Transmission Expansion Advisory Committee (TEAC) Recommendations to the PJM Board

PJM Staff White Paper

PJM Interconnection

July 2020

For Public Use

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Contents

I. Executive Summary

On April 20, 2020, the PJM Board of Managers approved changes to the Regional Transmission Expansion Plan (RTEP), totaling $64.55 million, primarily to resolve baseline reliability criteria violations.

Since then, PJM has identified additional baseline reliability criteria violations and the transmission system enhancements needed to solve them, at an estimated cost of $58.72 million. Scope changes to existing projects will result in a net increase of $58.18 million, and project cancellations will result in a decrease of $3.85 million. This yields an overall RTEP net increase of $113.05 million, for which PJM recommended Board approval. With these changes, RTEP projects will total $38,348.74 million since the first Board approvals in 2000.

PJM sought Reliability and Security Committee consideration and full Board approval of the additional RTEP baseline projects summarized in this white paper. On July 28, 2020, the Board approved the addition of RTEP baseline projects as well as other changes to the RTEP as summarized in this paper.

II. Baseline Reliability Recommendations

A key dimension of PJM's RTEP process is baseline reliability evaluation, necessary before subsequent interconnection requests can be analyzed. Baseline analysis identifies system violations to reliability criteria and standards. PJM then develops transmission system enhancements to solve identified violations and reviews them with stakeholders through the Transmission Expansion Advisory Committee (TEAC) and Subregional RTEP Committees prior to recommendation to the Board. Baseline reliability transmission enhancement costs are allocated to PJM load.

III. Baseline Reliability Projects Summary

A summary of baseline projects with estimated costs equal to or greater than $5 million is provided below. A complete listing of all recommended projects and their associated cost allocations is included in Attachment A (for allocation to a single zone) and Attachment B (for allocation to multiple zones). Projects with estimated costs less than $5 million typically include transformer replacements, line reconductoring, breaker replacements and upgrades to terminal equipment, including relay and wave trap replacements.

1. **Dominion Transmission Zone**
   - Install a second Chickahominy 500/230 kV transformer: $22 million
2. **APS Transmission Zone**
   - Reconductor Yukon-Smithton-Shepler Hill Jct 138 kV. Upgrade terminal equipment at Yukon 138 kV and replace line relaying at Mitchell and Charleroi 138 kV: $21.4 million
3. **DLCO Transmission Zone**
   - Reconductor the DLCO portion (4.2 miles) of Wilson-Mitchell 138 kV: $7.5 million

4. **AMPT Transmission Zone**
   - Establish a new 138/69 kV substation with one 138 kV circuit breaker, one 138/69 kV 130 MVA transformer and three 69 kV circuit breakers. Construct a 0.15 mile 138 kV 795 ACSR transmission line between Brim 138/69 kV substation (First Energy) and the newly proposed AMPT substation. Loop the Bowling Green Sub No. 5-Bowling Green Sub No. 2 69 kV line in and out of the newly established substation: $5.7 million

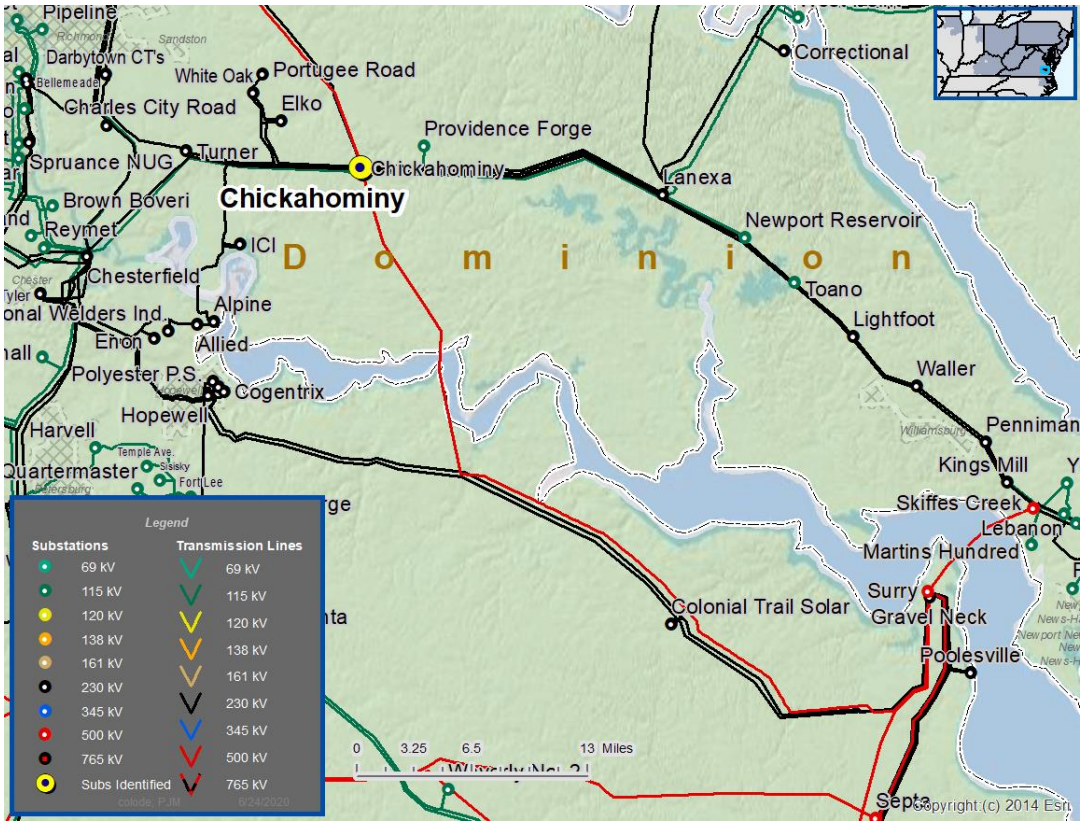
PJM also recommended projects totaling $2.12 million that include terminal equipment replacements whose individual cost estimates were less than $5 million. A more detailed description of the larger-scope projects that PJM recommended to the Board are provided below:

Baseline Project b3213: Second Chickahominy 500/230 kV Transformer

Dominion Transmission Zone

Due to the deactivation of the Chesterfield 5 and 6 units, the Chickahominy 500/230 kV transformer is overloaded for the loss of Chickahominy-Surry 500 kV circuit.

Map 1. **Chickahominy 500/230 kV Transformer**



The recommended solution is to install a second Chickahominy 500/230 kV transformer. The estimated cost for this project is $22 million, with a required and projected in-service date of June 2023. The local transmission owner, Dominion, will be designated to complete this work.

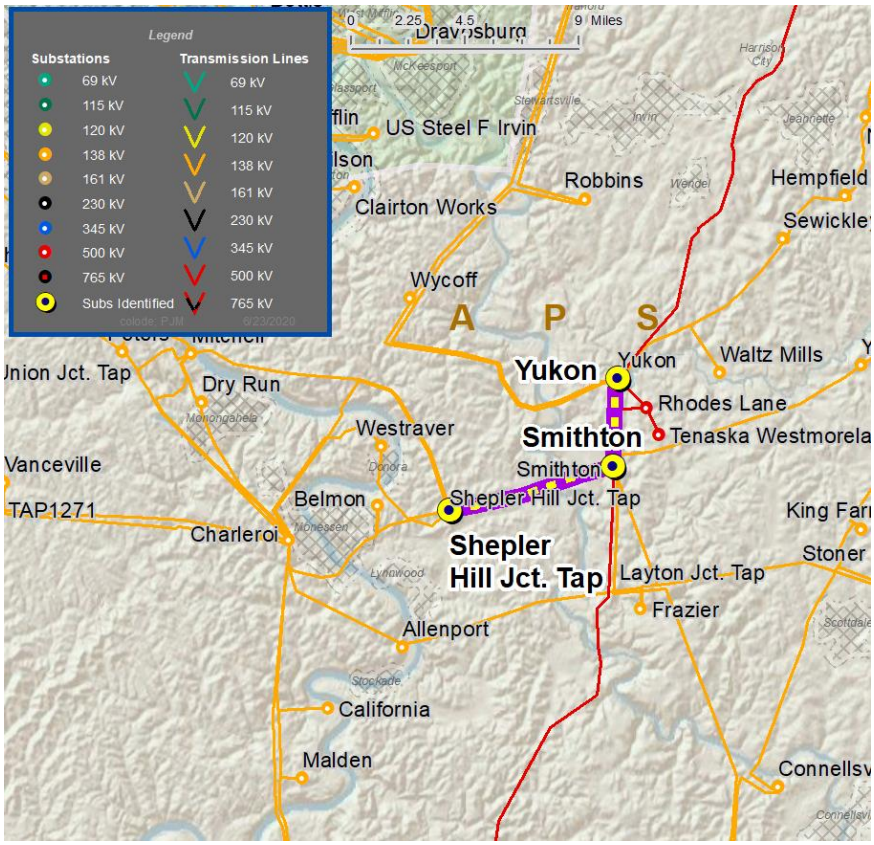
Beaver Valley Reinstatement Baselines

The Beaver Valley nuclear units, totaling 1,811 MW capacity, withdrew their deactivation request in March 2020. The reinstatement study has determined that the following scope of work is either still needed to maintain reliability or will be completed due to work progression.

APS Transmission Zone

The original project scope for baseline b2966 was previously canceled due to the scope change for baseline b3012 (driven by the Beaver Valley, Davis Besse and Perry nuclear deactivation notifications), which eliminated the need for the project. However, the Beaver Valley reinstatement study determined the scope of work is still needed to maintain reliability, and so the scope of work was reassigned to a new baseline b3214. The Yukon-Smithton and Smithton-Shepler Hill Jct 138 kV circuits are overloaded as a result of multiple tower contingencies.

Map 2. **Yukon-Smithton-Shepler Hill Jct 138 kV**

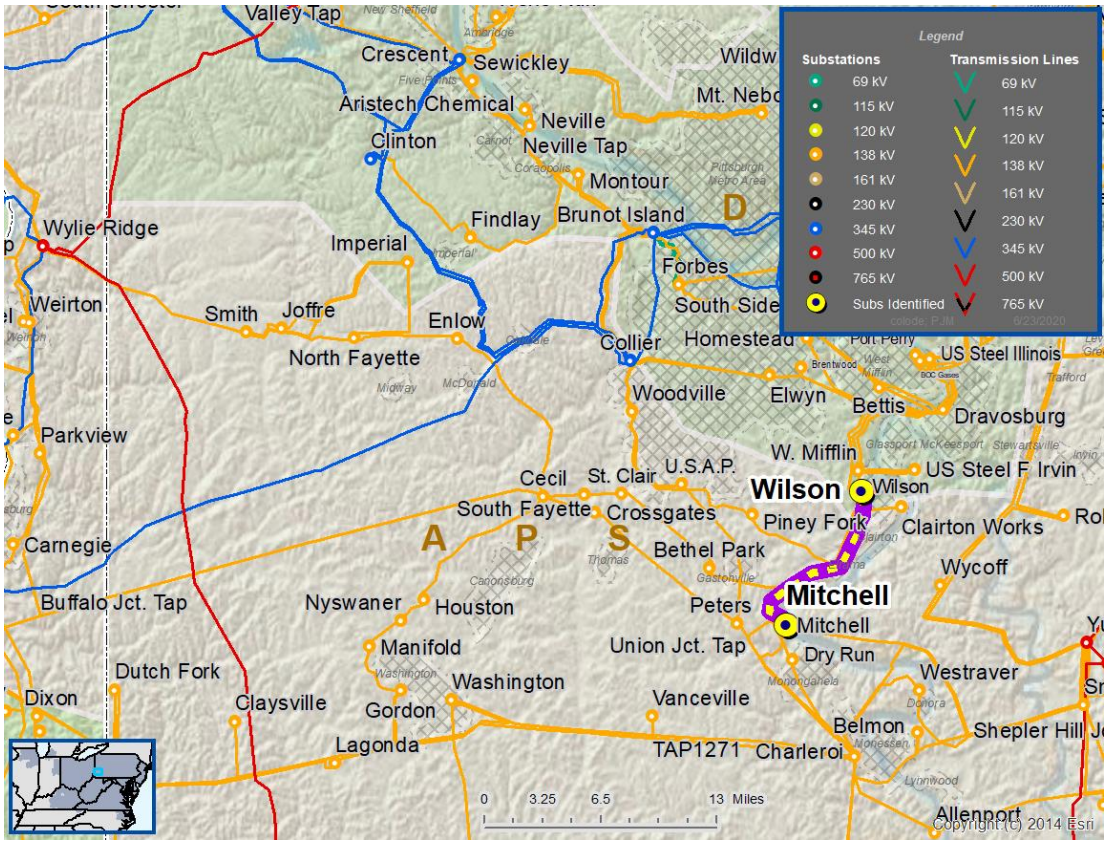


The recommended solution is to reconductor Yukon-Smithton-Shepler Hill Jct 138 kV, upgrade the terminal equipment at Yukon 138 kV, and replace line relaying at Mitchell and Charleroi 138 kV. The estimated cost for this project is $21.4 million, with a required and projected in-service date of June 2023. The local transmission owner, APS, will be designated to complete this work.

DLCO Transmission Zone

The Beaver Valley reinstatement study determined that several baseline projects will remain due to work progression, and baseline b3015.5 project scope is one such upgrade. However, due to a component of the overall upgrade no longer being required, and its potential impact on cost allocation, the baseline was reassigned to the new baseline b3217. The Wylie Ridge 500/345 kV transformer and multiple 138 kV facilities in APS and DLCO transmission zones are overloaded for various contingencies in the zones.

Map 3. **Wilson-Mitchell 138 kV**



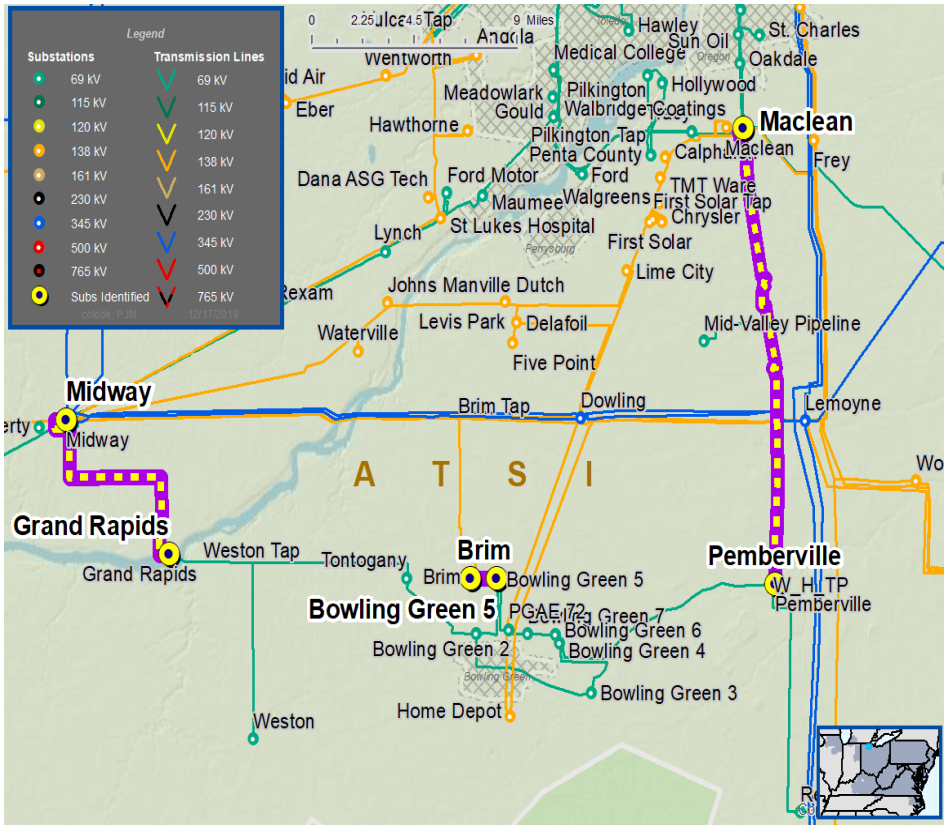
The recommended solution is to reconductor the DLCO portion (4.2 miles) of the Wilson-Mitchell 138 kV circuit. The total estimated cost for this project is $7.5 million, with a required and projected in-service date of June 2021. The local transmission owner, DLCO, will be designated to complete this work.

Baseline Project b3159: New AMPT 138/69 kV Substation in Bowling Green Area

AMPT Transmission Zone

There are multiple AMP Transmission FERC Form 715 Transmission Owner Planning Criteria thermal overloads and voltage violations on the 69 kV system in the Bowling Green and Pemberville area for the N-1-1 loss of Brim-Bowling Green substation No. 5 69 kV, combined with either the loss of the Midway-Grand Rapids or Maclean-Pemberville 69 kV.

Map 4. **Bowling Green and Pemberville Area**



The recommended solution is to establish a new 138/69 kV substation with one 138 kV circuit breaker, one 138/69 kV 130 MVA transformer, and three 69 kV circuit breakers. The project will also construct a 0.15 mile 138 kV 795 ACSR transmission line between Brim 138/69 kV substation (First Energy) and the newly proposed AMPT substation. The Bowling Green Sub No. 5-Bowling Green Sub No. 2 69 kV line will be looped in and out of the newly established substation. The total estimated cost for this project is $5.7 million, with a required and projected in-service date of June 2024. The transmission owner, AMPT, will be designated to complete this work.

IV. Transmission Owner Criteria Projects

Of the $58.72 million of the new recommended baseline transmission system enhancements, approximately $5.7 million is driven by transmission owner planning criteria (as discussed above for the b3159 AMPT project), which makes up 9.7 percent of the new project cost estimates.

V. Changes to Previously Approved Projects

PJM recommends the cancellation of the following projects:

- Baseline b3011.3 (upgrade terminal equipment at Yukon to increase rating on Yukon to Route 51 #1 138 kV line) is recommended for cancellation. The Beaver Valley reinstatement study determined the scope of work is still needed, but it is being reassigned to new baseline b3215 with updated description and cost.
- Baseline b3011.4 (upgrade terminal equipment at Yukon to increase rating on Yukon to Route 51 #2 138 kV line) is recommended for cancellation. The Beaver Valley reinstatement study determined the scope of work is still needed, but it is being reassigned to new baseline b3216 with updated description and cost.
- Baseline b3015.5 (reconductor Elrama-Mitchell 138 kV line, 4.2 miles of DLCO portion) is recommended for cancellation. The Beaver Valley reinstatement study determined that a portion of the scope is near completion, but it is being reassigned to new baseline b3217 with updated description and cost.

These changes yield a net RTEP decrease of $3.85 million.

PJM recommends modifying the scope/cost of the following projects:

- Baseline b3098 (rebuild 9.2 miles of Balcony Falls-Skimmer 115 kV and 3.8 miles of Balcony Falls-Cushaw 115 kV to current standards with a minimum rating of 261 MVA) requires additional scope. The additional scope is to rebuild Balcony Falls 115 kV substation and is due to Dominion's acquisition of the substation from Appalachian Power and Light (APL). The lattice structure on the property that all four lines and the cross bus terminates on was built in 1926, and visual inspection shows that the galvanizing is moderately to severely worn along large portions of the structure. There could also be space issues at the station. The additional scope has increased the total cost of the project from $20 million to $29 million. This change yields a net RTEP increase of $9 million.
- Baseline b3130 (Monmouth County 34.5 kV solution) has undergone a scope change after significant discussions with the New Jersey Board of Public Utilities. The previous scope included the conversion of approximately 44.1 miles of existing single circuit to double circuit 34.5 kV construction and 9.4 miles of additional 34.5 kV circuit to existing distribution pole lines. The revised scope converts approximately 52.4 miles of existing single circuit to double circuit 34.5 kV construction, 2.3 miles of additional 34.5 kV circuit to existing distribution pole lines, and 2.1 miles of new 34.5 underground cables. The scope change has increased the total cost of the project from $175 million to $223 million. This change yields a net RTEP increase of $48 million.

- Baseline b3087 (construct a new greenfield station to the west of the existing Fords Branch station, construct approximately 5 miles of new double circuit 138 kV line to loop in new station into the existing 138 kV circuit and remote end work at Cedar Creek station) requires additional scope. The additional scope is to install a 28.8 MVAR switching shunt capacitor at the new Fords Branch 138 kV station. Voltage magnitude violations were identified at the new Fords Branch substation and Cedar Creek substation for the N-1-1 loss of either Beaver Creek transformer #1 and Cedar Creek-Johns Creek 138 kV, or Beaver Creek-Kewanee (New Fords Branch) 138 kV and Cedar Creek-Johns Creek 138kV. The scope addition has increased the total cost of the project from $23.2 million to $23.7 million. This change yields a net RTEP increase of $0.5 million.

- Baseline b3099 (install a 138 kV 3000A 40 kA circuit switcher on the high side of the existing 138/34.5 kV transformer #5 at Holston station) requires additional scope. The additional scope is to install a 138 kV 3000A 40 kA circuit switcher for transformer #7 at Holston station. Transformer #7 serves distribution customers but is located in a transmission station, and after investigating the initial cost responsibility for the switcher installation with distribution, it was determined that the cost should be assigned to transmission. The scope addition has increased the total cost of the project from $0.7 million to $1.4 million. This change yields a net RTEP increase of $0.7 million.

- Baseline b3131 (at East Lima and Haviland 138 kV stations, replace line relays and wave trap on the East Lima-Haviland 138 kV facility) requires additional scope. The additional scope is to replace 500 MCM Cu Risers and bus conductors at Haviland 138 kV. These conductors were identified as elements with ratings between the existing ratings and the desired ratings for this facility during the course of scoping the solution. The scope addition does not impact the total cost for this project, and so the cost remains $1.5 million.

- The required in-service date for baseline b2753.9 (remove/open Kammer 345/138 kV transformer #301) has changed from May 31, 2020, to September 13, 2021. The opening of the circuit breakers to the Kammer 345/138 kV transformer #301 address the overdutied breakers at Kammer 138 kV. Due to the withdrawn queue of Y3-068, the re-study shows the breakers are overduty only after AB2-093, which has an in-service date of September 13, 2021. The cost for this project has decreased by $0.02 million.

These changes yield a net RTEP increase of $58.18 million.

VI. Review by the Transmission Expansion Advisory Committee (TEAC)

Project needs and recommended solutions as discussed in this report were reviewed with stakeholders during 2020, most recently at the June 2020 TEAC and Subregional RTEP Committee meetings. Written comments were requested to be submitted to PJM to communicate any concerns with project recommendations. No comments have been received as of this white paper publication date.

VII. Cost Allocation

Cost allocations for recommended projects are shown in Attachment A (for allocation to a single zone) and Attachment B (for allocation to multiple zones).

Cost allocations were calculated in accordance with Schedule 12 of the Open Access Transmission Tariff (OATT). Baseline reliability project allocations are calculated using a distribution factor methodology that allocates cost to the load zones that contribute to the loading on the new facility. The allocations will be filed at FERC 30 days following approval by the Board.

VIII. Board Approval

The PJM Reliability and Security Committee was requested to endorse the new baseline reliability projects and associated cost allocations, and recommend to the full Board, approval of the projects in this white paper to be included in PJM's RTEP. On July 28, 2020, the Board approved the addition of RTEP baseline projects as well as other changes to the RTEP as summarized in this paper. The RTEP will be published on PJM's website.

Attachment A – Reliability Project Single-Zone Allocations

Upgrade ID	Description	Cost Estimate ($M)	TO	Cost Responsibility	Required In-Service Date
b3087.4	Install 28.8 MVAR switching shunt at the new Fords Branch substation	$0.50	AEP	AEP	12/1/2023
b3098.1	Rebuild Balcony Falls substation	$9.00	Dominion	Dominion	6/1/2019
b3156	Replace line relaying and fault detector on the Wylie Ridge terminal at Smith 138 kV substation	$0.85	APS	APS	6/1/2024
b3157	Replace line relaying and fault detector relaying at Messick Rd. and Morgan 138 kV substations; Replace wave trap at Morgan 138 kV substation	$0.23	APS	APS	12/1/2024
b3158	Replace line relays on the Ridgeley line terminal at Messick Rd. 138 kV substation	$0.14	APS	APS	12/1/2024
b3159	Build a new 138/69 kV substation; Install one (1) 138 kV circuit breaker, one (1) 138/69 kV 130 MVA transformer, three (3) 69 kV circuit breakers; Build a 0.15 mile 138 kV 795 ACSR transmission line between the FE Brim 138/69 kV substation and the newly proposed AMPT substation (three steel poles); Loop the Bowling Green Sub No.5 – Bowling Green Sub No. 2 69 kV lines in and out of the newly established substation	$5.70	AMPT	ATSI	6/1/2024
b3213	Install 2nd Chickahominy 500/230 kV transformer for single contingency loss of Chickahominy-Surry 500 kV line	$22.00	Dominion	Dominion	6/1/2023
b3214	Reconductor the Yukon-Smithton-Shepler Hill Jct 138 kV Line. Upgrade terminal equipment at Yukon and replace line relaying at Mitchell and Charleroi	$21.40	APS	DL	6/1/2023
b3215	Upgrade terminal equipment at Yukon to increase rating on Yukon to Route 51 #1 138 kV line	$0.40	APS	APS	6/1/2021
b3216	Upgrade terminal equipment at Yukon to increase rating on Yukon to Route 51 #2 138 kV line	$0.50	APS	APS	6/1/2021
b3217	Reconductor Wilson to Mitchell 138 kV line – DL portion. 4.2 miles total. 2x795 ACSS/TW 20/7	$7.50	DL	DL	6/1/2021

Attachment B – Reliability Project Multi-Zone Allocations

None