Reliability Analysis Update

Transmission Expansion Advisory Committee

October 12, 2017

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2017 RTEP
Reliability Analysis Update

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Dominion Transmission Zone Baseline Project

Baseline Reliability - TO Criteria Violation

Replacement of Fixed Series Capacitors on Line #547 Lexington–Bath County & Line #548 Valley–Bath County

Problem Statement: Dominion "End of Life Criteria"

- The fixed series capacitors (FSC) on 500kV Line #547 at Lexington and on 500kV Line #548 at Valley were constructed in 2000/2001 to mitigate the Bath County angular stability issue. These two series capacitors need to be rebuilt to current standards based on Dominion's "End of Life" criteria. The existing summer emergency rating (Rating B) of the FSCs is 3118 MVA. The existing summer emergency rating for the line segments is 3954 MVA.
- Replacement is needed because:
  - Existing series capacitor units run out of spare parts, manufacturer no longer produce parts for legacy models.
  - The breaker module of the capacitor has a current rating of 3000 Amps, which makes the FSCs the thermal limiting factor (normal operation rating 2858 MVA; emergency rating 3118 MVA) to the transmission line (normal operation rating 3954 MVA ; emergency rating 3954 MVA).

Potential Solution:

Replace the existing FSCs with newer models of the same size. The current rating on the device will be increased from 3kA to 4kA for normal operation to provide higher thermal capacity.

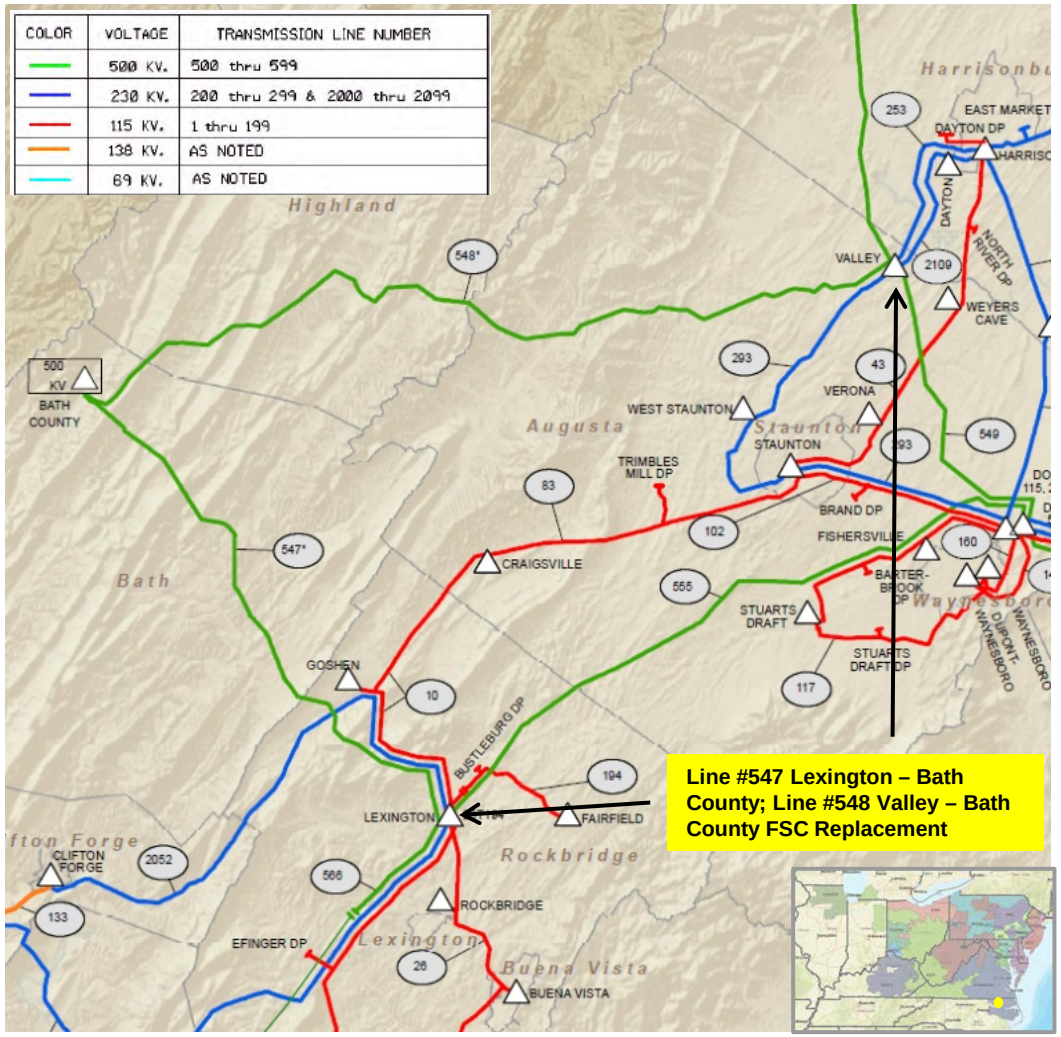
Alternatives:

Installation of 500kV Thyristor controlled series capacitor (TCSC) and FSC combined systems on Line #547 at Lexington and on Line #548 at Valley to replace existing FSCs. This device would be a TCSC unit combined with a fixed series capacitor unit which provides dynamic compensation at [43% 120%] of line impedance. The current rating on the device will be increased from 3 kA to 4 kA for normal operation. The combined capacitor system could potentially improve the stability of Bath County with higher a compensation range. Additionally, the TCSC could potentially help to mitigate transient stability and damp transient oscillations during a contingency that occurs close to the installation area.

Estimated Project Cost: $ 28.9 M (existing FSCs) / 35.7 M (alternative TCSC consideration)

Possible IS Date: 4/1/2020

Project Status: Conceptual



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Dominion Transmission Zone Baseline Project

Existing b2361 Cost Increase and Scope Modification

Original: Baseline Project: Idylwood to Scott's Run 230kV Line and Substation

Revised: Idylwood to Tysons 230kV Line and Rebuild Tysons with GIS

Problem Statement:

- N-1-1 loss of Line #2010 (Reston-Tysons) and Line #2035 (Idylwood-CIA) results in the loss of more than 300 MW (NERC Category P6 - Multiple Contingency – Two overlapping singles).

Date Original Project Presented: 08/21/2013 (SRRTEP); 09/12/2013 (TEAC)

Original Proposed Solution

- Construct a 230kV OH line along existing Line #2035 corridor, approx. 2.4 miles from Idylwood to Dulles Toll Road (DTR) and 2.1 miles on new right-of-way (ROW) along DTR to new Scott's Run Substation. (**Est. cost $32M**)

Reason for Scope Modification and Cost Increase:

- Project scope had to be modified due to issues with siting of the new Scott's Run substation in Fairfax County.
- Area is very densely populated and is in close proximity to interstate highways and the DC Metro rail system limiting the options of bringing an additional source into the area. Multiple substation options were also considered. (Refer to the next slide.)
- Very narrow existing right-of-way also limits the ability to expand.
- Conversion of Tysons to GIS was determined to be the best option given the obstacles presented.
- High real estate and land costs along with conversion to GIS drove costs considerably higher.

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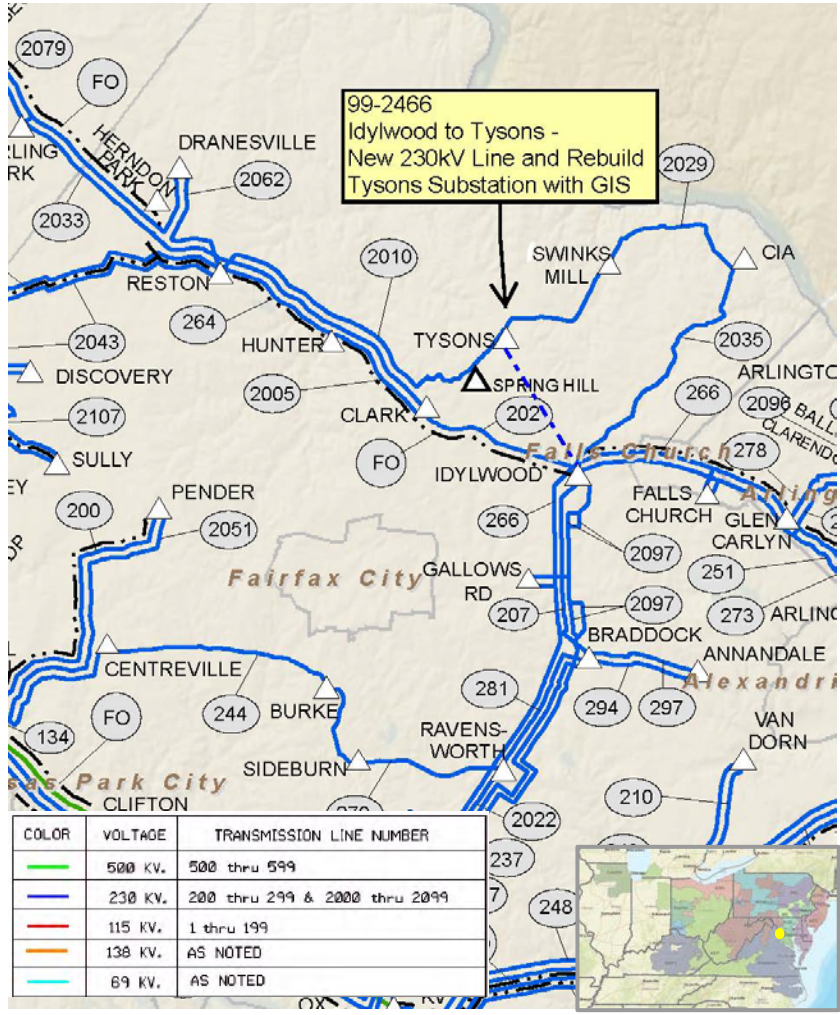

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Dominion Transmission Zone
Baseline Project b2361 - Sites Examined

Illustration of space constraints in the area and all the substation options considered

Primary Site

- Tysons Substation

Alternate Sites

- Jones Branch Road
- Chain Bridge Road*
- Scotts Run Road
- Cloverleaf

Eliminated Sites

- Liberty Crossing
- Transit Depot*
- Old Meadow Road

**Sites identified by Fairfax DOT*

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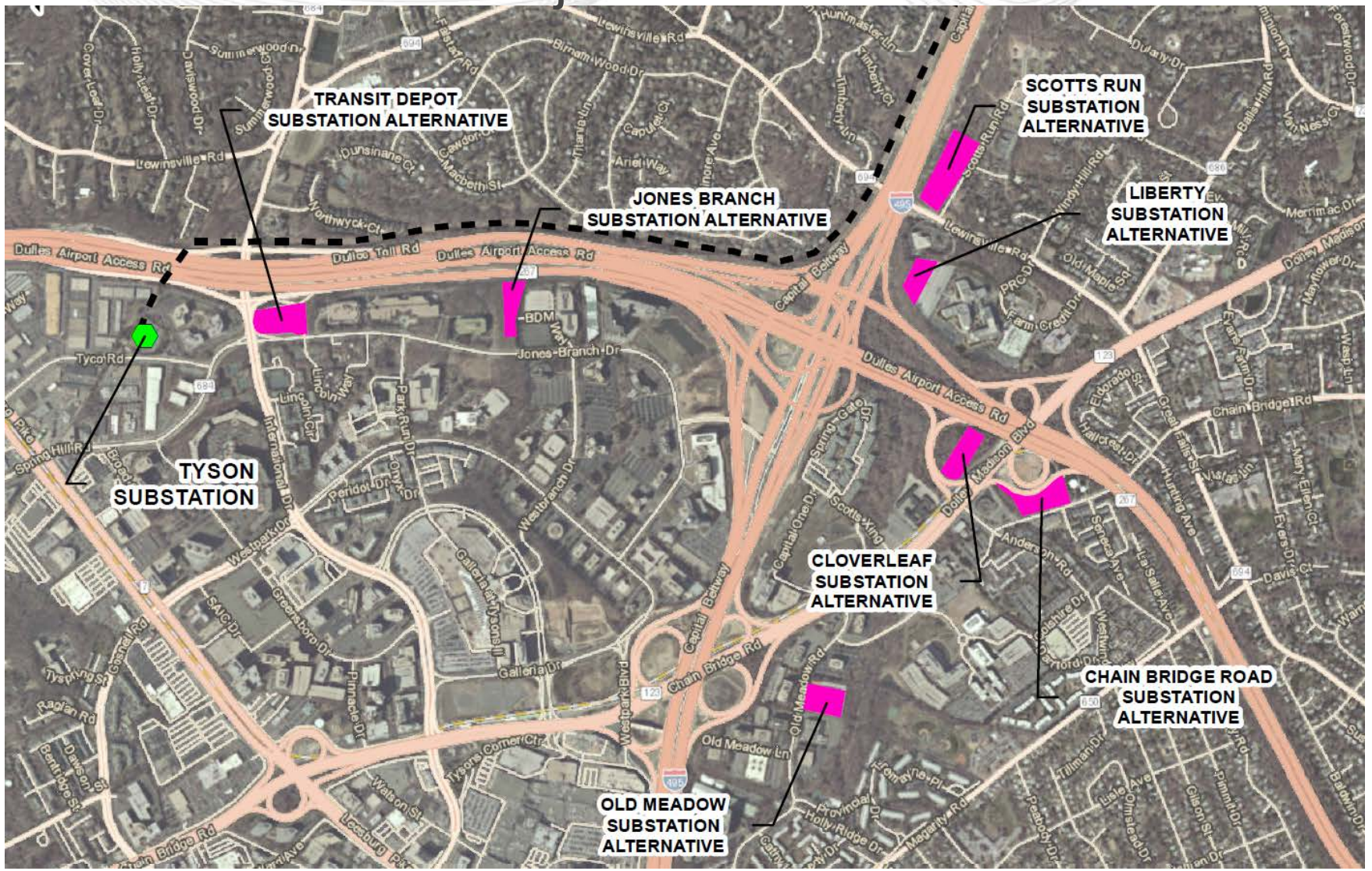

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Dominion Transmission Zone Baseline Project

Existing b2361 Cost Increase and Scope Modification

Original: Baseline Project: Idylwood to Scott's Run 230kV Line and Substation

Revised: Idylwood to Tysons 230kV Line and Rebuild Tysons with GIS

Revised Proposed Solution

- Construct a 230kV UG line approx. 4.5 miles from Idylwood to Tysons. Tysons Substation will be rebuilt, within its existing footprint, with a 6-breaker ring bus using GIS equipment. (**Est. cost $111.7M**)
- Cost increase due to change in terminal location (Scott's Run to Tysons), detailed evaluation of routes, and $29.2M to rebuild Tysons Sub using GIS equipment

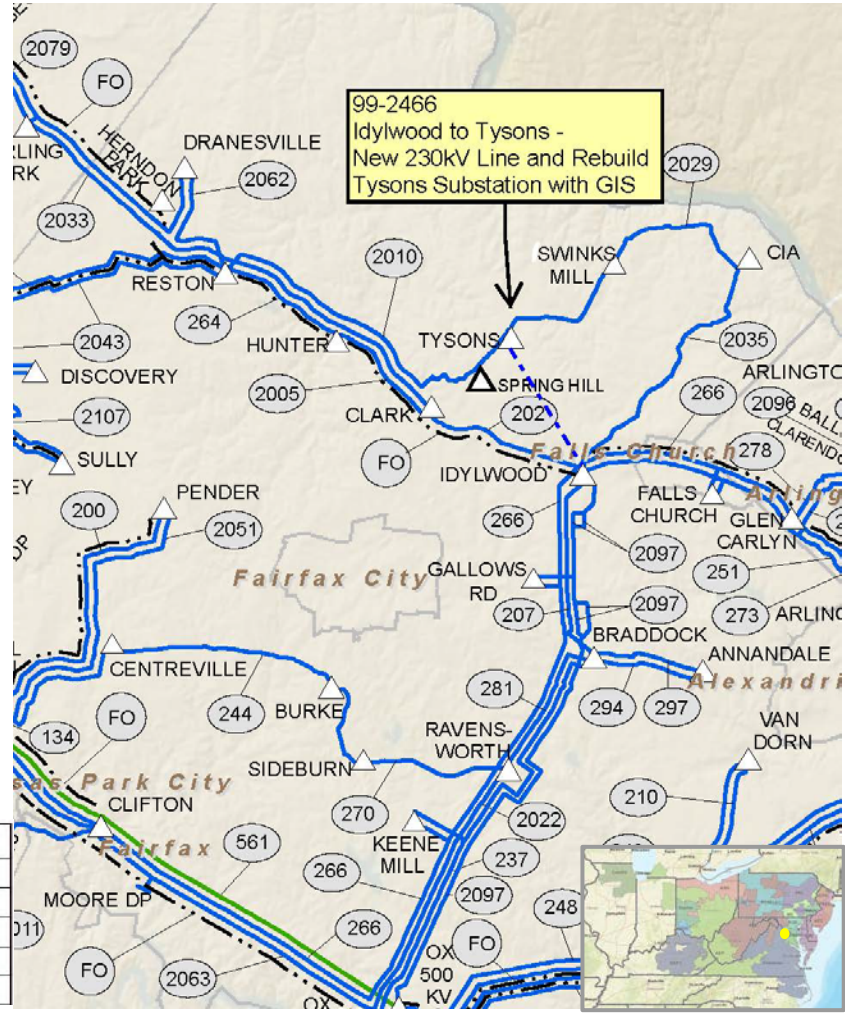
Alternatives

- Construct a 230kV OH line approx. 5.2 miles from Idylwood to Tysons. Rebuild Tysons Substation, within its existing footprint, with a 6-breaker ring bus using GIS equipment. (**Est. cost $122.6M**)

Original Projected IS Date: 6/1/2017

Revised Projected IS Date: 6/11/2022

Project Status: Conceptual



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

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Dominion Transmission Zone Baseline Project

Baseline Reliability - TO Criteria Violation

Line #205 and #2003 Partial Rebuild

Problem Statement: Dominion "End of Life Criteria"

- 230kV line #205 and #2003 run from Chesterfield to Locks and Poe respectively. An approximate 3 mile section of these lines from Chesterfield to Tyler was built on double circuit weathering steel (Corten) towers in 1962. The corten structures are in poor condition.
- Permanent MW load loss for removal of these lines is 140MW.
- These line sections need to be rebuilt to current standards based on Dominion's "End of Life" criteria.

Potential Solution:

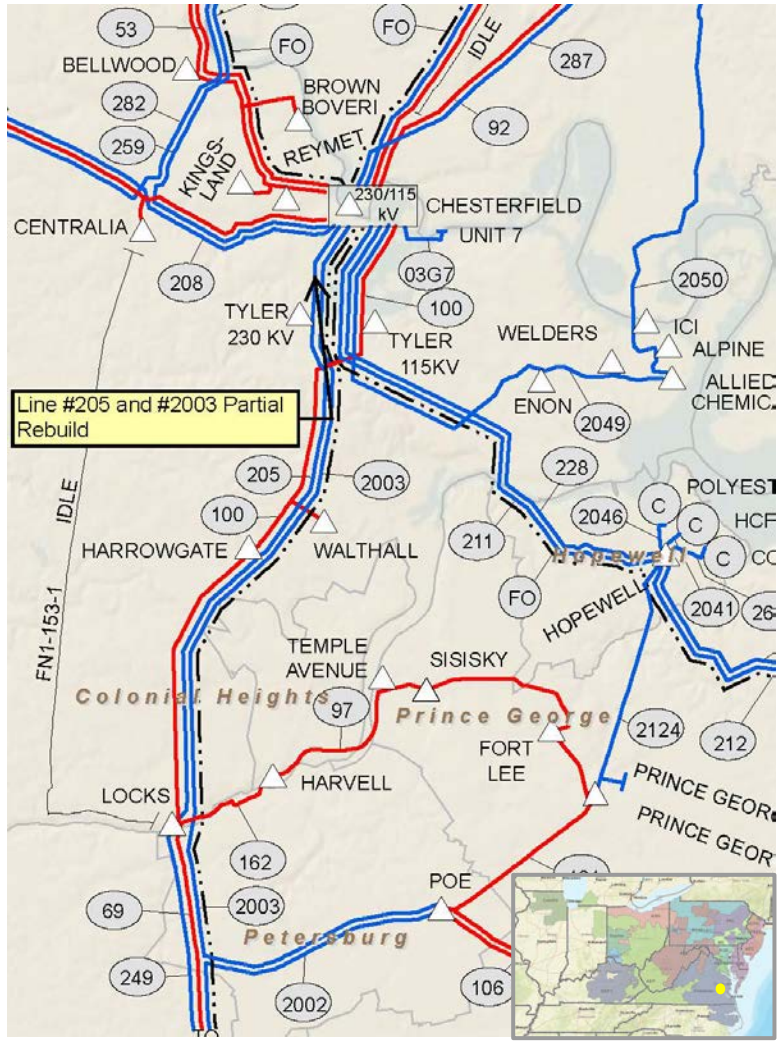
- Approximately 3 miles of line #205 and line #2003 will be rebuilt to current standard using with a summer emergency rating of 1047 MVA at 230kV. Proposed conductor is 2-636 ACSR. Considered structures include double circuit steel pole and double circuit galvanized steel tower. The Chesterfield -- Tyler segments of line #205 and #2003 have an existing summer emergency rating of 478MVA.

Alternatives: No feasible alternatives

Estimated Project Cost: $9.5 M

Possible IS Date: 12/31/2022

Project Status: Conceptual



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

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Dominion Transmission Zone Baseline Project

Project Cancellation

Baseline Reliability - Operational Performance

b2181 Prince George Line #2141 Auto-Sectionalizing Scheme

Problem Statement:

- Lockout of Line #2124 Hopewell – Prince George 230 kV causes an outage of Prince George Electric Cooperative's Brickhouse DP.

Recommended Solution:

- Install a transmission line sectionalizing scheme at Prince George Substation to automatically open the 230kV switch at Prince George for Line #2124 (Hopewell to Prince George 230 kV) lockout and allow Brickhouse DP to be re-energized from the 115kV source. This project adds a motor operator to an existing switch at Prince George and the control scheme. **(b2181)**

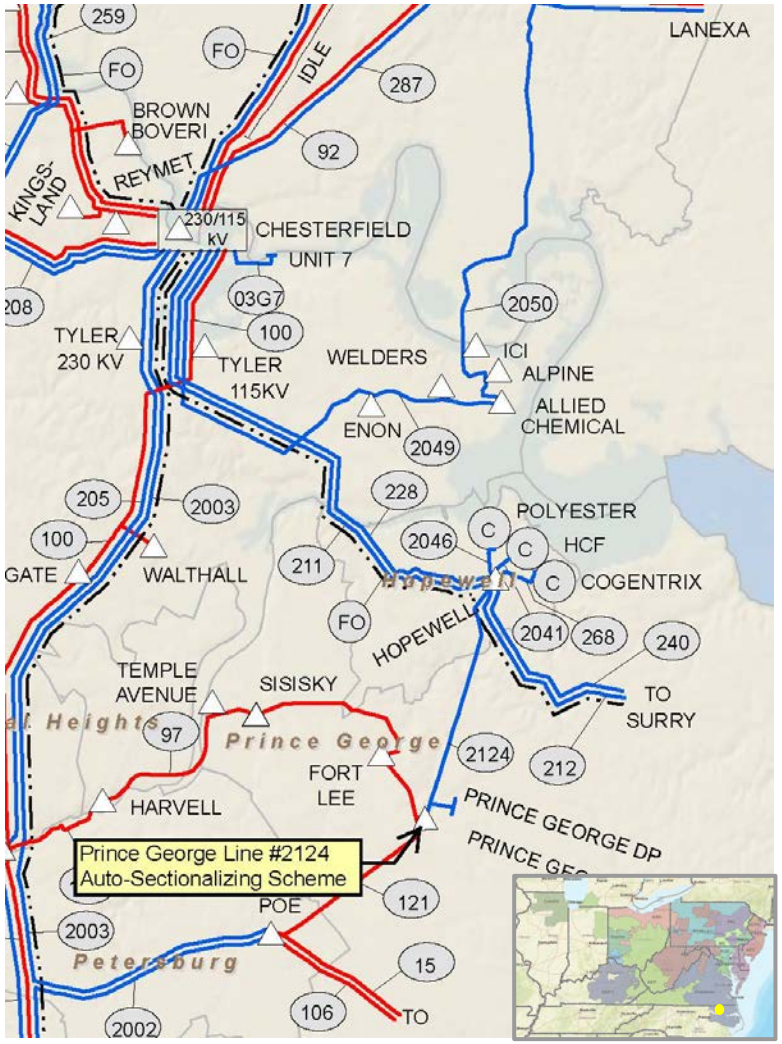
Reason for Cancellation:

- Coop has no current time frame for the installation of field ties to support required outage window.

Previous TEAC Date: 11/5/2012

Estimated Project Cost: $1.11 M

Projected IS Date: 5/31/2017



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

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Immediate Need Projects

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XLPE Cable Technology

- Cross-linked polyethylene
- No insulating oil required
  - Environmentally sound
  - No oil, associated pumps and loss of rating due to loss of pumping plant
- Lower O&M costs
- Higher Rating
- Industry moving to XLPE
- HPFF (High Pressure Fluid Filled a.k.a. Pipe Type Cable PTC) conductor future supply chain in question

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PSEG Transmission Zone

Generation Deliverability (Summer and Winter):

Previously presented: 9/14/2017

Problem Statement:

- The VFT – Warinanco 230 kV circuit is overloaded for several contingencies. (FG# GD-S26, GD-S27, GD-S28, GD-S33, GD-S556, GD-W37, GD-W38, GD-W39, and GD-W348)
- The Warinanco – Aldene 230 kV circuit is overloaded for tower contingency loss of the Linden to Deans and Linden to Sewaren 230 kV circuits. (FG# GD-W353)

Immediate Need:

- Due to the immediate need, the timing required for an RTEP proposal window is infeasible. As a result, the local Transmission Owner will be the Designated Entity.

Recommended Solution:

- Wreck and re-build the VFT – Warinanco – Aldene 230 kV circuit with paired conductor. Addresses tower age. Does not require new right of way. Paired conductor can address load requirement with room for future growth.

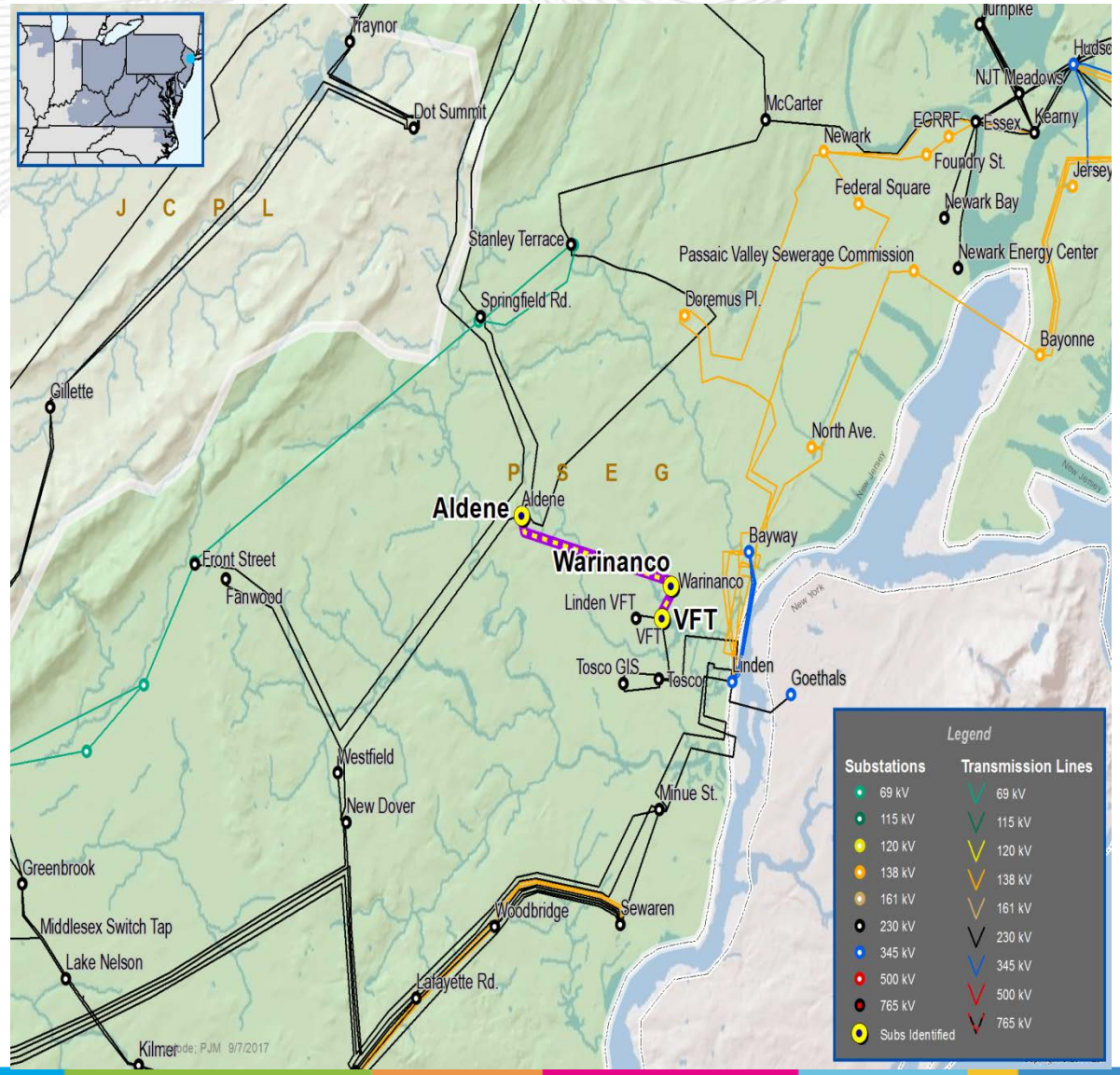
Alternative Solutions:

- Install parallel towerline - Dense, industrial area with limited property available. Would require new right of way and new station terminations.
- Install parallel XLPE cable - Requires opening the street. Adjacent to a railroad. Requires two new terminations. Create an impedance imbalance with the parallel overhead circuit. Cable will have lower impedance and lower capacity than the overhead circuit.

Estimated Project Cost: $90.4 M

Required IS date: 6/1/2018

Project Status: Conceptual



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PSEG Transmission Zone

Generation Deliverability (Summer):

Previously presented: 9/14/2017

Problem Statement:

- The Cedar Grove – Jackson Rd. 230 kV circuit is overloaded for tower contingency loss of the Cedar Grove – Athenia 230 kV circuits B2228 and K2263. (FG# GD-S601)

Immediate Need:

- Due to the immediate need, the timing required for an RTEP proposal window is infeasible. As a result, the local Transmission Owner will be the Designated Entity.

Recommended Solution:

- Replace existing cable with 5000kcmil XLPE cable.

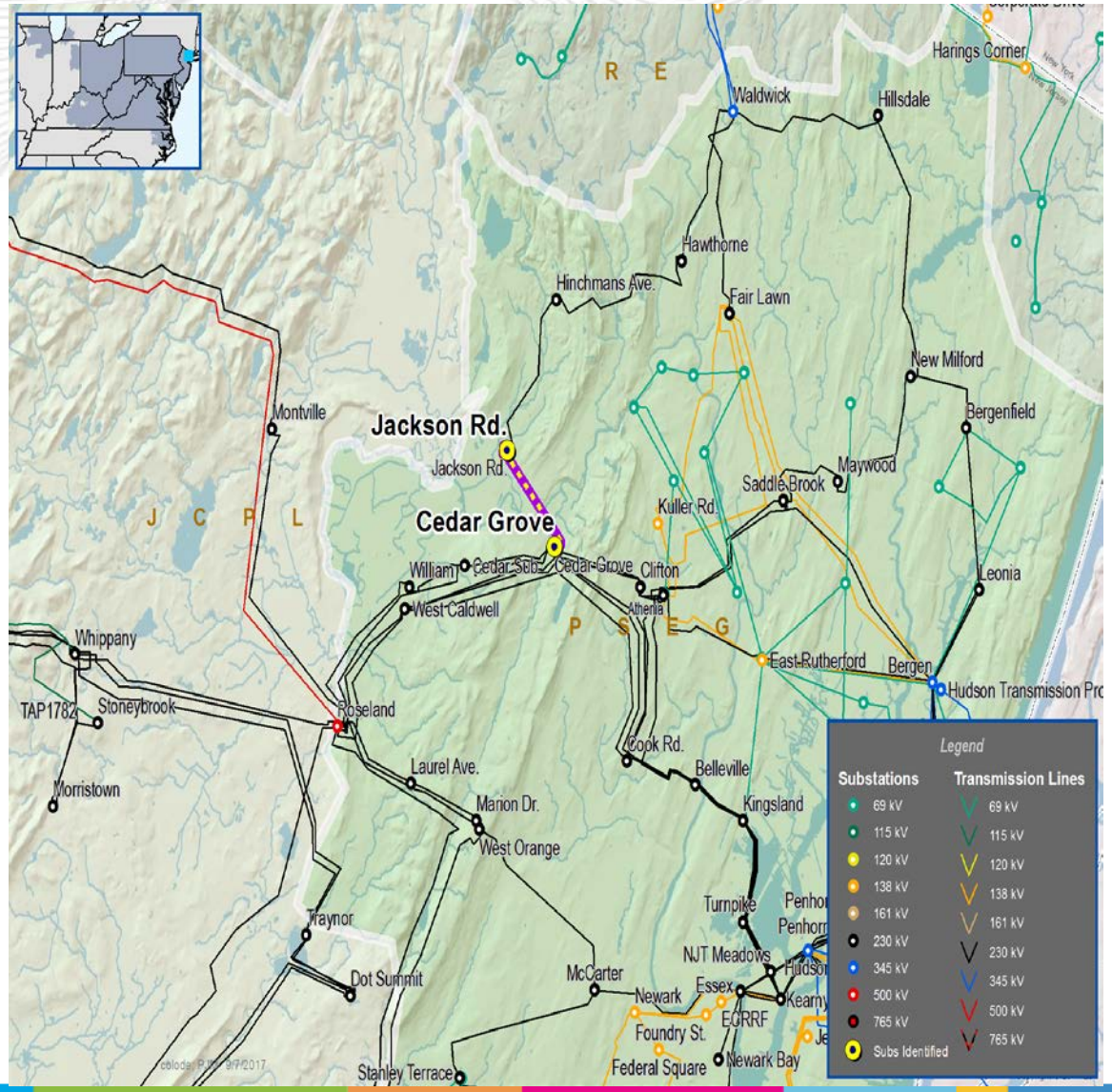
Alternative Solution:

- Re-conductor circuit with HPFF with 3500kcmil undergroud, pipe-type cable. Address age but not age of pipe. Alternative not recommended. Only one vendor for HPFF remains. Future availability of HPFF in question due to supply chain availability
- Abandon circuit - would leave a single transmission source from Waldwick 230kV for 215MW of load at Waldwick/Hawthorne/Hinchman/Jackson Rd. Violates FERC 715 criteria by leaving two sources to Jackson Rd. Would also render Waldwick PAR ineffective; 69kV would be the only outlet/inlet for PAR adjustments. Thermal overload on 69kV system for n-1-1.
- Replace with overhead construction - need right of way. Surrounding area is developed and densely populated. Requires two river crossings, interstate highway crossing, and a U.S. route crossing. Airport nearby. The construction of this alternative is not feasible.

Estimated Project Cost: $80 M

Required IS date: 6/1/2018

Project Status: Conceptual



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PSEG Transmission Zone

N-1-1 Thermal (Summer):

Previously presented: 9/14/2017

Problem Statement:

- The Maywood – Saddle Brook 230 kV circuit is overloaded (Rate A) for the loss of the Leonia – Bergenfield 230 kV circuit. (FG# N2-ST13)

Immediate Need:

- Due to the immediate need, the timing required for an RTEP proposal window is infeasible. As a result, the local Transmission Owner will be the Designated Entity.

Recommended Solution:

- Replace existing cable with 5000kcmil XLPE cable.

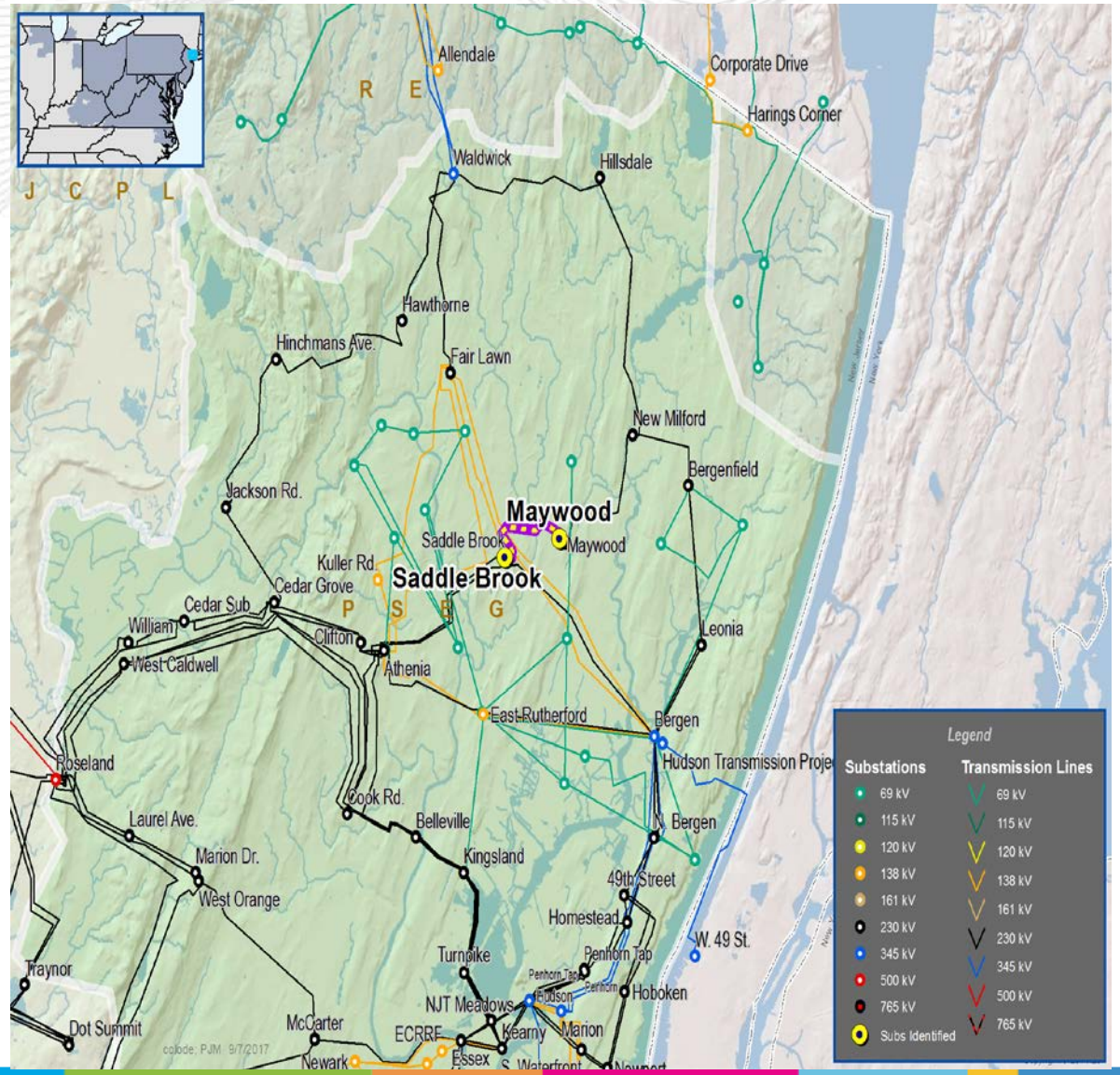
Alternative Solution:

- Re-conductor circuit with HPFF - Replace 2.71mi with 3500kcmil undergroud, pipe-type cable. Address age but not age of pipe. Alternative not recommended. Only one vendor for HPFF remains. Future availability of HPFF an issue in question due to supply chain availability
- Abandon circuit - Would leave a Maywood with a single underground transmission source. Violates FERC 715 criteria by leaving one source to Maywood.
- Replace with overhead construction - Need right of way. Surrounding area is developed and densely populated. Airport nearby. The construction of this alternative is not feasible.

Estimated Project Cost: $57.5 M

Required IS date: 6/1/2018

Project Status: Conceptual



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2017 Proposal Window #1 Update
Preliminary Recommendations

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APS Transmission Zone

Generation Deliverability and Baseline (Summer), (GD-S579, GD-S587, and N1-S175):

Problem Statement:

- The Pruntytown – White Hall Junction – McAlpin – Glen Falls 138 is overloaded for towerline outage loss of the Pruntytown – Maple Lake and Pruntytown – Shinns Run 138 kV circuits.

Alternatives considered:

2017_1-2A ($39.1 M)
2017_1-5A ($30.1 M)
2017_1-7E ($34.74 M)
2017_1-10G ($4.01 M)
2017_1-10H ($11.1 M)
2017_1-10I ($40.06 M)
2017_1-10J ($34.82 M)

Preliminary Recommendation:

- Replace terminal equipments at Pruntytown and Glen Falls 138 kV station.
- Reconductor approximately 8.3 miles of the McAlpin - White Hall Junction 138 kV circuit. 2017_1-10G

Estimated Project Cost: $ 4.01 M

Required IS date: 6/1/2022

Project Status: Conceptual

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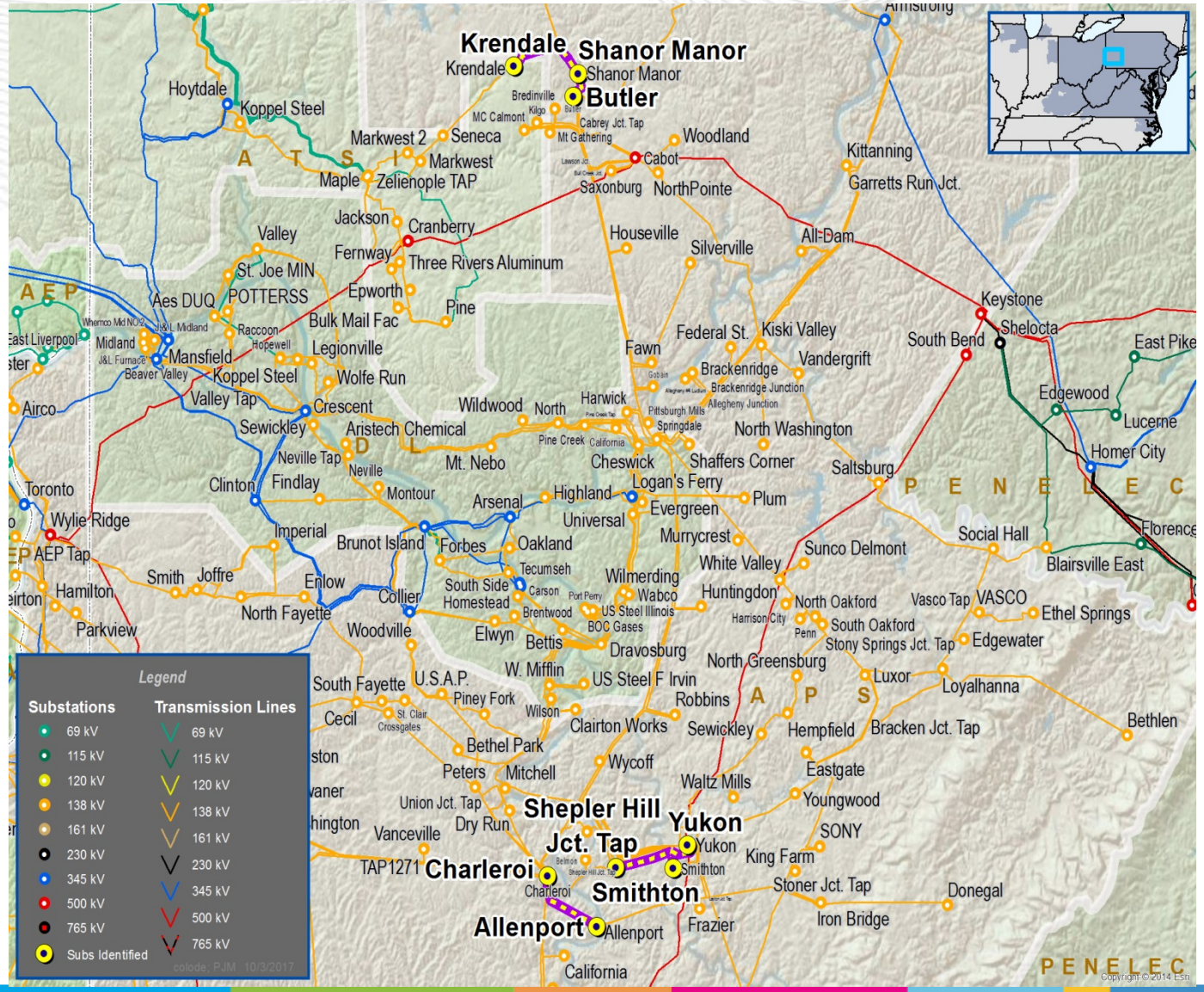
Generation Deliverability (Summer):

Problem Statement:

- The Butler – Shanor Manor –Krendale 138 kV circuit for multiple contingencies. (**GD-S044, GD-S53, GD-S766, GD-S765, GD-S786 and GD-S787**
- The Yukon – Smithon 138 kV circuit is overloaded for multiple contingencies. (**GD-S857, GD-S577 and GD-S578)**
- The Smithon – Shepler Hill Jct Tap 138 kV circuit is overloaded for tower line outages loss of the Charleroi – Yukon and Charleroi –Westraver 138 kV circuit OR loss of the Yukon – Chaleroi and Yukon – Westraver 138 kV circuits. **(GD-S583 and GD-S584)**
- The Allenport – Charleroi 138 kV circuit is overloaded for tower line outages loss of the Charleroi – Yukon and Charleroi –Westraver 138 kV circuit OR loss of the Yukon – Charleroi and Yukon – Westraver 138 kV circuits. **(GD-S581 and GD-S582)**



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APS Transmission Zone

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Generation Deliverability (Summer):

Alternatives considered:

- 2017_1-2B ($17 M)
- 2017_1-10A ($7.08 M)
- 2017_1-2C ($22.2 M)
- 2017_1-10B ($3.19 M)
- 2017_1-2D ($64.8 M)
- 2017_1-10C ($6.96 M)
- 2017_1-3A ($120.3 M)
- 2017_1-10D ($0.12 M)
- 2017_1-4A ($4.49 M)
- 2017_1-10E ($2.69 M)
- 2017_1-5B ($11.7 M)
- 2017_1-10F ($23.4 M)
- 2017_1-5C ($11.8 M)
- 2017_1-7A ($29.46 M)
- 2017_1-7G ($9.91 M)

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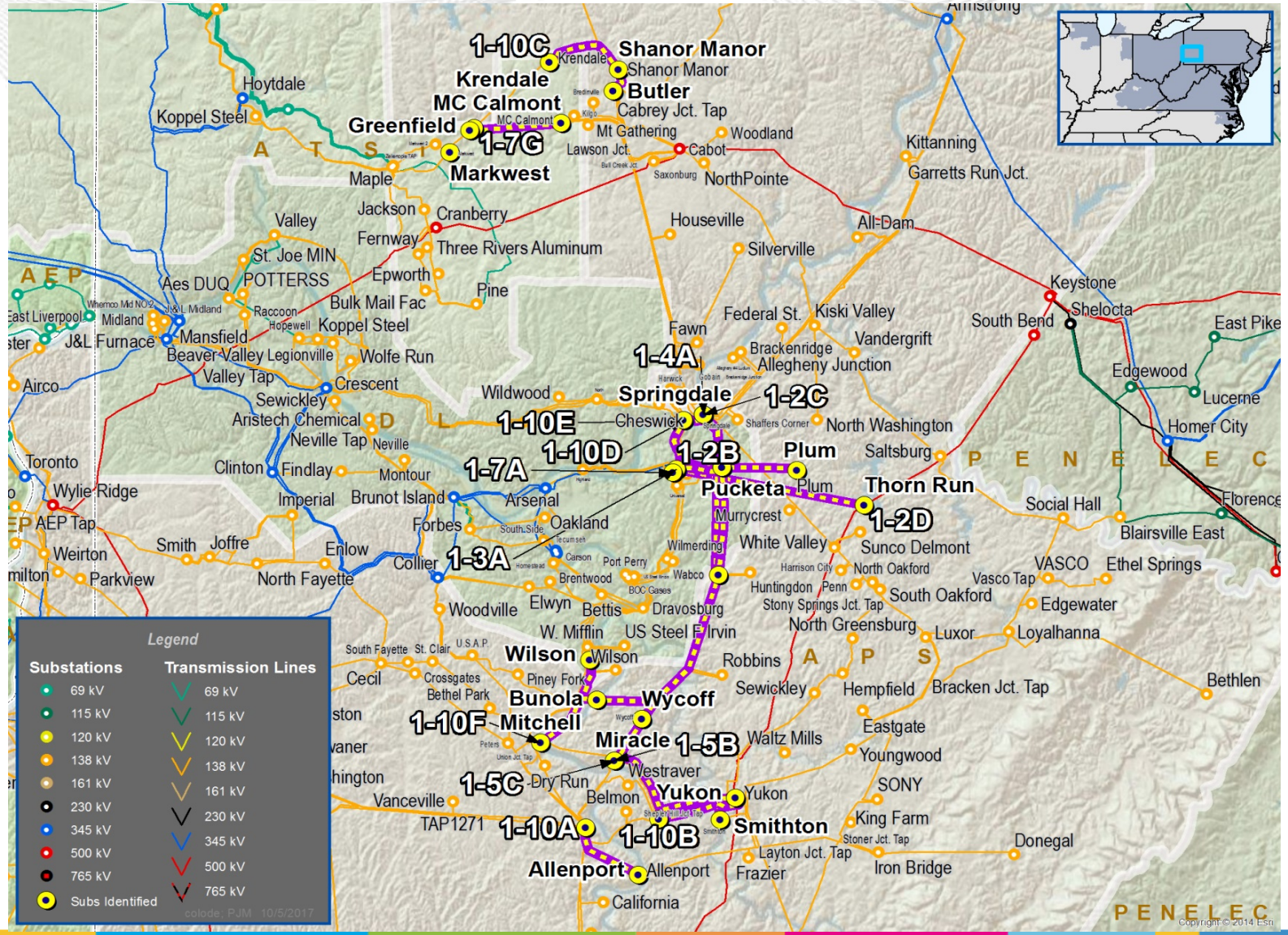

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APS Transmission Zone

2022 Window 1 APS/Duquesne area proposals Comparison

Proposal ID	Type Of Upgrade	Proposing Entity	Project Cost Estimate ($M)	FG #	Additional Issue
2017_1-10A	Upgrade	FirstEnergy	7.08	GD-S581, GD-S582	None
2017_1-10B	Upgrade	FirstEnergy	3.19	GD-S857, GD-S578, GD-S584, GD-S577, GD-S583	None
2017_1-10C	Upgrade	FirstEnergy	6.96	GD-S44, GD-S53, GD-S766, GD-S787, GD-S765, GD-S786	None
2017_1-10D	Upgrade	FirstEnergy	0.12	GD-S857, GD-S578, GD-S584, GD-S577, GD-S583, GD-S582, GD-S581	Springdale-Cheswick 138KV. Several Duquesne breakers overdutied
2017_1-10E	Upgrade	FirstEnergy	2.69	GD-S857, GD-S578, GD-S584, GD-S577, GD-S583, GD-S582, GD-S581	Springdale-Cheswick 138KV. Several Duquesne breakers overdutied
2017_1-2B	Greenfield	Northeast Transmission Development	17	GD-S857, GD-S578, GD-S582, GD-S584, GD-S577, GD-S581, GD-S583, GD-S44, GD-S53, GD-S766, GD-S787, GD-S765, GD-S786	Springdale - Pucketa 138kV #1&2 (approximately 2.5mi per circuit, $2.5 M). Several Duquesne breakers overdutied
2017_1-5B	Greenfield	Nextera	11.7	GD-S581, GD-S582, GD-S577, GD-S857, GD-S578, GD-S583, GD-S584	Belmont - Charleroi 138 kV Miracle - Mitchell 138 kV
2017_1-5C	Greenfield	Nextera	11.8	GD-S581, GD-S582, GD-S577, GD-S857, GD-S578, GD-S583, GD-S584	Additional cost due to a low cost estimate for the incombant work (FE estimate is $1**.5**M for the reconductor and $0.7 M for the cut in and remote work)
2017_1-4A	Greenfield	Duquesne	4.49	GD-S577, GD-S578, GD-S581, GD-S582, GD-S583, GD-S584, GD-S587	Springdale-Plum 138KV Cheswick – Wycoff 138kV
2017_1-2C	Greenfield	Northeast Transmission Development	22.2	GD-S857, GD-S578, GD-S582, GD-S584, GD-S577, GD-S581, GD-S583, GD-S44, GD-S53, GD-S766, GD-S787, GD-S765, GD-S786	Several Duquesne breakers overdutied
2017_1-2D	Greenfield	Northeast Transmission Development	64.8	GD-S857, GD-S578, GD-S582, GD-S584, GD-S577, GD-S581, GD-S583, GD-S44, GD-S53, GD-S766, GD-S787, GD-S765, GD-S786	Cost not Competitive
2017_1-3A	Greenfield	PSEG	120.3	GD-S44, GD-S53, GD-S857, GD-S578, GD-S582, GD-S584, GD-S581, GD-S583, GD-S577, GD-S766, GD-S787, GD-S765, GD-S786	Cost not Competitive
2017_1-7A	Greenfield	Transource	29.46	GD-S44, GD-S53, GD-S857, GD-S578, GD-S582, GD-S584, GD-S581, GD-S583, GD-S577, GD-S766, GD-S787, GD-S765, GD-S786	Cost not Competitive
2017_1-7G	Greenfield	Transource	9.91	GD-S44, GD-S53, GD-S766, GD-S787, GD-S765, GD-S786	Cost not Competitive Short circuit under evaluation
2017_1-10F	Greenfield	FirstEnergy	23.4	GD-S857, GD-S578, GD-S584, GD-S577, GD-S583, GD-S582, GD-S581	Cost not Competitive

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APS Transmission Zone

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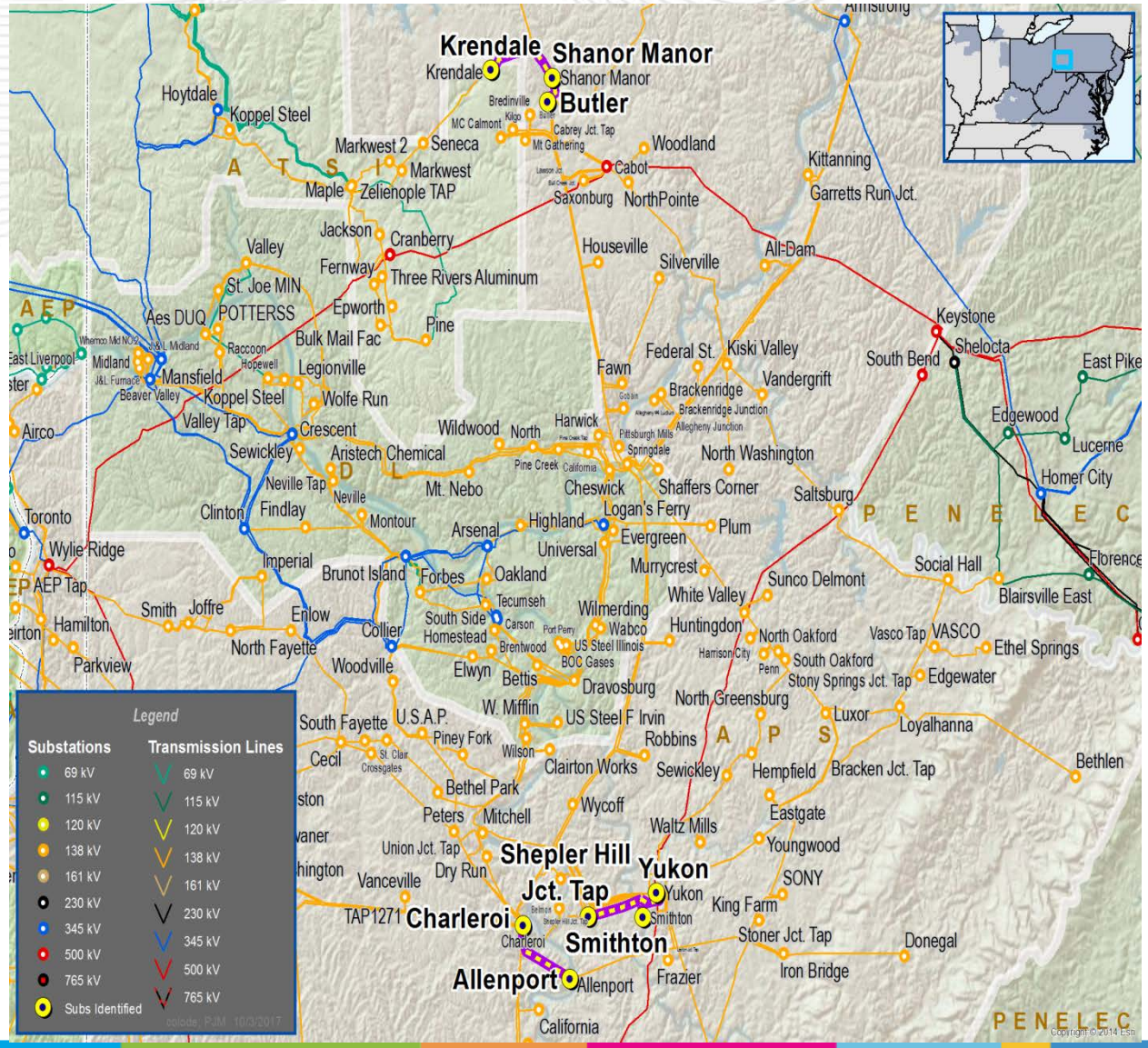
Preliminary Recommendation:

- Reconductor the Charleroi –Allenport 138KV Line with 954 ACSR Conductor, Replace Breaker Risers at Charleroi and Allenport. (2017_1-10A)
- Reconductor the Yukon - Smithton - Shepler Hill Jct 138 kV Line with 795 ACSS Conductor, Replace Line Disconnect Switch at Yukon. (2017_1-10B)
- Convert the existing 6 wire Butler - Shanor Manor - Krendale 138 kV Line into two separate 138 kV lines. New lines will be Butler - Keisters and Butler - Shanor Manor - Krendale 138 kV. (2017_1-10C)

Estimated Project Costs: $ 7.08 M
$ 3.19 M
$ 6.96 M

Required IS date: 6/1/2022

Project Status: Conceptual



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AEP/DEOK Transmission Zone

Generation Deliverability (Winter) (GD-W3, GD-W5, GD-W6, GD-W7, and GD-W8):

Problem Statement:

- The Tanner – Miami Fort 345 kV line is overloaded for multiple single contingencies

Alternatives considered:

2017_1-7B ($19.32 M)
2017_1-7D ($55.09 M)
2017_1-7F ($11.45 M)
2017_1-8C ($1.2 M)

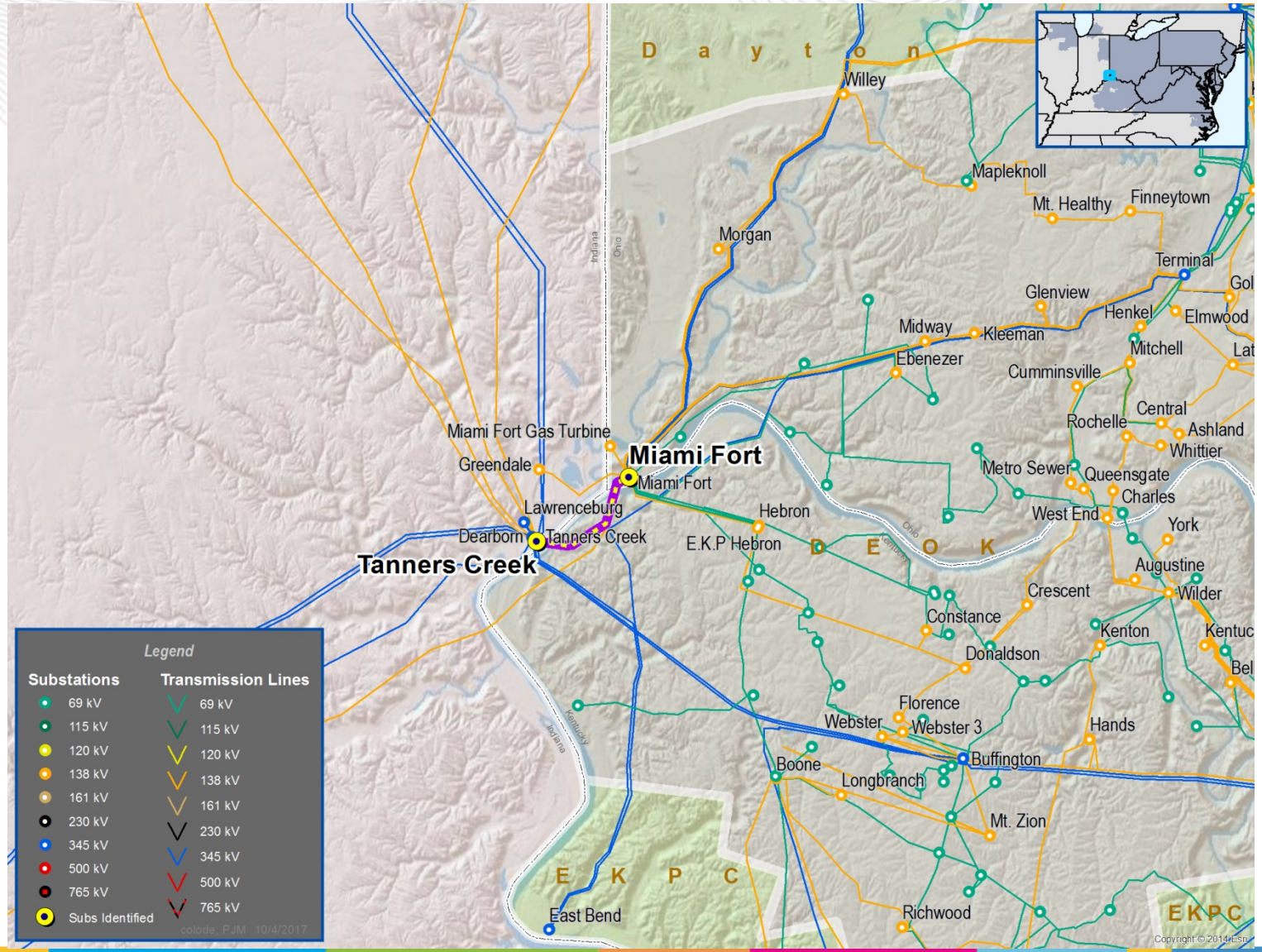
Preliminary Recommendation:

- Upgrade existing 345kV terminal equipment at Tanner Creek station. 2017_1-8C

Estimated Project Cost: $ 1.2 M

Required IS date: 12/1/2022

Project Status: Conceptual



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AEP Transmission Zone

Generation Deliverability (Winter) (GD-W92):

Problem Statement:

- The Maddox – East Lima 345 kV line is overloaded for the loss of the Marysville – Sorenson 765KV line

Alternatives considered:

2017_1-8A ($1.48 M)
2017_1-8B ($111.64 M)

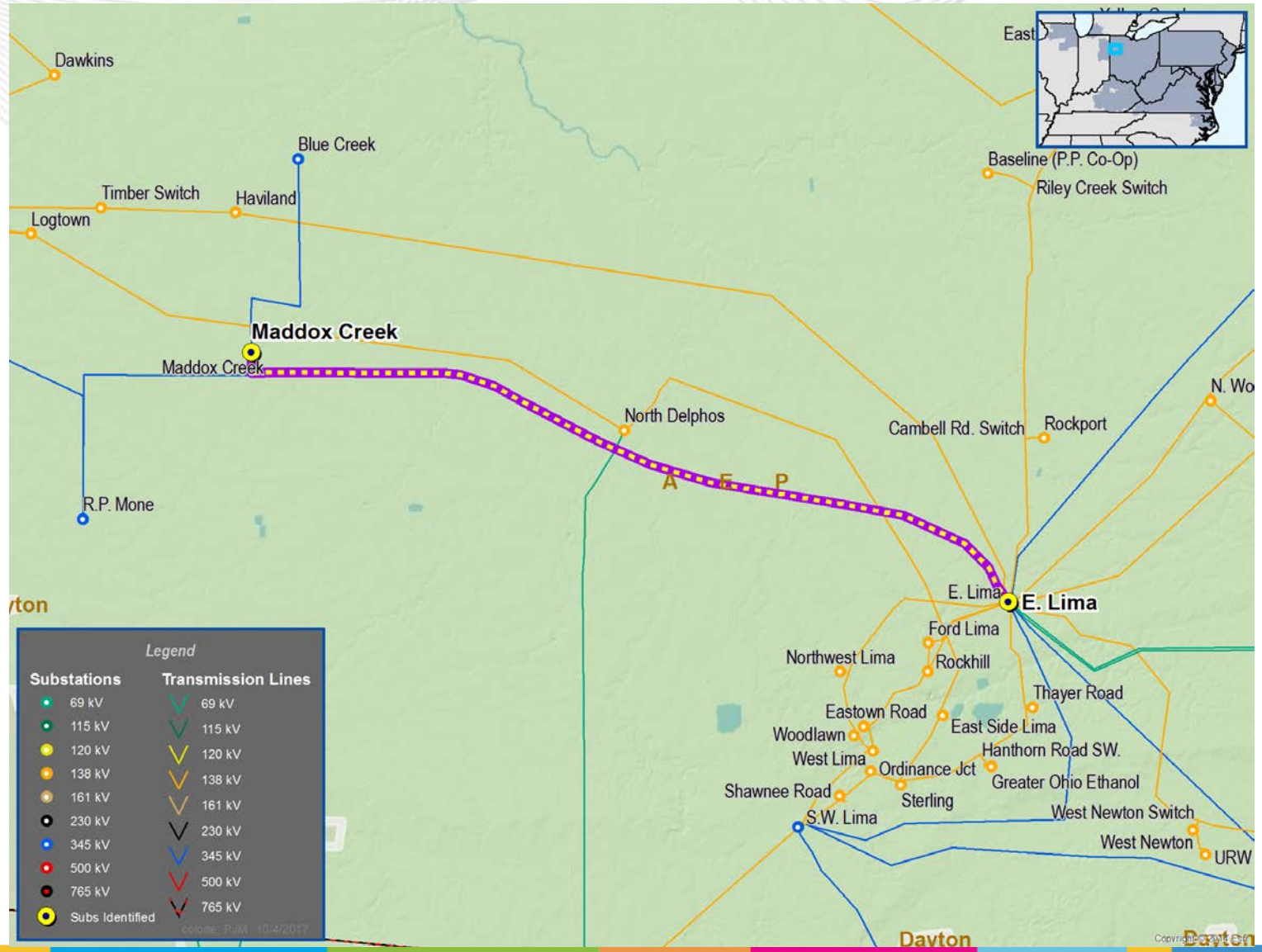
Preliminary Recommendation:

- Replace terminal equipment on Maddox Creek - East Lima 345kV circuit. 2017_1-8A

Estimated Project Cost: $ 1.48 M

Required IS date: 12/1/2022

Project Status: Conceptual



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DEOK Transmission Zone

Common Mode Outage and Basecase Analysis (Summer) (GD-S763, GD-S746, GD-S814, GD-S745, GD-S813, N1-S91, N1-S92 and N1-S126):

Problem Statement:

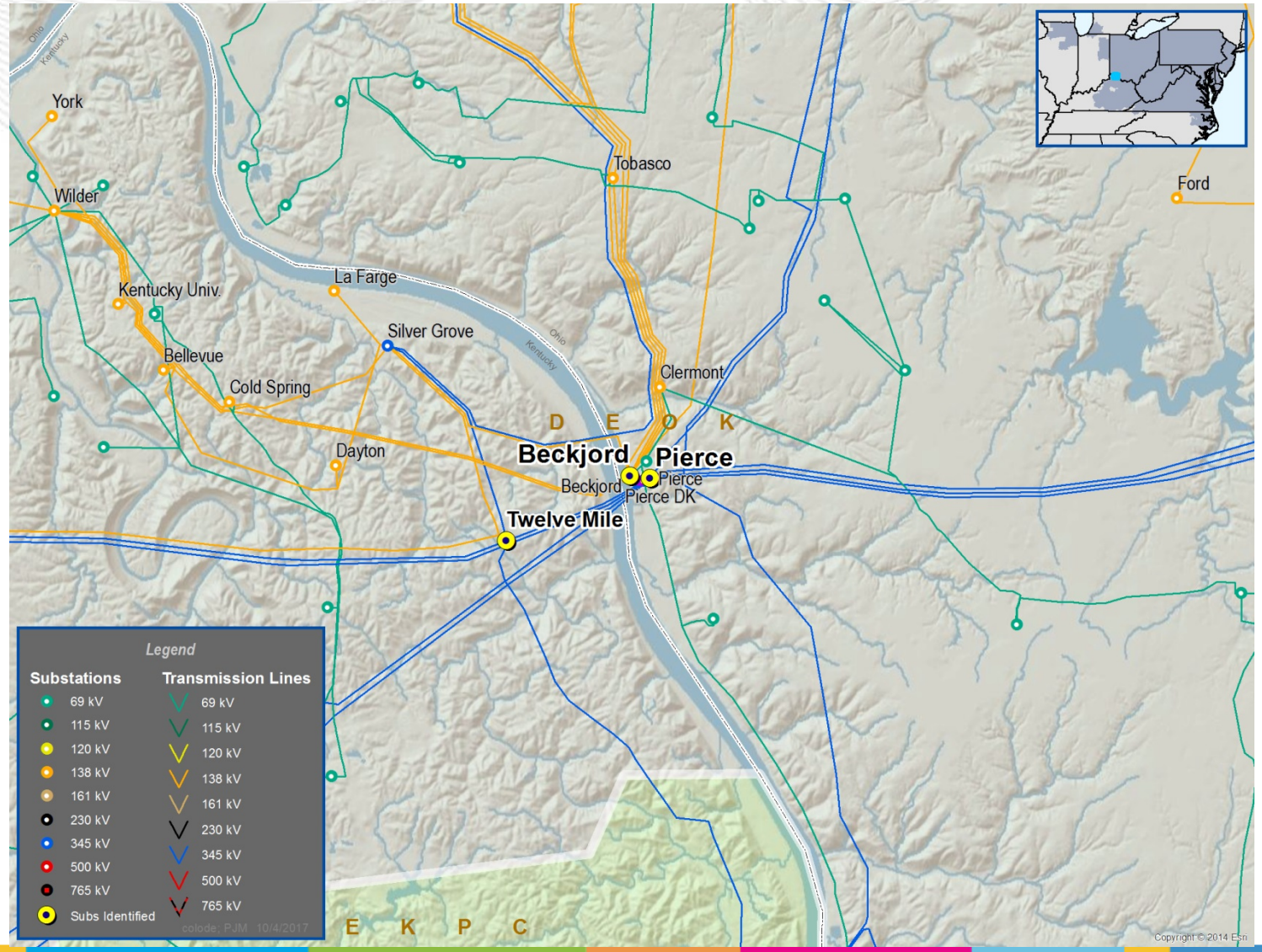
- The Pierce 345 /138kV transformer #18 is overloaded for the loss of the Pierce 345/138kV transformer #17 with the breaker stuck at Pierce.
- The Pierce 345 /138kV transformer #17 and the connected Pierce –Beckjord 138kV circuit are overloaded for the loss of the Pierce 345/138kV transformer #17 with the breaker stuck at Pierce.

Alternatives considered:

2017_1-6A ($20.16M) :The two existing 345/138kV transformers that connect Pierce 345kV Substation to Beckjord 138kV Substation are fed radially. This project will Reconfigure Pierce 345kV Substation by adding new breakers, moving a feeder, adding a third 345/138kV transformer, and feed the Pierce-Beckjord transformers in a breaker and a half or double bus configurations. The three transformer feeds will be distributed across the three sets of buses at Beckjord.

2017_1-2E ($12.7 M): Build a 345 kV switching station ("Twelvemile") interconnecting the existing Silver Grove - Zimmer 345 kV transmission line and the Pierce - Buffington 345 kV transmission line

Continued on the next slide…



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DEOK Transmission Zone

Continued from the previous slide……

Project ID	Project Sponsor	2017 RTEP Window #1 target reliability flowgates solved?	Cost Analysis
2017_1-**2E**	NTD	Yes; But causes an N-1-1 thermal overload on the Beckjord – Pierce 138kV line (violation)	Estimated overall project cost by sponsor of $12.7M ($9.7 NTD scope + $3M TO scope in current year) Cost cap = $14M (in-service year $'s) for NTD scope of work The fix for the new overload on the Beckjord – Pierce 138kv line is approximately $1M;
2017_1-**6A**	DEOK	Yes, with no additional overloads	The submitted cost $20.16M includes the Y3-064 merchant project cost, $0.5M, which shouldn't be included as baseline cost, The total estimated cost is $19.66M

Notes:

- NTD cost cap includes AFUDC and escalation, i.e. in-service year dollars
- Further reliability performance, economic performance and constructability/feasibility evaluations are in progress by PJM.

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Dominion Transmission Zone

Generation Deliverability (Summer) (GD-S126, GD-S585 and GD-S661):

Problem Statement:

- The Pleasant View – Ashburn 230 kV is overloaded for single contingency loss of the (Brambleton – Yardley 230 kV, for a tower line outage loss of the (Brambleton – Yardley plus (Brambleton – Poland Rd. 230 kV circuits.
- The Ashburn - Beaumeade 230 kV is overloaded for a tower line outage loss of the (Brambleton – Yardley plus (Brambleton – Poland Rd. 230 kV circuits.

Alternatives considered:

2017_1-1A ($4.52 M)
2017_1-1B ($7.11 M)
2017_1-1C ($3.05 M)
2017_1-7C ($9.74 M)

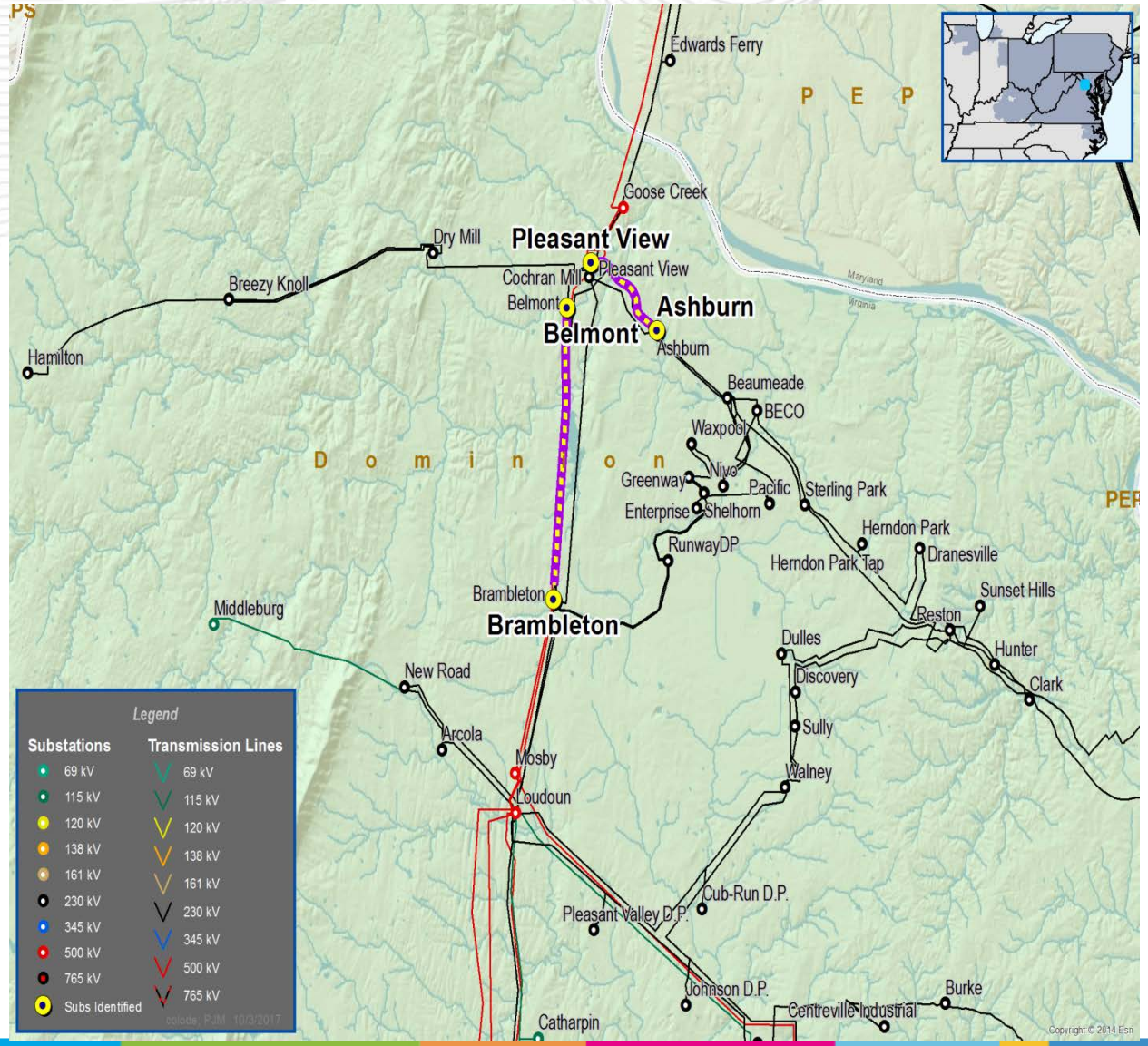
Preliminary Recommendation:

- Split Line #227 (Brambleton – Beaumeade 230 kV)and terminate into existing Belmont substation. 2017_1-1C

Estimated Project Cost: $ 3.05 M

Required IS date: 6/1/2022

Project Status: Conceptual



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Dominion Transmission Zone

Generation Deliverability (Summer) (GD-S107, GD-S159 and):

Problem Statement:

- The Possum Point – Woodbridge – Occoquan 230 kV circuit is overloaded for single contingency loss of the Possum Point – Possum Creek - Woodbridge – E.P.G. – Hayfield 230 kV circuit.

Alternatives considered:

2017_1-1D ($4.49 M)
2017_1-1E ($4.96 M)
2017_1-1F ($12.68 M)

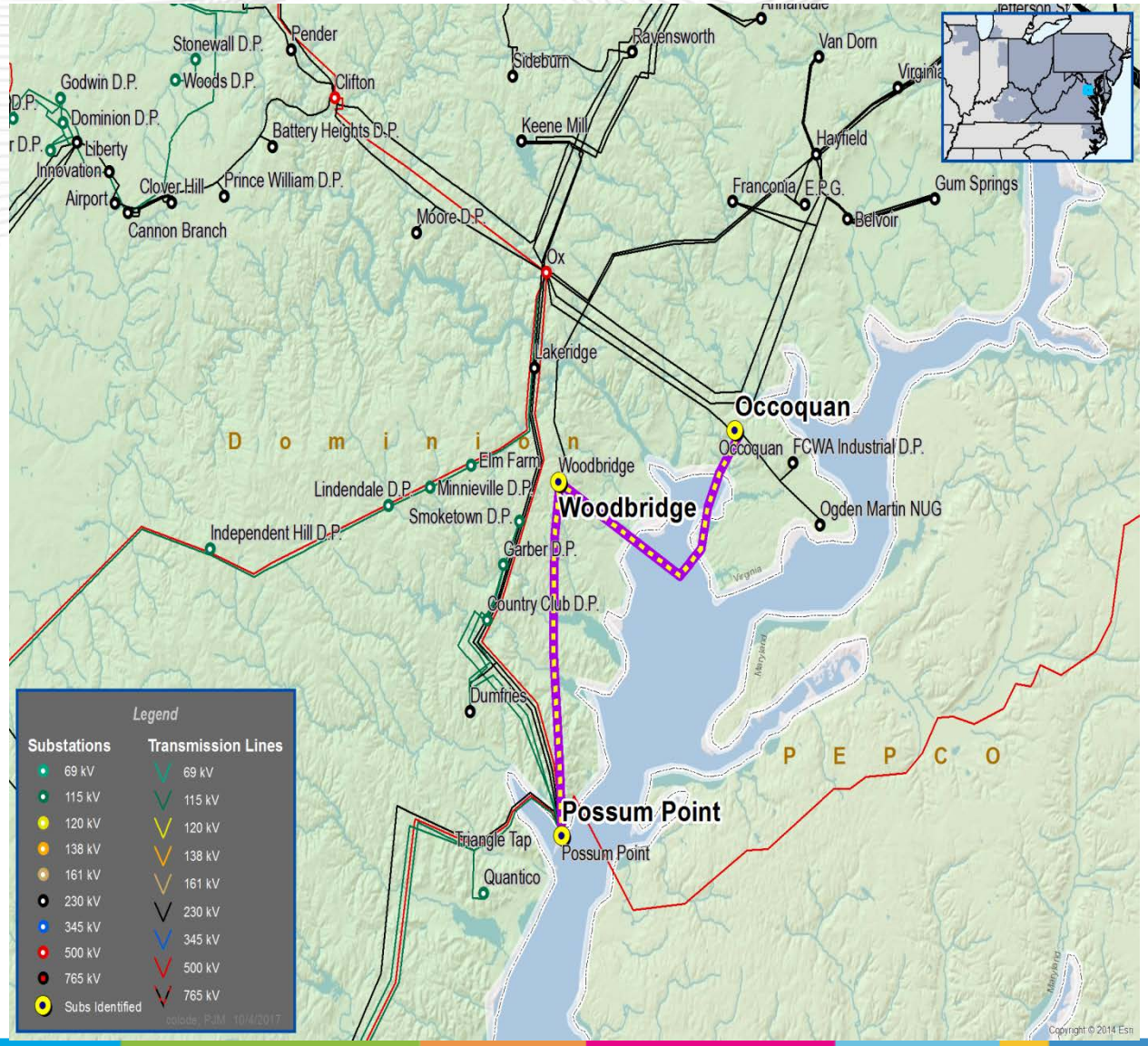
Preliminary Recommendation:

- Reconductor the Woodbridge to Occoquan 230kV line segment of Line 2001 with 1047 MVA conductor and replace line terminal equipment at Possum Point, Woodbridge, and Occoquan. 2017_1-1D

Estimated Project Cost: $ 4.49 M

Required IS date: 6/1/2022

Project Status: Conceptual



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DPL/PECO Transmission Zone

Generation Deliverability (Summer) (GD-S798 and GD-S815):

Problem Statement:

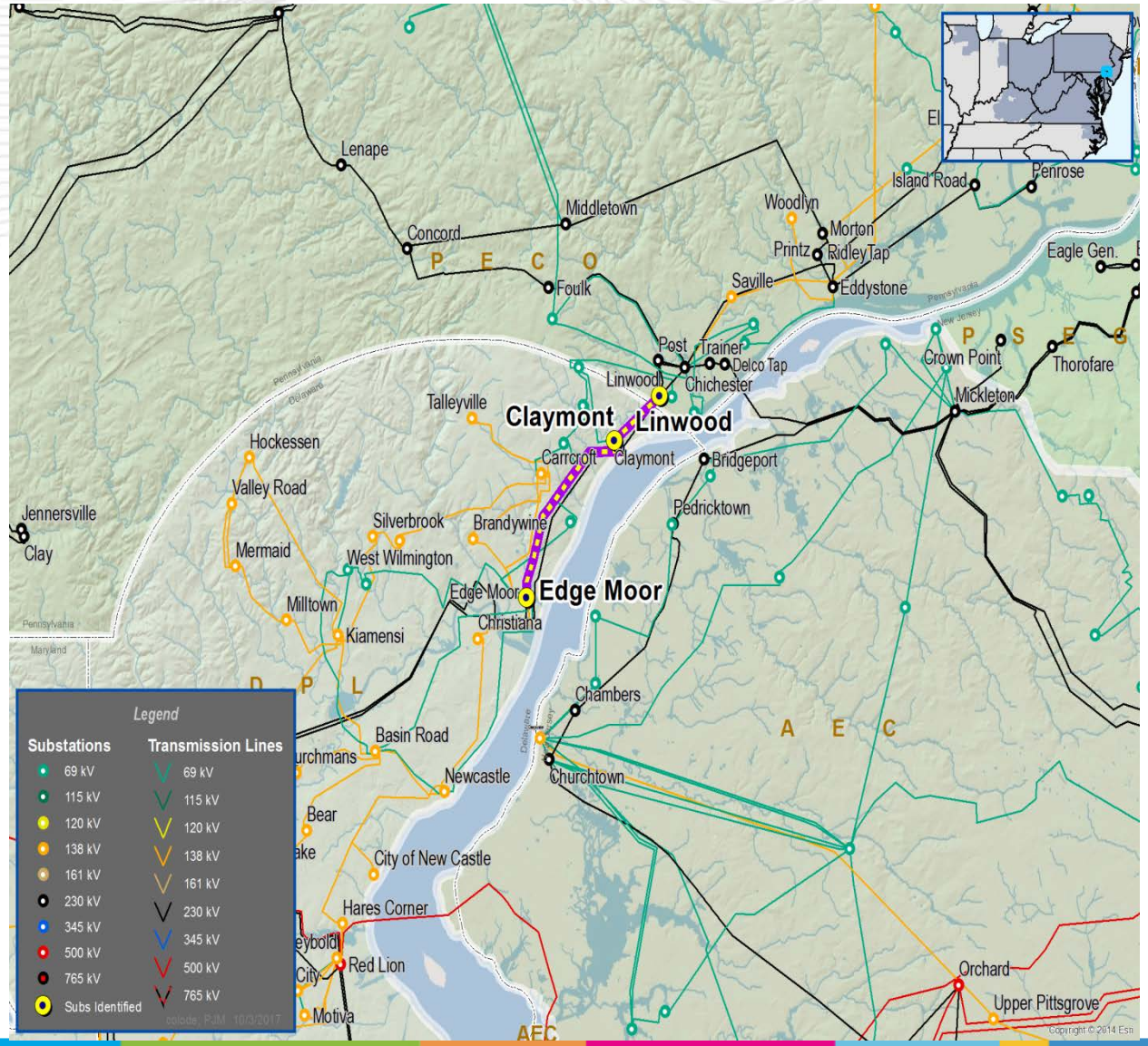
- The Edge Moor – Claymont – Linwood 230 kV circuit is overloaded for line fault stuck breaker contingency loss of the Edge Moor – Linwood 230 kV circuit and two units at Philips Island.

Alternatives considered:

2017_1-9A ($1.83 M)	2017_1-9H ($55.7 M)
2017_1-9B ($28.4 M)	2017_1-9I ($64 M)
2017_1-9C ($5.73 M)	2017_1-9J ($37.69 M)
2017_1-9D ($37.95 M)	2017_1-9K ($9.58 M)
2017_1-9E ($26.78 M)	2017_1-9L ($1.4 M)
2017_1-9F ($28.69 M)	2017_1-9M ($8.37 M)
2017_1-9G ($36.56 M)	2017_1-9N ($79.03 M)

Status:

- Study in progress



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PSE&G FERC 715 Local Criteria - Equipment Assessment

Roseland – Branchburg – Pleasant Valley Corridor

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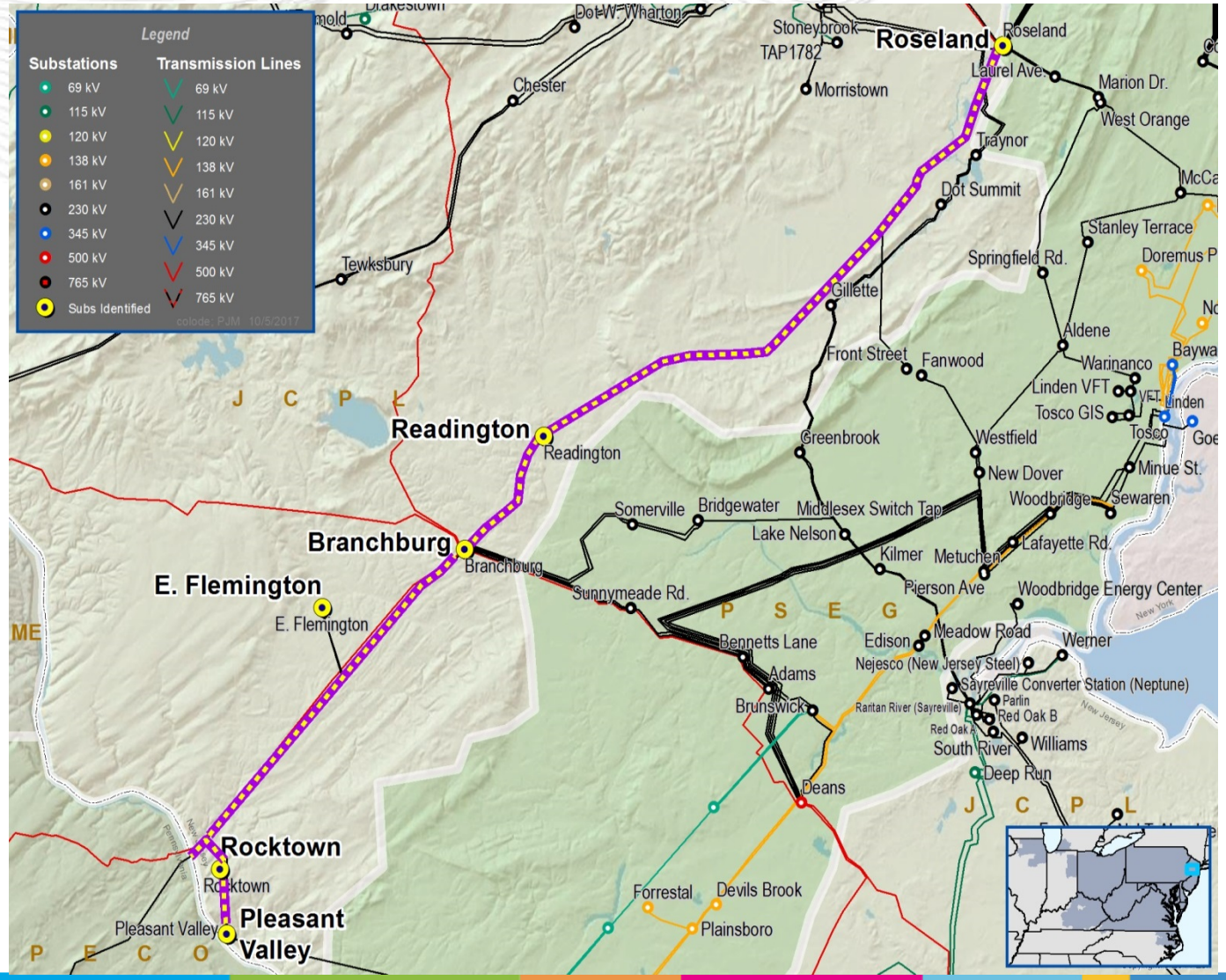
PSE&G Transmission Zone

Roseland – Branchburg – Pleasant Valley Corridor

- PSE&G's FERC 715 Transmission Owner criterion addresses equipment condition assessments
  - PSE&G assessed the condition of the Roseland to Branchburg to Pleasant Valley 230 kV circuits.



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- Refer to PSE&G criteria:

  VII. EQUIPMENT ASSESSMENT AND STORM HARDENING

  http://www.pjm.com/~/media/planning/planning-criteria/PSE&G-planning-criteria.ashx

  - Roseland to Branchburg is approximately 30 miles of 230 kV circuit and the average structure age is approximately 90 years.
  - Branchburg to Pleasant Valley is approximately 22 miles of 230 kV circuit and the average structure age is approximately90 years.
  - Parallel to Roseland-Branchburg 500kV corridor
  - The terrain is variable and includes rural, National Wildlife Refuge and municipalities
  - This facility also serves 240 MVA sub-transmission load in adjacent territory (JCP&L)

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Roseland – Branchburg – Pleasant Valley Corridor

- PSE&G commissioned external consultants to assess tower foundations and tower structures of the 50 mile Pleasant Valley-Branchburg-Roseland corridor
  - Assessment result:
    - The assessments identified towers with foundations needing reconstruction, towers exceeding loading capability, Also identified through LiDAR are NESC ground conflicts; the Project was developed as a result.
- These towers were built in 1927-1930. Small portions were rebuilt from 1961 to 2015 (see next slide). At 795 ACSR, some existing conductors are smaller than the current standard of 1590 ACSR.
- The two major components of the overall corridor are the Roseland – Branchburg segment and the Branchburg – Pleasant Valley segment

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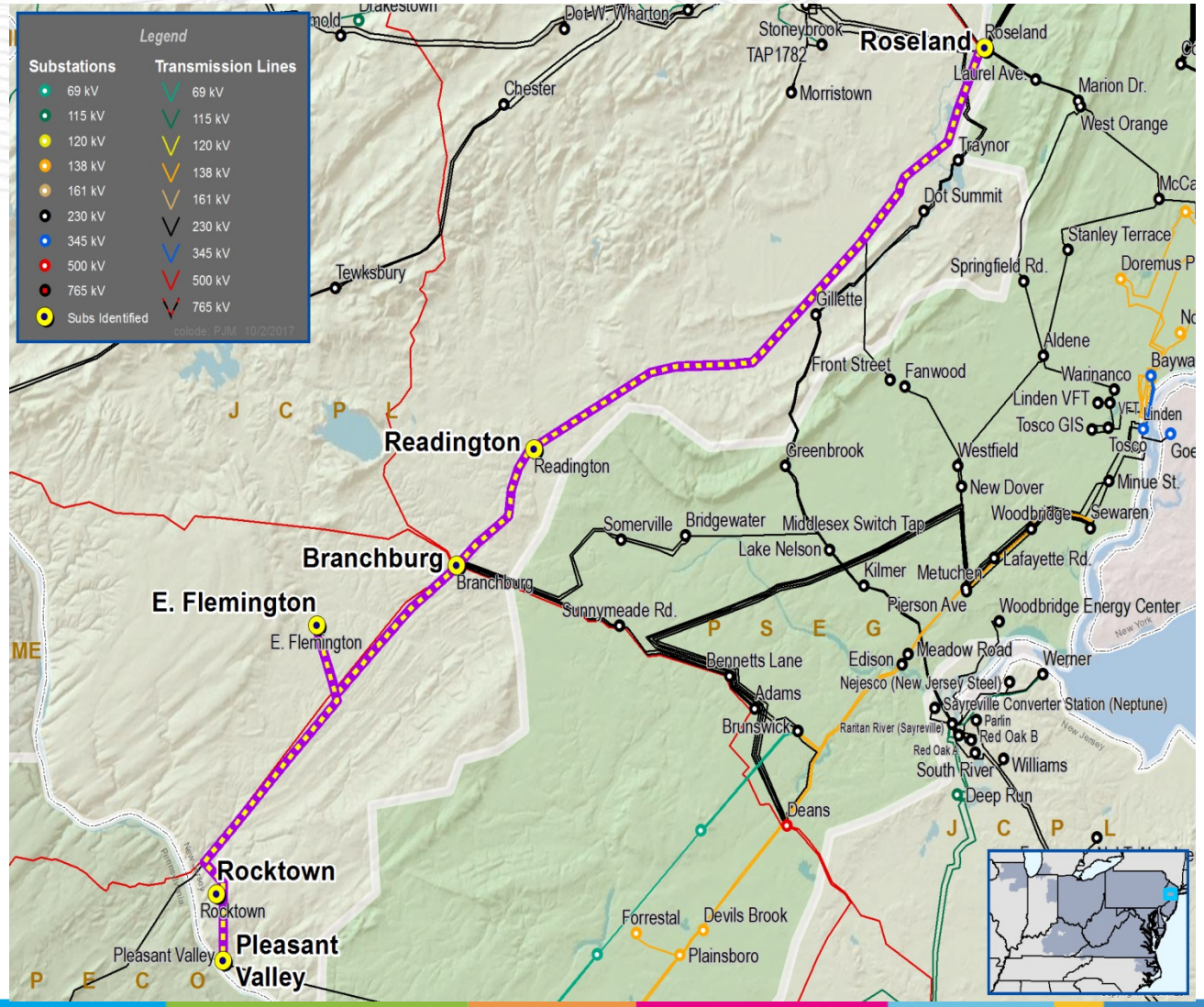
PSE&G Transmission Zone

Roseland – Branchburg – Pleasant Valley Corridor

- Assessment Result:
  - Consultant findings – Transmission Tower Foundation assessment
    - About 25% of structures for Roseland – Branchburg – Pleasant Valley will require either extensive foundation rehabilitation or total foundation replacement.
  - Consultant findings – Tower line assessment
    - Due to the present condition, 54% of the towers are exceeding 100% of the tower's load bearing capability, and 84% of the towers are exceeding 95% of the tower's capability.
    - 9% of spans violate LiDAR ground conflicts



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Roseland – Branchburg Segment

Tower Condition on Circuits U-2221, M-2265 (162 towers)	
Towers with foundation requiring extensive reconstruction	40 (25%)
Towers exceeding 95% loading capability	144 (89%)
Towers exceeding 100% loading capability	129 (80%)
LIDAR conflict (# spans)	17* (10%)

*LiDAR conflicts as of 9/29/2017

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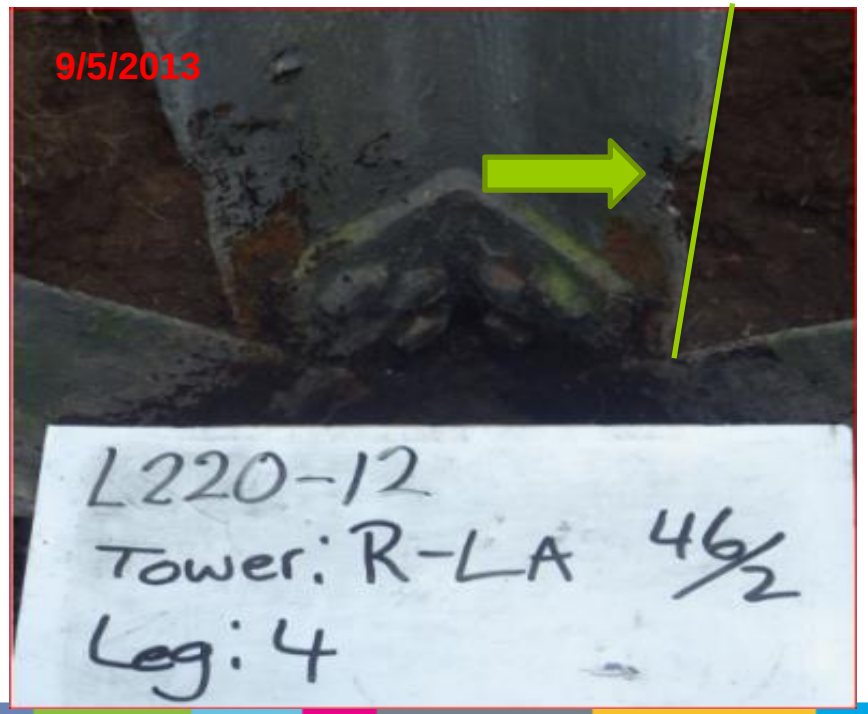
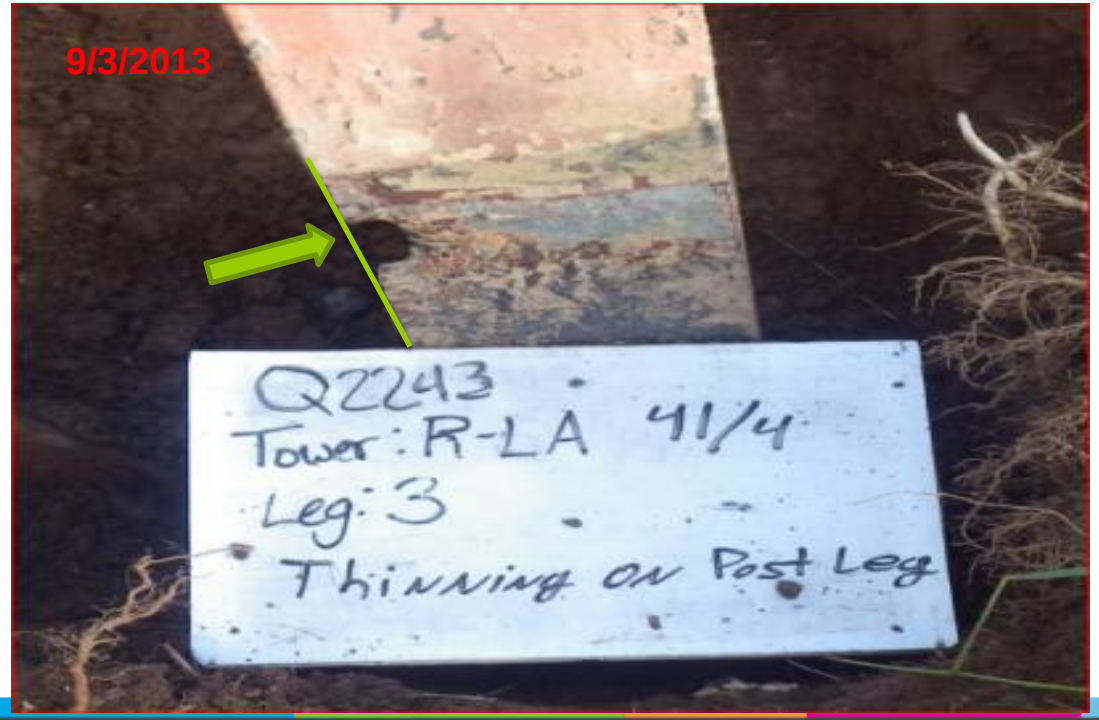
Branchburg – Pleasant Valley

Evaluate Towers on Circuits I-2209, Q-2243, Z-2357, L-220-12 (102 towers)	
Towers with foundation requiring extensive reconstruction	27 (26%)
Towers exceeding 95% loading capability	77 (76%)
Towers exceeding 100% loading capability	14 (14%)
LIDAR conflicts (# spans)	7* (7%)

*LiDAR conflicts as of 9/29/2017





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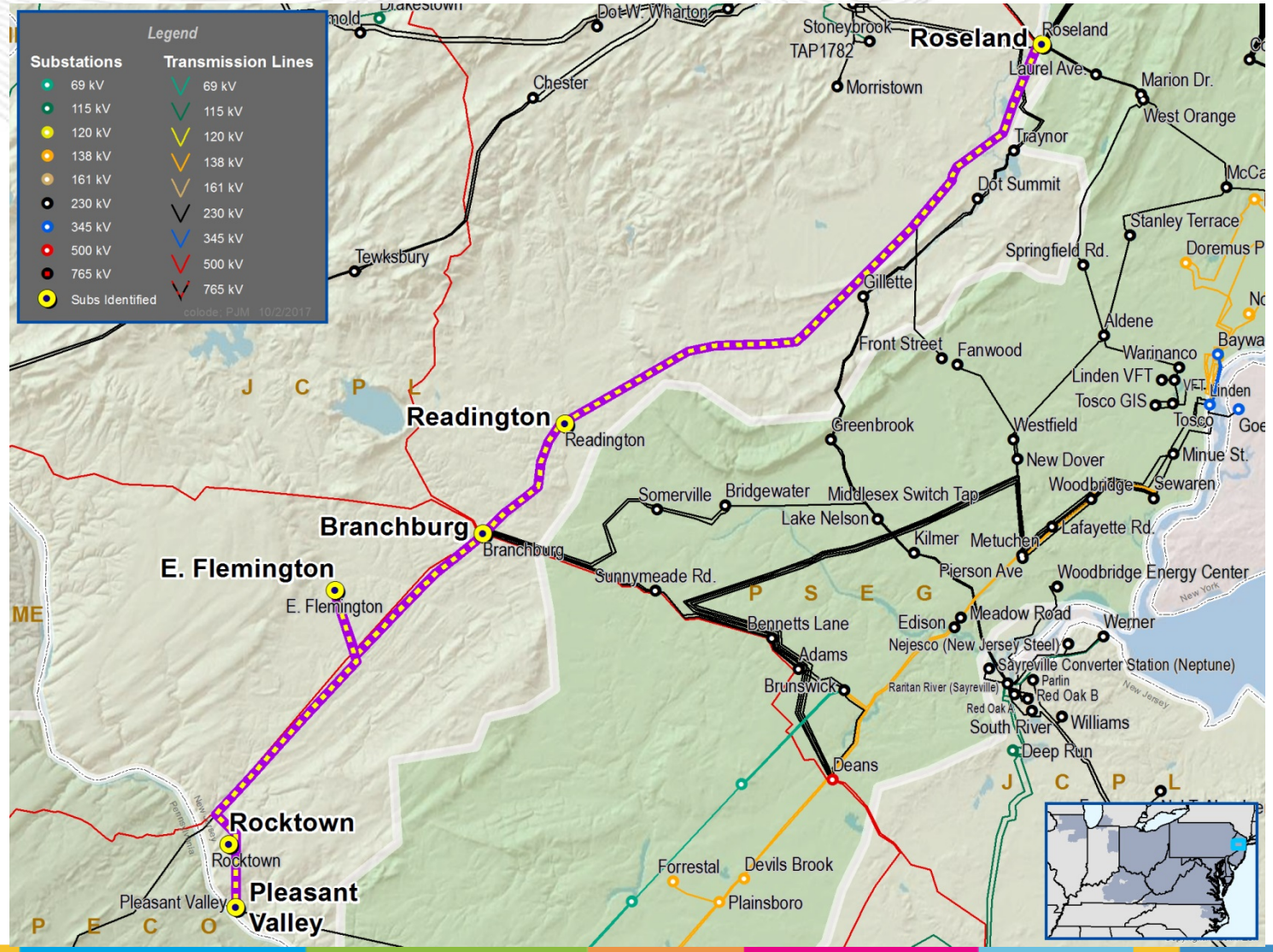
PSE&G Transmission Zone

Roseland – Branchburg – Pleasant Valley Corridor

Problem:

PSE&G FERC 715 local Transmission Owner Criteria

- Equipment condition assessment for the entire corridor
- Equipment has reached its end of life



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Solution Alternatives Considered

1. Remove and retire the 230 kV corridor without replacing

2. Install new parallel circuit on new right-of-way and remove existing 230 kV corridor

3. Replace the existing 230 kV single-circuit corridor with new dual-circuit structures and initially string one 230 kV circuit

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Solution Alternative #1: Remove the existing 230 kV corridor without replacing

- Would leave 240 MVA of JCP&L load supplied by 34.5kV sub-transmission with significant voltage and thermal violations
- Would require extensive construction, and associated cost, to relieve voltage and thermal violations on 34.5kV
- Loss of up to 996 MVA transmission system capacity
- Thermal/Voltage violations on the neighboring JCP&L system
- *Because of the above issues, removal without replacement is not a viable option*.

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Solution Alternative #2: Install New Circuit and Remove Existing

- Potential permitting challenges due to new facility
- Martinsville, East Flemington, Readington and Rocktown require feeds from 230/34.5kV substations and associated additional lines to loop in an out of each station
- Would require more than 50 miles of new overhead construction, new ROW and new permitting
- *Due to the above issues, installing new equipment in new areas is the highest cost option*

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Solution Alternative #3: Replace the existing 230 kV corridor with new structures

- Maintain system reliability
- Eliminate safety risk from damaged structures
- No new ROW required
- No new substations or reactive devices required
- No topology change – additional studies, extensive protection coordination not needed
- Minimal new siting, permitting and construction involved
- Maintain transmission capacity between Branchburg and Lawrence substations

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15 Year Analysis Results

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2017 RTEP 15 Year Analysis Simulation

- Test Procedure: Generator deliverability, load deliverability and common mode outage analysis for years 6 through 15
- Focus on events more likely to highlight long lead time violations single and tower line contingencies
- Full AC analysis followed by a linear extrapolation based on future forecasted load

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2017 RTEP 15 Year Analysis Simulation

2017 RTEP 15 Year Analysis								
Fr Bus	**Fr Name**	**To Bus**	**To Name**	**Circuit #**	**KVs**	**TO Zones**	**100% Year**	**Comment**
216915	CDRGV	217054	JACKSNRD	1	230/230	PSEG	2022	2017 RTEP Window 1
218307	ALDENE_2	218430	STANTER_1	1	230/230	PSEG	2022	
218316	WARINICO_2	217122	ALDENE_4	1	230/230	PSEG	2022	2017 RTEP Window 1
219050	VFT_1	219049	WARINICO_1	1	230/230	PSEG	2022	2017 RTEP Window 1
219110	GLOUCSTR	219755	CUTHBERT_4	1	230/230	PSEG	2022	
228401	MCKLTON	228402	MONROE	1	230/230	AEC	2032	
228401	MCKLTON	228402	MONROE	2	230/230	AEC	2032	
243233	05TANNER	249567	08M.FORT	1	345/345	AEP/DEOK	2022	2017 RTEP Window 1
246929	05MADDOX	242935	05E LIMA	1	345/345	AEP/DEOK	2022	2017 RTEP Window 1
314004	6ASHBURN	314010	6BEAMEAD	1	230/230	Dominion	2022	2017 RTEP Window 1
314041	6GLEBE	314185	6RADNOR	1	230/230	Dominion	2032	
314072	6PL VIEW	314004	6ASHBURN	1	230/230	Dominion	2030	2017 RTEP Window 1
314094	6WOODBR	314067	6OCCOQUN	1	230/230	Dominion	2022	2017 RTEP Window 1
314196	6LADYSMITH	314911	8LADYSMITH	1	230/500	Dominion	2028	

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Short Circuit Projects

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BGE Transmission Zone

Problem: Short Circuit

- The Conastone 230kV breakers ‘2322 B5’ and ‘2322 B6’ are overstressed

Significant Driver:

- Creating new Furnace Run 500kV and 230kV stations (b2752)”

Immediate Need:

- Due to the immediate need, the timing required for an RTEP proposal window is infeasible. As a result, the local Transmission Owner will be the Designated Entity.

Alternatives Considered:

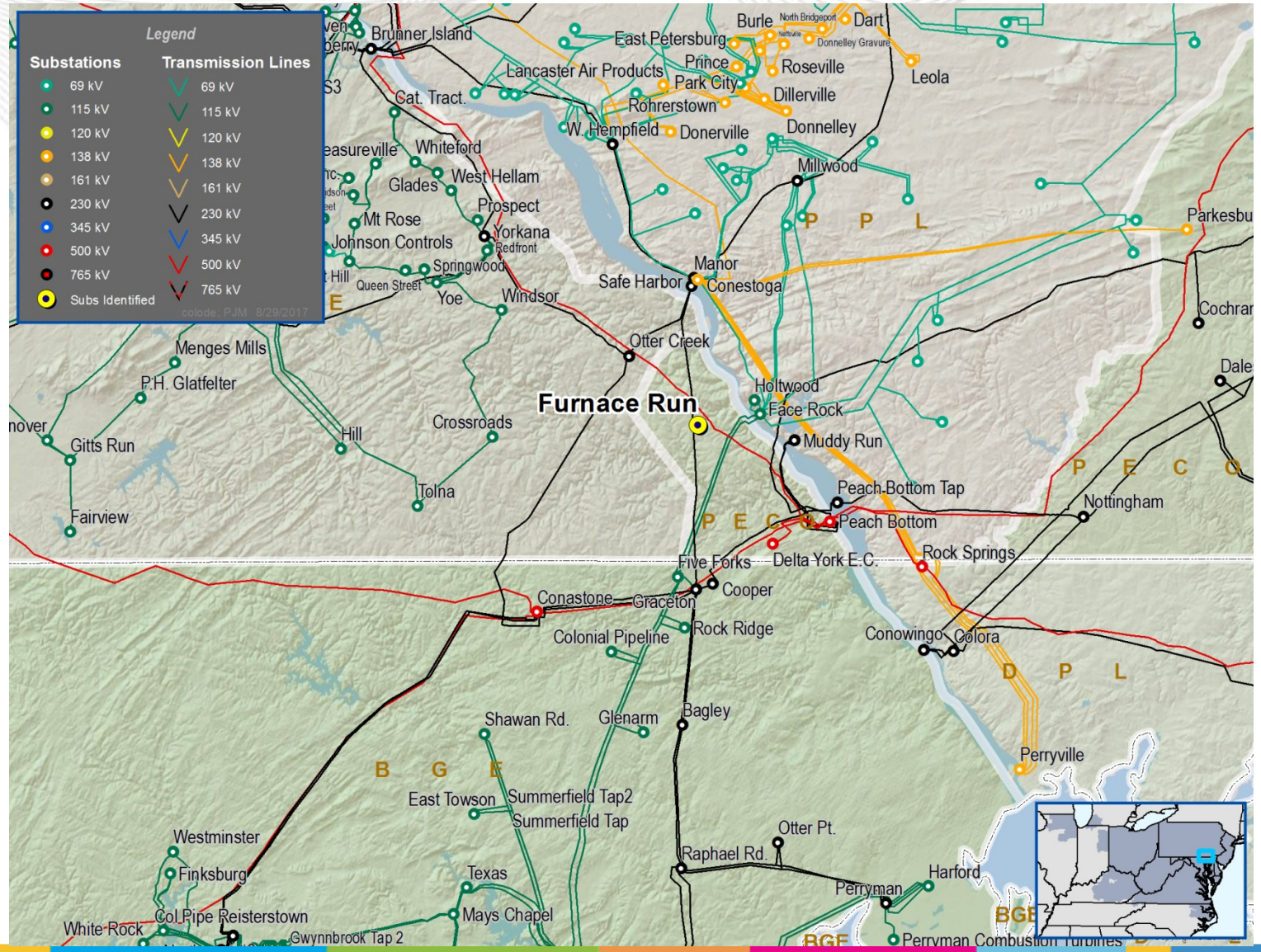
- Due to the immediate need of the project no alternatives were considered

Recommended Solution:

- Replace Conastone 230kV breakers ‘2322 B5’ and ‘2322 B6’ with 63kA breakers (b2752.8 & b2752.9)

Estimated Project Cost: $1.07 M

Required IS Date: 6/1/2020



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Penelec Transmission Area

Problem: Short Circuit

- The Keystone 500kV “NO. 14 Cabot” and “NO. 16 Cabot” breakers are overstressed

Proposed Solution:

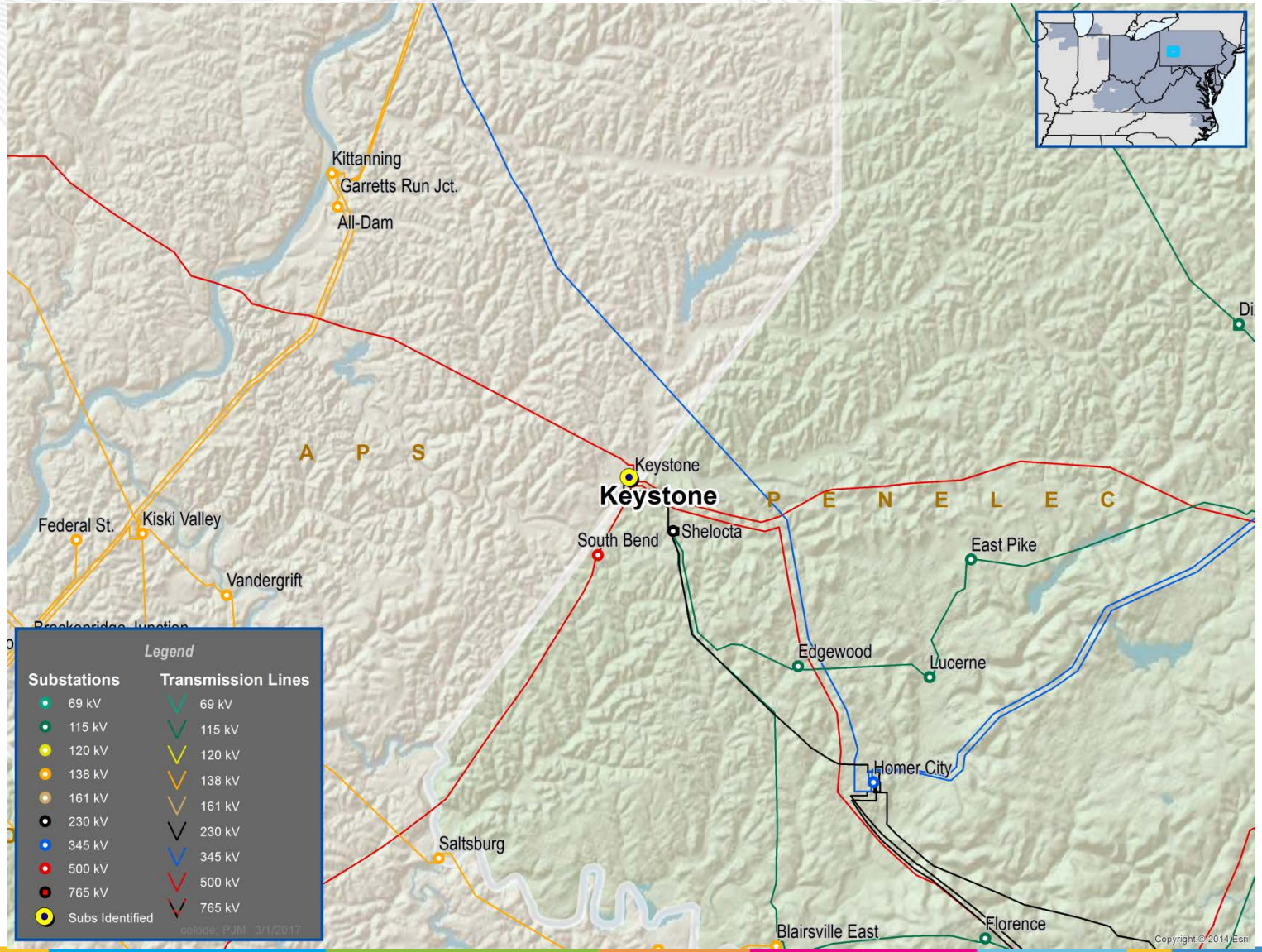
- Replace the Keystone 500kV “NO.14 Cabot” and “NO. 16 Cabot” with 50kA breakers (b2953 &2954)

Estimated Project Cost:

$1.24 M (per breaker)

Required IS Date:

June 1, 2020



Supplemental Projects

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AEP Transmission Zone Supplemental Project

Supplemental Project: Broadford 765 kV CB-Q1 Replacement

Date Project Last Presented: 9/14/2017 TEAC

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Broadford 765kV Q1 is a 50 kA air blast breaker type PK10D that will be replaced. PK's have historically presented a safety concern for field personnel in general. From experience, PK's are prone to catastrophic bushing failures (shards of porcelain are usually violently expelled from the bushing) and can result in injury to anyone inside the station. Additional drivers include age (1969 Mfg. year), number of fault operations (32; Mfg. recommendation is 10) and lack of available repair parts.

Selected Solution:

- Replace the Broadford 765kV Q1 Circuit Breaker with a new 4000A, 63KA breaker. (S1381)

Alternatives: No feasible alternatives

Estimated Project Cost: $3.3 M

Projected IS Date: 3/31/2019

Project Status: Engineering

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AEP Transmission Zone Supplemental Project

Supplemental Project: Jacksons Ferry 765/500 XFR Replacement

Date Project Last Presented: 9/14/2017 TEAC

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Several circuit breakers at Jacksons Ferry station are showing signs of deterioration. These breakers are 3000 A 50 kA air blast PK breakers, which present a significant safety concern for individuals entering the station. From historical experience AEP has determined that PK breakers are prone to catastrophic bushing failures which could result in injury to anyone inside the substation fence. The drivers for replacement of these breakers are age, potential bushing damage, number of fault operations, and a lack of available repair parts.

Transformer 1 phases 1, 2, 3 are all showing significant signs of deterioration. Drivers for replacement include dielectric strength breakdown (winding insulation), short circuit strength breakdown (due to the amount of through fault events), and accessory damage (bushings). All three phases of Transformer 1 will be replaced with 500 MVA units. Larger sized units were evaluated but due to physical limitations (tunnel systems) in the area it was required to install 500MVA transformers. In addition to the physical limitations, there is no justification of installing units larger than 500MVA.

Selected Solution:

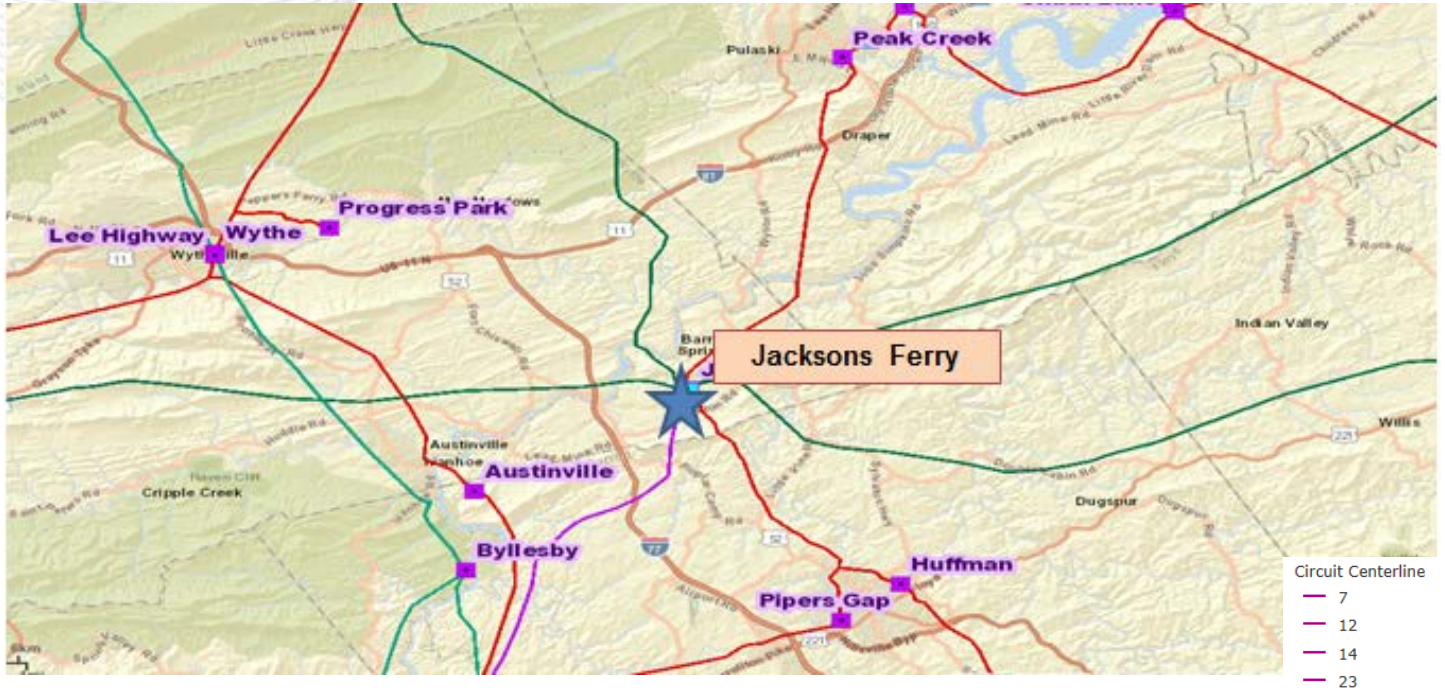
- Replace Jacksons Ferry 765/500 kV 500 MVA Transformer #1 (all three phases) and 138kV Circuit Breaker 'R1', 'P', and 'P2' with 3000A 63kA Circuit Breakers. (S1382)

Alternatives: No feasible alternatives

Estimated Project Cost: $27 M

Projected IS Date: 12/01/2020

Project Status: Scoping



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Dominion Transmission Zone Supplemental Project

Supplemental Project: Winter's Branch 230kV Delivery

Problem Statement:

- Dominion Distribution has submitted a DP Request for a new substation to accommodate a new datacenter campus in Prince William County. Initial installation will include a 84MVA 230-34.5kV transformer.

Potential Solution:

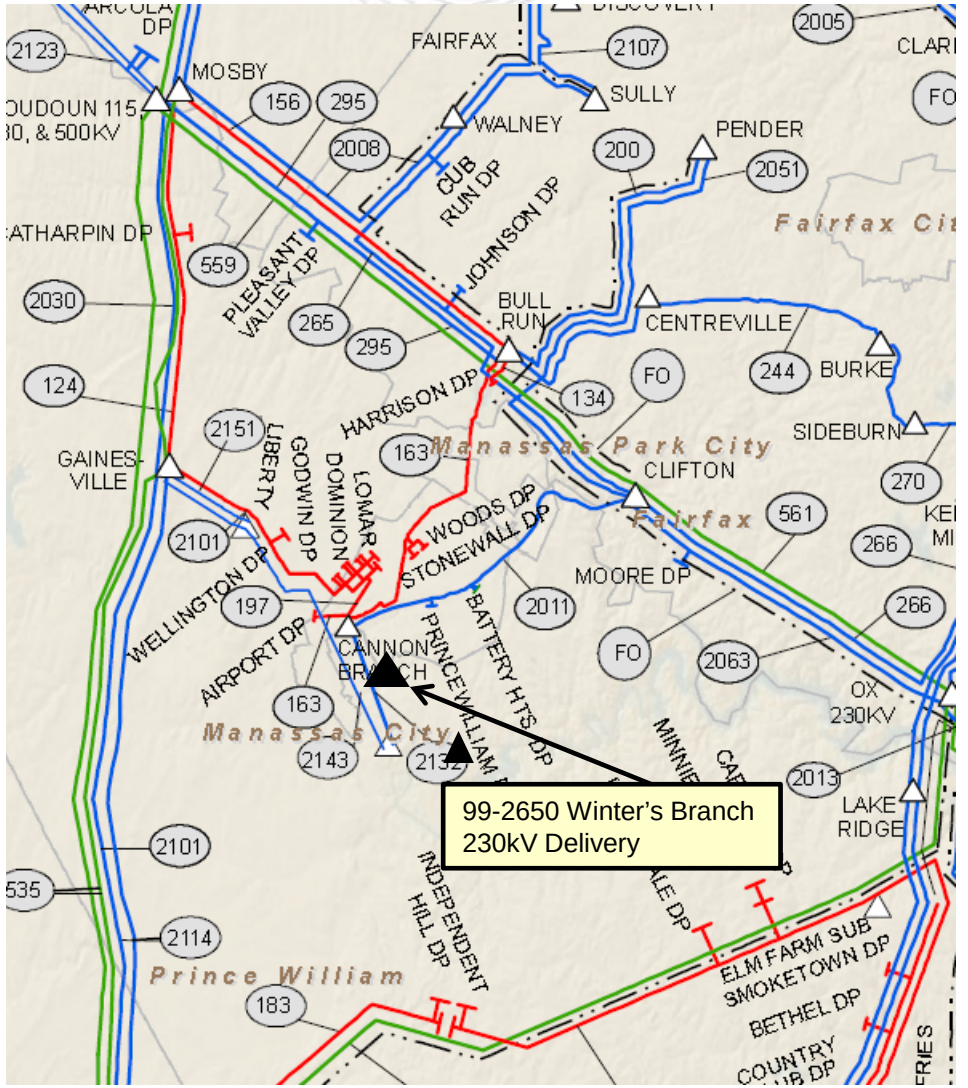
- Interconnect the new substation by tapping the 230kV Line #2132 (Cloverhill – Cannon Branch) to the proposed Winter's Branch Substation. The new substation will be set up for an ultimate six-breaker 230kV ring bus to meet the future growing demands of the region. Install line switches, a 230kV circuit switcher, and high side switches and necessary bus work for the new transformer.

Estimated Project Cost: $4.3 M

Possible IS Date: 7/15/2019

Project Status: Conceptual

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



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Dominion Transmission Zone Supplemental Project

Supplemental Project: Allied 230kV Line #2049 and #2050 Terminal Equipment Replacement

Date Project Last Presented: 9/14/2017 TEAC

Problem Statement:

- Allied substation 230kV Line #2049 and #2050 terminal equipment needs to be replaced due to age and operational issues.

Selected Solution:

- Replace three 230kV breakers, two line wave traps, and associated line terminal equipment at Allied substation **(s1378)**

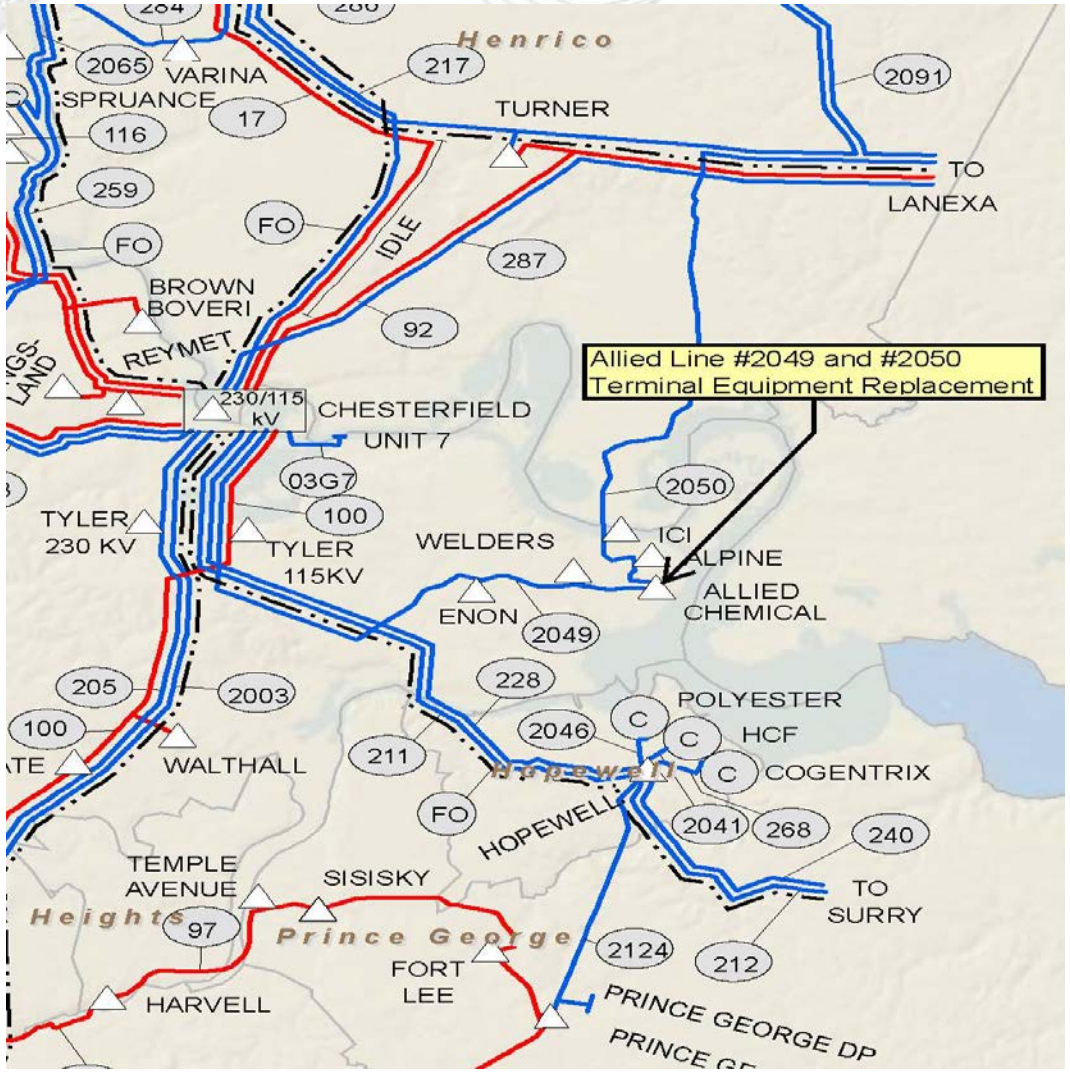
- The two new 3000A wave traps increase the summer emergency rating of the National Welders – Allied segment of Line #2049, and the Alpine – Allied segment of Line #2050 from 797MVA to 956MVA.

Estimated Project Cost: $2.2 M

Projected IS Date: 11/30/2017

Project Status: Engineering

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



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Dominion Transmission Zone Supplemental Project

Supplemental Project: Chesterfield 230kV Line #2049 Wave Trap Replacement

Date Project Last Presented: 9/14/2017 TEAC

Problem Statement:

- Chesterfield 230kV Line #2049 wave trap and associated line terminal equipment needs to be replaced.

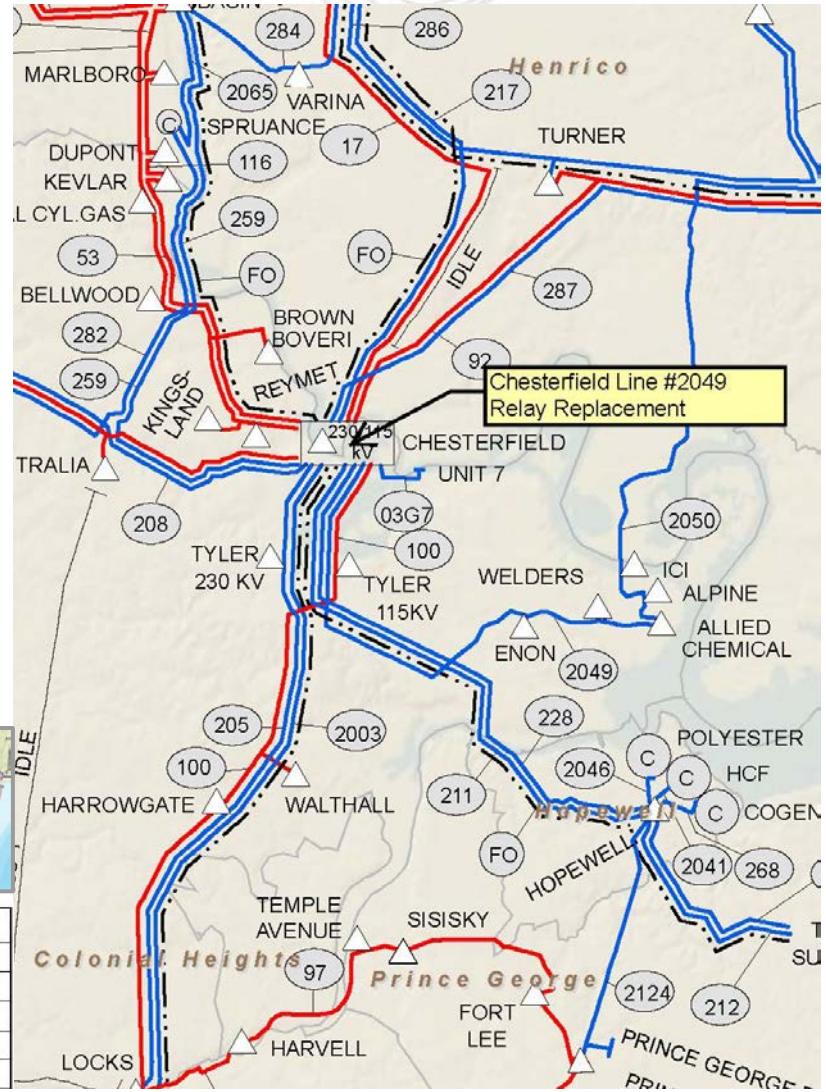
Selected Solution:

- At Chesterfield 230 kV, replace existing Line #2049 2000A wave trap with a 3000A wave trap. Chesterfield – Enon line segment summer emergency rating will be increased from 797MVA to 927MVA due to wave trap replacement. **(s1379)**

Estimated Project Cost: $0.5 M

Projected IS Date: 11/30/2017

Project Status: Engineering



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

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Dominion Transmission Zone Supplemental Project

Supplemental Project: Line #238 Wave Trap and Line Terminal Equipment

Date Project Last Presented: 9/14/2017 TEAC

Problem Statement:

- Clubhouse line #238 wave trap, Carson line #238 breaker and associated line terminal equipment need to be replaced due to age.

Selected Solution:

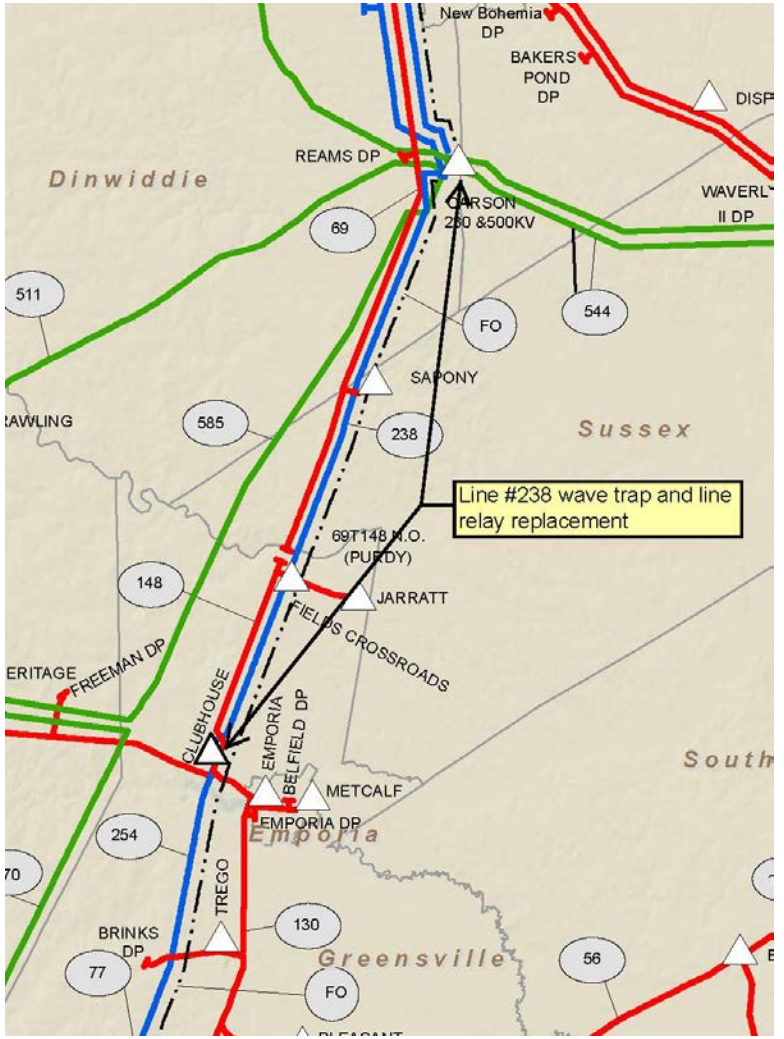
- Replace one 230kV breaker and #238 line relay at Carson. Replace existing line #238 1600A wave trap at Clubhouse with a 3000A wave trap. Sapony – Clubhouse segment summer emergency rating will be increased from 637MVA to 722MVA. **(s1380)**

Estimated Project Cost: $1.2 M

Projected IS Date: 11/15/2017

Project Status: Engineering

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



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2017 RTEP Next Steps

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Upcoming TEAC Meetings and anticipated PJM Board Review

October

10/12 – TEAC Reliability Analysis Update and Market Efficiency Update – Today's Meeting
10/17 – PJM Board of Managers Review of September TEAC Recommendations
10/19 – TEAC Market Efficiency Update
10/30 – Sub-regional RTEP – PJM South
10/31 – Sub-regional RTEP – PJM Mid-Atlantic

November

11/02 – Sub-regional RTEP – PJM West – Morning
11/02 – TEAC Reliability Analysis Update – Afternoon
- *2017 RTEP Window #1 - Reliability Recommendations*

11/9 – TEAC Reliability Analysis Update

December

12/04 – PJM Board of Managers Review of November TEAC Recommendations
12/14 – TEAC Reliability Analysis Update and 2018 RTEP Assumptions Review
12/18 – Sub-regional RTEP – PJM South – Morning
12/18 – Sub-regional RTEP – PJM West – Afternoon
12/19 – Sub-regional RTEP – PJM Mid-Atlantic

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Upcoming TEAC Meetings and anticipated PJM Board Review

10/12 – TEAC Reliability Analysis Update and Market Efficiency Update – Today's Meeting

10/17 – PJM Board of Managers Review of September TEAC Recommendations

10/19 – TEAC Market Efficiency Update

- **2016/17 Long Term Window – RPM Market Efficiency**

10/30 – Sub-regional RTEP – PJM South

10/31 – Sub-regional RTEP – PJM Mid-Atlantic

11/2 – Sub-regional RTEP – PJM West – Morning

11/2 – TEAC Reliability Analysis Update – Afternoon

- **2017 RTEP Window #1 - Reliability Recommendations**

12/4 – PJM Board of Managers Review of November TEAC Recommendations

12/14 – TEAC Reliability Analysis Update and 2018 RTEP Assumptions Review

12/18 – Sub-regional RTEP – PJM South – Morning

12/18 – Sub-regional RTEP – PJM West – Afternoon

12/19 – Sub-regional RTEP – PJM Mid-Atlantic

(If necessary, additional online/teleconference meetings to be held to review potential and recommended solutions)

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Questions?

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Appendix

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APS/Duquesne Area Proposal Comparison

Comparison of APS/Duquesne Area Proposals

Proposal ID	Type Of Project	Proposing Entity	Proposed Project Cost Estimate ($M)	Additional/Remaining Issue	Total Cost to fix all Flowgates ($M)	Project Description	Flowgate ID
2017_1-1DA	Upgrade	FirstEnergy	$ 7.1	None	1DA+1DB+1DC = $17.23	Re-conductor line with 954 ACSR, Replace breaker risers at Charlerol and Allenport	GD-0581, GD-0582
2017_1-1DB	Upgrade	FirstEnergy	$ 3.2	None	1DA+1DB+1DC = $17.23	Re-conductor the Yukon - Smithton - Shepler Hill Jct 138kV line with 795 ACSS, Replace line disconnect switch at Yukon	GD-0857, GD-0578, GD-0584, GD-0577, GD-0583
2017_1-1DC	Upgrade	FirstEnergy	$ 7.0	None	1DA+1DB+1DC = $17.23	Convert the existing 6 wire Butler - Shanor Manor - Krendale 138kV line to two separate 138kV lines. New lines will be Butler - Kelsters and Butler - Shanor Manor - Krendale 138kV.	GD-044, GD-053, GD-0766, GD-0787, GD-0765, GD-0786
2017_1-1DD	Upgrade	FirstEnergy	$ 0.1	Springdale-Cheswick 138kV Several Duquesne breakers overdutied.	1DD + $10+$9 > $19	Replace the bus and line disconnect switches, bus taps, and bus conductor at the Cheswick terminal at Springdale substation.	GD-0857, GD-0578, GD-0584, GD-0577, GD-0583, GD-0582, GD-0581
2017_1-1DE	Upgrade	FirstEnergy	$ 2.7	Springdale-Cheswick 138kV Several Duquesne breakers overdutied	1DE + $10+$9 > $19	Re-conductor the Springdale - Cheswick 138kV line and Upgrade the terminal equipment at Springdale	GD-0857, GD-0578, GD-0584, GD-0577, GD-0583, GD-0582, GD-0581
2017_1-2B	Greenfield	Northeast Transmission Development	$ 17.0	Springdale - Pucketa 138kV #1&2 (approximately 2.5mi per circuit, $2.5 M) Several Duquesne breakers overdutied	2B + $12+ $2.5 > $31	Build a single circuit 138kV line from the existing Logans Ferry 138kV substation to a new substation ("Pucketa") interconnecting the existing Springdale - AA2-161 138kV line and the Springdale - Huntingdon 138kV line.	GD-0857, GD-0578, GD-0582, GD-0584, GD-0577, GD-0581, GD-0583, GD-044, GD-053, GD-0766, GD-0787, GD-0765, GD-0786
2017_1-5B	Greenfield	Nextera	$ 11.7	Belmont - Charlerol 138kV Miracle - Mitchell 138kV	5B + $3+ 2.5 +10C > $24	Build a new 138kV switching station (including a 5 ohm series reactor) connecting the following existing lines: Yukon-Charlerol 138kV and Mitchell-Sheppler Hill JCT 138kV line. Build new ~1 mile of 138kV connecting new Miracle switching station to Wycoff Tap.	GD-0581, GD-0582, GD-0577, GD-0857, GD-0578, GD-0583, GD-0584
2017_1-5C	Greenfield	Nextera	$ 11.8	Additional cost due to a low cost estimate for the incumbent work (FE estimate is $1.5M for the Re-conductor and $0.7 M for the cut-in and remote work)	5C +$2.2+10C > $20	Build a new 138kV switching station connecting the following existing lines: Yukon-Charlerol 138kV and Mitchell-Sheppler Hill Jct 138kV line. Build new ~1 mile of 138kV connecting new Miracle switching station to Wycoff Tap. Re-conductor Miracle – Mitchell 138kV line	GD-0581, GD-0582, GD-0577, GD-0857, GD-0578, GD-0583, GD-0584
2017_1-4A	Greenfield	Duquesne	$ 4.5	Springdale-Plum 138kV, Cheswick - Wycoff 138kV, and Waycoff - Yukon 138kV	4A + $4.5 + $1+ 10C > $17 plus potential breakers	Reconfigure the DLC-owned Cheswick-Plum and APS-owned Springdale-Wycoff-Yukon 138kV lines to create two (2) new tie lines between DLC and APS. These lines would be reconfigured to become the Cheswick-Wycoff-Yukon and Springdale-Plum 138kV DLC-APS tie-lines. Once the lines are reconfigured, a portion of the newly established Springdale-Plum line would be reconductored.	GD-0577, GD-0578, GD-0581, GD-0582, GD-0583, GD-0584, GD-0587
2017_1-2C	Greenfield	Northeast Transmission Development	$ 22.2	Several Duquesne breakers overdutied	2C + breaker cost > $22.2	Build a single circuit 138kV line from the existing Logans Ferry 138kV substation to a new substation ("Pucketa") interconnecting the existing Springdale - AA2-161 138kV line and the Springdale - Federal Street 138kV line. Connect the remaining Pucketa - Federal Street 138kV transmission line to the existing Schaffers Corner 138kV substation.	GD-0857, GD-0578, GD-0582, GD-0584, GD-0577, GD-0581, GD-0583, GD-044, GD-053, GD-0766, GD-0787, GD-0765, GD-0786
2017_1-2D	Greenfield	Northeast Transmission Development	$ 64.8	Cost not competitive	2D = $64.8	Build a single circuit 345kV line from the existing Logans Ferry 345kV substation to a new substation ("Thorn Run") interconnecting the existing South Bend - Yukon 500kV line.	GD-0857, GD-0578, GD-0582, GD-0584, GD-0577, GD-0581, GD-0583, GD-044, GD-053, GD-0766, GD-0787, GD-0765, GD-0786
2017_1-3A	Greenfield	PSEG	$ 120.3	Cost not competitive	3A = $120.3	Tap the South Bend to Yukon 500kV line and Build a 500kV line to Logan's Ferry	GD-044, GD-053, GD-0857, GD-0578, GD-0582, GD-0584, GD-0581, GD-0583, GD-0577, GD-0766, GD-0787, GD-0765, GD-0786
2017_1-7A	Greenfield	Transource	$ 29.5	Cost not competitive	7A = $29.46	Establish Barking Road 138kV switch station by cutting into the exisitng Logan's Ferry – Highland 138kV line #2 and the Logan's Ferry – Universal 138kV line. Establish Wright Road 138kV switch station by cutting into the exisitng Springdale – Huntingdon 138kV line and the Springdale – Yukon 138kV (via AA2-161 and Wycoff). Build the Barking Rd - Wright Rd 138kV double circuit line.	GD-044, GD-053, GD-0857, GD-0578, GD-0582, GD-0584, GD-0581, GD-0583, GD-0577, GD-0766, GD-0787, GD-0765, GD-0786
2017_1-7G	Greenfield	Transource	$ 9.9	Upper Harmony - Market West 138kV (3 miles)	7G +$1.5 +10A+10B ≈ $21.68	Establish a new 138kV switch station near Seneca by cutting into the Markwest - Seneca 138kV line section. Construct a new 138kV line from the new station to McCalmont station.	GD-044, GD-053, GD-0766, GD-0787, GD-0765, GD-0786
2017_1-1DF	Greenfield	FirstEnergy	$ 23.4	Cost not competitive	1DF+1DC = $30.36	Build Bunola Substation, Loop in the Mitchell - Wilson 138kV line, Build double circuit 138kV lines (~2.43 miles) to Wycoff Jct.-Wycoff section of Springdale - Wycoff Jct - Yukon 138kV line. Re-conductor ~1.7 miles of Wycoff Jct.-Wycoff line section.	GD-0857, GD-0578, GD-0584, GD-0577, GD-0583, GD-0582, GD-0581

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Revision History

- V1 – 10/6/2017 – Original Slides Posted
- V2 – 10/9/2017 –
  - Removed original Slide #46
  - Added slide # 9-13 and 26
- V3 – 10/11/2017 –
  - Slide #16: Correct the typo for Charlerio
  - Clarified costs on Slide #23
  - Corrected calendars on Slides #53-54
- V4 – 10/17/2017 –
  - Slide #47: Updated the problem statement
- V5 – 12/13/2017
  - Added table between slides 14 and 15.
- V6 - 1/5/2018 –
  - Slide #20: Corrected Required IS date to 12/1/2022 the problem statement
  - Slide #21: Corrected Required IS date to 12/1/2022 the problem statement
  - Moved “Comparison of APS/Duquesne Area Proposals” table to the Appendix.

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