Alternatives to Surry – Skiffes Creek 500 kV Overhead Project

Identification and Power Flow Analysis

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EXECUTIVE SUMMARY

The objective of this report is to provide a detailed engineering analysis of some of the alternatives that exist to Dominion Virginia Power’s Surry – Skiffes Creek 500 kV overhead transmission line project (Project) across the James River in Virginia. The report has been prepared by Tabors Caramanis Rudkevich (TCR) for the National Trust for Historic Preservation with the goal of answering three questions:

**Question:** Is the Project needed to maintain electrical reliability in the region following the decommissioning of two coal-fired power plants, Yorktown 1 and 2, and given the operational limits imposed on the oil-fired unit Yorktown 3?

**Answer:** No. The Project could be removed from service currently without any reliability criteria violations, as described more fully within this report.

**Question:** If new facilities are needed, are there alternatives to the Project that can meet North American Electric Reliability Corporation (NERC) reliability requirements to satisfy existing and forecasted electrical demand?

**Answer:** New facilities are not currently needed. However, if the Project was removed from service and Yorktown 3 were decommissioned, then alternatives exist that would satisfy existing and forecasted electrical demand as defined in the PJM 2025 RTEP.

**Question:** Are the alternatives identified by TCR technically feasible, NERC compliant, and cost effective to implement?

**Answer:** Yes. The alternatives are cost effective compared to the Project, are NERC compliant, and satisfy all relevant planning criteria, including Dominion Virginia Power's Planning Criteria.

To answer these questions, TCR developed and completed modeling of alternatives using the 2025 PJM Regional Transmission Expansion Plan (RTEP) models and using the Dominion Virginia Power Planning Criteria. Using the 2025 PJM RTEP cases, TCR determined that if the Project is removed from the system and no further action is taken (i.e., no alternative is implemented), there are no reliability violations for any of the conditions modeled by PJM in its planning assessments. **Put simply, the 2025 PJM RTEP confirms the Project is not needed to satisfy NERC reliability requirements.**

Despite confirming that the Project is not currently needed, TCR identified and fully evaluated five alternatives that could be implemented instead of the Project should Yorktown 3 be retired. Each of the five alternatives satisfies all relevant NERC reliability requirements, is generally less costly to implement than the Project, and could be implemented prior to any retirement of Yorktown 3.

Table 1 summarizes the results of the TCR analyses demonstrating that the 5 alternatives provide for delivery of energy and reliability at a cost well less than that of the Project.
Table 1: Summary of Alternatives

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCR Alternative 1: Rebuild/Reconductor Alternative 1</td>
<td>57 Million Dollars</td>
</tr>
<tr>
<td>TCR Alternative 2: Rebuild/Reconductor Alternative 2</td>
<td>99 Million Dollars</td>
</tr>
<tr>
<td>TCR Alternative 3: Rebuild/Reconductor Alternative 3</td>
<td>62 Million Dollars</td>
</tr>
<tr>
<td>TCR Alternative 4: Bypass Right of Ways</td>
<td>112 Million Dollars$^1$</td>
</tr>
<tr>
<td>TCR Alternative 5: Non-Wires Alternatives</td>
<td>TBD$^2$</td>
</tr>
</tbody>
</table>

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2 Exact cost information for deployment of non-wires alternatives would require information and cooperation from DVP to calculate. But industry practice and history indicate that it would be less than the cost incurred to construct the Surry-Skiffes Creek Project.
CHAPTER 1: Introduction and Purpose

1.1: Introduction and Background

TCR was engaged by the National Trust for Historic Preservation to provide expertise in identifying alternative transmission configurations to the Project proposed, constructed, and operated by Dominion Virginia Power (DVP) that crosses the James River in Virginia.

Prior to the construction of the Project, in 2017 TCR evaluated and presented to the U.S. Army Corps of Engineers a set of similar alternatives. These alternatives were based on the then-known reliability requirements in the North Hampton Roads Area (NHRA) in which the Yorktown Peninsula and the Project are located. In the intervening time period, PJM has developed and made available its most recent Regional Transmission Expansion Plan (RTEP) power flow models. These updated power flow models have confirmed TCR’s earlier conclusions that electrical load in the NHRA has been in decline.

TCR based the analyses in this Report on the most recent 2025 PJM RTEP power flow models. Using the PJM RTEP models, TCR identified five alternatives that meet all NERC reliability requirements and do so at a lower or comparable cost to ratepayers than the Project and can be constructed in a short period and prior to any retirement of Yorktown 3. Three of the alternatives use existing transmission lines and require only upgrading existing transmission equipment. One alternative would require construction of new 230kV lines, and a final alternative would not require any transmission line changes (a Non-Wires Alternative).

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3 The 2025 Regional Transmission Expansion Plan Baseline Base Cases are posted at: https://pjm.com/planning/competitive-planning-process.aspx (last accessed 10/19/2020).
1.2: Objective
The objective of the current report is to identify multiple alternatives to the Project, which was energized in February 2019. TCR was commissioned to answer a series of questions leading to the identification of multiple alternatives to the Project:

- Given current demand, supply, and transmission assets (other than the Project), would there be a credible probability of a reliability crisis (e.g., blackout or brownout) in the NHRA?
- If there is such credible probability, how great is it and what would or could be operational alternatives to correct for that contingency?
- In the absence (removal) of the Project, are there alternative transmission facilities investments that could be made that would mitigate that risk to the same extent as the Project?
- What would be the costs and time to construct alternatives that would mitigate the risk of a reliability event if the Project is decommissioned?
2.1: Analytic Methodology

The methodology for identification and quantification of alternatives for the Project focused on assuring that the alternatives identified would meet the NERC Standard TPL-001-4 — Transmission System Planning Performance Requirements, as specified in the reliability criteria of DVP for application in the NHRA. The most critical planning criteria in the NHRA is to maintain power flows below the “Load Dump” (LD) ratings\(^ 4\) of all transmission facilities that remain in service after pre-specified, multi-element transmission outages. Table 2 lists and describes the three most critical planning criteria.

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning Event P6</td>
<td>Independent, sequential outage of two individual transmission facilities, with adjustments made after the first outage (also known as (N-1-1) contingency under NERC)</td>
</tr>
<tr>
<td>Multiple Contingency (two overlapping single outages)</td>
<td></td>
</tr>
<tr>
<td>Planning Event P7</td>
<td>Loss of two adjacent circuits on a common structure (i.e. on a tower)</td>
</tr>
<tr>
<td>Multiple Contingency (common structure)</td>
<td></td>
</tr>
<tr>
<td>Extreme Event</td>
<td>The most severe Extreme Event in the area is the simultaneous outage of all transmission facilities on a Right of Way (due to weather or other external cause)</td>
</tr>
</tbody>
</table>


Additionally, when the overload on a line is less than the LD rating but is greater than the “Short Term Emergency” (STE) rating\(^ 5\) system reinforcements may not be required if operational system adjustments can reduce thermal overloads to less than the STE rating. The DVP Transmission Planning Criteria\(^ 6\) state that allowed system adjustments include:

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\(^4\) Load Dump ratings are 15-minute transmission equipment ratings, as defined in the DVP Transmission Planning Criteria, Version 17, Effective 3/24/2020, page 5.

\(^5\) Short Term Emergency ratings are 8-hour transmission equipment ratings, as defined in the DVP Transmission Planning Criteria, Version 17, Effective 3/24/2020, page 5.

• Generation re-dispatch (excludes nuclear generation)
• Phase angle regulator adjustment
• Load tap changer adjustment
• Capacitor bank switching
• Line switching
• Inductor switching

The analyses began by ensuring that the alternatives met these most critical criteria. Then, TCR verified that all other criteria specified in the DVP Transmission Planning Criteria, such as performance requirements after single-outages, were also met.

2.2: Power Flow Modeling

The power flow cases used by TCR to complete this Report are identical to PJM's 2025 RTEP cases, except that TCR removed the Project from the power flow cases in order to model alternatives. It should be noted that PJM does not include Extreme Events in the PJM RTEP model/modeling process. TCR developed the Extreme Events evaluated in this report based on information contained in the letter from DVP to the National Parks Conservation Association (NPCA) (March 21, 2016), other documents submitted by DVP as part of the Surry-Skiffes Creek regulatory review process, and TCR engineering judgment.

It is also notable that the PJM 2025 RTEP Summer Peak case includes Yorktown 3 as being online, despite the limitations on its operation to only 8% of the hours in the year. Thus, while there may be long-term business plans to decommission Yorktown 3, the unit is included in PJM’s most current RTEP. Additionally, the number of hours that Yorktown 3 is anticipated to be needed for any alternative discussed in this report are well within the unit’s operational limits. However, to avoid any dispute about the need for Yorktown 3’s availability to make TCR’s alternatives viable, TCR also removed Yorktown 3 from appropriate power flow cases to model situations where Yorktown 3 is not available, replacing the Yorktown 3 generation by increasing the dispatch of other units in DVP that were not at their maximum dispatch. Other than these two changes – removal of the Project and disconnecting Yorktown 3 – TCR made no modifications to the load or generation profiles in the 2025 RTEP power flow cases except as explicitly indicated in the Alternatives.

2.3: Sources of Data for Analysis

Based on input provided by its individual utility members, PJM annually models the full interconnection (i.e., all reported transmission facilities, planning criteria, and power flows) and publishes the model results as part of the RTEP process. The RTEP includes the definition of each contingency used to model the Planning Events used by PJM to assure that it does and will meet NERC Standards. In sum, the RTEP models are created annually by PJM using data supplied by independent utilities and includes data provided by DVP.

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8 See NERC Standard TPL-001–4 — Transmission System Planning Performance Requirements.
Since the Project was initially proposed in 2012, PJM has significantly revised its RTEP model because it was consistently over forecasting demand growth. This is helpful context to understand the modeling outcomes in this Report. In 2012, the RTEP forecast that the Summer Peak power load would be 1708 megawatts ("MW") in NHRA by 2020. PJM's 2025 RTEP now forecasts just 1458 MW of Summer Peak power load by 2025. The 2025 PJM RTEP unambiguously demonstrates that there is no need to maintain the Project to satisfy all relevant reliability criteria, as more fully discussed below.

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9 PJM Load Forecasting Model Whitepaper (April 27, 2016) available at https://www.pjm.com/~/media/library/reports-notices/load-forecast/2016-load-forecast-whitpaper.ashx ("the accuracy of the PJM model decayed noticeably, with a trend towards over-forecasting. Each successive load forecast tended to be lower for a given year than the forecast produced one year prior") (last accessed 10/19/2020). The decrease in demand is even steeper in PJM's filings with the Federal Energy Regulatory Commission (FERC). In 2012, PJM's FERC filings projected summer peak power flows of 1600 MW in 2012, 1663 MW in 2013, and 1871 MW in 2022. In PJM's 2019 FERC filings, however, peak summer power loads are projected to be just 1397 MW in 2019 and 1412 MW in 2028. Thus, there is a clear and continuing drop in demand in NHRA. This drop in demand was not being accurately forecasted by PJM's RTEP, which was part of the justification for why PJM revised its forecasting model in 2016.
CHAPTER 3: Results: Alternatives to Surry – Skiffes Creek 500 kV River Crossing

3.1: Results in the absence of Surry – Skiffes Creek with Yorktown 3 online.
Based only on the planning criteria contained in the PJM 2025 RTEP Summer Peak power flow case minus the Project and with Yorktown 3 online (as it is in the 2025 PJM RTEP), there are no reliability violations i.e., DVP is fully in compliance with NERC standards without the Project being in service under Summer Peak and Winter Peak conditions.

3.2: Alternatives to Surry – Skiffes Creek in the event that Yorktown 3 is fully retired.
While the PJM 2025 RTEP includes Yorktown 3 as online in its Summer Peak case, the discussion that follows is provided to demonstrate that there are alternatives available to the Project even if Yorktown 3 were to be fully retired at some point in the future.

TCR evaluated the potential impact of Yorktown 3 retirement under Summer Peak conditions by disconnecting Yorktown 3 in the PJM 2025 RTEP Summer Peak case and replacing the Yorktown 3 electric generation by increasing the dispatch of other units in DVP that were not at their maximum dispatch.

In addition to increasing available generation, to model this scenario, TCR also connected the capacitors at Lanexa, and Rock Landing which were disconnected in the case with Yorktown 3 on line.10 Given this configuration there were no voltage violations, and 3 flow violations when considering the Load Dump (LD) ratings (see Table 2 above for conditions defined by DVP that require use of LD ratings). Two of these occur under the Extreme Event of the outage of all four lines in the Chickahominy – Lanexa Right of Way:

- 6CHCKTUK (314522) -> 6BENCHRCH (313818) CKT 1 at 6CHCKTUK, 105.4% of LD rating
- 6BENCHRCH (313818) -> 6COPELAND (313866) CKT 1 at 6BENCHRCH, 100.5% of LD rating
A third violation occurs under the outage of Winchester – Poolesville and Lightfoot – Waller (lines 214 and 2102, P6 event):

- 6CHCKTUK (314522) -> 6BENCHRCH (313818) CKT 1 at 6CHCKTUK, 101.2% of LD rating11

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10 With these capacitors disconnected there were 21 voltage violations of NERC criteria.

11 When considering Short Term Emergency (STE) ratings rather than LD rating, 9 additional violations occur the details of which are listed in Appendix A.1.
Figure 2 shows the Summer Peak violations in the absence of the Project and Yorktown 3.

Figure 2: Most critical violation in absence of the Project and Yorktown 3 under PJM RTEP 2025 Summer Peak conditions.

- **Summer peak power flow with:**
  - Yorktown 3 unit offline
  - Capacitors at Lanexa and Rock Landing energized
  - Without Surry – Skiffes Creek

- **Worst violations:**
  - **Contingency: Chickahominy – Lanexa Right of Way (Extreme Event), four lines**
    - Flow violations over LD rating for Chuckatuck – Benns Church – Copeland 230 kV: 0.5-5.4% (15.8-21.3% over STE rating)
    - Flow violations over STE rating for Poolesville - Winchester and Copeland – Newport News – Shellbank 230 kV: 4.8-6.8%
  - **Contingency: Winchester – Poolesville and Chickahominy – Lightfoot (N-1-1, P6 event: LN 214-2102)**
    - Flow violation over STE rating for Chuckatuck – Benns Church – Copeland 230 kV: 11-16.5%
    - Flow violation over STE rating for Copeland – Newport News – 230 kV: 2.5%

In addition to evaluating Summer Peak conditions with Yorktown 3 offline, this section addresses the remaining two 2025 RTEP cases: Winter Peak and Low Load. Both of these cases have Yorktown 3 offline.¹²

Without the Project, and with three capacitors connected,¹³ the 2025 PJM RTEP Winter Peak case has no flow violations to NERC criteria over the LD ratings. When considering the STE ratings, there were 5 flow violations. Two of these violations can be fully solved with an allowed system adjustment (redispatch).¹⁴

The 2025 PJM RTEP Low Load case has no violations to NERC criteria without the Project. In other words, the Project is not required for reliability under Low Load conditions. And, if Yorktown 3 and the Project are both removed, there are still no criteria violations under Low Load conditions.

Based on the assessment of PJM RTEP 2025 models without the Project and with Yorktown 3 offline, TCR proceeded to identify alternatives to the Project under the condition in which Yorktown 3 is retired and not available year-round.

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¹² In reality, Yorktown 3 is online in the 2025 Winter Peak case but with a minimal dispatch of 24 MW. To be conservative, we disconnected it, as that 24 MW dispatch would be infeasible in practice.

¹³ We connected the capacitors at Yorktown, Lanexa and Newport News to eliminate voltage violations under Winter Peak conditions without the Project.

¹⁴ Two contingencies led to overloads of the Chickahominy 500/230 kV transformer. To fully relieve those overloads, we shut down the CC connected to Chickahominy (A82-068) and replaced the reduced generation by increasing generation elsewhere in PJM (allowable system adjustment). The contingencies that led to these contingencies are (1) Outage of lines Winchester – Poolesville and Chuckatuck – Newport News 230 kV (Planning Event P7), lines 214 and 263 and (2) Outage of the Elmont 500/230 kV transformer and the Elmont – Ladysmith 500 kV line (Planning Event P4, breaker stuck contingency DVP_P4-2: HIT574).
TCR developed four sets of physical transmission expansion alternatives and one Non-Wires alternative that ensure electrical reliability of NHRA and satisfy all NERC criteria as specified in the DVP Planning Criteria in the absence of both the Project and Yorktown 3. The alternatives were developed using a range of engineering approaches. The first set of alternatives rely on Rebuilding and Reconductoring existing transmission assets (3 alternatives), the second set of alternatives rely on bypassing the critical right of ways (1 alternative) and the final alternative provides a Non–Wires alternative (1 alternative).

### 3.2.1: Rebuilding and Reconductoring

The following three alternatives rely on rebuilding and reconductoring existing transmission assets. These alternatives fully meet all NERC reliability criteria as specified in the DVP Planning Criteria, i.e., the alternatives remove the most critical violations displayed in Figure 2 and those listed in Appendix A for both the Summer and Winter Peak cases.

#### 3.2.1.1: Rebuild / Reconductor Alternative 1

**Figure 3: Rebuild/Reconductor Alternative 1**

- **Reconductor/Rebuild Brushcreek – Benne Church – Copeland – Newport News – Shellbank 230 kV and the section of line reconductored on common towers to current 230 kV standard (e.g., STE 1047 MVA):**
  - Total length in 26.46 miles (four segments are 5.54, 11.59, 2.48, and 6.85, respectively, per PIM System Map; approx. 15 miles are for towers with double circuits)
  - Estimated cost is $52 million*

- **Rebuild/reconductor line #2113 from Lanexa to Lightfoot with STE of 1047 MVA (i.e., extend project b3056 to include the specified 15.3 mile segment):**
  - Estimated cost is $5 million**

- **If there are overloads on the Poolesville – “Benn Church” section of the Poolesville – Winchester line (there can be 7% overloads using STE rating), reconfigure upon the occurrence of the Chickahominy – Lanexa Right of Way contingency (corrective action, allowed by DVP Planning Criteria as a system adjustment) to shift more load to the Benn Church – Copeland line, for example:**
  - Open Yorktown – Rock Landing 230 kV (open G37292 and 29282; i.e., open the Yorktown end of line #290), and
  - Open Safford Creek – Warwick 230 kV (open X72138 and 213872; i.e., open the Safford Creek line end of #2138)

- Total estimated cost is $57 million

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15 Rebuilding of a line may require expansion of the right of way, replacement of all towers, and upgrading of cable that is larger in diameter and therefore heavier. Reconductoring, on the other hand, does not require replacement of towers, only replacing of cable. Reconductoring generally does not require expansion of the right of way.
3.2.1.2: Rebuild / Reconductor Alternative 2

Figure 4: Rebuild/Reconductor Alternative 2

- Rebuild/Reconductor Chuckatuck – Benns Church – Copeland – Newport News – Shellbank 230 kV and the section of line Poolesville – Winchester installed on common towers to current 230 kV standard (e.g., STE 1047 MVA)
  - Total length is 26.46 miles (four segments are 5.54, 11.59, 2.48, and 6.85, respectively, per PJM System Map; approx. 10 miles are for towers with double circuits
  - Estimated cost is $52 million
- Rebuild/reconductor line #2113 from Lanexa to Lightfoot with STE of 1047 MVA (i.e., extend project b3056 to include the specified 15.5 mile segment)
  - Estimated cost is $5 million
- If there are overloads on the Poolesville – “Benns Church” section of the Poolesville – Winchester line (there can be 7% overloads using STE rating), reconductor/rebuild that section as well (+29.7 miles, i.e., +$42 million at same rate as *)
- Total estimated cost is $99 million

Figure 5: Rebuild/Reconductor Alternative 3

- Rebuild/Reconductor Chuckatuck – Benns Church – Copeland – Newport News – Shellbank 230 kV and section of line Poolesville – Winchester installed on common towers to current 230 kV standard (e.g., STE 1047 MVA)
  - Total length is 26.46 miles (four segments are 5.54, 11.59, 2.48, and 6.85, respectively, per PJM System Map; approx. 10 miles are for towers with double circuits
  - Estimated cost is $52 million
- Rebuild/reconductor line #2113 from Lanexa to Lightfoot with STE of 1047 MVA (i.e., extend project b3056 to include the specified 15.5 mile segment)
  - Estimated cost is $5 million**
- If there are overloads on the Poolesville – “Benns Church” section of the Poolesville – Winchester line (there can be 7% overloads using STE rating), then tap 230 kV line Poolesville – Winchester at Benns Church, connecting the two buses at Benns Church, and reconductor/rebuild Winchester – Wheaton (+2.4 miles for Winchester – Wheaton and +1 mile for the tap, i.e., +$5 million at same rate as *)
- Total estimated cost is $62 million

* Estimate developed assuming a cost of $1.4 million/mile, based on project b3056 (estimated cost $86 million per PJM RTEP and 61 miles of length per PJM System Map, includes two river crossings), and twice the cost for the 10-mile section with double-circuit towers and river crossing.
** Estimate developed assuming a cost of $0.325 million/mile, based on project b3056 (estimated cost $4 million per PJM RTEP and 12.3 miles of length per PJM System Map).
3.2.2: Bypassing Critical Right of Ways

The second approach to develop an alternative requires the construction of two new 230 kV lines in the NHRA that would allow the flow of energy to bypass two critical right of ways, Chickahominy–Lanexa and Lanexa–Skiffes shown in Figure 6 below. As with the other alternatives, this alternative was modeled in the absence of both the Project and Yorktown 3. The alternative builds a new 230 kV line between Brookwoods and Slaterville (about 20 miles, along I-64, between I-64 and route 249) using current standards for 230 kV overhead lines, and builds a new 230 kV line between Hayes and Harmony (about 31 miles, on the existing right of way) using all current and relevant standards for construction of new 230 kV transmission lines.

**Figure 6: Alternative to Bypass Critical Right of Ways**

This alternative meets all reliability requirements in conjunction with an allowed DVP system adjustment. With this alternative, there is a minor overload over STE rating with the P6 event 214+2102 (Poolsville – Winchester and Chickahominy – Waller 230 kV). Opening the Shellbank 230/115 kV transformer after the first outage, an allowed DVP system adjustment, fully relieves the minor overload.

Bypassing the critical right of ways is an option that was proposed to DVP by TCR in 2016 and rejected by DVP in a November 17, 2016 letter to the Corps of Engineers. The estimated cost of this alternative according to DVP was $140 million. This alternative is estimated by TCR to cost about $112 million based on the cost of other, comparable projects as published in the PJM RTEP (see Figure 6 for more details).

3.2.3: Non-Wires Alternatives

In addition to the physical alternatives (reconductoring/rebuilding and bypassing critical right of ways) discussed above, there are a range of potential alternatives that are commonly referred to as Non-Wires Alternatives. Non-Wires Alternatives are based on operational or behavioral actions that can be
taken as needed to maintain reliability and which do not rely on the development of transmission assets.

The Non–Wires Alternatives rely on the development of 325 MW of alternative energy generation resources in the NHRA. These resources could be a combination of traditional or renewable generation, storage technologies, demand response, or further improvements in energy efficiency as is happening at present in the region. Distributed Energy Resources such as rooftop or utility scale solar are rapidly becoming major sources of incremental energy throughout much of the power industry both in front of and behind the customer meter. Utility–scale photovoltaics (solar) installation combined with rooftop solar are available technologies to supply added capacity to the NHRA. Solar electric is specifically attractive as an alternative because it will most likely be available during summer peak hours when any additional capacity could be needed for reliability purposes.

For the purposes of evaluating the non–wires alternative, we have assumed that the location of the now decommissioned Yorktown 1 and 2 is used as the site of the resources, with the understanding that resources would most likely be distributed throughout the NHRA. These resources (for modeling purposes assumed to be located at Yorktown) would need to be dispatched when load in the NHRA exceeds 1233 MW or exceeds 1233 MW minus any incremental utility scale or behind the meter solar generation. This would be done such that the NHRA load net of the resources would not exceed 1233 MW. Per the 2025 PJM RTEP power flow case, the NHRA summer peak load is 1458 MW. As such, at most 225 MW of resources could be used in normal operations under high load conditions. The remaining 100 MW would stay on stand–by and would be deployed should the Chickahominy–Lanexa Right of Way (Extreme Event) contingency occur, as a system adjustment that is allowed by the NERC criteria and the DVP Planning Criteria.

Load control is another type of Non–Wires alternative that could be used to meet the NHRA’s load demand in the absence of the Project. The required action on the part of DVP would be to develop (or implement if currently already an option) a direct load control program with implementation on only those hours in which the demand level had been estimated to be greater than 1233 MW. If the net need was 100MW this direct load control could be relied upon as standby capacity or could be deployed only under the Chickahominy – Lanexa Right of Way extreme condition contingency. DVP today provides energy conservation and load management programs to both residential and commercial customers.


CHAPTER 4: Costs and Time to Construct or Implement

TCR developed estimates of the cost for all rebuild and reconductor alternatives based on documented project costs for similar projects as found in recent PJM RTEP reports for Alternatives 1 to 4. As an example, for 230kV lines such as the rebuild/reconductor creating the parallel path to Chickahominy between Brookwoods and Slaterville, TCR based the costs on PJM project B3089 of $1.4 million/mile with linear distances based upon PJM system maps. Where new switching stations were required, as between Hayes and Harmony, the estimate was based on RTEP project B2900 at $0.51 million per station and $3.37 million/mile based on RTEP project B2743.5.

Table 2 below provides a summary of the results of the TCR analyses with Yorktown 3 retired. The Table demonstrates that even should Yorktown 3 be retired (a fact that is not indicated in the PJM 2025 RTEP), the five alternatives below were fully evaluated and confirmed to provide for delivery of energy and reliability at a cost well less than that of the Surry–Skiffes Project. The alternatives could also be implemented quickly and prior to any decommissioning of Yorktown 3.

**Table 1: Summary of Alternatives**

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Estimated Cost</th>
</tr>
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<tbody>
<tr>
<td>TCR Alternative 1: Rebuild/Reconductor Alternative 1</td>
<td>57 Million Dollars</td>
</tr>
<tr>
<td>TCR Alternative 2: Rebuild/Reconductor Alternative 2</td>
<td>99 Million Dollars</td>
</tr>
<tr>
<td>TCR Alternative 3: Rebuild/Reconductor Alternative 3</td>
<td>62 Million Dollars</td>
</tr>
<tr>
<td>TCR Alternative 4: Bypass Right of Ways</td>
<td>112 Million Dollars18</td>
</tr>
<tr>
<td>TCR Alternative 5: Non–Wires Alternatives</td>
<td>TBD19</td>
</tr>
</tbody>
</table>

18 DVP estimated $140 Million, see footnote 1.

19 Exact cost information for deployment of non–wires alternatives would require information and cooperation from DVP to calculate. But industry practice and history indicate that it would be less than the cost incurred to construct the Surry–Skiffes Creek Project.
CHAPTER 5: Conclusions

Based on power flow analyses completed by TCR using PJM's 2025 RTEP, TCR determined that the Project is not necessary to maintain reliability and satisfy NERC standards. Further, given current demand, supply and transmission assets in the NHRA, there is not a credible probability of a reliability crisis (e.g., blackout or brownout) in the NHRA if the Project is removed from service, so long as Yorktown 3 remains in service, as it is in the 2025 PJM RTEP. However, if Yorktown 3 is decommissioned, then TCR determined, that the Project (or a suitable alternative) is necessary to maintain reliability standards in the Summer and Winter Peak cases. To address these concerns, TCR developed five alternatives that would maintain reliability and satisfy all relevant standards if Yorktown 3 were unavailable. Each of these alternatives could be completed at less cost than was incurred to construct the Project and could be constructed in a short timeframe, prior to any decommissioning of Yorktown 3.
APPENDIX A:
Flow Violations with Yorktown 3 Offline under STE Ratings as referenced in the text

A.1: Summer Peak

Violations for the outage of all lines in the Chickahominy – Lanexa Right of Way (Extreme Event), lines 92, 2024, 2102 and 2129:

- 6BENCHCH (313818) -> 6COPELAND (313866) CKT 1 at 6BENCHCH, 115.73% of STE rating
- 6CHCKTUK (314522) -> 6BENCHCH (313818) CKT 1 at 6CHCKTUK, 121.28% of STE rating
- 6COPELAND (313866) -> 6NP NEWS (314398) CKT 1 at 6COPELAND, 106.8% of STE rating
- 6NP NEWS (314398) -> 6SHELBNK (314407) CKT 1 at 6NP NEWS, 104.77% of STE rating
- 6POOLSVL (314540) -> 6WINCHST (314421) CKT 1 at 6POOLSVL, 106.83% of STE rating

Violations for the outage of all lines in the Lanexa – Skiffes Right of Way (Extreme Event), lines 169, 177, 2102 and 2113:

- 6BENCHCH (313818) -> 6COPELAND (313866) CKT 1 at 6BENCHCH, 115.73% of STE rating
- 6CHCKTUK (314522) -> 6BENCHCH (313818) CKT 1 at 6CHCKTUK, 121.28% of STE rating
- 6COPELAND (313866) -> 6NP NEWS (314398) CKT 1 at 6COPELAND, 106.8% of STE rating
- 6NP NEWS (314398) -> 6SHELBNK (314407) CKT 1 at 6NP NEWS, 104.77% of STE rating
- 6POOLSVL (314540) -> 6WINCHST (314421) CKT 1 at 6POOLSVL, 106.83% of STE rating

Violations for the outage of lines Winchester – Poolesville and Chickahominy – Lightfoot 230 kV (Planning Event P6), lines 214 and 2102:

- 6BENCHCH (313818) -> 6COPELAND (313866) CKT 1 at 6BENCHCH, 115.73% of STE rating
- 6CHCKTUK (314522) -> 6BENCHCH (313818) CKT 1 at 6CHCKTUK, 121.28% of STE rating
- 6COPELAND (313866) -> 6NP NEWS (314398) CKT 1 at 6COPELAND, 106.8% of STE rating
- 6NP NEWS (314398) -> 6SHELBNK (314407) CKT 1 at 6NP NEWS, 104.77% of STE rating
- 6POOLSVL (314540) -> 6WINCHST (314421) CKT 1 at 6POOLSVL, 106.83% of STE rating

Violations for the outage of lines Crittenden – Surry and Winchester – Poolesville 230 kV (Planning Event P7), lines 214 and 226:

- 6CHCKTUK (314522) -> 6BENCHCH (313818) CKT 1 at 6CHCKTUK, 100.85% of STE rating

A.2: Winter Peak

Violations for the outage of all lines in the Chickahominy – Lanexa Right of Way (Extreme Event), lines 92, 2024, 2102 and 2129:

- 6BENCHCH (313818) -> 6COPELAND (313866) CKT 1 at 6BENCHCH, 101.67% of STE rating
- 6CHCKTUK (314522) -> 6BENCHCH (313818) CKT 1 at 6CHCKTUK, 106.11% of STE rating
- 6COPELAND (313866) -> 6NP NEWS (314398) CKT 1 at 6COPELAND, 102.46% of STE rating

These flow violations over STE ratings in the Winter Peak case are similar but significantly lower than those found for Summer Peak conditions.