

USACE Preliminary Alternatives Conclusions White Paper

RE: NAO-2012-0080 / 13-V0408

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The Norfolk District Regulatory Branch (Corps) is currently reviewing an application from Dominion Virginia Power (Dominion) who proposes to construct a new high voltage aerial electrical transmission line, known as the Surry-Skiffes Creek -Wheaton project. The proposed project consists of three components; (1) Surry – Skiffes Creek 500 kilovolt (kV) aerial transmission line, (2) Skiffes Creek 500 kV – 230 kV – 115 kV Switching Station, and (3) Skiffes Creek – Wheaton 230 kV aerial transmission line. In total, the proposed project will permanently impact 2,712 square feet (0.06 acres) of subaqueous river bottom and 281 square feet (0.01 acres) of non-tidal wetlands, and convert 0.56 acres of palustrine forested wetlands to scrub shrub non-tidal wetlands.

As proposed, the transmission lines will cross portions of the James River, Woods Creek, and Skiffes Creek. In addition to structures being built within the James River, structural discharges are proposed in non-tidal wetlands. The proposed activities will require a Corps permit pursuant to Section 10 of the Rivers and Harbor Act and Section 404 of the Clean Water Act.

Additional information specific to the proposed project and alternatives can be found at <http://www.nao.usace.army.mil/Missions/Regulatory/SkiffesCreekPowerLine.aspx> . Our website also contains links to the applicant's and consulting party websites, which contain additional project information and perspectives on the project.

In response to several public notices the Corps has received numerous comments both supporting and in opposition to the project. Opposition to the project is largely focused on the potential impacts to historic and cultural resources. Many commenters have suggested Dominion explore alternatives to the proposed action including burial or relocation of the proposed line.

As part of its initial application materials Dominion provided information on alternatives to the proposed work. At the request of the Corps and in response to comments received during the public notice process and the National Historic Preservation Act Section 106 review process, Dominion has provided further information on alternatives. The Corps has considered Dominion's alternatives analysis and supplemental information as well as information on alternatives supplied through public, agency, and consulting party comments. The Corps has also considered the basic purpose and need for the project. We have evaluated each alternative against the purpose and need and review criteria in light of all information supplied to date. Following is a general summary of our preliminary findings:

Project Need:

Dominion currently supplies power to the North Hampton Roads Load Area (NHRLA) via generation from the Yorktown Power Station (approximately 1,141 Mw) and two transmission corridors that deliver power into the service area. The NHRLA consist of approximately 285,000 customers comprised of the Peninsula (*Counties of Charles City, James City and York and the Cities of Williamsburg, Yorktown, Newport News, Poquoson, and Hampton*), Middle Peninsula (*Counties of Essex, King William, King and Queen, Middlesex, Mathews, Gloucester, and City of West Point*), and Northern Neck (*Counties of King George, Westmoreland, Northumberland, Richmond and Lancaster, and the City of Colonial Beach*). Yorktown Power Station is comprised of two Coal fired plants (Yorktown 1 & 2) that produce approximately 323Mw and one oil fired plant (Yorktown 3) that produces 818Mw. Due to environmental restrictions Dominion can only operate Yorktown 3 intermittently (8% of year) and the unit has an approximately 3 day start up time. Additionally, Dominion anticipates retiring Yorktown 3 by 2020.

With current configurations and without additional power input into the service area by 2019, Dominion would be unable to maintain compliance with the North American Electric Reliability Corporation (NERC) standards. The NHRLA is currently dependent on power generated from the Yorktown Power Station (approximately 1,141 Mw) and two transmission corridors that deliver power into the service area. Dominion's power flow studies project the demand for electricity in this area will grow by 8% between 2015 and 2020. This increase will cause a load growth that will exceed Dominion's ability to remain compliant with NERC standards given the current configuration. NERC has confirmed that these standards are absolute requirements that have no waiver provision. NERC has the authority to impose fines of up to \$1 million per day, per violation.

In December 2011, the United States Environmental Protection Agency (EPA) passed the Mercury Air and Toxics Standards (MATS) Rule requiring power generation facilities to reduce toxic air pollutant emissions. Dominion's Yorktown Power Station, specifically Yorktown Units 1 and 2, is subject to these required reductions. The MATS rule requires that facilities be compliant by April 2015. However, facilities may request a one-year extension from the state regulatory agency with jurisdiction over the area where the facility is located—here, the Virginia Department of Environmental Quality. After April 2016, the Environmental Protection Agency can exercise its enforcement discretion to allow facilities to operate for up to one additional year under an Administrative Order. To achieve compliance with MATS, Dominion must retrofit, repower or decommission Yorktown Units 1 and 2. EPA has confirmed that this interpretation of timelines is accurate.

Project Purpose:

- (1) Basic:** To continue providing the North Hampton Roads Load Area (NHRLA) with reliable, cost effective, bulk electrical service consistent with mandatory North American Electric Reliability Corporation (NERC) Reliability Standards for transmission facilities and planning criteria.
- (2) Overall:** Provide sustainable electrical capacity into the NHRLA in a manner that addresses future load growth deficiencies, replaces aging infrastructure, complies with Federal regulations, including MATS, and maintains compliance with NERC Reliability Standards.

Alternatives Considerations:

Dominion has provided information on various alternatives to the proposed action explored as part of its initial project evaluation as well as in response to Corps inquiries and public comment. These include generation alternatives, upgrades to existing facilities, use of existing transmission lines, and the construction of new transmission at varying capacities. The general criteria in evaluating these alternatives are:

- Continue to provide the NHRLA with electrical service that meets current demand and reasonable projected future load growth
- Compliance with NERC Reliability Criteria Standards
- Compliance with MATS
- Cost
- Existing Technology/Engineering
- Siting/land use Restrictions

Decommission: Loss of the generation capacity of Yorktown 1 and 2 creates violations of NERC Category B, C and D. Absent an improvement to the load area upon implementation of the EPA MATS Rule and the retirement of Yorktown Units 1 and 2, Dominion will be required to implement pre-contingency load shedding (i.e., rolling blackouts) in the NHRLA to prevent the possibility of cascading outages impacting the reliability of the interconnected transmission system. The load flow modeling evidence establishes a need for new electric infrastructure to address approaching reliability violations projected for Dominion's transmission system.

Retrofitting: Retrofitting of the Yorktown facility alone would not increase capacity and would be cost prohibitive. The Yorktown units are nearly 60 years old and would require substantial structural and environmental upgrades to become compliant with MATS. Dominion estimates that these upgrades would cost over \$1 billion. Additionally, since retrofitting would not substantially increase output capacity, additional projects would be needed before 2019 to avoid NERC non-compliance.

Repowering: Dominion examined the potential to repower some or all of the Yorktown units to natural gas. There is currently no sufficient gas supply to support year-round operation of gas-fired generation at Yorktown and significant expansion of the regional gas supply would be required. Currently, the region does not have adequate infrastructure to support this expansion and there is no certainty when this infrastructure may be in place.

New Generation: Upon the determination that Yorktown Units 1 and 2 should be retired, Dominion considered new generation options throughout the area. Options such as combined-cycle, combustion turbine and coal generation were considered. Also considered were small scale generation sources such as biomass, wind and solar. A standalone generation solution was found to be \$633 million to satisfy 2016 NERC reliability criteria. An additional \$722 million would be required to provide sufficient generation by 2021, bringing the total cost of a standalone generation solution to an estimated \$1.3 billion. Stand-alone generation would also face siting, permitting and construction timeline constraints.

214/263 230 kV Line Rebuild (James River Bridge Crossing): Line 214 and Line 263 are located adjacent to the James River Bridge. Dominion evaluated rebuilding these lines to a higher capacity. However, the load flow analysis showed that the rebuild of these lines would not resolve the 2016 NERC criteria nor would it resolve the 2021 criteria. This alternative is also problematic in that outages of the existing Lines 214 and 263 would be required during the demolition and rebuild of this corridor. Without replacement generation already in place, outages of these lines would result in NERC violations.

Chuckatuck – Newport News 230 kV Line (Whittier Hybrid): The Chuckatuck – Newport News 230 kV Line, or the Whittier Hybrid, involves the building of a new 15.4 mile long transmission line along new or expanded right-of-way (ROW) between the Chuckatuck and Whealton Substations. This alternative requires the construction of new line through several miles of wetlands between Chuckatuck and the James River as well as the expansion of existing ROW in congested residential areas. This alternative also involved a new crossing of the James River in the vicinity of the existing James River Crossing. Regardless of the physical and routing constraints of this alternative, this proposed alternative does not resolve all of the NERC reliability criteria.

Surry – Whealton 500 kV Line: This alternative would entail the construction of a new 500 kV line, adjacent to the US Highway 17 James River Bridge from Surry to Whealton. Physical, electrical, routing, siting, and environmental constraints exist. The existing corridor contains a 230 kV line. This

corridor is not sufficient to accommodate a 500 kV line and would need to be expanded. This would require acquisition of new ROW through residential areas, historic districts, and wetlands. An additional crossing of the James River would be required to be constructed as well. The same obstacles outlined above in the Chuckatuck – Newport News 230 kV Line Whittier Hybrid alternative would apply. Construction of a new switching station would still be required in conjunction with the construction of a 500 kV line. The likely location for this station would be either the Winchester or Whealton Substation. Either site would need to be expanded by at least 15 acres to accommodate the electrical equipment required to convert the 500 kV line to the 230 kV connection. Winchester or Whealton Substation, are located in developed areas and would require the demolition of homes and businesses to obtain the necessary expansion required.

Chickahominy – Lanexa 500 kV: The existing Lanexa corridor extends from the Chickahominy Substation in Charles City County to the Lightfoot Substation in Lightfoot, Virginia. This alternative evaluated the potential to expand a 14.3 mile section of this existing corridor to construct a new overhead 500 kV line. The corridor is currently occupied by three 230 kV lines and one 115 kV line. While this alternative allowed for the construction of a 500 kV line, any event causing the loss of the entire ROW would result in cascading outages impacting the NHRLA, northern Virginia, the City of Richmond and parts of North Carolina.

Chickahominy – Skiffes Creek 500 kV: The Chickahominy – Skiffes Creek alternative utilizes a ROW currently owned by Dominion that extends approximately 37.9 miles from the Chickahominy Substation in Charles City County to the proposed Skiffes Creek Switching Station in James City County. Approximately 13 miles of this route is existing, cleared ROW while the remaining 24.9 miles is unimproved ROW that would require clearing for construction of the proposed line. The Chickahominy – Skiffes Creek 500 kV resolves the NERC reliability violations due to the retirement of Yorktown Units 1 and 2 by 2016.

Surry – Skiffes Creek 500 kV Underground (Alternating Current): The placement of an underground Alternating Current (AC) 500 kV line of this capacity is on the cutting edge of technology. Underground lines in general present reliability and operational concerns, as locating and repairing damaged underground lines is significantly more difficult than locating and repairing overhead lines. Existing underground projects were examined for comparison while evaluating the feasibility of this alternative. This comparison supported information supplied by Dominion regarding the concerns with this alternative.

Surry – Skiffes Creek 500 kV Underground (High Voltage Direct Current): An HVDC alternative would require the conversion of AC power to DC, the installation of an underground HVDC crossing in the James River, and the conversion of DC power back to AC. This alternative is presented with routing and siting constraints, land acquisition requirements, reliability concerns, cost, increased environmental and cultural impacts and time constraints.

Surry-Skiffes Creek-Whealton 500 kV Overhead (Dominion’s Preferred Alternative): This alternative consists of three components; (1) Surry – Skiffes Creek 500 kilovolt (kV) aerial transmission line, (2) Skiffes Creek 500 kV – 230 kV – 115 kV Switching Station, and (3) Skiffes Creek – Whealton 230 kV aerial transmission line. This alternative fully resolves the NERC criteria violations with the retirement of Yorktown Units 1 and 2.

High Tension Low Sag Conductors (HTLS): Use of HTLS conductors would require the majority of 230kV-115kV system in the NHRLA to be upgraded. Use of HTLS conductors on the Surry-Skiffes

Creek-Wheaton 500 kV Overhead (Dominion's Preferred Alternative) pose no reduction in the number of towers needed to cross the James River.

Hybrid Alternatives: Several combinations of retrofitting, repowering and retirement combined with transmission construction were also evaluated. These included several configurations of 230 kV lines, both overhead and underground, combined with retention of generation at Yorktown. None of these combination alternatives can resolve all NERC Reliability Violations in 2016 without the construction of additional transmission or generation.

Save The James Alliance Alt Solution: This alternative includes the closing of Yorktown 1 and continued operation of Yorktown 2, while building an underground 230kV line across James River, and constructing future generation facilities. Continued operation of Yorktown 2 in its present condition is not compliant with MATS. This hybrid alternative would require Dominion to run Yorktown 2 in violation of MATS indefinitely or long enough to retrofit or repower one or both of the Yorktown Units or to develop new generation. For this reason, this alternative presents the same obstacles of retrofitting, repowering and new generation as discussed above.

Demand-Side Management (DSM): Rather than approaching power usage from the supply side, DSM resources include activities and programs undertaken to influence the amount and timing of electricity use, as well as market purchases from outside power generators to reduce overall demand. DSM resources are already included in the transmission planning process. Additional amounts cannot be assumed to be available to address NERC reliability violations due to transient and voluntary nature of these resources.

Alternative	Electrically Compliant w/NERC (Absent Time Restrictions)				Meets Purpose & Need
Decommission Yorktown Power Station with No Replacement Project	N				N
Demand-Side Management	N				N
Line 214/263 230kV Rebuild James River Bridge Crossing (standalone)	N				N
Chuckatuck-Newport News 230kV Line (Whittier Hybrid)	N				N
Chickahominy – Lanexa 500kV	N				N
Underground 230kV Single Circuit (standalone)	N				N
Underground 230kV Double Circuit (standalone)	N				N
Underground Alternative 230kV (PAR)	N				N
		2017 MATS Compliance based on Aug 2013 JPA	Estimated Construction Cost	Constraints	
Continue Operations at Yorktown Power Station under Current Infrastructure	Y (until 2019)	N	** Fines/Penalties	- Doesn't comply with MATS - Fails to provided future growth capacity	N

Retrofit Yorktown Power Station w/ Antipollution Control Equipment	Y(until 2019)	N	>\$1 Billion	- Fails to provide future growth capacity	N
Repowering Yorktown Power Station with Natural Gas	Y (until 2019)	N	Unreported	- Inadequate supply of natural gas - Fails to provide future growth capacity	N
New Generation (gas, biomass, wind, solar, etc)	Y	N	>\$715 Million	- Fuel Supply & Siting Issues	N
Save The James Alliance Alt Solution -- Close Yorktown 1 Continue to Operation Yorktown 2 Build Underground 230kV line Build Generation	Y	N	Unreported	- Continued operation of Unit #2 in its present condition is not compliant with MATS.	N
Surry-Wheaton Overhead 500kV	Y	N	Unreported	- Not constructible due to route alignment and ROW obtainment for Wheaton Substation - Blocks ability to construct future 500kV line from Surry and undermines operation capacity of Surry Nuclear Power Plant	N
Underground Surry-Skiffes-Wheaton 500kV (High Voltage Direct Current)	Y	N	>\$700 Million - \$1 Billion	- Siting issues with required converter stations	N
High Tension Low Sag Conductors	Y	N	>\$400 Million	- Use on 230kV alternatives would require reconductoring virtually the entire 230kV-115kV system in the NHRLA. -Use on 500kV S-S-W cost \$370,000 more in cost and had no reduction in the number of towers needed to cross the James River.	N
Line 214/263 230kV Rebuild James River Bridge Crossing Plus Retrofit Yorktown	Y	N	>\$1 Billion	Cost & Time 120 months to construct	N
Underground Double Circuit 230kV (w/add'l facilities)	Y	N	\$515 Million	Cost & Time	N
Underground Single Circuit 230kV Plus Retrofit	Y	N	>\$1.8 Billion	Cost & Time 60 months to construct	N
Underground Double Circuit 230kV Plus Retrofit	Y	N	>\$1.1 Billion	Cost & Time 60 months to construct	N
Underground Surry-Skiffes-Wheaton 500kV (High Voltage Alternating Current)	Y	N	Unreported	**	N
Chickahominy-Skiffes-Wheaton 500kV	Y	Y***	\$265 Million	15 Months to Construct	Y
Surry-Skiffes-Wheaton 500kV OH (AC)	Y	Y***	\$180 Million	18 Months to Construct	Y

** The placement of an underground Alternating Current (AC) 500 kV line of this capacity is on the cutting edge of technology.

***In August 2013, when Dominion submitted their Department of Army application, only two alternatives could be completed within the mandated timelines associated with MATS rule. Presently, these two alternatives can no longer be completed before April 2017.

Available Alternatives:

Only two remaining alternatives are available for consideration at the time of Dominion’s application submittal in August 2013; (1) Surry - Skiffes 500kV Preferred Alternative, and (2) Chickahominy – Skiffes Creek 500 kV alternative.

Table below provides a general impact comparison:

Alternative	Aquatic Resource	Endangered Species	Cultural Resource
Surry-Skiffes-Wheaton 500 kV OH (AC) (Dominion’s Preferred)	<ul style="list-style-type: none"> • Conversion of 0.56 ac non-tidal wetlands • Direct loss of approx 3000 sq ft of tidal & non-tidal resources. 	<ul style="list-style-type: none"> • Atlantic Sturgeon, Anadromous fish, Northern Long Eared Bat, Small Whorled Pogonia, Sensitive Joint Vetch, Bald Eagle, Hog Island Wildlife Manage Area • Not likely to adversely affect with incorporated protective measures. 	<ul style="list-style-type: none"> • Direct adverse effects to Lower JR Historic District, Capt John Smith Trail, and 44JC0662 • Indirect adverse effects to Carters Grove, Jamestown Island, and Colonial Parkway • Nationwide River Inventory
Chickahominy –Skiffes – Wheaton 500kV	<ul style="list-style-type: none"> • 62.00 ac of non-tidal wetland conversion for new ROW construction. • Direct losses of tidal & non-tidal aquatic resources are estimated to comparable to S-S-W. 	<ul style="list-style-type: none"> • Atlantic Sturgeon, Anadromous Fish, Northern Long “Eared Bat, Small Whorled Pogonia, Sensitive Joint Vetch, Bald Eagle, Chickahominy Wildlife Management Area • Potential Impacts likely, but with protective measures affects should not be adverse and therefore comparable to S-S-W. 	<ul style="list-style-type: none"> • Comprehensive Historic Property Identification has not been completed for this corridor; however resources such as Capt John Smith Trail and Colonial National Historic Park would be present. • Adverse Effects Likely • Nationwide River Inventory

Preliminary Findings:

The Corps fully considered all information supplied to date from both Dominion and the public. Additionally, Corps Electrical Engineers have evaluated the information for technical accuracy. In screening the various alternatives, the Corps focused on the ability to sustain sufficient power supply to meet current demand and predicted future growth, existing technology, implementation cost and ability to maintain/achieve compliance with federal laws.

At this time, most alternatives, including Dominion’s preferred alternative would potentially require Dominion to operate Yorktown in violation of MATS in order to ensure uninterrupted service to NHRLA. However, there is substantial difference among the alternatives in the length of time of non-compliance. Increasing time of non-compliance increases Dominion’s exposure to legal action and increasing fines thereby, increasing cost and affecting the practicability of alternatives.

Based on information supplied to date, many of these alternatives could be eliminated based on cost alone. The costs used in this analysis include alignment acquisition and construction. Dominion’s preferred alternative is estimated to cost \$180 million to fully implement. The next lowest cost alternative is the Chickahominy-Skiffes-Wheaton 500kV alternative at approximately \$265 million. Other alternatives have substantially greater costs but also present technical challenges and/or substantially increase the time Dominion would be non-compliant with regulations.

Therefore, based on information presented to date, our preliminary finding is that two alternatives appear to meet the project purpose while reasonably complying with the evaluation criteria. These

are Surry-Skiffes-Wheaton 500 kV OH (AC) (Dominion's Preferred) and Chickahominy –Skiffes – Wheaton 500kV. We have determined that other alternatives are unavailable due to cost, engineering constraints and/or logistics. Please note this is not a decision on whether Dominion's preferred alternative is or is not permissible, nor does it exclude further consideration of alternatives should new information become available.