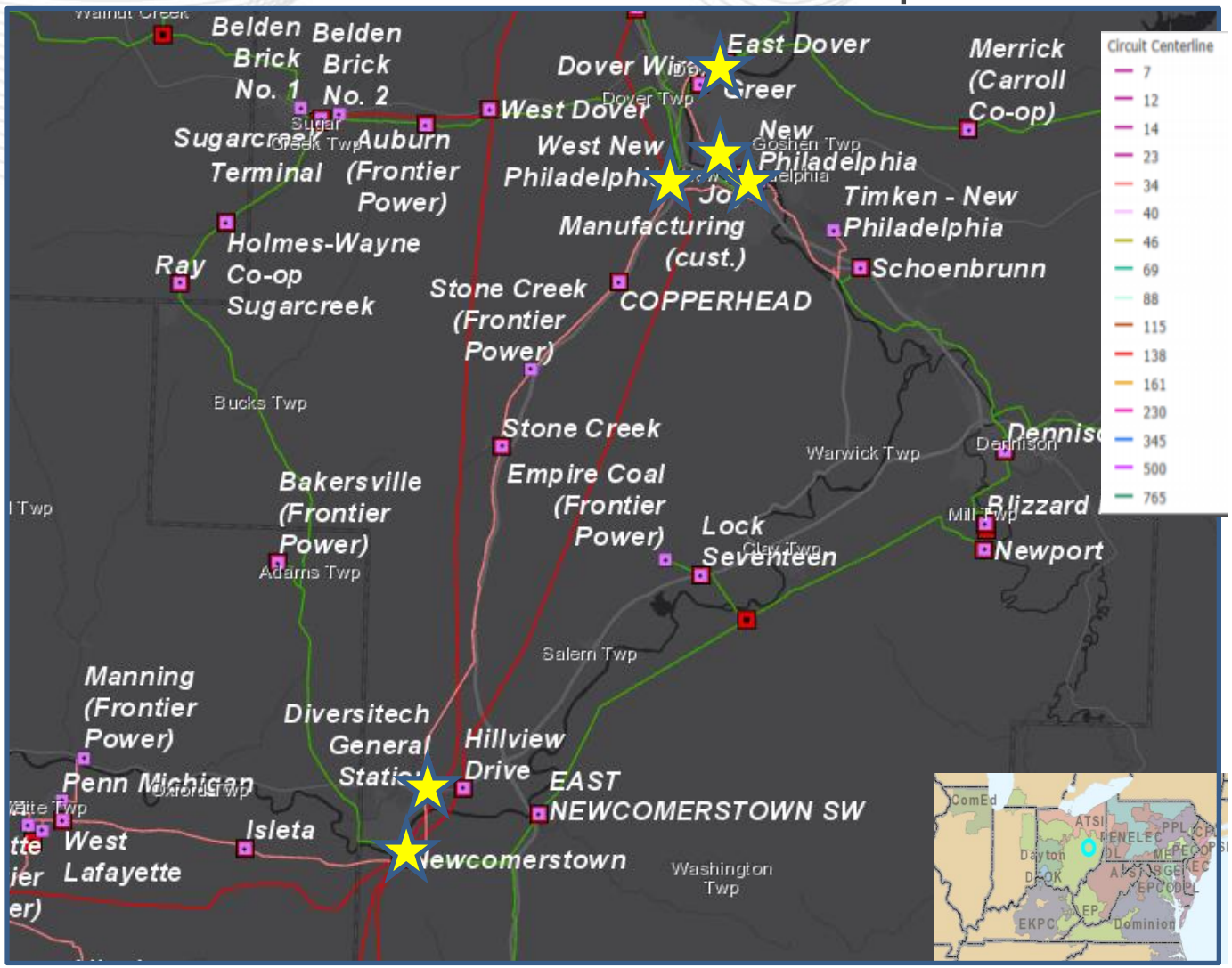
Problem Statement:

AEP-T356,AEP-T357,AEP-T358,AEP-T359,AEP-T360,AEP-T361,AEP-T362,AEP-T363,AEP-T364,AEP-T365

The GEN TIRE-Newcomerstown, The GREENR- MILL ST SS, New Philadelphia – New PHILA 34.5kV and GREERZ – GREER 69KV branches are overloaded for the loss of the West New Philadelphia – Newcomerstown 138kV line with West New Philadelphia 139/69kV transformer and the South Canton - Bolivar – North Intertie 138kV line.

Existing Facility Rating:

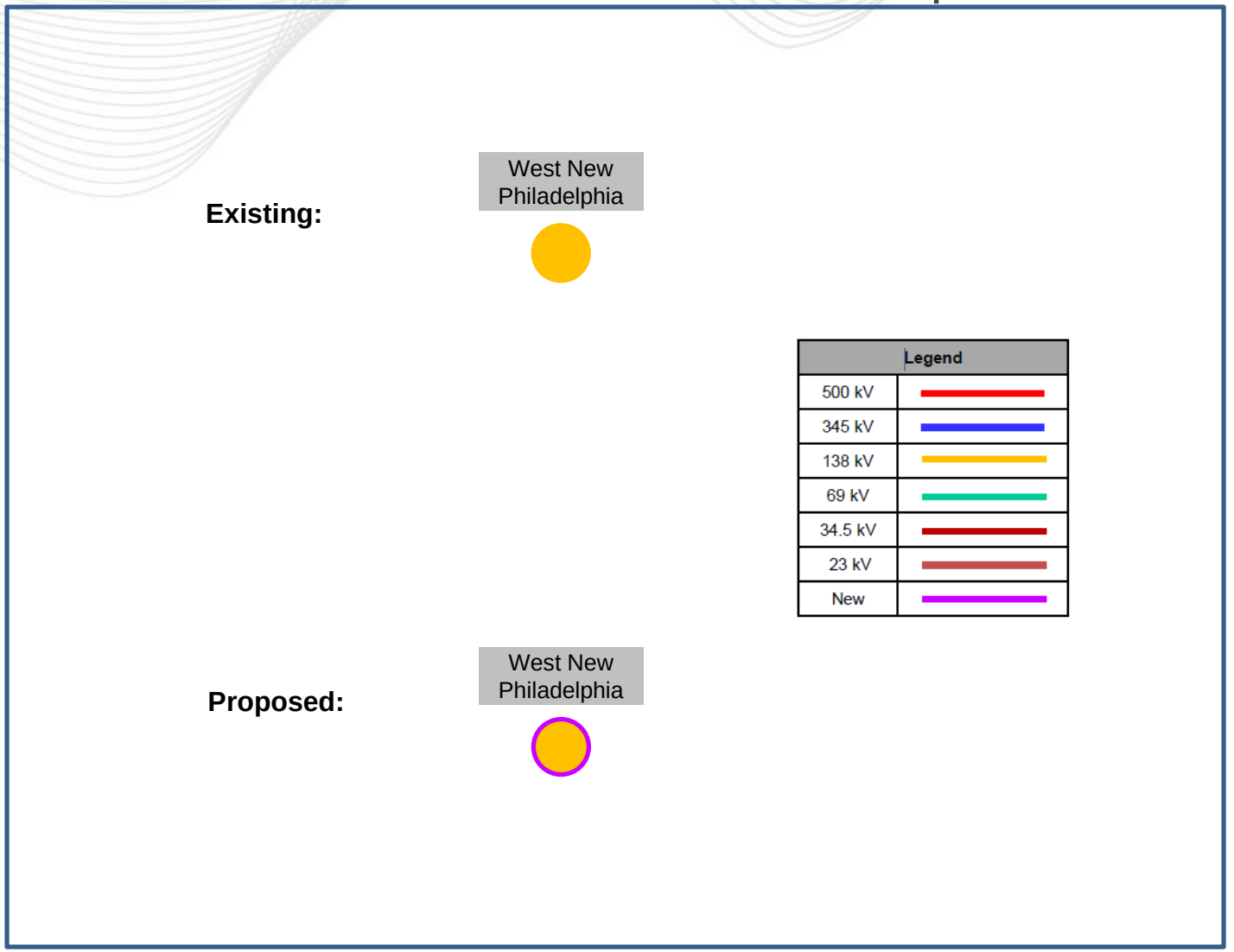
Branches	SN/SE (MVA)	WN/WE (MVA)
The GEN TIRE-Newcomerstown 34.5KV	17/17	24/24
GREENR- MILL ST SS 34.5KV	15/15	22/22
New Philadelphia – New PHILA 34.5kV	23/23	23/23
GREERZ – GREER 69KV	31/31	43/43



AEP Transmission Zone: Baseline
West New Philadelphia station

Proposed Solution:
Proposal #2020_1-179: At West New Philadelphia station, add a high side 138 kV breaker on the 138/69 kV transformer #2 along with a 138 kV breaker on the line towards Newcomerstown.

Estimated Cost: $2.02M



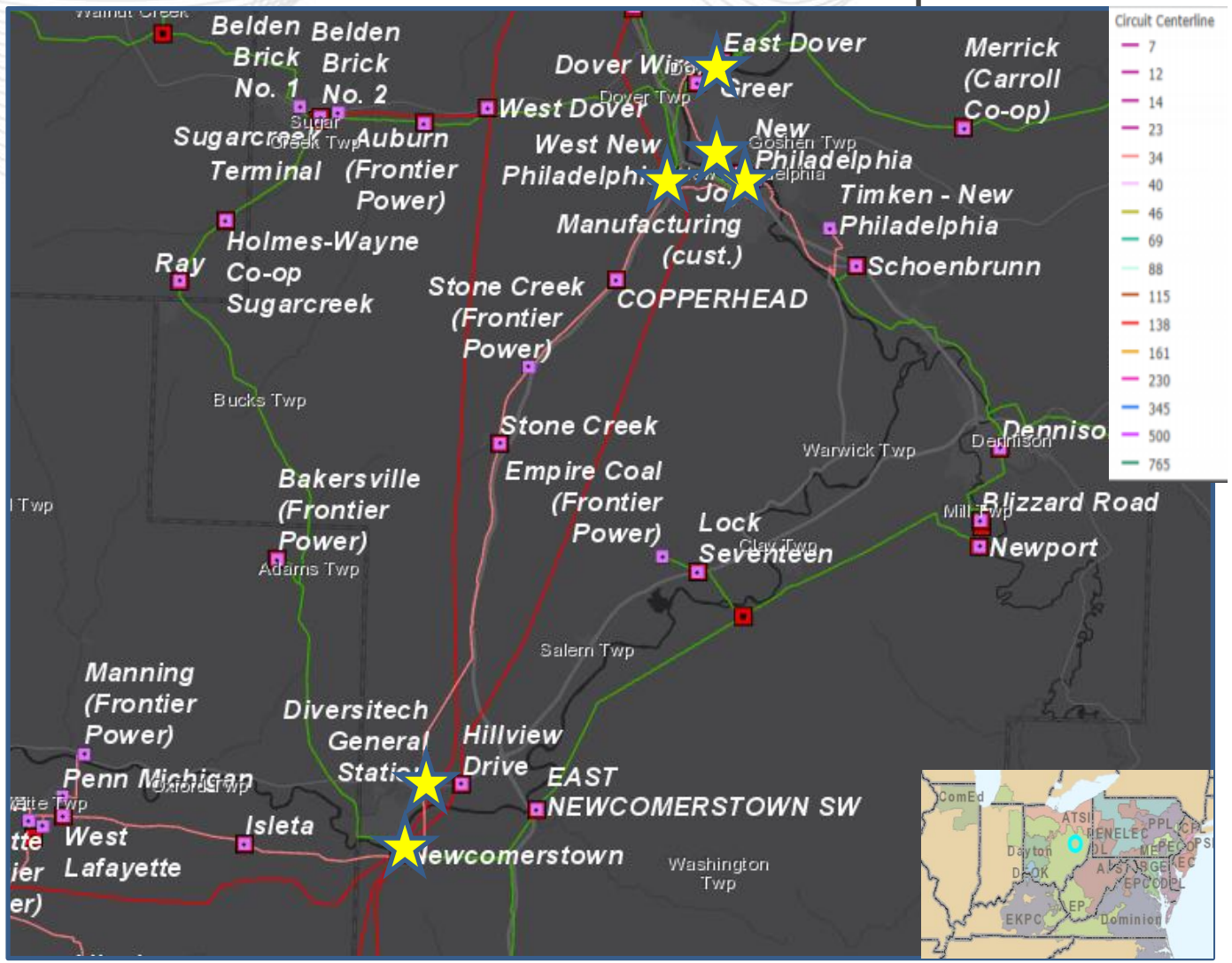
AEP Transmission Zone: Baseline West New Philadelphia station

Additional Benefits: this project also solves FG# AEP-T187,AEP-T189,AEP-T211,AEP-T212,AEP-T352,AEP-T353,AEP-T374,AEP-T375,AEP-T448,AEP-T449, AEP-VM563,AEP-VM564,AEP-VM567,AEP-VM568,AEP-VM627,AEP-VM628,AEP-VM630,AEP-VM631,AEP-VM632,AEP-VM633,AEP-VM634,AEP-VM635,AEP-VM638,AEP-VM639,AEP-VM704,AEP-VM705,AEP-VM707,AEP-VM708,AEP-VM709,AEP-VM710,AEP-VM711,AEP-VM712,AEP-VM713,AEP-VM714,AEP-VM826,AEP-VM827,AEP-VM836,AEP-VM837,AEP-VD632,AEP-VD633,AEP-VD636,AEP-VD637,AEP-VD681,AEP-VD682,AEP-VD703,AEP-VD722,AEP-VD723,AEP-VD724,AEP-VD726,AEP-VD727,AEP-VD732,AEP-VD734,AEP-VD790,AEP-VD791,AEP-VD792,AEP-VD793,AEP-VD794,AEP-VD796,AEP-VD797,AEP-VD798,AEP-VD799,AEP-VD802,AEP-VD1115,AEP-VD1116,AEP-VD1125,AEP-VD1128, which are overload on W.NEW PHIL 138/34.5kV transformer and low voltage magnitude and voltage drop violations at buses W.NEW PHIL 138kV, NINTIE 138kV, COPPERHE 34.5kV, STONECK8 34.5kV, STONE CK 34.5kV, E.MILLSTSS 34.5kV, and GRADALL 34.5kV.

Proposal Window Exclusion: Below 200kV Exclusion

Alternatives: N/A

Required In-Service: 6/1/2025



AEP Transmission Zone: Baseline Dragoon

Process Stage: First Review

Criteria: AEP FERC 715 Criteria

Assumption Reference: 2025 RTEP assumption

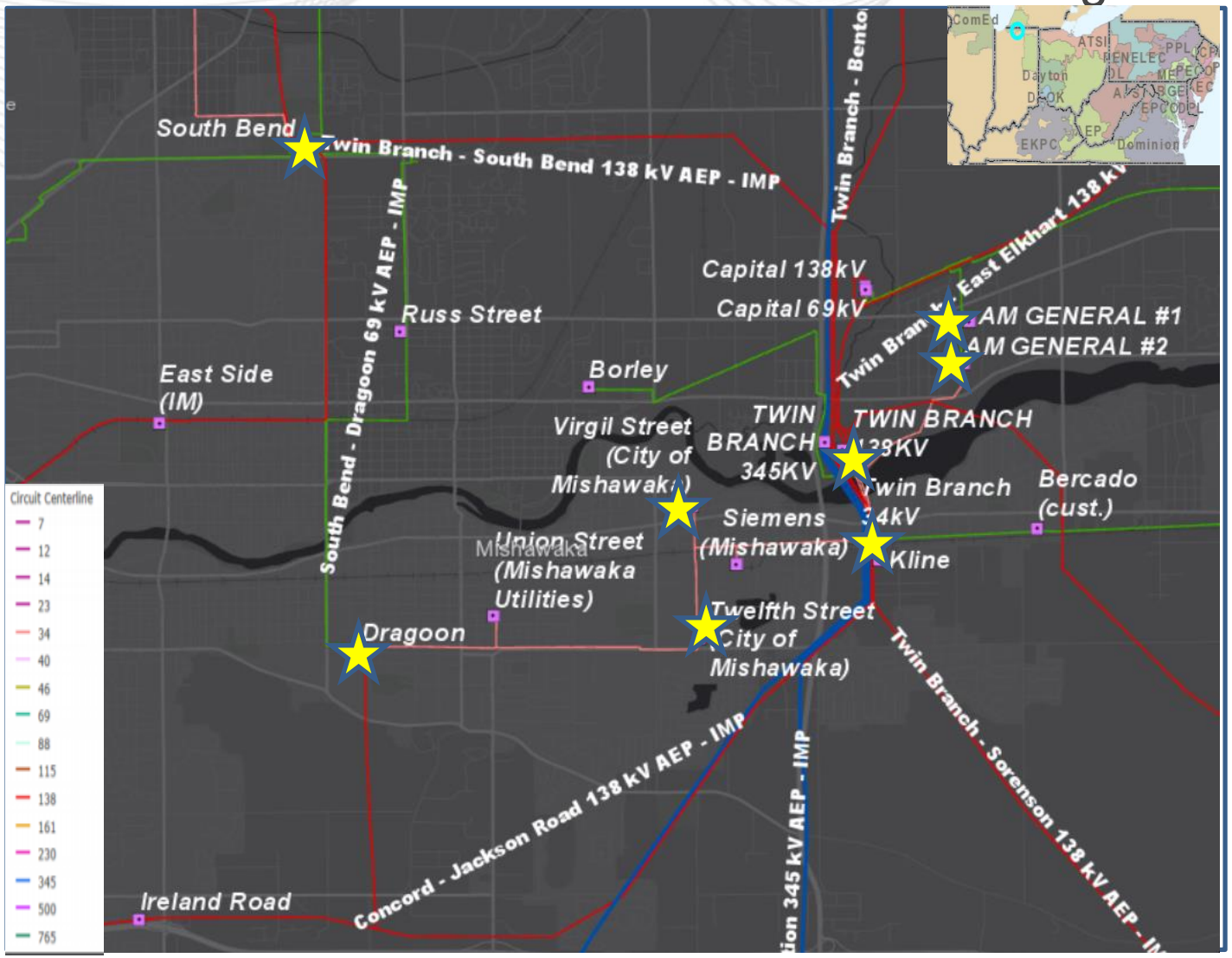
Model Used for Analysis: 2025 Summer case and 2025 Winter case

Proposal Window Exclusion: None

Problem Statement:

AEP-T7,AEP-T8,AEP-T9,AEP-T10,AEP-T11,AEP-T220,AEP-T224,AEP-T235,AEP-T236,AEP-T241,AEP-T242,AEP-T245,AEP-T246,AEP-T247,AEP-T248,AEP-T249,AEP-T254,AEP-T255,AEP-T263,AEP-T264,AEP-T275,AEP-T276,AEP-T282,AEP-T283,AEP-T378,AEP-T379,AEP-T382,AEP-T383,AEP-T386,AEP-T387,AEP-T392,AEP-T393,AEP-T394,AEP-T395,AEP-T396,AEP-T397,AEP-T400,AEP-T401,AEP-T402,AEP-T408,AEP-T411,AEP-T417,AEP-T419,AEP-T420,AEP-T427,AEP-T428,AEP-T435,AEP-T436,AEP-T439,AEP-T440,AEP-T441,AEP-T461,AEP-T462,AEP-T463,AEP-T465

The AM General #2– AM General #1, AM General #2– Twin Branch2, Beiger – Virgil S, BEIGER-Kline, CAP AV – AM General #1, Dodge SS -12th St, 12th ST – Virgil, Dragoon – Railroad, Grape Rd – South Bend 34.5kV lines and Kline and South Ben 138/69/34.5 kV transformers are overloaded for multiple N-1-1 contingency pairs.



AEP Transmission Zone: Baseline Dragoon

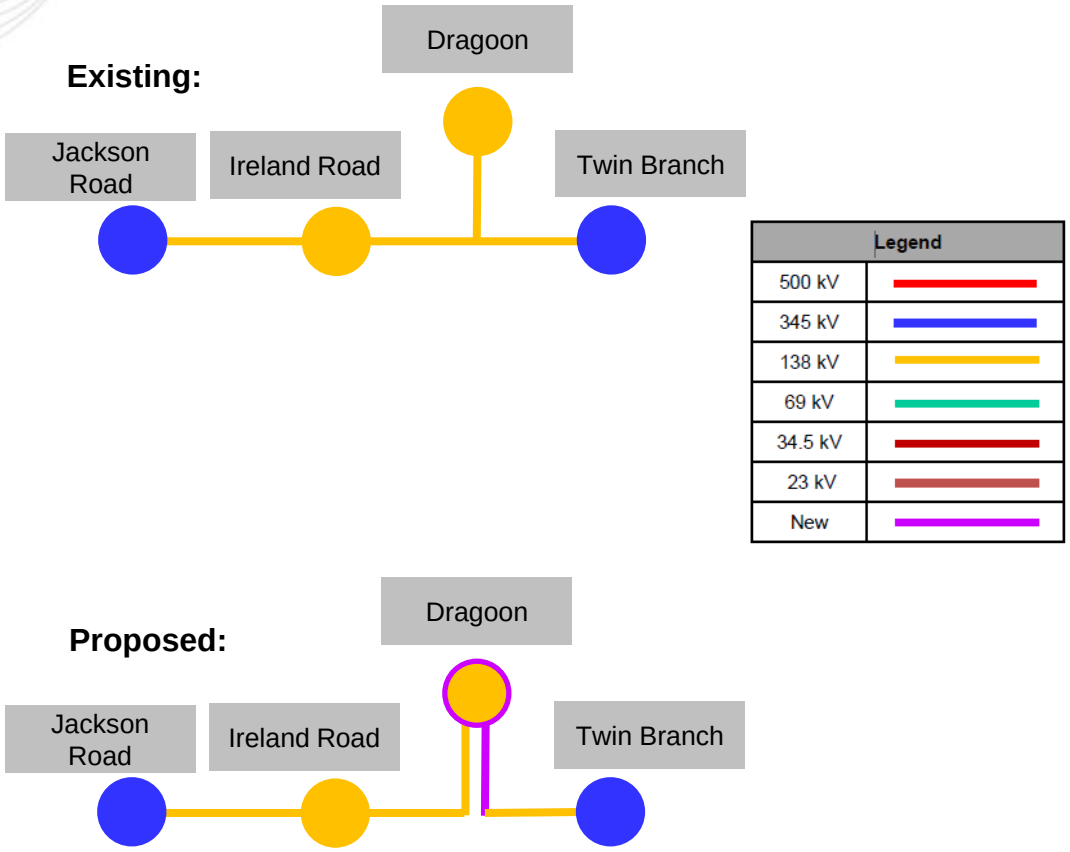
Existing Facility Rating:

Branches	SN/SE (MVA)	WN/WE (MVA)
05AM GENRL_2 -05AM GENRL_1 34.5KV	55/62	69/76
05AM GENRL_2 - 05TWIN BRCH2 34.5KV	55/62	69/76
05BEIGER - 05VIRGIL S 34.5KV	76/76	98/98
05BEIGER - 05KLINE 34.5KV	76/76	98/98
05CAP AV - 05AM GENRL_1 34.5KV	62/62	78/78
05DODGE SS - 0512TH ST 34.5KV	41/45	53/57
05DRAGOON - 05RAILROAD 34.5KV	56/56	70/70
05GRAPE RD -05SOUTHBEN 34.5KV	62/62	78/78
05VIRGIL S - 0512TH ST 34.5KV	41/45	53/57
05KLINE (138/69/34.5KV)	60/60	60/60
05SOUTHBEN (138/69/34.5KV)	55/55	55/55

Proposed Solution:

Proposal #2020_1-308: Install 1.7 miles of 795 ASCR 138kV conductor along the other side of Dragoon Tap 138 kV line, which is currently double circuit tower with one position open. Additionally, install a 2nd 138/69/34.5kV transformer at Dragoon, install a high side circuit switcher on the current transformer at Dragoon Station, and install 2-138kV line breakers on the Dragoon-Jackson 138kV and Dragoon-Twin Branch 138kV lines. The Dragoon-Jackson 138kV branch ratings will be (219/251/277/303). The Dragoon-Twin Branch 138kV ratings will be(219/251/277/303).

Estimated Cost: $4.894M



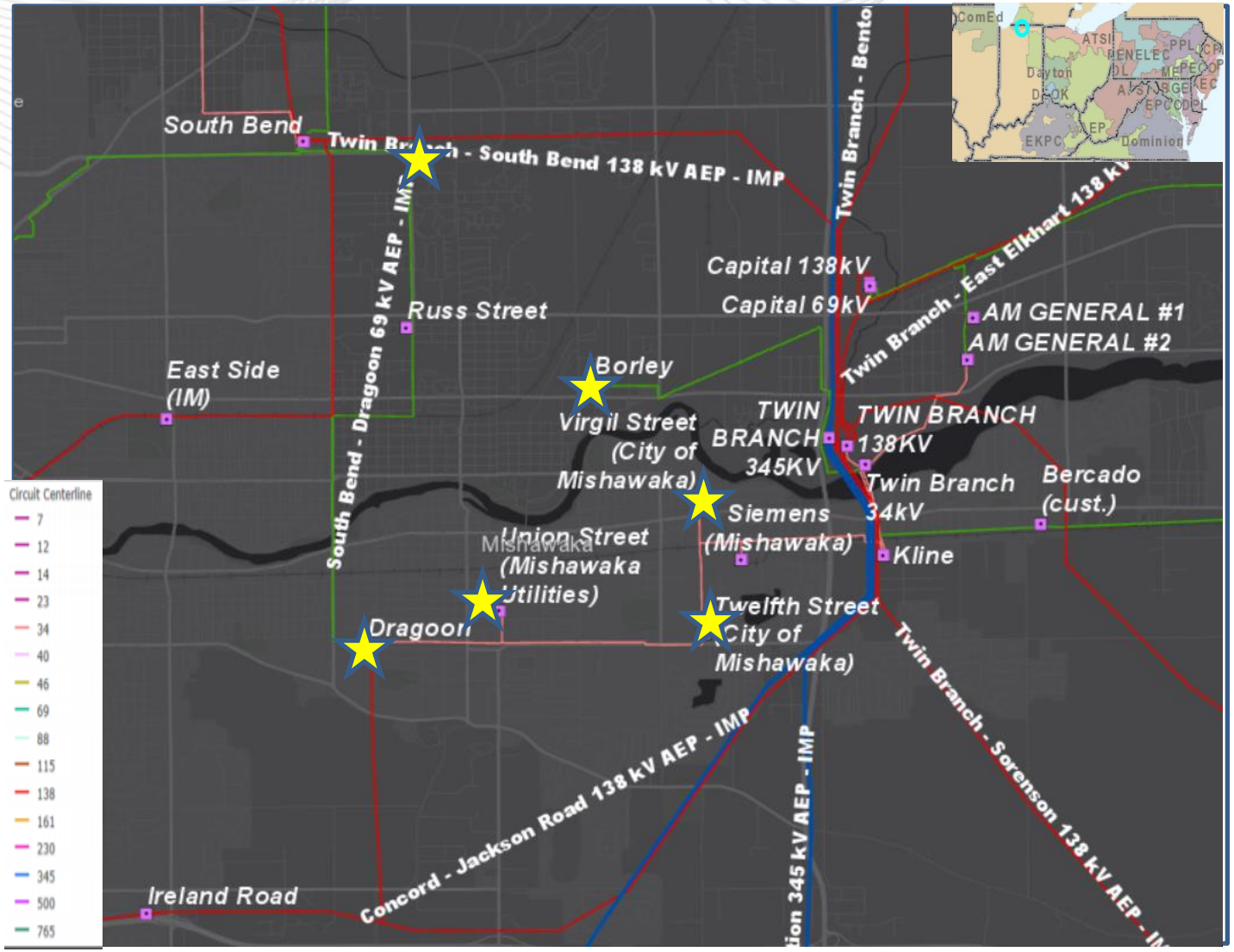
AEP Transmission Zone: Baseline Dragoon

Additional Benefits: this project also solves FG# AEP-VM623,AEP-VM624,AEP-VM625,AEP-VM626,AEP-VM629,AEP-VM636,AEP-VM637,AEP-VM641,AEP-VM642,AEP-VM643,AEP-VM644,AEP-VM678,AEP-VM680,AEP-VM684,AEP-VM685,AEP-VM686,AEP-VM687,AEP-VM688,AEP-VM689,AEP-VM690,AEP-VM691,AEP-VM692,AEP-VM693,AEP-VM694,AEP-VM695,AEP-VM696,AEP-VM697,AEP-VM698,AEP-VM699,AEP-VM706,AEP-VM715,AEP-VM716,AEP-VM717,AEP-VM718,AEP-VM719,AEP-VM720,AEP-VM731,AEP-VM749,AEP-VM750,AEP-VM751,AEP-VM752,AEP-VM753,AEP-VM754,AEP-VM755,AEP-VM756,AEP-VM757,AEP-VM758,AEP-VM759,AEP-VM760,AEP-VM765,AEP-VM766,AEP-VM767,AEP-VM768,AEP-VM769,AEP-VM770,AEP-VM771,AEP-VM772,AEP-VM773,AEP-VM774,AEP-VM775,AEP-VM776,AEP-VM777,AEP-VM778,AEP-VM779,AEP-VM780,AEP-VM781,AEP-VM782,AEP-VM784,AEP-VM785,AEP-VM786,AEP-VM787,AEP-VM788,AEP-VM793,AEP-VM794,AEP-VM795,AEP-VM797,AEP-VM798,AEP-VM799,AEP-VD684,AEP-VD700,AEP-VD701,AEP-VD725,AEP-VD728,AEP-VD729,AEP-VD730,AEP-VD731,AEP-VD733,AEP-VD735,AEP-VD736,AEP-VD737,AEP-VD755,AEP-VD770,AEP-VD776,AEP-VD777,AEP-VD781,AEP-VD795,AEP-VD800,AEP-VD801,AEP-VD810,AEP-VD811,AEP-VD863,AEP-VD868,AEP-VD869,AEP-VD872,AEP-VD891,AEP-VD893,AEP-VD956,AEP-VD962,AEP-VD963,AEP-VD964,AEP-VD965,AEP-VD966,AEP-VD967,AEP-VD968,AEP-VD969,AEP-VD970, AEP-VM783, AEP-VM796 which are voltage magnitude and voltage drop violations at buses 12TH ST 34.5kV, BEIGER 34.5kV, BORLEY 34.5kV, GRAPE RD 34.5kV, LOGAN ST 34.5kV, MILES MISH 34.5KV, RAILROAD 34.5kV, RUSS ST 34.5KV, UNION 34.5kV, VIRGIL S 34.5KV.

Proposal Window Exclusion: Below 200kV Exclusion

Alternatives: N/A

Required In-Service: 6/1/2025



AEP Transmission Zone: Baseline Fremont

Process Stage: First Review

Criteria: AEP FERC 715 Criteria

Assumption Reference: 2025 RTEP assumption

Model Used for Analysis: 2025 Summer case and 2025 Winter case

Proposal Window Exclusion: None

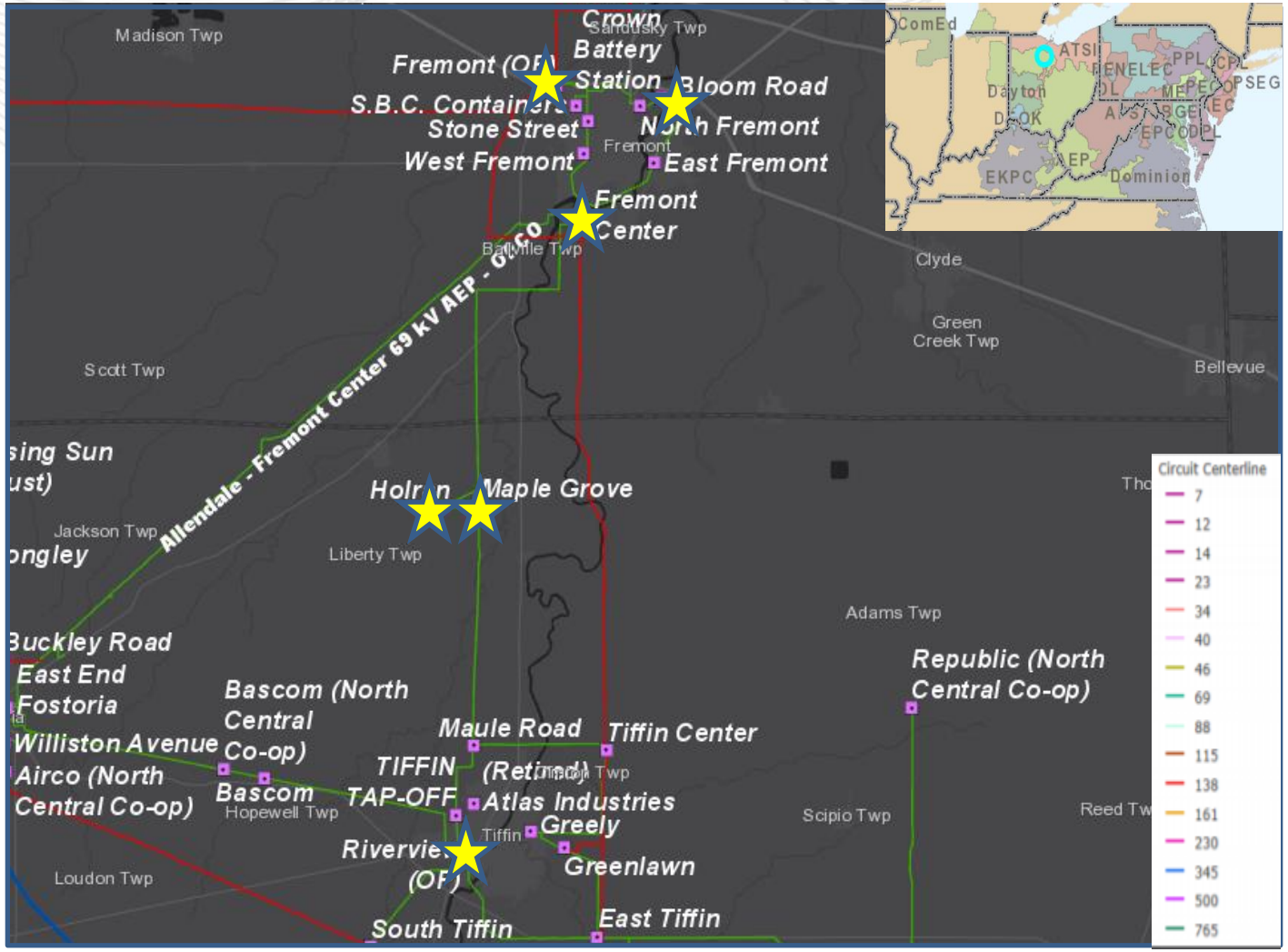
Problem Statement:

AEP-T168, AEP-T169, AEP-T170

The Fremont Center – Holran - Maple GR – Riverview 69kV lines are overloaded for AEP_P4_#7728_05FREMCT 138_C (loss of Fremont Center –Tiffin 138kV line, West Fremont – Fremont – Fremont Center 138kV line, Fremont 138/69/12KV transformer, Fremont Center 138/69KV transformer and Fremont Center 138kV switching shunt).

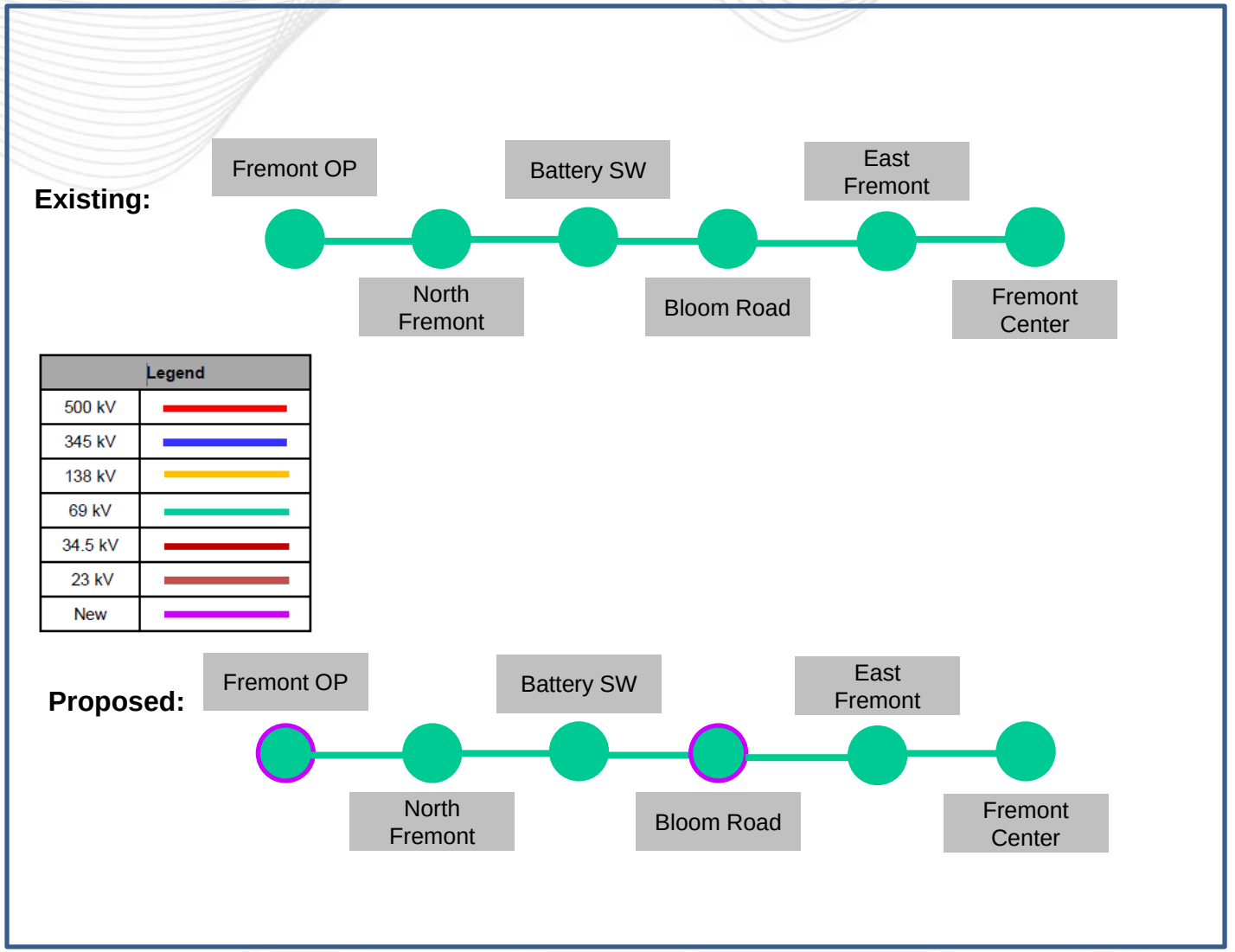
Existing Facility Rating:

	SN/SE (MVA)	WN/WE (MVA)
05MAPLE GR - 05RIVERVIE 69KV	31/31	43/43
05MAPLE GR - 05HOLRAN 69KV	31/31	43/43
05HOLRAN - 05FREMNT C 69kV	31/31	43/43



AEP Transmission Zone: Baseline Fremont

Proposed Solution:
Proposal #2020_1-503: Install a 138 kV circuit breaker at Fremont station on line towards Fremont Center and install a 9.6 MVAR 69 kV capacitor bank at Bloom Road station.
Estimated Cost: $1.758M



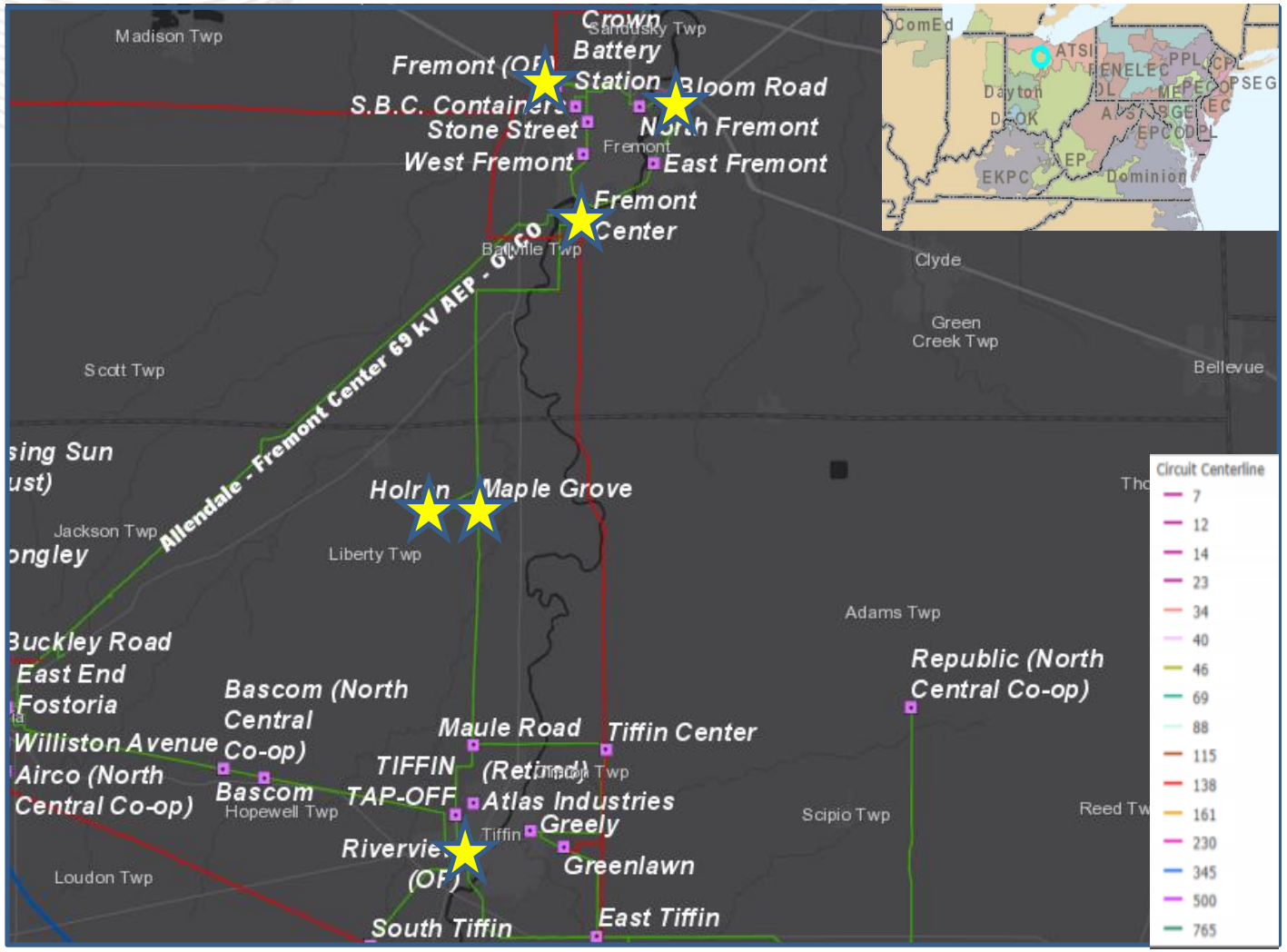
AEP Transmission Zone: Baseline Fremont

Additional Benefits: this project also solves FG# ,AEP-VM551,AEP-VM552,AEP-VM571,AEP-VM572,AEP-VM573,AEP-VM574,AEP-VM575,AEP-VM576,AEP-VM577,AEP-VM578,AEP-VM579,AEP-VM580,AEP-VM581,AEP-VM582,AEP-VM583,AEP-VM584,AEP-VM585,AEP-VM586,AEP-VM587,AEP-VM588,AEP-VM589,AEP-VM590,AEP-VM591,AEP-VM592,AEP-VM593,AEP-VM594,AEP-VM595,AEP-VM596,AEP-VM597,AEP-VM598,AEP-VM599,AEP-VM600,AEP-VM601,AEP-VM602,AEP-VM603,AEP-VM604,AEP-VM605,AEP-VM606,AEP-VM607,AEP-VM608,AEP-VM609,AEP-VM610,AEP-VM611,AEP-VM612,AEP-VM613,AEP-VM614,AEP-VM615,AEP-VM616,AEP-VM617,AEP-VM618,AEP-VM619,AEP-VM620,AEP-VM621,AEP-VM622,AEP-VM804,AEP-VM805,AEP-VM806,AEP-VM807,AEP-VD581,AEP-VD582,AEP-VD618,AEP-VD640,AEP-VD641,AEP-VD642,AEP-VD643,AEP-VD644,AEP-VD645,AEP-VD646,AEP-VD647,AEP-VD648,AEP-VD649,AEP-VD650,AEP-VD651,AEP-VD652,AEP-VD653,AEP-VD654,AEP-VD655,AEP-VD656,AEP-VD657,AEP-VD904,AEP-VD905,AEP-VD906,AEP-VD907,AEP-VD984,AEP-VD985,AEP-VD986,AEP-VD987,AEP-VD988,AEP-VD989,AEP-VD990,AEP-VD991,AEP-VD992,AEP-VD993,AEP-VD1046,AEP-VD1047,AEP-VD1048,AEP-VD1049,AEP-VD1050,AEP-VD1051,AEP-VD1098,AEP-VD1099 which are voltage magnitude and drop violations at buses BATTERY SS 69kV, BLOOM RD 69KV, CLYDE 69kV, E FREMON 69KV, FREMNT C 69KV, HOLRAN 69kV, MAPLE GR 69kV, N FREMON 69KV, SBC COUNT 69kV, STONE ST 69kV and W. FREMONT 69kV.

Proposal Window Exclusion: Below 200kV Exclusion

Alternatives: N/A

Required In-Service: 6/1/2025



AEP Transmission Zone: Baseline Rockhill

Process Stage: First Review

Criteria: AEP FERC 715 Criteria

Assumption Reference: 2025 RTEP assumption

Model Used for Analysis: 2025 Summer case and 2025 Winter case

Proposal Window Exclusion: None

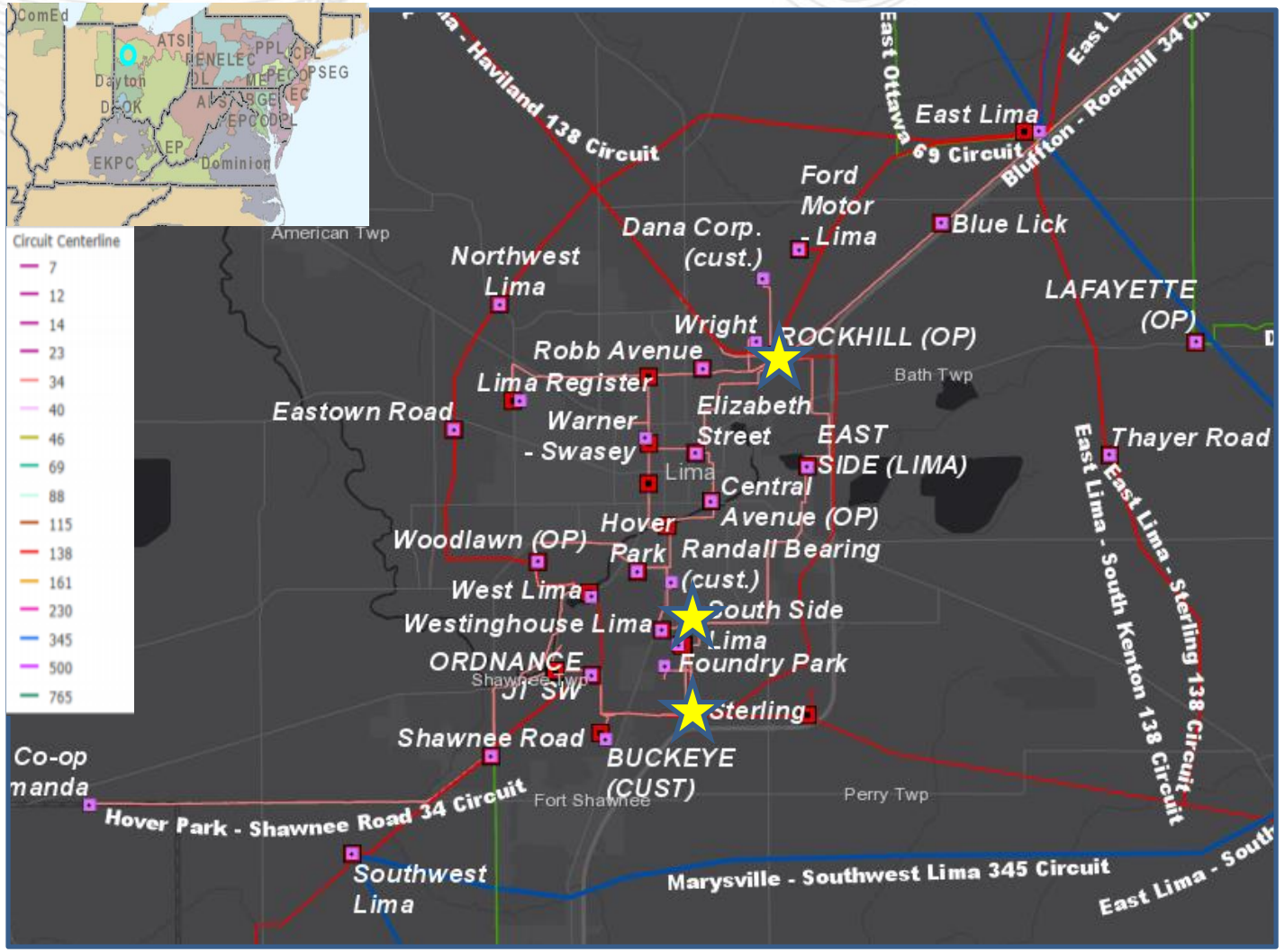
Problem Statement:

AEP-T281,AEP-T284,AEP-T285,AEP-T286,AEP-T287,AEP-T288,AEP-T289,AEP-T290,AEP-T291,AEP-T292,AEP-T293,AEP-T298

The Days Inn - Rockhill, Days Inn – South Side, Exc&L PM – South Side, Exc&L PM – Sterling1 34.5kV lines are overloaded for AEP_P1-3_#12222_05ROCKHILL2 138_1-2 (the loss of East Lima – Rockhill – Eastow 138kV line and Rockhill 138/34.5kV transformers 1&2) and AEP_P1-2_#5226_2061 (The loss of East Lima – Ford Lima2 13kV line)

Existing Facility Rating:

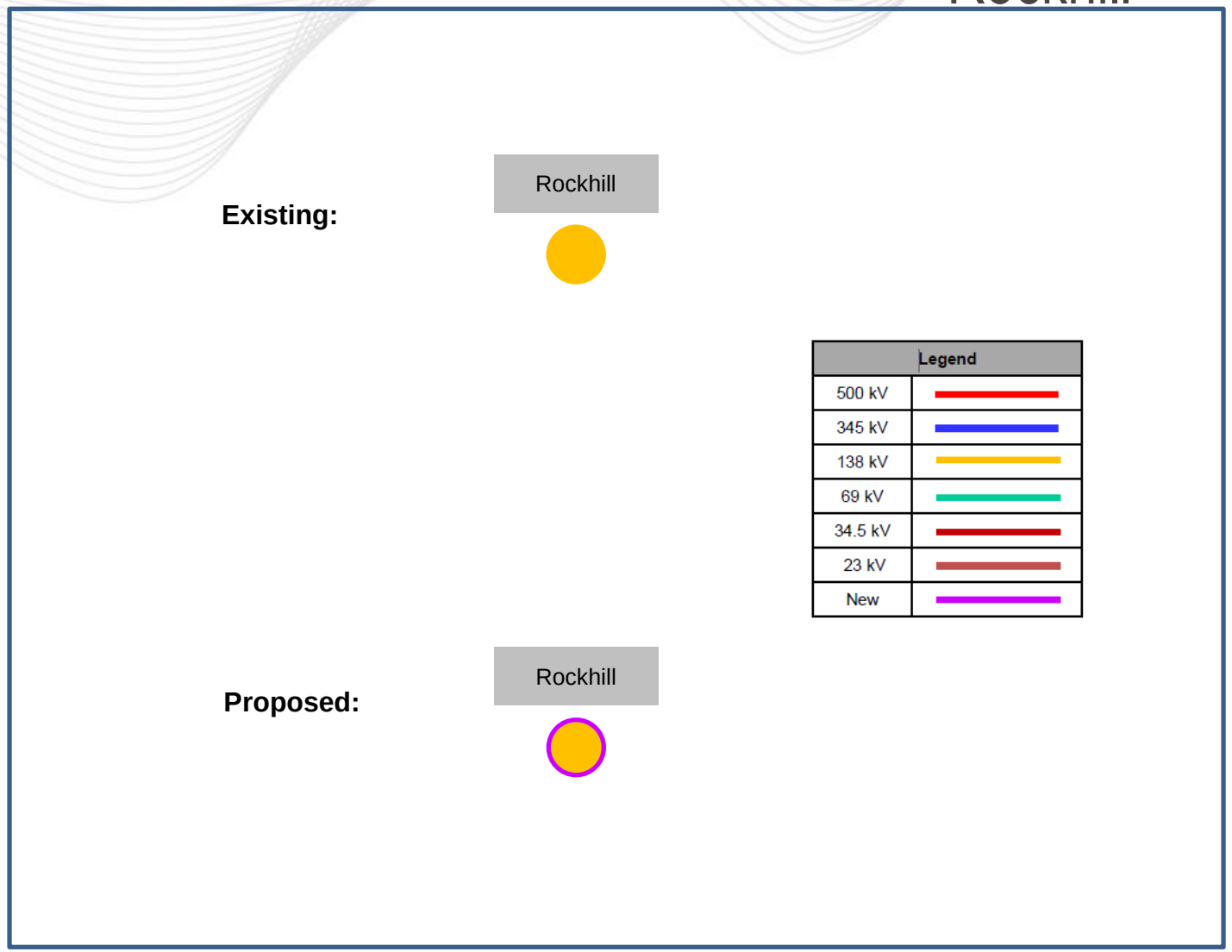
Branches	SN/SE (MVA)	WN/WE (MVA)
05DAYS INN - 05ROCKHILL 34.5kV	27/27	38/38
05DAYS INN - 05S SIDE 34.5kV	27/27	38/38
05S SIDE - 05EXC&L PM 34.5kV	34/43	45/51
05EXC&L PM - 05STERLING1 34.5KV	41/45	53/57



AEP Transmission Zone: Baseline Rockhill

Proposed Solution:
Proposal #2020_1-848: Install two 138 kV circuit switchers on the high side of 138/34.5 kV transformers #1 & #2 at Rockhill station.

Estimated Cost: $1.471M



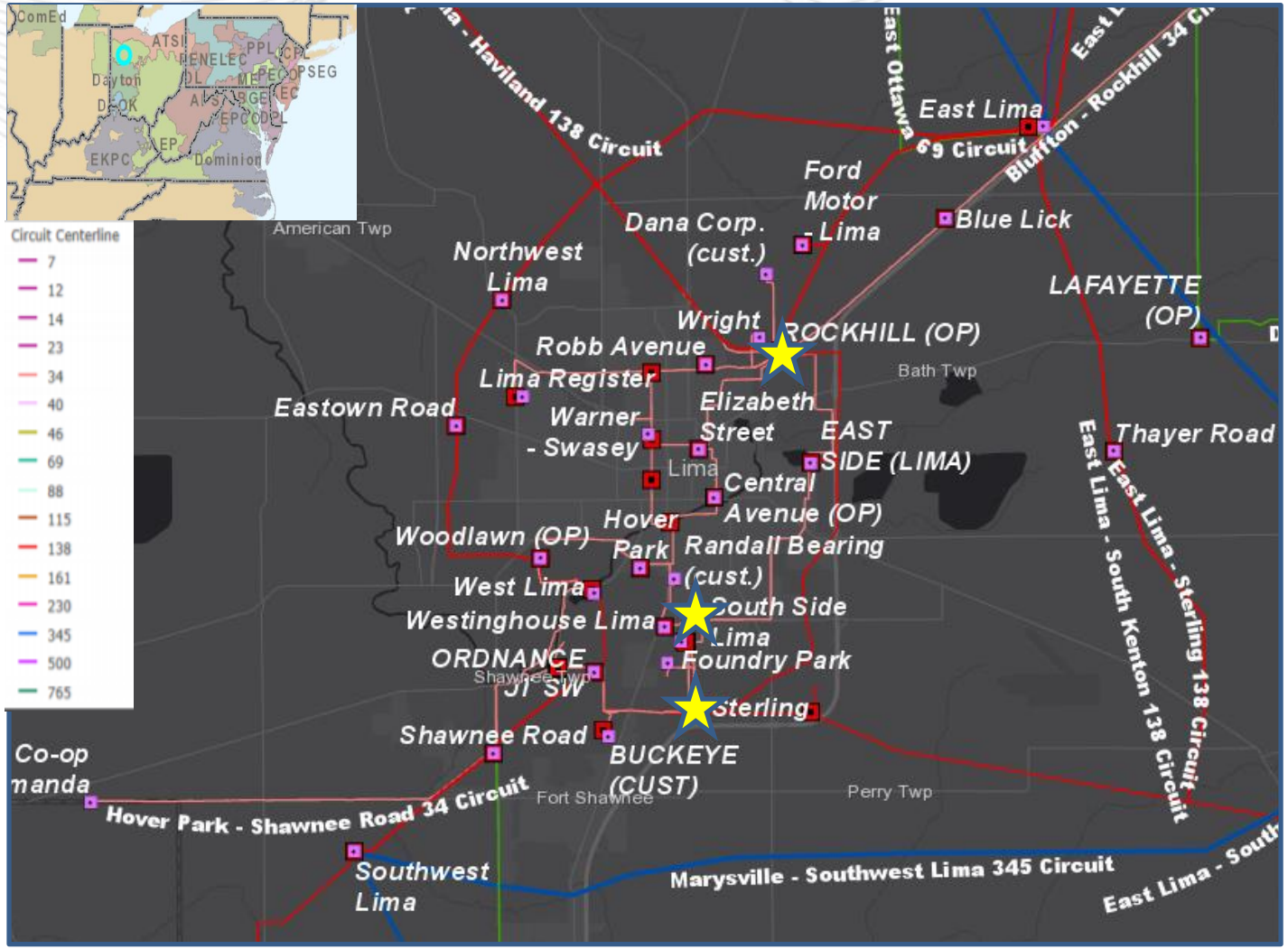
AEP Transmission Zone: Baseline Rockhill

Additional Benefits: this project also solves FG# AEP-T267,AEP-T268,AEP-T412,AEP-T416, AEP-VM553,AEP-VM554,AEP-VM559,AEP-VM560,AEP-VM565,AEP-VM566,AEP-VM569,AEP-VM570,AEP-VM640,AEP-VM645,AEP-VM646,AEP-VM647,AEP-VM648,AEP-VM649,AEP-VM650,AEP-VM651,AEP-VM652,AEP-VM657,AEP-VM662,AEP-VM663,AEP-VM672,AEP-VM673,AEP-VM676,AEP-VM677,AEP-VM679,AEP-VM681,AEP-VM682,AEP-VM683,AEP-VM729,AEP-VM730,AEP-VM732,AEP-VM733,AEP-VM734,AEP-VM735,AEP-VM736,AEP-VM737,AEP-VM738,AEP-VM739,AEP-VM745,AEP-VM746,AEP-VM747,AEP-VM748,AEP-VM761,AEP-VM762,AEP-VM763,AEP-VM764,AEP-VM800,AEP-VM803,AEP-VM832,AEP-VM833,AEP-VM834,AEP-VM835,AEP-VM842,AEP-VM843,AEP-VM844,AEP-VM845,AEP-VD602,AEP-VD605,AEP-VD610,AEP-VD612,AEP-VD634,AEP-VD635,AEP-VD638,AEP-VD639,AEP-VD748,AEP-VD749,AEP-VD750,AEP-VD751,AEP-VD752,AEP-VD756,AEP-VD757,AEP-VD758,AEP-VD759,AEP-VD760,AEP-VD762,AEP-VD766,AEP-VD771,AEP-VD774,AEP-VD778,AEP-VD779,AEP-VD780,AEP-VD782,AEP-VD783,AEP-VD784,AEP-VD787,AEP-VD816,AEP-VD817,AEP-VD818,AEP-VD819,AEP-VD820,AEP-VD833,AEP-VD835,AEP-VD838,AEP-VD840,AEP-VD843,AEP-VD859,AEP-VD864,AEP-VD870,AEP-VD873,AEP-VD883,AEP-VD884,AEP-VD885,AEP-VD892,AEP-VD895,AEP-VD896,AEP-VD899,AEP-VD902,AEP-VD903,AEP-VD909,AEP-VD1121,AEP-VD1122,AEP-VD1123,AEP-VD1124,AEP-VD1131,AEP-VD1132,AEP-VD1133,AEP-VD1134, which are overloads on the EXC&L PM- S SIDE 34.5kV line and the EXC&L PM- STERLING1 34.5kV line, and voltage magnitude and/or drop violations at buses BLUELICKSS 34.5kV, CEN AVE 34.5KV, DANA COR 34.5kV, DAYS INN 34.5kV, ELIZABET 34.5kV, JONES CT 34.5kV, MILCORSS 34.5kV, ROBB AVE 34.5kV, ROCKHILL 34.5KV, ST RITA 34.5kV, SUP META 34.5kV, WRIGHT 34.5kV, FORD LIMA1 138kV, FORD LIMA2 138kV, and ROCKHILL1 138kV.

Proposal Window Exclusion: Below 200kV Exclusion

Alternatives: N/A

Required In-Service: 6/1/2025



Dominion Transmission Zone: Baseline Manassas Area

Process Stage: First Review

Criteria: N-1-1 Load Drop (Summer and Winter), 300 MW Load Loss

Assumption Reference: 2025 RTEP assumption

Model Used for Analysis: 2025 RTEP Summer & Winter cases

Proposal Window Exclusion: Immediate Need

Problem Statement:

- Various load drop violations in the Manassas area greater than 300 MW:
  - The loss of 230kV Line #2195 Cannon Branch-Winters Branch and 230kV Line #2196 Pioneer-Sandlot (N2-SLD5, N2-WLD2).
  - The loss of 230kV Line # 2195 Cannon Branch-Winters Branch and 230kV Line #2148 Cloverhill-Sandlot (N2-SLD6, N2-WLD3).
  - The loss of 230kV Line #2195 Cannon Branch-Winters Branch and 230kV Line #2187 Liberty-Pioneer (N2-SLD7 , N2-WLD1).
  - The loss of 230kV Line#2011 Cannon Branch-Liberty and 230kV Line #2187 Liberty-Pioneer (N2-SLD10, N2-WLD6).

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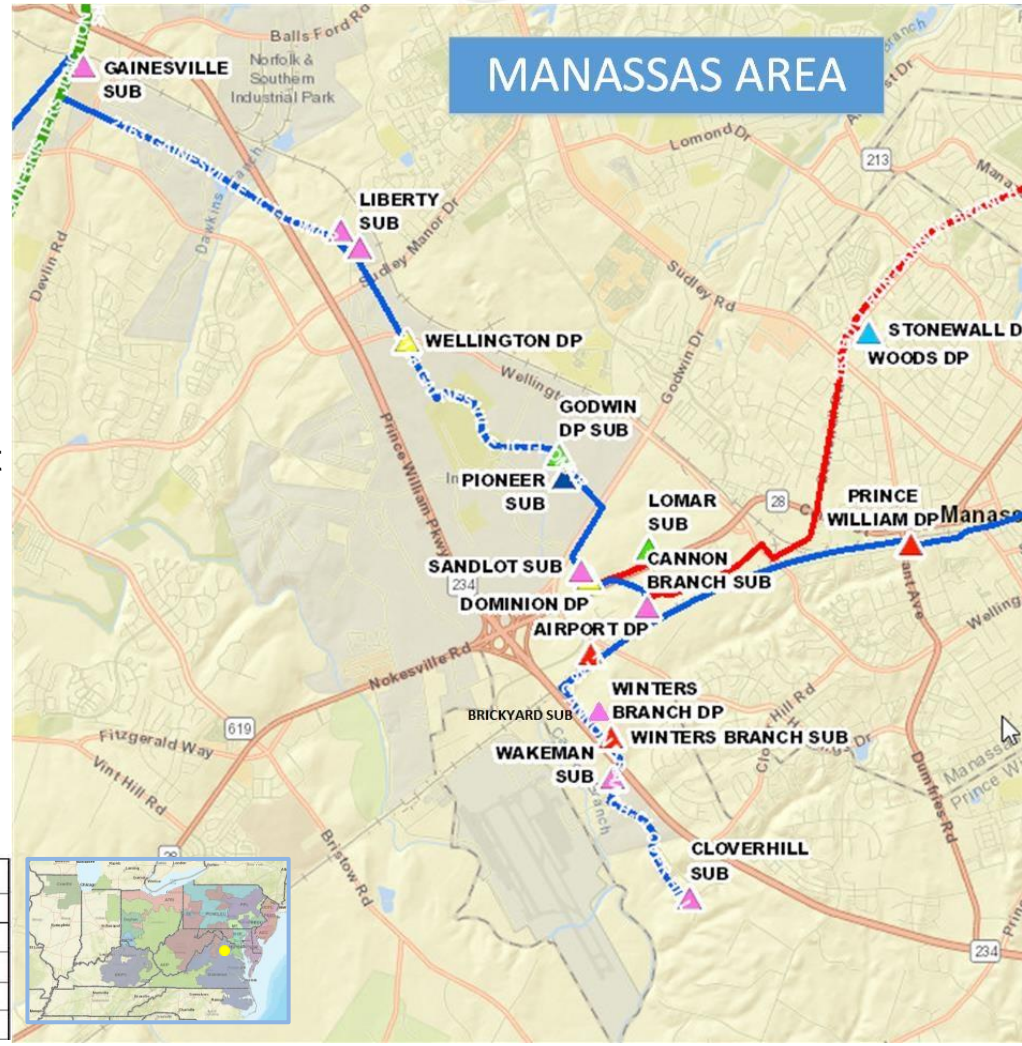


COLOR	VOLTAGE	TRANSMISSION LINE NUMBER
	500 KV.	500 thru 599
	230 KV.	200 thru 299 & 2000 thru 2099
	115 KV.	1 thru 199
	138 KV.	AS NOTED
	69 KV.	AS NOTED

Dominion Transmission Zone: Baseline Manassas Area

Proposed Solution:
Convert 115kV Line #172 Liberty-Lomar and Line#197 Cannon Branch-Lomar to 230kV to provide a new 230kV source between Cannon Branch and Liberty. The majority of Line #172 Liberty-Lomar and Line #197 Cannon Branch-Lomar is adequate for 230kV operation. A wreck and rebuild will be required on 0.36 mile segment of line between Lomar and Cannon Branch junction. Substation work will be required at Liberty, Wellington, Godwin, Pioneer, Sandlot, Cannon Branch, Brickyard, and Winters Branch.

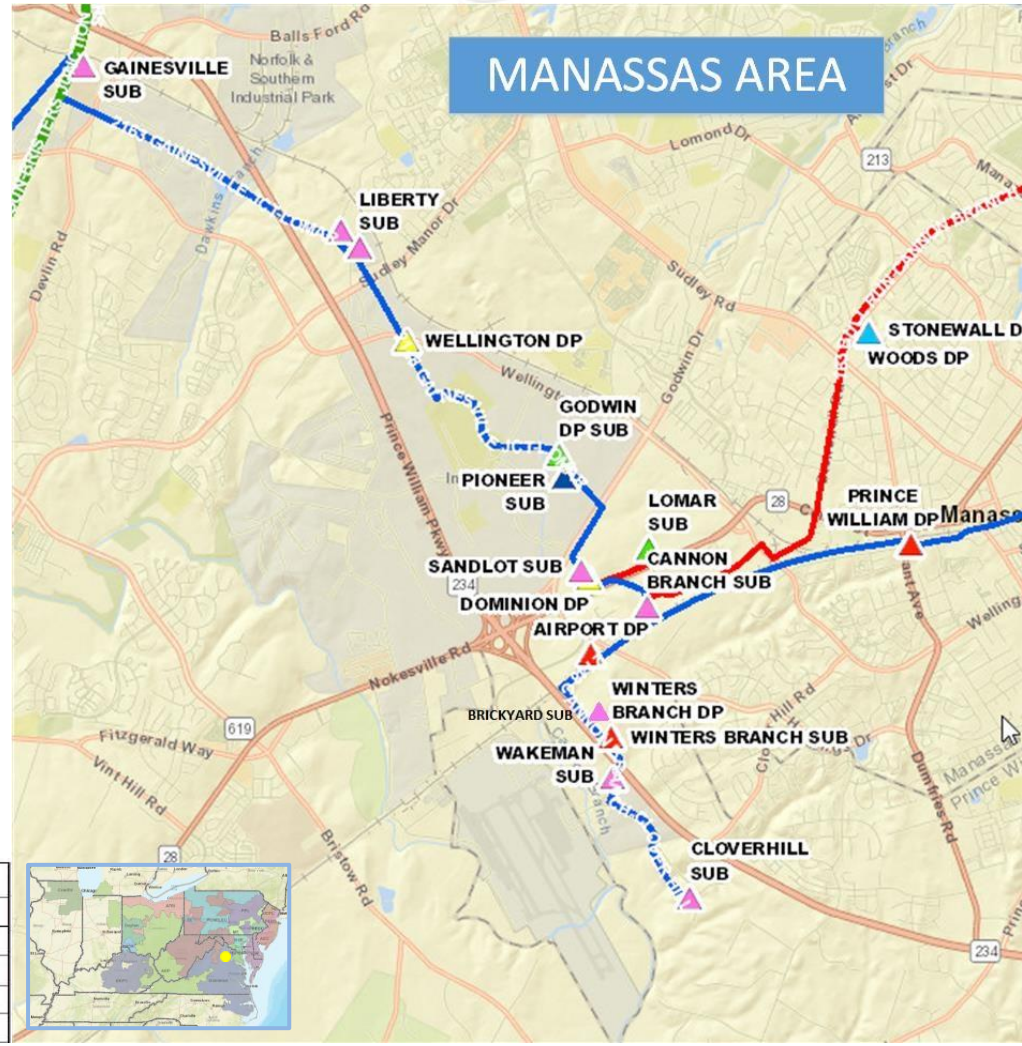
Extend Line #2011 Cannon Branch – Clifton to Winters Branch by removing the existing Line #2011 termination at Cannon Branch and extending the line to Brickyard creating Line #2011 Brickyard-Clifton and extending a new line between Brickyard and Winters Branch. Substation work will be required at Cannon Branch, Brickyard, and Winters Branch.

Estimated Cost: $45.0 M

- 115kV to 230kV Line Conversion: $ 10 M
- Substation Work for 115kV to 230kV Line Conversion: $ 21 M
- 230kV Line #2011 Extension: $ 10 M
- 230kV Line #2011 Substation Work for Extension: $ 4 M

Alternatives: N/A

Required In-Service: 12/1/2023



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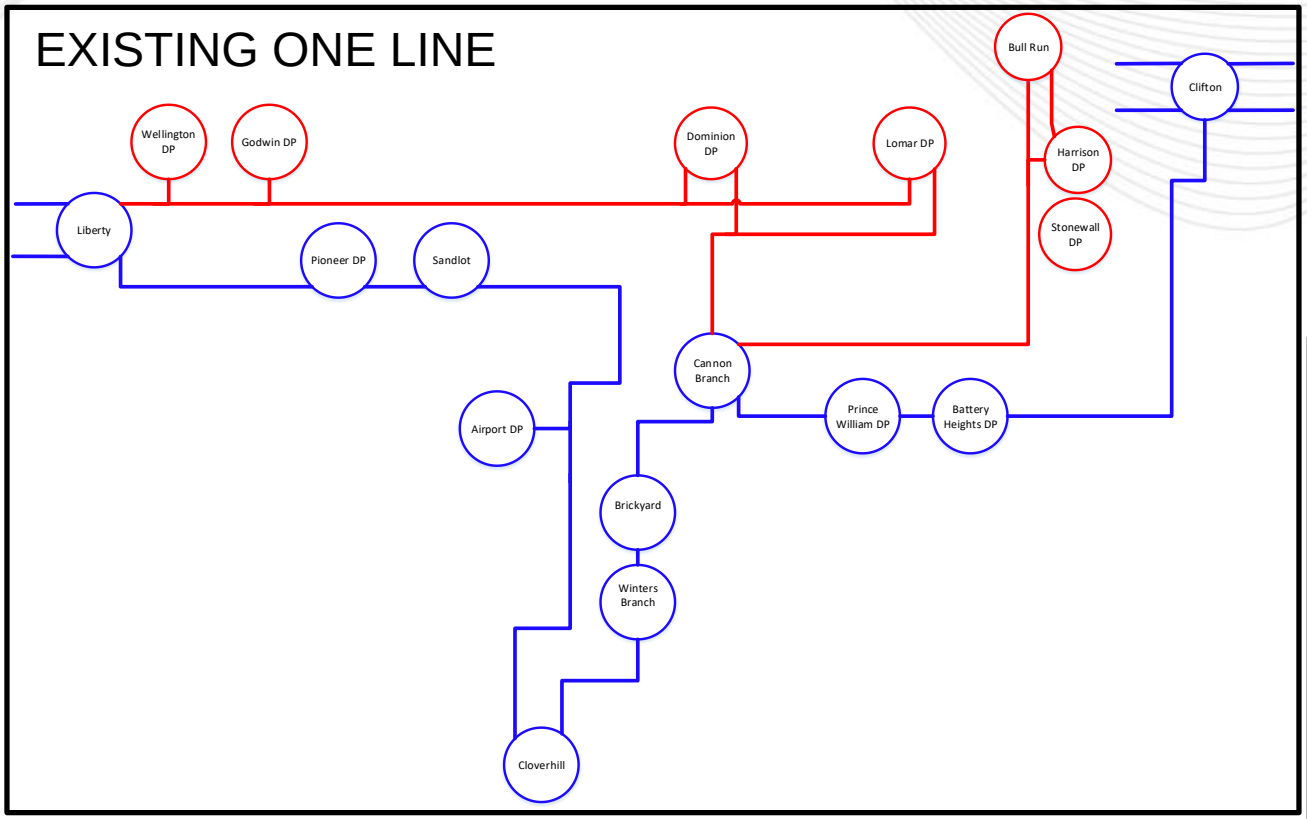
	115 KV.	1 thru 199
	138 KV.	AS NOTED
	69 KV.	AS NOTED

Dominion Transmission Zone: Baseline Manassas Area



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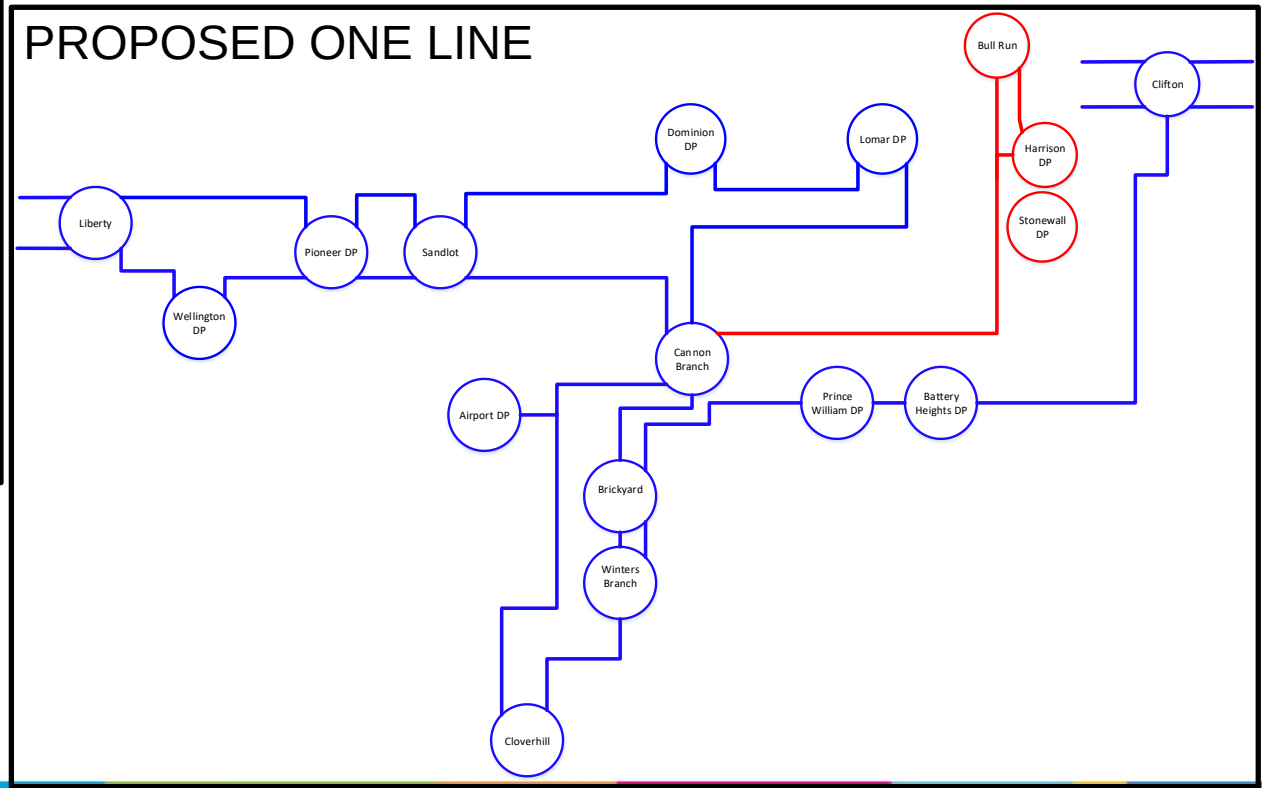


PPL Transmission Zone: Baseline
Steel City 500/230 kV transformer #1

Process Stage: First Review

Criteria: Summer Generator Deliverability

Assumption Reference: 2025 RTEP assumption

Model Used for Analysis: 2025 RTEP Summer case

Proposal Window Exclusion: Substation Equipment

Problem Statement: Steel City 500/230 kV transformer #1 is overloaded for single contingency loss of the Hosensack – Steel City 500 kV circuit. (FG# GD-S6)

Existing Facility Rating: 685SN/879SE, 864WN/1017WE MVA

Proposed Facility Rating: 884SN/SE1200 MVA

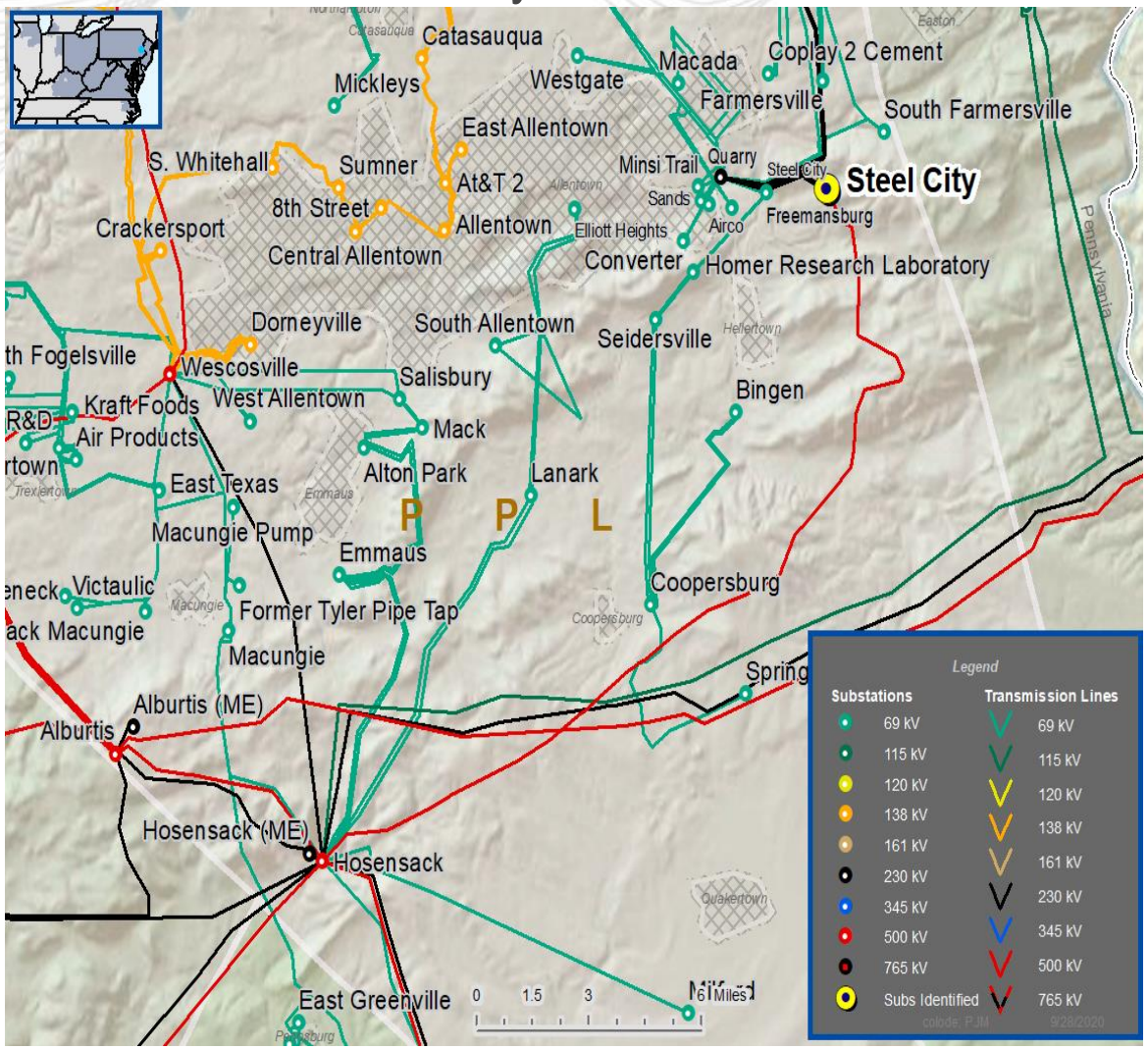
1109WN/WE1200 MVA

Proposed Solution:
Replace terminal equipment (bus conductor) on the 230 kV side of the Steel City 500/230 kV transformer #1.

Estimated Cost: $0.091 M

Alternatives: N/A

Required In-Service: 6/1/2025



Short Circuit Project

AEP Transmission Zone Baseline
Tanners Creek 345kV Circuit Breaker "R1"

Process Stage: First review

Criteria: Overdutied breaker

Assumption Reference: PJM Planning criteria

Model used for analysis: 2020 Series -2022 Short circuit model

Proposal Window Exclusion: Immediate Need

Problem Statement:

The Tanners creek 345 kV circuit breaker "R1" is identified as overdutied after running the breaker analysis following a model review and correction to short circuit base case.

Proposed Solution:

TRV capacitors will be added to the breaker "R1" to increase the breaker capacity from 50kA to 63kA.

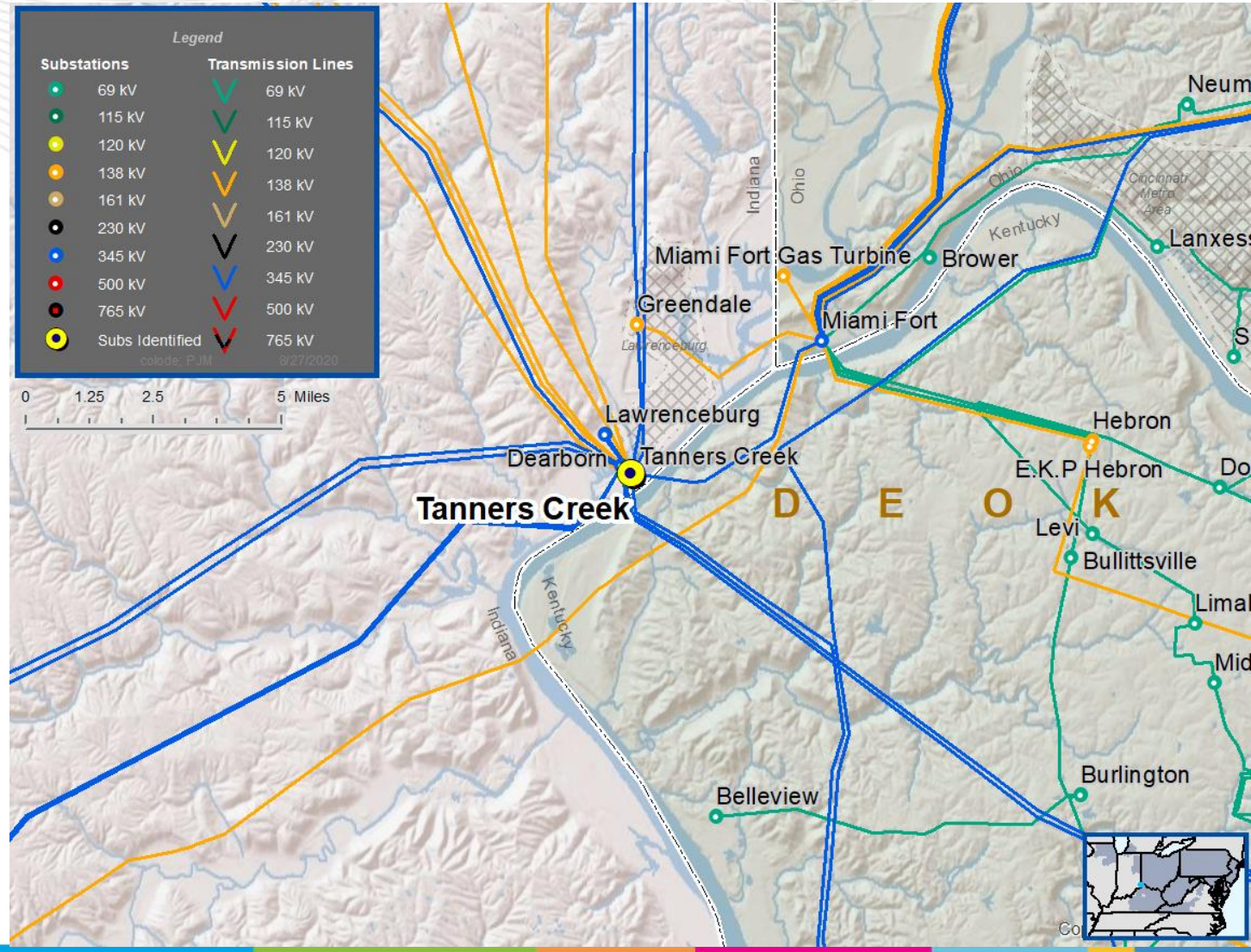
- **Estimated Cost: $0.05M**

Alternatives: None

- Estimated Cost: N/A

Required In-Service Date: Immediate need

In-Service Date: 12/27/2020



Recommended Solution
Baseline Reliability Projects

Dominion Transmission Zone: Baseline 500kV Line #514 Rebuild (End of Life Criteria)

Process Stage: Second Review

Criteria: Dominion's FERC 715 Planning Criteria (C.2.9 – End of Life Criteria)

Assumption Reference: FERC 715 Planning Criteria

Model Used for Analysis: 2020 Series 2025 RTEP

Problem Statement:

- The Doubs(FE) - Goose Creek(DEV) 500kV transmission Line #514 is an approximately 18-mile long line(3-miles is DEV owned) primarily constructed on weathering (COR-TEN®) steel lattice structures.
- Third party assessment has determined that the towers have corroded to a point where they exhibit pre-mature thinning of structure members and packout at joints. If left unaddressed these issues could result in failure of structures and potentially the collapse for the line. (DOM-O5)

Existing Facility Rating: 2323/2323/2671 MVA

Proposed Facility Rating: 4330/4330/4979 MVA Summer

4980/5023/5928 MVA Winter

Note: The End of Life issue identified for Line #514 is linked to the M-3 need identified as APS-2020-011

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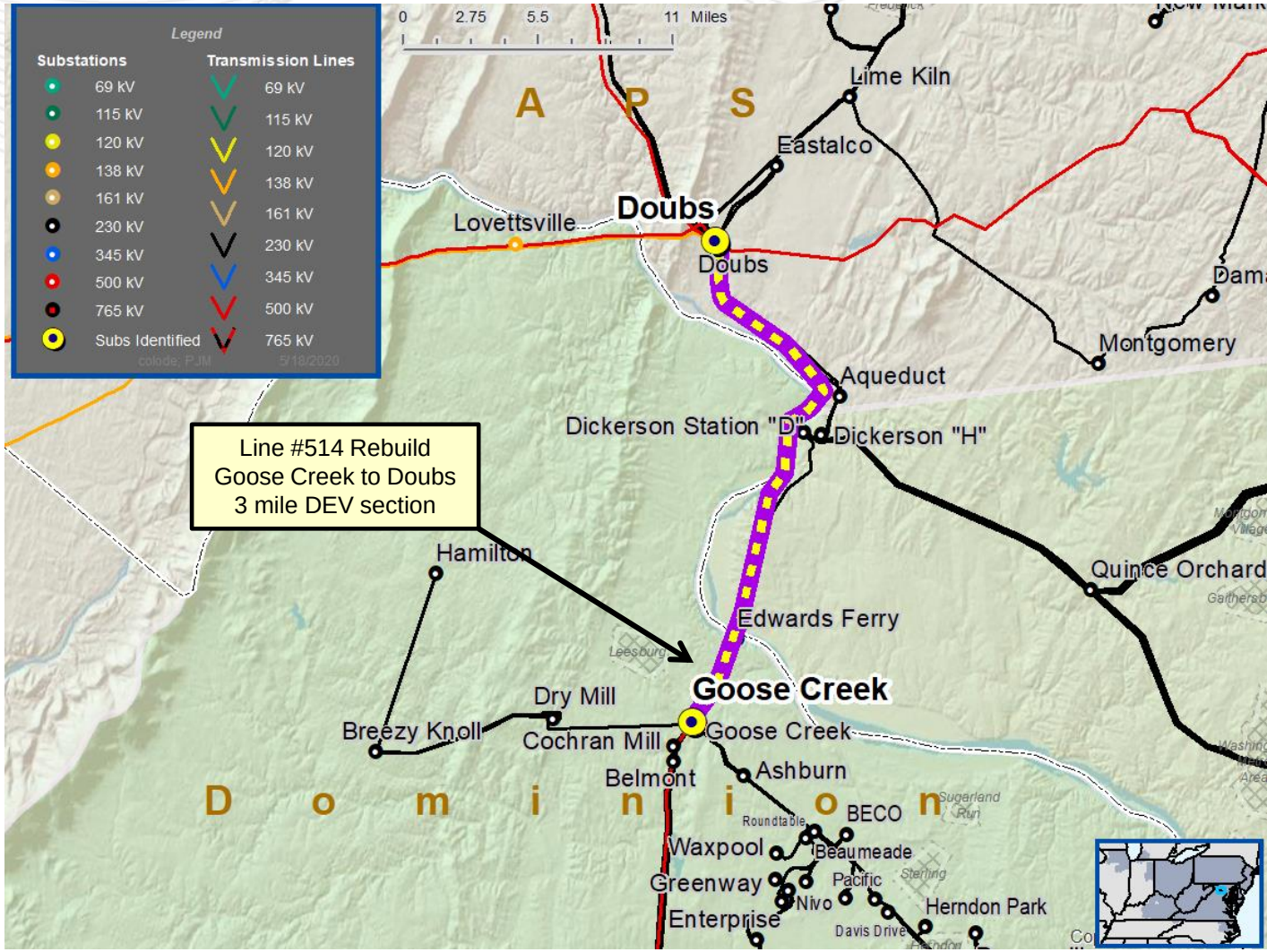
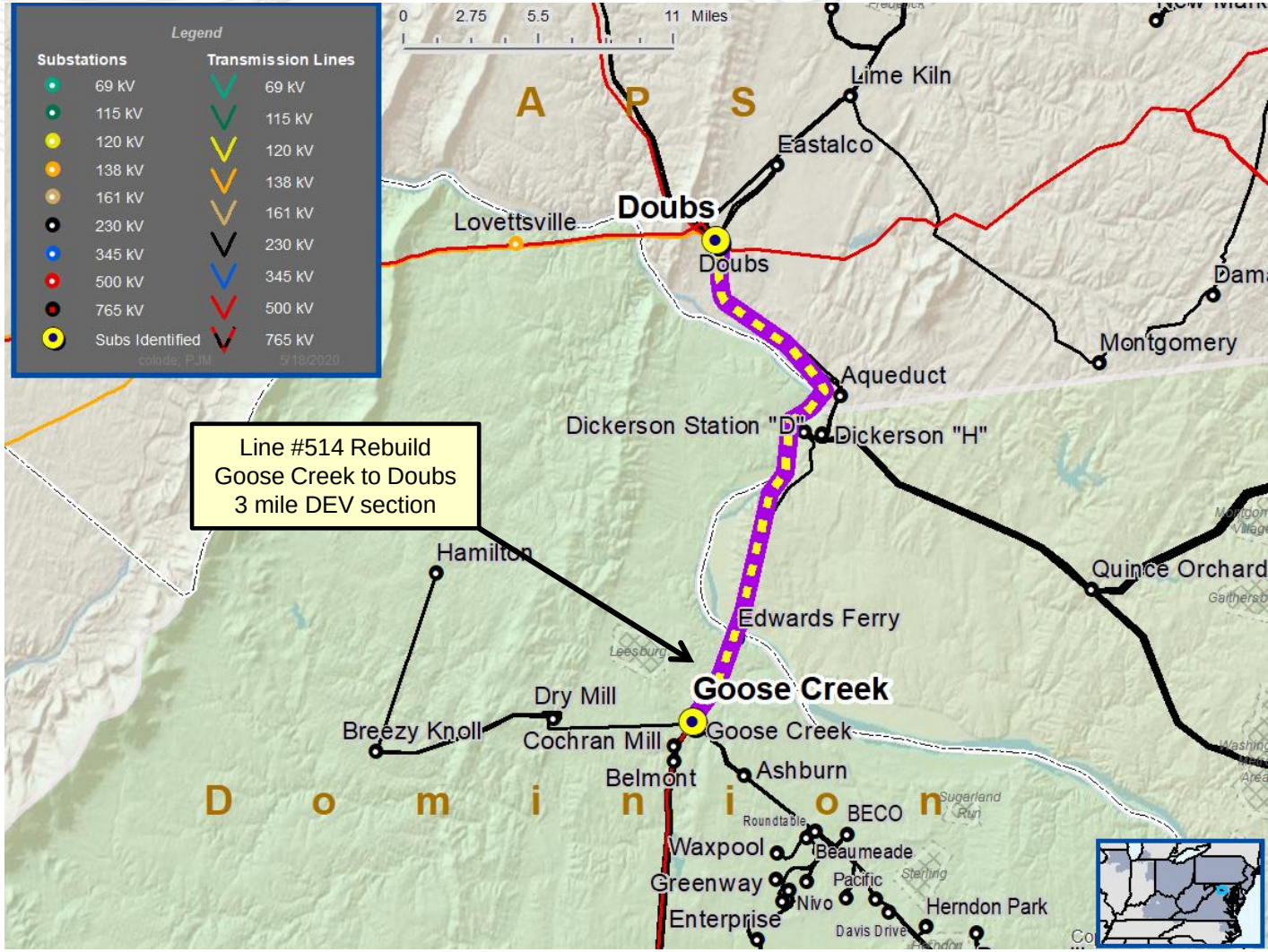


Dominion Transmission Zone: Baseline 500kV Line #514 Rebuild (End of Life Criteria)

Recommended Solution:
Proposal 2020-W2-441: DEV's portion of Line #514 consists of 16 structures and 3 of these structures were replaced in 2014 with galvanized structures. Replace the remaining 13 COR-TEN® towers with galvanized steel towers. Reconductor 3 mile section with 3-1351.5 ACSR 45/7. Upgrade line terminal equipment at Goose Creek substation to support the Line #514 rebuild. **(b3247)**

- **Estimated Cost:** $7.6M

Required In-Service: 6/1/2025



Dominion Transmission Zone: Baseline Northern Neck Area

Process Stage: Second Review

Criteria: Winter N-1-1 Thermal & Voltage, 300 MW Load Loss

Assumption Reference: 2025 RTEP assumption

Model Used for Analysis: 2025 RTEP winter case

Proposal Window Exclusion: Immediate Need

Problem Statement:

- Various voltage magnitude and drop violations in the Northern Neck area for the loss of 230kv Line #224 Lanexa – Northern Neck and 230kV Line #2145 Birchwood – Dahlgren. (N2-WVM28-N2-WVM63, N2-WVD1-N2-WVD60).
- Overload of 115kV Lines Rappahannock – Whitestone and Harmony Village – Greys Point for the loss of 230kV Line #224 Lanexa – Northern Neck and 230kV Line #2145 Birchwood – Dahlgren. (N2-WT9-N2-WT12)
- Continued use of operating procedure to open 115kV Line 65 at Northern Neck end to accommodate outages on one of the two 230 kV feeds into Northern Neck to mitigate thermal overloads on Line 65 and also to help control & mitigate voltage issues when either of the 230kV feeds are out going to the Northern Neck area results in a PJM planning criteria violation of dropping over 300 MW in the 2022/2023 timeframe based on the 2020 PJM load forecast.

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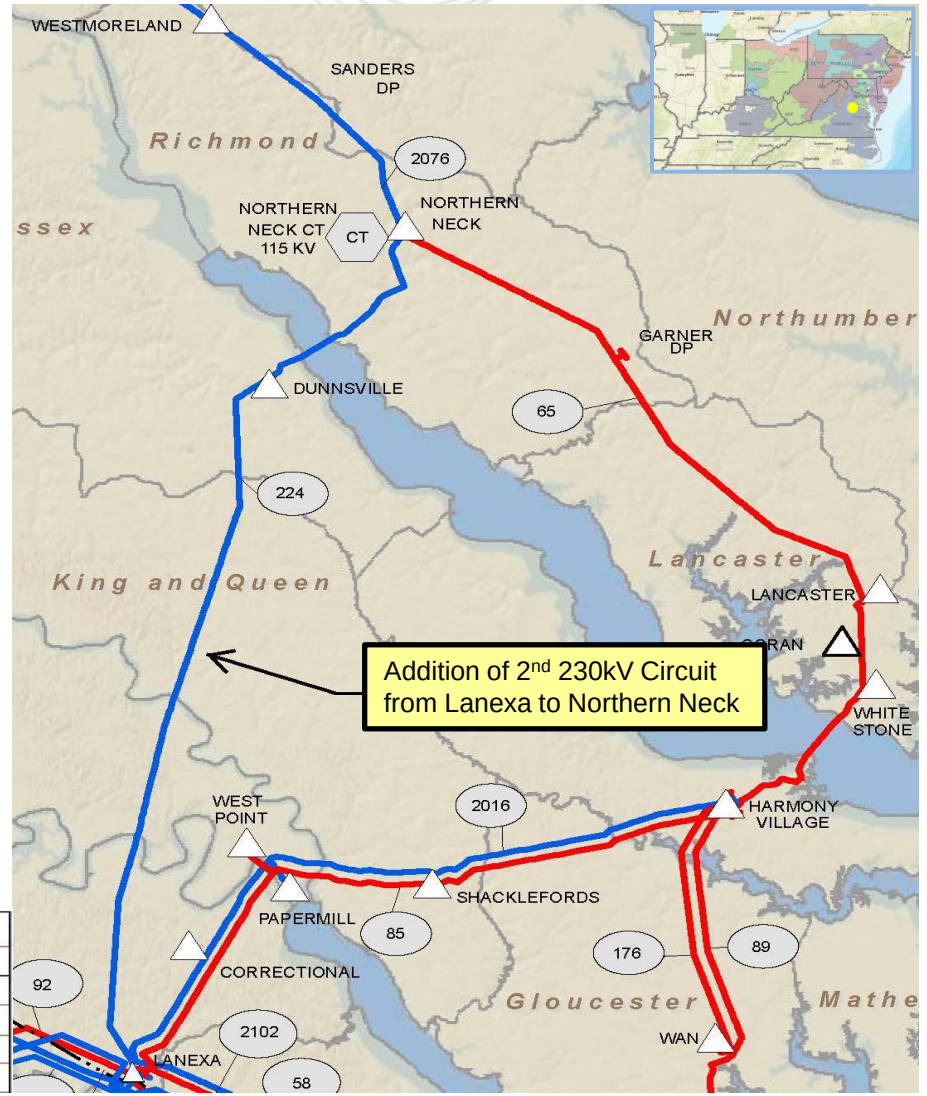

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	115 KV.	1 thru 199
	138 KV.	AS NOTED
	69 KV.	AS NOTED

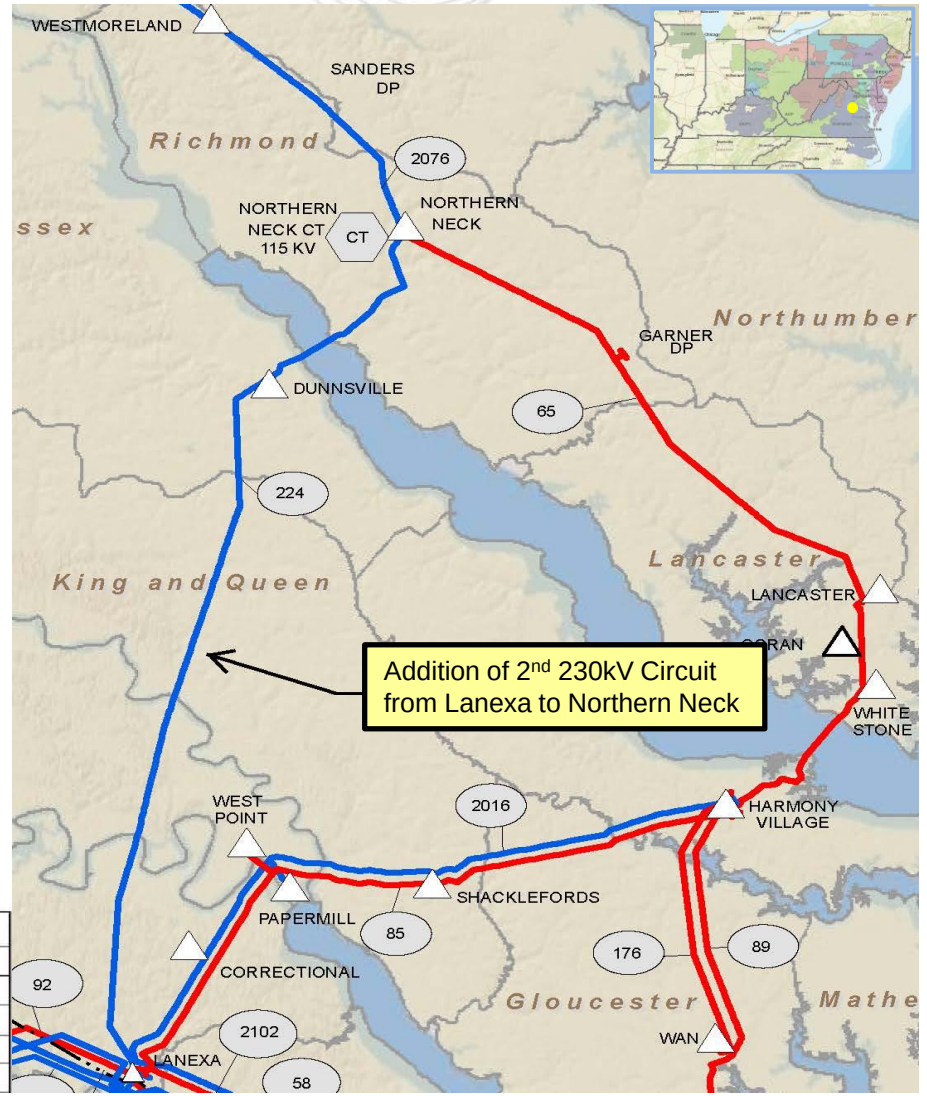
Dominion Transmission Zone: Baseline Northern Neck Area

Recommended Solution:
Install a 2nd 230kV circuit with a minimum summer emergency rating of 1047 MVA between Lanexa and Northern Neck Substations. The 2nd circuit will utilize the vacant arms on the double-circuit structures that are being installed on the Line #224 (Lanexa-Northern Neck) End-of-Life rebuild project (b3089). The Northern Neck terminal will be expanded from a 230kV, 4-breaker ring bus to a 6-breaker ring bus while the Lanexa terminal will be expanded from a 6-breaker ring bus to a breaker-and-a-half arrangement.

Estimated Cost: $23.0 M

- New 230 kV Circuit: $14.0 M **(b3223.1)**
- Northern Neck Substation work: $ 5.0 M **(b3223.2)**
- Lanexa Substation work: $ 4.0 M **(b3223.3)**

Required In-Service: 6/1/2023



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2020 RTEP Window 1 Update

2020 RTEP Proposal Window 1 - Statistics

Timeline

- Window 1 Opened: July 1, 2020
- Window 1 Closed: August 31, 2020

47 proposals received from 8 entities

- 8 proposal includes cost containment provisions
- 12 proposals include greenfield construction

2020 RTEP Proposal Window 1 - Proposals

Proposal ID#	Project Type	Project Description	Total Construction Cost M$	Zone	kV Level	Analysis	Flowgate	Cluster
479	Upgrade	Line #2172 Reconductor - Brambleton to Evergreen Mills - Partial	1.846	Dominion	230kV	Thermal, GenDeliv	N1-ST33,GD-S12,N2-ST2,N2-ST4,N2-ST5,N2-ST6,N2-ST7,N2-ST9,N2-ST11,N2-WT2,N2-WT3,DOM-T2	1
26	Upgrade	Line #2172 - Reconductor Brambleton to Evergreen Mills - Full	2.316	Dominion	230kV	Thermal, GenDeliv	N1-ST33,GD-S12,N2-ST2,N2-ST4,N2-ST5,N2-ST6,N2-ST7,N2-ST9,N2-ST11,N2-WT2,N2-WT3,DOM-T2	1
740	Upgrade	Line #2210 Reconductor - Brambleton to Evergreen Mills - Partial Reconductor	2.014	Dominion	230kV	Thermal, GenDeliv	N1-ST32,GD-S11,N2-ST1,N2-ST3,N2-ST8,N2-ST10,N2-ST13,N2-ST14,N2-ST15,N2-WT1,N2-WT8,DOM-T1	1
735	Upgrade	Line #2210 Reconductor - Brambleton to Evergreen Mills - Full Reconductor	2.257	Dominion	230kV	Thermal, GenDeliv	N1-ST32,GD-S11,N2-ST1,N2-ST3,N2-ST8,N2-ST10,N2-ST13,N2-ST14,N2-ST15,N2-WT1,N2-WT8,DOM-T1	1

2020 RTEP Proposal Window 1 - Proposals

Proposal ID#	Project Type	Project Description	Total Construction Cost M$	Zone	kV Level	Analysis	Flowgate	Cluster
704	Greenfield	Waxpool Loop - Nimbus to Farmwell line extension	5.703	Dominion	230kV	Load Drop	N2-SLD8,N2-WLD4	2
376	Greenfield	Waxpool Loop - Loop Line #2031 Option	17.698	Dominion	230kV	Load Drop	N2-SLD8,N2-WLD4	2
883	Greenfield	Waxpool Loop - Shellhorn Option	41.203	Dominion	230kV	Load Drop	N2-SLD8,N2-WLD4	2

2020 RTEP Proposal Window 1 - Proposals

Proposal ID#	Project Type	Project Description	Total Construction Cost M$	Zone	kV Level	Analysis	Flowgate	Cluster
493	Upgrade	Line #2213 Reconductor - Cabin Run to Yardley Ridge - Partial Reconductor	1.112	Dominion	230kV	Thermal	N2-ST12	3
134	Upgrade	Line #2213 Reconductor - Cabin Run to Yardley Ridge - Full Reconductor	1.747	Dominion	230kV	Thermal	N2-ST12	3

Proposal ID#	Project Type	Project Description	Total Construction Cost M$	Zone	kV Level	Analysis	Flowgate	Cluster
860	Upgrade	Relieve 300 MW Load Drop on Line#219 and Line#2066 (winter N-1-1, Tower, and FB)	6.219	Dominion	230kV	Load Drop	N1-WLD-1,N1-WLD-2,N2-WLD5	4

2020 RTEP Proposal Window 1 - Proposals

Proposal ID#	Project Type	Project Description	Total Construction Cost M$	Zone	kV Level	Analysis	Flowgate	Cluster
575	Upgrade	Crete-St. John 345 kV Reconductoring Proposal	8.25	ComEd	345kV	GenDeliv	GD-W3,GD-W4	5
173	Upgrade	Reconductor 345 kV Line 94507 Crete - St. John	22.786	ComEd	345kV	GenDeliv	GD-W3,GD-W4	5
573	Upgrade	Reconductor 345 kV Lines 6607 East Frankfort - Crete and 94507 Crete - St. John	50.251	ComEd	345kV	GenDeliv	GD-W3,GD-W4	5
148	Greenfield	Cedar Run - Cline 345kV Transmission Project	29.629	ComEd	345kV	GenDeliv	GD-W3,GD-W4	5
281	Upgrade	Rebuild 345 kV double circuit Lines 94507 and 97008 Crete - St. John	42.485	ComEd	345kV	GenDeliv	GD-W3,GD-W4	5
354	Upgrade	Rebuild 345 kV Lines 6607/6608 East Frankfort - Crete and 94507/97008 Crete - St. John	88.935	ComEd	345kV	GenDeliv	GD-W3,GD-W4	5

2020 RTEP Proposal Window 1 - Proposals

Proposal ID#	Project Type	Project Description	Total Construction Cost M$	Zone	kV Level	Analysis	Flowgate	Cluster
241	Upgrade	Crete - St. John SmartValve	12	ComEd	345kV	GenDeliv	GD-W3,GD-W4	5
901	Upgrade	Install Series Inductor on Line 94507	7.998	ComEd	345kV	GenDeliv	GD-W3,GD-W4	5
393	Greenfield	Zebedee 345 kV Greenfield Station	25.91	ComEd	345kV	GenDeliv	GD-W3	5
235	Greenfield	Goodenow-Lemon Lake 345kV Greenfield Line and Stations	46.194	ComEd	345kV	GenDeliv	GD-W3	5

2020 RTEP Proposal Window 1 - Proposals

Proposal ID#	Project Type	Project Description	Total Construction Cost M$	Zone	kV Level	Analysis	Flowgate	Cluster
602	Greenfield	North Woodcock-East Leipsic 69 kV Line	25.93	AEP	69kV, 138kV, 35kV	Thermal	AEP-T63,AEP-T70,AEP-T71,AEP-T72,AEP-T73,AEP-T66,AEP-T67,AEP-T64,AEP-T65,AEP-T68,AEP-T69	6
957	Upgrade	East Leipsic-New Liberty 138 kV Conversion	34.418	AEP	69kV, 138kV, 35kV	Thermal	AEP-T63,AEP-T70,AEP-T71,AEP-T72,AEP-T73,AEP-T66,AEP-T67,AEP-T64,AEP-T65,AEP-T68,AEP-T69	6
317	Upgrade	Richlands to East Lepsic 138 kV	58.514	AEP	69kV, 138kV, 35kV	Thermal	AEP-T63,AEP-T70,AEP-T71,AEP-T72,AEP-T73,AEP-T66,AEP-T67,AEP-T64,AEP-T65,AEP-T68,AEP-T69	6
341	Greenfield	East Leipsic-Maroe 69kV Loop	27.149	AEP	69kV, 138kV, 35kV	Thermal	AEP-T63,AEP-T70,AEP-T71,AEP-T72,AEP-T73,AEP-T66,AEP-T67,AEP-T64,AEP-T65,AEP-T68,AEP-T69	6
608	Greenfield	East Leipsic to Maroe 69 kV Single Circuit	25.157	AEP	69kV, 138kV, 35kV	Thermal	AEP-T63,AEP-T70,AEP-T71,AEP-T72,AEP-T73,AEP-T66,AEP-T67,AEP-T64,AEP-T65,AEP-T68,AEP-T69	6

2020 RTEP Proposal Window 1 - Proposals

Proposal ID#	Project Type	Project Description	Total Construction Cost M$	Zone	kV Level	Analysis	Flowgate	Cluster
270	Greenfield	Birch Ridge - Natrium 138kV Transmission Project	16.637	AEP	69kV	Thermal	AEP-T219,AEP-T221,AEP-T222,AEP-T223,AEP-T225,AEP-T226,AEP-T227,AEP-T228,AEP-T229,AEP-T230,AEP-T231,AEP-T232,AEP-T233,AEP-T234,AEP-T237,AEP-T238,AEP-T239,AEP-T240,AEP-T243,AEP-T244,AEP-T250	7
804	Upgrade	Kammer-Natrium Upgrades	4.599	AEP	69kV, 138kV	Thermal, GenDeliv	N1-ST41,N1-ST42,GD-S298,GD-S446,GD-S315,AEP-T219,AEP-T221,AEP-T222,AEP-T223,AEP-T225,AEP-T226,AEP-T227,AEP-T228,AEP-T229,AEP-T230,AEP-T231,AEP-T232,AEP-T233,AEP-T234,AEP-T237,AEP-T238,AEP-T239,AEP-T240,AEP-T243,AEP-T244,AEP-T250	7
538	Upgrade	Natrium Area Line Reconfiguration	5.635	AEP	69kV, 138kV	Thermal, GenDeliv	N1-ST41,N1-ST42,GD-S298,GD-S446,GD-S315,AEP-T219,AEP-T221,AEP-T222,AEP-T223,AEP-T225,AEP-T226,AEP-T227,AEP-T228,AEP-T229,AEP-T230,AEP-T231,AEP-T232,AEP-T233,AEP-T234,AEP-T237,AEP-T238,AEP-T239,AEP-T240,AEP-T243,AEP-T244,AEP-T250	7

2020 RTEP Proposal Window 1 - Proposals

Proposal ID#	Project Type	Project Description	Total Construction Cost M$	Zone	kV Level	Analysis	Flowgate	Cluster
182	Upgrade	Newcomerstown-Salt Fork Switch 69 kV Rebuild	15.884	AEP	69kV	Thermal	AEP-T366,AEP-T367,AEP-T368,AEP-T373	8
109	Upgrade	West Cambridge Transformer Addition	4.309	AEP	69kV	Thermal	AEP-T366,AEP-T367,AEP-T368,AEP-T373	8

Proposal ID#	Project Type	Project Description	Total Construction Cost M$	Zone	kV Level	Analysis	Flowgate	Cluster
628	Upgrade	Lancaster Area Switching Improvements	1.466	AEP	69kV	Thermal	AEP-T376,AEP-T377,AEP-T384,AEP-T385,AEP-T388,AEP-T389	9
915	Upgrade	Lancaster Area Line Rebuilds	11.147	AEP	69kV	Thermal	AEP-T376,AEP-T377,AEP-T384,AEP-T385,AEP-T388,AEP-T389	9

2020 RTEP Proposal Window 1 - Proposals

Proposal ID#	Project Type	Project Description	Total Construction Cost M$	Zone	kV Level	Analysis	Flowgate	Cluster
697	Upgrade	Mount Vernon Area Line Reconfiguration	1.286	AEP	69kV, 138kV	Thermal	AEP-T424,AEP-T429,AEP-T430,AEP-T431,AEP-T464,AEP-T466,AEP-T467,AEP-T469	10
872	Upgrade	Mount Vernon Area Line Rebuilds	12.846	AEP	69kV, 138kV	Thermal	AEP-T424,AEP-T429,AEP-T430,AEP-T431,AEP-T464,AEP-T466,AEP-T467,AEP-T469	10

2020 RTEP Proposal Window 1 - Proposals

Proposal ID#	Project Type	Project Description	Total Construction Cost M$	Zone	kV Level	Analysis	Flowgate	Cluster
494	Upgrade	Pumphrey Transformer Replacement	4.692	BGE	115kV	GenDeliv	GD-S480,GD-S483	11
763	Upgrade	Erdman Reconfiguration	0	BGE	115kV	GenDeliv	GD-S480,GD-S483	11
514	Upgrade	Pumphrey-Graceton Transformer Replacement	9.01	BGE	115kV	GenDeliv	GD-S480,GD-S483	11
420	Upgrade	Constitution-Concord 110567/110568 Re-conductor - Partial 110563/110564 Re-conductor	14.73	BGE	115kV	GenDeliv	GD-S480,GD-S483	11
836	Upgrade	Constitution-Concord 110567/110568 Concord-Monument Street 110563/110564 Re-conductor	20.587	BGE	115kV	GenDeliv	GD-S480,GD-S483	11
962	Upgrade	Pumphrey Transformer, Constitution-Concord 110567/110568 Re-conductor, Partial 110563/110564 Re-conductor	19.422	BGE	115kV	GenDeliv	GD-S480,GD-S483	11
191	Upgrade	Pumphrey Transformer, Constitution-Concord 110567/110568 Concord-Monument Street 110563/110564 Re-conductor	25.279	BGE	115kV	GenDeliv	GD-S480,GD-S483	11

2020 RTEP Proposal Window 1 - Proposals

Proposal ID#	Project Type	Project Description	Total Construction Cost M$	Zone	kV Level	Analysis	Flowgate	Cluster
721	Greenfield	Stonewater - Waxpool 230kV Transmission Project	29.25	Dominion	230kV	Thermal, GenDeliv, Load Drop	GD-S11,GD-S12,N2-SLD,8N2-WT1,N2-WT2,N2-WT3,N2-WT8,N2-WLD4	1,2

2020 RTEP Proposal Window 1 - Proposals

Proposal ID#	Project Type	Project Description	Total Construction Cost M$	Zone	kV Level	Analysis	Flowgate	Cluster
855	Upgrade	Pierce Brook Substation, Install 2nd 345 kV Reactor	8.077	PENELEC	345kV	Voltage, Voltage and Magnitude	N2-SVM52,N2-SVM53,N2-SVM54,N2-SVM55,N2-WVM15,N2-WVM16,N2-WVM17,N2-WVM18,N2-WVM19	N/A
179	Upgrade	West New Philadelphia Breaker Installation	2.02	AEP	35kV, 69kV	Thermal	AEP-T356,AEP-T357,AEP-T358,AEP-T359,AEP-T360,AEP-T361,AEP-T362,AEP-T363,AEP-T364,AEP-T365	N/A
848	Upgrade	Rockhill Circuit Switcher Install	1.471	AEP	35kV	Thermal	AEP-T281,AEP-T284,AEP-T285,AEP-T286,AEP-T287,AEP-T288,AEP-T289,AEP-T290,AEP-T291,AEP-T292,AEP-T293,AEP-T298	N/A
503	Upgrade	Fremont Breaker and Bloom Road Cap Bank Installation	1.758	AEP	69kV	Thermal	AEP-T168,AEP-T169,AEP-T170	N/A
308	Upgrade	Dragoon Transformer and Line Addition	4.894	AEP	35kV	Thermal	AEP-T7,AEP-T8,AEP-T9,AEP-T10,AEP-T11,AEP-T220,AEP-T224,AEP-T235,AEP-T236,AEP-T241,AEP-T242,AEP-T245,AEP-T246,AEP-T247,AEP-T248,AEP-T249,AEP-T254,AEP-T255,AEP-T263,AEP-T264,AEP-T275,AEP-T276,AEP-T282,AEP-T283,AEP-T378,AEP-T379,AEP-T382,AEP-T383,AEP-T386,AEP-T387,AEP-T392,AEP-T393,AEP-T394,AEP-T395,AEP-T396,AEP-T397,AEP-T400,AEP-T401,AEP-T402,AEP-T408,AEP-T411,AEP-T417,AEP-T419,AEP-T420,AEP-T427,AEP-T428,AEP-T435,AEP-T436,AEP-T439,AEP-T440,AEP-T441,AEP-T461,AEP-T462,AEP-T463,AEP-T465	N/A

Note: “N/A” in the cluster column denotes that only one proposal was received to mitigate the violations identified by the flowgates listed

- July 1, 2020 – Proposal Window No.1 opened
- August 31, 2020 – Proposal Window No.1 closed

PJM evaluating proposals and violations

- Proposals presented for violations without competing proposals in this slide deck based on completion of reviews
- PJM performing analysis for other violations with multiple proposals
  - Performance, constructability, cost commitment reviews

Window 1 Billing

- Per the PJM Operating Agreement, PJM can now recover our costs for competitive windows
- Larger proposals required deposits, smaller proposals did not require deposits
- PJM is totaling up internal costs to date (thru end of September)
- Projects that have deposit already received as per above will have the deposit utilized first to cover their cost. Projects that did not require a deposit will be billed
- Before any external costs are incurred (constructability / financial / cost commitment), PJM will pre-bill for those costs as a way for developer to indicate they want their project to proceed forward with that external review per Operating Agreement §1.5.8(c)(1)(iii) and funds must be provided within 15 calendar days per Operating Agreement §1.5.8(c)(1)(v)

2020 RTEP Window 2 Update

2020 RTEP Proposal Window 2 - Proposals

Timeline

- Window 2 Opened: July 1, 2020
- Window 2 Closed: July 31, 2020

1 proposal was received from 1 entity

- Proposal is from an incumbent entity

2020 RTEP Proposal Window 2 - Statistics

Proposal ID#	Project Type	Proposing Entity	Project Description	Total Construction Cost M$	Zone	kV Level	Analysis	Flowgate
441	Upgrade	VEPCO	Line #514 Goose Creek – Doubs(FE) 500 kV Line Rebuild	7.641	Dominion	500kV	End of Life	DOM-05

- Second presentation completed in these slides
- PJM intends to take this solution to the Board at the December Board meeting

2020 RTEP Window 3 Update

- September 18, 2020 – Proposal Window No.3 opened
- October 19, 2020– Target to close Proposal Window No.3

This window includes 24 Thermal AEP FERC 715 Violations, primarily on 69kV facilities resulting from contingency correction:

- 8 flowgates are from the 2020 RTEP Window 1 violations
- 16 flowgates are new violations for 2020 RTEP Window 3

Competitive Planner Contact Information

- If you have any questions related to Competitive Planning Process and Competitive Planner Tool, please contact ProposalWindow-Admin@pjm.com
- If you need an assistance with registration to Competitive Planner Tool, please contact AccountManager@pjm.com
- PJM Competitive Planning Process Webpage
  https://www.pjm.com/planning/competitive-planning-process.aspx
- Access Competitive Planner tool through PJM Planning Center Webpage
  https://www.pjm.com/markets-and-operations/etools/planning-center.aspx
- Competitive Planner Tool Updates at Tech Change Forum
  https://www.pjm.com/committees-and-groups/tech-change-forum.aspx

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Reliability Analysis Update

Member Hotline

(610) 666 – 8980

(866) 400 – 8980

custsvc@pjm.com

Questions?

Upcoming TEAC Meetings

2020

- TEAC meetings are the following Tuesdays or Wednesday in 2020
- 1/7, 2/4, 3/10, 4/14, 5/12, 6/2, 7/7, 8/4, 9/1, 10/6, 11/4 (Wednesday), 12/1.

Revision History

- V1 – 9/25/2020 – Original slides posted
- V2 – 10/01/2020 – Added more projects
- V3 – 10/1/2020 – Inserted proposal window information
- V4 – 10/6/2020 – Update Window 1 slides
- V5 – 11/17/2020 – Corrected Proposal ID #855 on slide 42 to reference the PENELEC zone
- V6 – 12/2/2020 – Slide #10, Corrected the 2nd Dragoon transformer KV level from 138/34.5KV to 138/69/34.5kV
- V7 – 2/5/2020 – Slide #11, Added FGs: AEP-VM783, AEP-VM796