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BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION

Application Of NextEra Energy Transmission MidAtlantic, Inc., for All of the Necessary Authority, Approvals, and Certificates of Public Convenience (1) to Begin to Furnish and Supply Electric Transmission Service in Greene County and Fayette County, Pennsylvania; (2) for Certain Affiliated Interest Agreements; and (3) for any Other Approvals Necessary to Complete the Contemplated Transactions	:	Docket No. A-2026-_____

and

Application of NextEra Energy Transmission MidAtlantic, Inc., Filed Pursuant to 52 Pa. Code Chapter 57 Subchapter G, for Approval to Site and Construct a 500 kV Transmission Line Associated with the MidAtlantic Resiliency Link Project Located in Portions Of Greene County and Fayette County, Pennsylvania	:	Docket No. A-2026-_____ A-2026-3060856-AEL-3/4/26

NextEra Energy Transmission MidAtlantic, Inc.

Statement No. 6

Direct Testimony of
Phillip Givens
Senior Manager of Transmission Project Engineering, Engineering & Construction – NextEra Energy Resources, LLC

Topics Addressed:

NEET MA Fitness
Description of Design Features
Description of Safety Features
ROW Requirements
Explanation of Engineering and Construction Process
Electric and Magnetic Field (EMF) Mitigation Measures

Dated: March 3, 2026

I. INTRODUCTION AND BACKGROUND OF WITNESS

Q. Please state your name and business address.

A. My name is Phillip Givens. My business address is 700 Universe Boulevard, Juno Beach, Florida 33408.

Q. By whom are you employed and what is your position?

A. I am employed by NextEra Energy Resources, LLC ("NextEra Energy Resources") as Senior Manager of Transmission Line Project Engineering. NextEra Energy Resources is an indirect, wholly owned subsidiary of NextEra Energy, Inc. ("NextEra Energy") and is an affiliate of the applicant in this proceeding, NextEra Energy Transmission MidAtlantic, Inc. ("NEET MA" or "Applicant").

Q. Please provide an overview of your responsibilities as a Senior Manager of Transmission Line Project Engineering with NextEra Energy Resources.

A. In my role as Senior Manager of Transmission Line Project Engineering, I am responsible for the execution of NextEra Energy Transmission, LLC ("NEET") transmission projects. This includes projects that have been developed internally, projects directly awarded, projects won through competitive solicitation, and projects involving interconnection with existing NEET assets. I ensure that the projects are designed according to the National Electrical Safety Code ("NESC") and industry standards as well as internal NEET standards. My team's projects range from 138 kilovolt ("kV") to 765 kV alternating current ("AC") lines. One of my team's primary responsibilities includes participation in route development and route analysis. My responsibilities with competitive transmission projects such as the MidAtlantic Resiliency Link Project ("MARL Project" or the

"Project") begin as a subject matter expert ("SME") to inform design criteria and design decisions. My responsibilities shift to managing the design efforts after a project is awarded and continue through construction and energization.

Q. On whose behalf are you submitting this testimony?

A. I am submitting this testimony on behalf of NEET MA, the Applicant in this proceeding. NEET MA is requesting all necessary authority, approvals, and Certificates of Public Convenience ("CPC") from the Pennsylvania Public Utility Commission ("PAPUC" or "Commission"): (1) to begin to furnish and supply electric transmission service in Greene County and Fayette County, Pennsylvania; (2) for certain affiliated interest agreements; and (3) for any other approvals necessary or required. In addition, NEET MA is requesting PAPUC approval to site and construct a new 500 kV high-voltage ("HV") transmission line associated with the MARL Project located in portions of Greene County and Fayette County, Pennsylvania.

Q. Please describe your educational and professional background.

A. I have a Bachelor of Science degree in Electrical Engineering from the University of Florida, and a Master's degree in Transmission & Distribution Engineering from Gonzaga University. I am a registered Professional Engineer in Florida and Texas. I have over 40 years of experience in transmission line design—20 years with NEET MA affiliate Florida Power & Light Company ("FPL"), three years with Brugg Cables as an optical ground wires ("OPGW") product engineer, and over 17 years with NextEra Energy Resources. I have received two awards from the Southeastern Electric Exchange for Excellence in

Engineering. I have two patents for compact 345 kV double-circuit structures. During my career, I have also been responsible for evaluating electric and magnetic field ("EMF") levels for proposed transmission projects.

Q. Have you previously provided written testimony before the PAPUC or any other regulatory Commission?

A. No, I have not testified previously before the PAPUC. I have testified before the State of Arizona Power Plant and Transmission Line Siting Committee on behalf of NextEra Energy Resources subsidiaries Selma Energy Center, LLC, Harquahala Flats Energy Storage, LLC, and Eloy Valley Energy Center III, LLC, for Certificates of Environmental Compatibility to construct a 230 kilovolt ("kV") generation transmission line and a 500 kV generation tie line, respectively.

Q. What is the purpose of your direct testimony?

A. The purpose of my direct testimony is to support NEET MA's "*Application of NextEra Energy Transmission MidAtlantic, Inc., Filed Pursuant to 52 Pa. Code Chapter 57 Subchapter G, for Approval to Site and Construct a 500 kV Transmission Line Associated with the MidAtlantic Resiliency Link Project Located in Portions Of Greene County and Fayette County, Pennsylvania*" (hereinafter, "Siting Application"). I also support NEET MA's "*Application Of NextEra Energy Transmission MidAtlantic, Inc., for All of the Necessary Authority, Approvals, and Certificates of Public Convenience (1) to Begin to Furnish and Supply Electric Transmission Service in Greene County and Fayette County, Pennsylvania; (2) for Certain Affiliated Interest Agreements; and (3) for any Other*

Approvals Necessary to Complete the Contemplated Transactions" (hereinafter, the "CPC Application"). The CPC Application requests the issuance of a CPC and other related approvals for public utility status and to begin to furnish or supply electric transmission public utility service in Pennsylvania, related to the portions of the MARL Project that traverse Pennsylvania (the "Pennsylvania Portions"), described in further detail below.

Q. Please provide an overview of your direct testimony.

A. My direct testimony consists of eight sections, including this introductory Section I and conclusion in Section VIII. Section II provides additional detail regarding NEET MA's technical and operational fitness, through its affiliates, to design, construct, own, operate and maintain electric transmission facilities. Section III describes the engineering and construction design features of the MARL Project. Section IV describes the location of the Project's Proposed Route and the engineering considerations involved in selecting the Proposed Route. Section V discusses engineering alternatives to the MARL Project. Section VI describes the engineering and construction process that is applicable to the MARL Project. Finally, Section VII describes the measures that NEET MA will undertake to mitigate EMF.

Q. Are you sponsoring any exhibits as a part of your direct testimony?

A. Yes. I sponsor the following Exhibits:

- Exhibit PG-1 – One-Line Diagram of the MARL Project
- Exhibit PG-2 – Drawings of Expected Structure Types
- Exhibit PG-3 – Proposed Route Slope Statistics and Contour Maps

- Exhibit PG-4 – Project Design Criteria

II. TECHNICAL AND OPERATIONAL FITNESS OF NEET MA

Q. Please describe NEET MA's and its affiliates' experience with constructing and operating electric transmission infrastructure.

A. NextEra Energy affiliates have decades of experience in the construction of transmission lines, substation facilities, and related infrastructure. NextEra Energy companies have proven capabilities in engineering, procurement, constructing, operating, and maintaining high-voltage transmission line projects in compliance with the design, reliability, and operation standards set by a variety of authorities in North America. NextEra Energy's subsidiaries own approximately 13,470 circuit miles of high-voltage transmission, approximately 82,000 miles of distribution lines, and over 1,310 substations across North America. These transmission lines and other infrastructure assets are located in 38 states and four Canadian provinces across a wide range of geographies. NextEra Energy subsidiaries have built over 1,000 miles of 500 kV transmission lines in Florida, Arizona, Montana, and Ontario, Canada. Further, NEET subsidiaries own and operate approximately 2,100 miles of high-voltage transmission lines and 44 substations across North America, in California, Illinois, Indiana, Kansas, Kentucky, Missouri, Nevada, New Hampshire, New York, Oklahoma, Texas, and Ontario, Canada. Of the approximately 2,100 circuit miles owned by NEET's subsidiaries, 1,323 miles were greenfield projects constructed since 2010. NextEra Energy's subsidiaries have a proven track record of developing transmission projects on time and on budget.

Q. Can you provide additional details on this track record?

A. Yes. Between 2003 and 2024, NextEra Energy subsidiaries completed 457 major capital projects, reflecting an aggregate investment of $95 billion in generation and transmission assets. Of these major capital projects, 78 percent were completed on time or early, and these projects were completed at a collective $1 billion below their initial budgets.

Q. Will NEET MA use the services of its affiliates for the engineering and construction of the MARL Project?

A. Yes. NEET MA currently uses support services from various of its NextEra Energy affiliates, including NEET, NextEra Energy Resources, and FPL. NEET MA plans to utilize these services for engineering and construction of the MARL Project. Doing so allows NEET MA to access the significant expertise of the NextEra Energy corporate organization for the MARL Project and will enable NEET MA to provide service in a cost-efficient manner. With respect to engineering and construction, NEET MA plans to utilize the significant expertise within the NextEra Energy Engineering and Construction ("E&C") organization to manage the engineering, design, and construction of the MARL Project. NextEra Energy's E&C team has highly skilled and experienced line design engineers, construction and project managers, and SMEs that have extensive knowledge and experience covering transmission line design, standards and specifications, civil, structural and geotechnical, as well as specialized electrical studies. Within E&C, the Transmission Project Engineering Team manages the design of the line and hires and oversees a project's Engineer of Record. E&C's execution team ("Execution Team") manages the construction of transmission projects using construction superintendents at

the job site who ensure that installation specifications are followed, environmental permit requirements are met using best practices, and that the project's right of way ("ROW") is restored after construction is complete. The E&C team that will oversee the MARL Project's construction has over 90 years of construction experience.

NEET MA also plans to utilize the services of NextEra Energy's Integrated Supply Chain ("ISC") for procurement of equipment and services for the MARL Project. The ISC group manages all purchase and service contracts, utilizing NextEra Energy's unique market position as the largest electric utility in the country to procure services and materials with favorable prices and terms. ISC consists of nearly 500 sourcing and procurement specialists, and this team procured over $16 billion in materials and services in 2024 alone. The ISC team that will be responsible for procuring equipment and materials for the MARL Project has over 50 years of relevant procurement experience. Utilizing ISC's significant purchasing power will provide NEET MA with several important benefits:

- Favorable commercial terms and competitive pricing for high quality, reliable, and durable components from well-known and highly respected industry providers. In addition to preferred pricing, favorable commercial terms include improved flexibility in managing suppliers, greater leverage to complete the MARL Project on time and within budget, and other contractual protections that minimize risk to NEET MA and the MARL Project.

- Access to supply is enhanced with a strong commercial position with key suppliers, which allows NEET MA to leverage supplier relationships for priority access to products, reducing Project risk.

- Strategic long-term contracts across the NextEra Energy enterprise, the durations of which provide flexibility for both parties to adjust to market conditions.

- A robust competitive bidding process applying specification documents developed by internal SMEs. In addition to the bidding and contracting effort, ISC will coordinate deliveries to the site, monitor vendor progress, and expedite delivery of materials if needed to maintain Project schedule.

In addition, due to the magnitude of business with the suppliers, NextEra Energy's ISC is well positioned to address emerging issues during material production (*e.g.*, specification changes, additional quantities required) with minimal impact to cost or schedule. Besides material and labor pricing, the procurement contracts negotiated with suppliers impose strict terms and conditions ("T&C") that, although hard to quantify, are likely to result in additional contract administration benefits. These T&Cs generally include favorable payment schedules and terms (often with no payments prior to delivery), avoidance of restocking or other fees if an order is reduced or changed, and warranties on products from defects and shipping damage. ISC also works closely with E&C to ensure material is packaged, shipped, and received in an orderly manner and on schedule.

Q. Will NEET MA use any third parties to support the engineering and construction of the MARL Project?

A. Yes. E&C will utilize third-party engineering firms for the MARL Project for line design, surveying, access plan development, and geotechnical investigation. All third-party engineering teams will be overseen by E&C personnel.

Specifically, NEET MA has contracted with WSP USA Inc. ("WSP"), formerly Power Engineers, Inc. and referenced as WPS throughout this testimony, to perform the transmission line design and to serve as the Engineer of Record. NEET MA also has been working with Quanta Infrastructure Solutions Group LLC to determine the access plan and construction plan for the MARL Project. Additionally, NEET MA has engaged SAM, Inc. to collect and process LiDAR data and provide aerial imagery along the Project route.

NEET MA will select its construction contractor ("Contractor") for the MARL Project well in advance of the construction start date. NEET MA may use additional service providers as design progresses.

Q. Does NextEra Energy emphasize safety and reliability in its engineering and construction projects?

A. Yes. NEET MA emphasizes safety for its employees and service providers as well as for the public. At NextEra Energy and its subsidiaries, safety is a core value and is recognized as the cornerstone of sustaining operational excellence. NextEra Energy recognizes that prioritizing safety as a core value is beneficial to employees and their families, communities, landowners, customers, and to the company. NextEra Energy's vision for its employees is to establish and promote a safety culture based on the principle that zero injuries at work and home is an achievable result. As a result of the company's focus on safety, NextEra Energy subsidiaries consistently outperform the Transmission & Distribution industry in recordable injury rates as reported by the Bureau of Labor Statistics for both construction and operation.

NEET MA will implement this focus on a "Zero Today" policy in its internal and contractor safety programs, plans, and procurement throughout the lifecycle of the MARL Project. NEET MA has adopted best management practices that include frequent communication among the land services, environmental, engineering, and construction teams during the permitting and construction phases to ensure a safe and successful project.

To ensure public safety and reliability, the MARL Project will be designed to meet or surpass applicable local and state codes, the NESC, North American Electric Reliability

Corporation ("NERC") requirements, American Society of Civil Engineers ("ASCE") recommendations, PJM requirements, the interconnecting transmission owners' requirements, and NextEra Energy standards. Appropriate standards and applicable permit requirements will be met for construction and installation, and applicable safety procedures will be followed during and after installation.

NEET MA also expects the third-party companies providing it with services to adhere to the same high standards of safety and health that we do. During construction of the MARL Project, each morning, field teams will convene a meeting to address safety and applicable environmental issues. During the meeting, the teams discuss specific activities planned for the day, including daily safety-related behaviors, conditions, and job hazard analyses, as well as review any environmental compliance requirements that could impact construction activities. In addition, during construction, the MARL Project will have a dedicated safety manager for all safety and health concerns who will have access to significant safety resources within the NextEra Energy organization. Where required, a third-party environmental monitor will be present at the worksite to ensure compliance with permit requirements regarding threatened and endangered species or other areas of concern.

III. DESCRIPTION OF ENGINEERING AND CONSTRUCTION DESIGN FEATURES

Q. Please describe the proposed MARL Project at a high level.

A. NEET MA's MARL Project is a new, approximately 107.5-mile, 500 kV transmission line that will traverse portions of Pennsylvania, West Virginia, Maryland, and Virginia, as well as the new 500/138 kV Woodside Substation to be located in Frederick County, Virginia.

A high level one-line diagram of the MARL Project is provided as NEET MA Exhibit PG-1.

The proposed route for the MARL Project ("Proposed Route") is broken down into multiple segments across the four states, with 10.7 miles being in Pennsylvania. Specifically, NEET MA proposes to construct a new 67.7-mile 500 kV transmission line from the existing FirstEnergy Corp. ("FirstEnergy")-owned 502 Junction Substation in Greene County, Pennsylvania east to the existing FirstEnergy-owned Black Oak Substation in Allegany County, Maryland; a new 39.8 mile 500 kV transmission line from Black Oak to a handoff point with FirstEnergy in Frederick County, Virginia (a portion of the Black Oak-Woodside line) (the "Handoff Point"); the new Woodside 500/138 kV Substation in Frederick County, Virginia;[1] and remaining single-span line segments that connect Woodside to multiple existing 500 kV and 138 kV transmission lines owned by Virginia Electric and Power Company (referred to in my testimony as "Dominion Energy") and FirstEnergy into the Woodside Substation. From the Handoff Point with FirstEnergy, the FirstEnergy line will continue east and terminate into the Woodside Substation.

The Proposed Route is described and depicted in detail in the Routing Study provided as Attachment 3 to the Siting Application.

Q. Please describe the portions of the MARL Project that will be located in Pennsylvania.

A. The Pennsylvania portions of the MARL Project ("Pennsylvania Portions") consist of approximately 10.7 miles of transmission line and traverse Greene and Fayette counties. The Pennsylvania Portions of the Project begin at the 502 Junction Substation in Greene

[1] NEET MA's affiliate, NextEra Energy Transmission Virginia, Inc. ("NEET VA"), will construct, own, and operate the portions of the MARL Project located in Virginia along with the Woodside Substation.

County, Pennsylvania, parallelling two existing transmission lines traveling southeast for 2.7 miles before entering Monongalia County, West Virginia. It then travels east 3.1 miles before reentering Greene County, Pennsylvania, near Fort Martin Power Station. The Proposed Route then travels east for 1.4 miles in Greene County, Pennsylvania, before crossing the Monongahela River and entering Fayette County, Pennsylvania. In Fayette County, Pennsylvania, the Proposed Route travels east as a greenfield section through undeveloped private property for 6.6 miles before reentering Monongalia County, West Virginia. The Pennsylvania Portions of the Proposed Route parallel and abut existing transmission line ROW for 2.3 out of 10.7 miles (or 21.1% of the Proposed Route within Pennsylvania).

Q. What width, length, and total acreage of row will the MARL Project utilize?

A. NEET MA is proposing a transmission ROW that is typically 200 feet-wide, based upon NEET MA's project design, design standards, anticipated structure types, number of structures, span distances, terrain, and soil conditions. This proposed ROW width may vary at some locations to accommodate topographic features and crossing requirements and to provide flexibility in final structure placement. For example, in several spans, additional ROW width may be required for blowout,[2] where the spans may be longer due to terrain or to avoid sensitive areas such as critical cold-water streams. At all times, the width of the ROW will be sufficient to ensure the safe and reliable operation of the MARL Project. The total length of the ROW for the Pennsylvania Portions of the Proposed Route will be

[2] As described in the Routing Study, the aerial easement blowout area is a designated section within the ROW Corridor that requires additional transmission line easement area to accommodate engineering considerations (*e.g.*, increased span lengths), which can result in greater line sway. These areas are necessary due to constraints, such as uneven terrain, steep slopes, or natural obstructions that make the standard ROW Corridor width impractical or unsafe.

10.7 miles and the total acreage for the Pennsylvania Portions of the Proposed Route will be 266.9 acres, based upon the proposed 200-foot ROW width.

Q. How did NEET MA determine the width for the ROW?

A. The 200-foot ROW width is typical for 500 kV transmission lines with a horizontal phase configuration. The objective was to establish a width that would satisfy all required clearances to features existing at the very edge of the ROW, including NESC clearances, and to satisfy the NERC FAC-003 vegetation management requirements. The ROW width was informed by preliminary tower spotting to evaluate conductor blowout and required horizontal clearances under at rest and blowout conditions. By establishing a basic ROW width for the entire MARL Project, the safe and reliable operation of the line is ensured.

Q. Is NEET MA requesting flexibility within the corridor for the Proposed Route?

A. Yes, consistent with 52 Pa. Code § 57.76(b), NEET MA is requesting that the Commission grant NEET MA the flexibility to adjust the location of its ROW up to 500 feet on either side of the proposed centerline (referred to as the "Siting Corridor" in the Routing Study). In those areas that may require aerial easement blowout, the maximum width for the Siting Corridor will be approximately 715 feet.

Flexibility in the location of the ROW and structure locations is necessary for multiple reasons. First, landowners may request that NEET MA adjust the location of the line or shift structure locations to minimize impact to their use of the land. In addition, once on-the-ground surveys can be conducted, there may be constraints identified that require a shift in the alignment or structure locations. Additionally, subsurface utility

engineering and title searches may indicate underground facilities or encumbrances that were not known at the time of the routing study.

Q. Please provide the proposed line voltage for the MARL Project.

A. The MARL Project has a line voltage of 500,000 volts (500 kV) AC.

Q. How many circuits does the MARL Project utilize?

A. One. The MARL Project is a single-circuit project.

Q. Please provide the MARL Project's number of circuits per structure.

A. The MARL Project will have one circuit per structure.

Q. What type of transmission structures does NEET MA propose to use for the MARL Project, and what are their dimensions?

A. NEET MA will utilize single-circuit self-supported galvanized steel lattice tower structures with a horizontal phase configuration and estimates that it will install 452 structures across the entire MARL Project. On the Pennsylvania Portions of the Proposed Route, NEET MA anticipates it will install a total of 44 structures. The exact number of each structure type may change slightly as the project design is finalized.

The lattice tower family includes tangent structures, running angle structures and dead-end structures. The most common structure is the tangent structure, making up 64% of all structures. Based on preliminary structure spotting, the structure heights range from 85 to 190 feet tall with an average height of 145 feet. When final design is complete, the

height range may change. The typical tangent lattice tower structure will have four 3- to 8- foot diameter drilled pier concrete foundations with varying depths, and the footprint of the typical lattice tangent towers will range from 24 feet by 24 feet to 50 feet by 50 feet.

The foundations are expected to be predominantly drilled concrete pier foundations. Foundation diameter and depth, as well as foundation type, will depend on soil conditions. Alternative foundation types such as micro-pile or grillage type foundations may also be used in areas where accessibility is difficult or where soil profiles are unfavorable for pier foundations. Additional structure dimension data is summarized in the table below, and additional structure details, including diagrams of the expected structure types, are available in NEET MA Exhibit PG-2.

Table 1: NEET MA MARL Project Structure Types (Total Project)

Structure Type	Qty on Project	Footprint/ leg spread (ft)	Concrete pier foundation size, Dia (ft)	Concrete pier foundation length (ft)
Tangent 0-3 deg	290	24 x 24 to 50 x 50	3 to 8	15 to 60
Running Angle 3-20 deg	71	28 x 28 to 60 x 60		
Strain and Dead-end structures	91	27 x 27 to 68 x 68		
Total	**452**			

Q. Why did NEET MA select these transmission structures for the MARL Project?

A. NEET MA's engineers, aided by its professional estimators, determined that lattice tower structures are the most cost-effective and reliable solution for the MARL Project and are easier to construct in rough terrain with difficult access. In general, structure selection is influenced by voltage, terrain, land use and other factors. At 500 kV, the predominant phase configuration is horizontal, which would require either a tubular steel H-frame or

lattice structures. In certain pinch points, it may be necessary to use a vertical or triangular phase configuration, which would require either a lattice structure or a tubular steel monopole.

NEET MA and its affiliates have utilized both lattice and tubular steel 500 kV structures. NEET MA's affiliates have built more than 1,000 circuit miles of 500 kV lines since 1980. These lines utilized both self-supported lattice structures and tubular steel H-frames and monopole structures. NEET MA's affiliates have also built 250 miles of 230 kV double-circuit line in Ontario, Canada using guyed-Y lattice towers due to terrain. In addition, NEET MA's affiliates have completed the design of a 58-mile double-circuit 500 kV line in Nevada using self-supported lattice towers and tubular steel structures, which will be going into construction in 2026.

Based upon this extensive transmission construction experience and the Project's characteristics, NEET MA selected lattice tower structures as the primary transmission structure for the MARL Project because they are the most cost-effective and suitable structure for the Project. Rough terrain makes lattice structures more favorable and practical, given the ability to use smaller foundations and lighter weight structures that can be assembled at the structure site. Lattice towers are light weight, and the foundations are smaller than those required for tubular steel H-frame structures. In addition, lattice towers can better accommodate changes in slope at the structure location using leg extensions. Because they are best suited for the Project, lattice tower structures are also the most cost-effective structure type for use in the MARL Project.

Q. Please describe the anticipated slope of the ROW for the Pennsylvania Portions.

A. The MARL Project goes through the Appalachian Mountains. The terrain profile along the centerline of the MARL Project varies throughout the length of the project. In many locations, the slope of the elevation change is significant. Exhibit PG-3 to my testimony includes statistics on the slope along the centerline (% of line with Slope of X to Y) and contour maps. The slope along the centerline and access roads will affect the method of clearing, ROW preparation and access plan, and line construction.

Q. What size and type of transmission conductor does NEET MA plan to use for the MARL Project?

A. NEET MA's design will utilize triple-bundled 1780 kcmil 84/19 Chukar ACSR conductor for each of the three phase positions (nine conductors for the circuit), along with two optical ground wires to facilitate lightning shielding and provide the primary and secondary communication paths for line protection.

Q. Why did NEET MA select the conductor for the MARL Project?

A. NEET MA selected the triple-bundled 1780 kcmil 84/19 Chukar ACSR conductor bundle because it achieved the rating and lower impedances needed to address the violations identified by PJM in the 2022 Window 3 solicitation. With 500 kV AC lines, a three-conductor bundle option is common in order to ensure adequate thermal transfer capability, reactive margins, lower losses, and increased operational flexibility to manage the voltage fluctuations during high transfer periods across transmission interfaces.

Q. What is the nominal capacity (MVA) of the MARL Project?

A. The nominal capacity of the MARL Project is 4,490 MVA based on the summer normal (continuous) rating.

Q. What is the nominal span length between structures for the MARL Project?

A. NEET MA estimates that it will install approximately 4.2 structures per mile with an average span of approximately 1,258 feet between structures.

Q. Will NEET MA obtain land rights associated with temporary construction access and permanent off-ROW access?

A. Yes. NEET MA anticipates acquiring property rights associated with temporary construction, permanent off-ROW access, and material laydown yards. With respect to temporary construction access, for example, NEET MA anticipates that it would need to obtain a temporary construction easement in the area needed for conductor pulls behind a dead-end structure. Once the line is placed in service, this easement would no longer be necessary. Off-ROW access may be temporary or permanent; for example, a stream crossing can be accomplished with temporary bridge mats that endure for the length of construction, or with a permanent permitted culverted installation.

The off-ROW access is shown in Attachment 1a of the Pennsylvania Environmental Review Document ("ERD") that is provided in Appendix A of the Routing Study. A breakdown of the permanent and temporary access road and additional temporary impacts outside of the ROW for the Proposed Route are shown in Table 2.1-2 in Section 2.1.3 of the Pennsylvania ERD. Access roads will have a 16- to 20-foot driving surface width. A

summary of the impacts for impacts inside and outside of the ROW for access roads along the Proposed Route is provided in the table below.

Table 2: MARL Proposed Route Access Road Summary

Row Label	Inside ROW (acres)		Outside ROW (acres)		Grand Total (acres)
	Permanent Access Road Limit of Disturbance ("LOD")	Temporary Access Road LOD	Permanent Access Road LOD	Temporary Access Road LOD	
MD	0.2	54.8	1.3	64.3	120.6
PA	0.9	8.3	1.6	24.7	35.5
VA	-	3.7	-	1.9	5.5
WV	4.9	71.5	4.3	140.5	221.3
Grand Total	**6.0**	**138.4**	**7.1**	**231.4**	**382.9**

As described in the direct testimony of NEET MA Witness Sarah Powers in NEET MA Statement No. 8, NEET MA will work with local landowners to secure easements for material and equipment laydown areas. (NEET MA St. No. 8, pp. 6-8.) These laydown areas will generally require about 25 acres and will be spaced approximately 25 miles apart to allow the Contractor to efficiently store and source the materials and equipment to complete the Project construction. These laydown yards will be graded, rocked, and fenced but will be used only temporarily. Upon construction completion, the landowner's property will be restored to its original use or left as is if the landowner requests.

Q. Will NEET MA design its facilities to meet necessary reliability and safety requirements or concerns?

A. Yes. As described above, NEET MA emphasizes safety and reliability in engineering and designing its transmission projects. NEET MA's engineers are designing the MARL Project according to PJM's specifications for the MARL Project, Institute of Electrical and Electronics Engineers ("IEEE") guidelines, ASCE standards, American National Standards

Institute standards, Occupational Safety and Health Administration requirements, NERC standards, the NESC, and prudent utility practice. Public safety and worker safety are critical considerations in the design, construction, and operation of transmission facilities, and safety and security have been and will continue to be a major focus in the preparation of all specifications and designs. Based on the results of its preliminary engineering studies, NEET MA is designing the MARL Project to ensure the Project's safe and reliable operation in conformance with generally accepted practices for a project of this type.

Q. Please describe the minimum line tension and sag parameters for the conductors planned for the MARL Project.

A. Conductor tension limits and design weather cases are provided in the design criteria in NEET MA Exhibit PG-4. The minimum line tension corresponding to maximum conductor sag occurs when the conductor is bare (no ice), and the conductor is at its maximum temperature of 120 degrees Celsius. This condition is used to verify that NESC clearances are met over ground and other features. The sag and tension of the conductor in each sag-section of the line is determined using specified tension limits that determine the maximum allowable sag in each span. The sag and tension are determined for a set of weather cases that include ice and wind loadings, extreme ice and wind loadings, loadings that combine the effects of ice and wind, and for the determination of the bare conductor sag used for compliance with NESC clearances.

Q. Please describe the minimum conductor-to-ground clearances under maximum operating conditions that NEET MA's design will meet.

A. The basic minimum conductor-to-ground design clearance under maximum operating conditions for the MARL Project will be 31.5 feet. A list of commonly used clearances is provided in NEET MA Exhibit PG-4. There are many different clearances that control the conductor height above ground depending on the above ground features such as roads and railroads. NEET MA will design the line with adequate clearance to ground, linear facilities and various features to ensure the safety of the public and utility employees, based primarily on the NESC, NERC Vegetation Management Clearances, crossing agreements, and good engineering practice.

Q. How will the MARL Project be interconnected to the transmission grid?

A. The MARL Project will interconnect to the existing FirstEnergy 502 Junction and Black Oak Substations, as well as connecting to the Handoff Point with FirstEnergy in Frederick County, Virginia. In addition, the new Woodside Substation will interconnect to FirstEnergy's line from the Handoff Point with the MARL Project, in addition to existing FirstEnergy and Dominion Energy 500 kV and 138 kV transmission lines. NEET MA is in discussions with FirstEnergy and Dominion Energy regarding the MARL Project's interconnections, and transmission interconnection agreements with these utilities ultimately will be executed and filed with FERC.

IV. LOCATION OF THE PROPOSED ROUTE AND ENGINEERING CONSIDERATIONS

Q. Where will the Proposed Route of the MARL Project be located in Pennsylvania?

A. As discussed above, the Pennsylvania Portions of the Proposed Route will consist of 10.7 miles of 500 kV transmission line and related facilities in Greene and Fayette counties,

beginning at the existing FirstEnergy 502 Junction Substation in Greene County, Pennsylvania, traversing approximately 2.7 miles before entering Monongalia County, West Virginia. It then travels east 3.1 miles before reentering Greene County, Pennsylvania, near Fort Martin Power Station. The Proposed Route then travels east for 1.4 miles in Greene County, Pennsylvania, before crossing the Monongahela River and entering Fayette County, Pennsylvania. In Fayette County, Pennsylvania, the Proposed Route travels east as a greenfield section through undeveloped private property for 6.6 miles before reentering Monongalia County, West Virginia.

Q. Did NEET MA evaluate engineering and construction considerations to determine the Proposed Route?

A. Yes. Engineering and construction considerations were included in the routing criteria NEET MA evaluated to select the Proposed Route.[3]

In evaluating the alternative routes from an engineering and construction perspective, NEET MA's overall priorities were avoiding or minimizing constraints requiring unique or extraordinary design or construction requirements and maximizing the ability to construct the Project safely and efficiently. Thus, more specifically, the engineering and construction considerations focused on finding suitable locations for structures and conductor pull locations, avoiding steep slopes and having reasonable access, line length, number of large line deflection angles, avoiding geohazards and certain land uses like mining and oil fields, evaluating the manner and feasibility of major crossings, and entrances and exits into and out of substations. During its routing review,

[3] A complete list and detailed discussion of the routing criteria are provided in the Direct Testimony of Heather Heater in NEET MA Statement No. 5 and in the Routing Study appended as Attachment 3 to the Siting Application.

NEET MA evaluated the impacts of each alternative route based on these key engineering considerations.

Q. From an engineering perspective, why did NEET MA select the Proposed Route and reject Alternative Routes B through F?

A. As described in the Routing Study (Attachment 3 to the Siting Application) and Mrs. Heater's Direct Testimony in NEET MA Statement No. 5, the overarching goal of the Routing Study was to identify an end-to-end route that best: (1) reasonably minimizes adverse impacts on area land uses and the natural environment and built environment; (2) minimizes special engineering design requirements that could result in increased costs; and (3) can be constructed and operated in a safe, timely, and reliable manner. Regarding the application of the engineering and construction routing criteria to this overall routing goal specifically, the Routing Study analysis determined that the Proposed Route (Route A) was the route that best minimized special design requirements and maximized NEET MA's ability to construct the line in a safe, timely and reliable manner. From an engineering perspective Route A was superior to the alternative routes due to its overall length (line length), the number of angle structures, number of unique landowners crossed, and number of 500 kV line crossings.

V. ALTERNATIVES TO THE MARL PROJECT

Q. What, if any, engineering alternatives to the MARL Project did NEET MA consider?

A. As discussed in detail below, NEET MA reviewed several engineering alternatives to the proposed MARL Project, including: (1) adding new transmission structures to existing ROWs; (2) building the transmission line underground (or "undergrounding" the Project);

and (3) design alternatives. However, these alternatives would not be feasible or cost-effective or would not meet PJM's needs for the MARL Project. I will discuss certain of these alternatives from an engineering perspective, while NEET MA Witness Matt Pawlowski describes other alternatives from a transmission planning perspective in NEET MA Statement No. 2. (NEET MA. St. No. 2, pp. 16-23.)

Q. Could NEET MA add new transmission structures to existing transmission ROWs to accommodate the MARL Project?

A. No, it cannot. Simply put, the MARL Project requires new transmission corridors to accommodate its structures and facilities. The existing ROWs (owned by other transmission utilities) already contain existing 500 kV and 138 kV transmission lines. In order to maintain proper clearances to the edge of the ROW and to adjacent transmission lines complying with the NESC, NERC reliability standards, and operational standards, NEET MA could not build new transmission structures within the existing ROWs. Rather, NEET MA would need to expand these existing ROWs. By paralleling existing transmission ROW to the greatest extent possible, NEET MA is essentially expanding the ROW of existing transmission corridors. However, in many areas, the existing ROWs are now abutting homes, businesses, or other sensitive areas, and so expanding these existing ROWs would not be feasible across the entire length of the project.

Q. Why is NEET MA not proposing to build the MARL Project underground?

A. There are several reasons why NEET MA is not proposing the MARL Project be built underground. First and foremost, undergrounding a 500 kV AC transmission line is cost-

prohibitive, at least 10 to 20 times more expensive than building 500 kV AC overhead transmission lines. Thus, an underground solution would not cost-effectively meet PJM's need for service.

From an engineering perspective, it is also very difficult to transmit large amounts of power for 500 kV AC over distances of more than a few miles. In order to match the summer normal rating of the overhead MARL 500 kV AC transmission line, three or four underground cables would be needed per phase. The more cables per phase, the more reactive power is consumed. The consumption of reactive power (MVARs) reduces the ability to transmit real power (MW). Thus, transmitting significant amounts of power on an underground 500 kV transmission line would require significant additional reactive compensation equipment. To my knowledge, all long-haul underground extra high-voltage installations are high-voltage direct current ("HVDC") installations, requiring converter stations. HVDC lines are typically more expensive to build and have longer construction schedules due to the converter stations required to convert the AC power to DC power. The longest underground 500 kV AC line in the U.S. is less than five miles long.

Building a 500 kV AC line underground also would require excavating multiple continuous trenches where practical and permissible, and multiple large-diameter horizontal directional drills per crossing, separated by significant distance to minimize the potential for overheating. This would result in significantly greater and more prolonged disruptions to properties, farms, roads, and natural areas than the construction of an overhead transmission line.

Undergrounding a 500 kV AC transmission line also would require more extensive maintenance and repair time in the event of a failure, which could result in the need for

lengthier transmission outages and impact reliability when maintenance or repairs are needed. Finally, underground cable also takes a significantly longer time to manufacture than overhead conductor, meaning it takes much longer to obtain cable. Due to its size, underground cable can only be delivered terrestrially in reel lengths of approximately 2,000 to 2,200 feet, compared to around 9,000 feet for the overhead conductor we are using. For underground cable, splices must be made in large manholes, so multiple manholes are required about every 2,000 feet for underground. All of these facts create additional costs, schedule issues, and landowner and environmental impacts.

Q. Did NEET MA consider other design alternatives?

A. As I have described previously, NEET MA, along with its experienced affiliates, carefully selected the particular structure and conductor types ultimately selected for the MARL Project and determined that the lattice tower structures and the selected conductor were the most efficient and cost-effective.

VI. CONSTRUCTION PROCESS AND PROJECT SCHEDULE

Q. Please describe, in general terms, the construction process for the MARL Project.

A. NEET MA and its Contractor will establish a local construction management office within the construction site and staff the MARL Project with a team of experienced professionals. When unrestricted ROW access is obtained, permits are in hand, road use agreements are established, material ready to be delivered, and the project design package is finalized, NEET MA will authorize the Contractor to mobilize. Early in the construction process, material staging or laydown areas are developed. The Contractor will mobilize a small

team to receive material and store it. NEET MA Execution Team Construction Managers are assigned to oversee the construction.

The Contractor will begin ROW preparation with tree clearing within the ROW and off-ROW access paths. Heavy equipment will be used to grade access paths and structure pads. This work will be done in compliance with the stormwater pollution prevention plan ("SWPPP"), erosion control, and silt fences, and other best practices. Land agents will be directed to notify landowners of activity on their land, working closely with the on-site Execution Team to keep landowners aware of construction activities, and address any concerns.

Following ROW preparation and access road preparation, the Contractor will install foundations, structures, conductor and shield wires, in that order, followed by optical fiber splicing. When construction is complete or nearing completion, a walkdown will be conducted as final verification that the line was constructed as designed. A punch list will be generated for items that the contractor will need to fix.

Any temporary ground impacts (roads, pads, crossings, and siltation and erosion control) will be restored to original condition to the extent possible. Final commissioning and testing of substation equipment will be coordinated with FirstEnergy. The commissioning process includes verification of the protection and control equipment, which would de-energize the line in the event of a fault. Once testing is complete, the Project will be placed in service and turned over to the NEET MA Operations team. ROW restoration may continue after placing the line in service. NEET MA Operations will continue to maintain the facilities.

Q. What is the current in-service date for the MARL Project?

A. As discussed by Ms. McCormick, NEET MA's Designated Entity Agreement with PJM requires that the Woodside Substation be placed in service by December 31, 2028 and the entire MARL Project, including the Pennsylvania Portions, be placed in service by December 31, 2031. (NEET MA St. No. 1, pp. 23-25.) As Dr. Abdulsalam describes in his testimony, PJM has identified a need date for this scope of work beginning in June 2027. (NEET MA St. No. 3, p. 9.) In coordination with PJM, NEET MA is working to provide a pathway to accelerate the in-service date to December 2029 or earlier, pending regulatory approvals.

Based upon the December 2031 in-service date, NEET MA's anticipated schedule is provided below:

Table 3: NEET MA's Anticipated Schedule under the DEA

Activity	Estimated Start	Estimated Completion
Permitting and Regulatory Approvals	January 2026	October 2028
ROW Negotiations	August 2025	April 2029
Line Construction	November 2029 or as soon as applicable permits and approvals are obtained	December 2031
In-Service Date		December 31, 2031

Q. Please describe NEET MA's anticipated construction process for the MARL Project.

A. NEET MA plans to build the line in three zones and construct each zone as individual line sections. Each zone will go through the full sequence of construction activities, beginning with clearing and ending with restoration concurrently. This strategy will allow better control of the work sequence and schedule. In NEET MA's project schedule, the timing of clearing, transmission structure installation, and stringing operations have been

overlapped and staggered to minimize the overall length of the schedule, maximize the efficiency of each operation, and include enough float to ensure no single operation is impeded by a delay in a preceding operation.

Q. Does NEET MA plan to competitively bid for services and equipment for the transmission line?

A. Yes. As I described previously, NEET MA has established supplier networks through NextEra Energy's ISC. To ensure the best price for major transmission line components including labor, ISC routinely competitively bids, evaluates, and sources for delivery using well-established procurement processes.

Q. How does NEET MA plan to staff the construction process for the MARL Project?

A. NEET MA will utilize a combination of highly skilled NextEra Energy E&C personnel, along with experienced third-party contractors to construct the MARL Project. NEET MA will retain a third-party construction Contractor for the MARL Project, as I discussed above. In addition, NEET MA expects to utilize a hierarchy of E&C personnel under a Construction Project Manager, with multiple Construction Managers covering the transmission line and substation construction. Under each Construction Manager, one or more Construction Field Superintendents will oversee the Contractor's work for the duration of the project. The NEET MA construction staff are the interface with other NEET MA project team members as well. The NEET MA construction staff will work closely with other NEET MA team members such as the development team, E&C, ISC, land agents, environmental agents, and the crossing coordinator. Similarly, land agents are the

interface and point of contact for the landowners and will coordinate construction activities with landowners, as Ms. Powers describes in her testimony in NEET MA Statement No. 8. (NEET MA St. No. 8, pp. 11-12, 15.)

Q. Does NEET MA expect to use union labor for construction of the MARL Project?

A. While NEET MA's Contractor will directly contract for labor for the MARL Project, NEET MA expects that the Contractor will make reasonable efforts to utilize local labor to supplement its established workforce, coordinating with local union halls. In addition, some of the construction work will likely utilize non-union labor.

Q. Will NEET MA utilize any standards and procedures regarding construction and restoration in ROW areas for the MARL Project?

A. Yes. NEET MA will require that its Contractor adhere to the requirements within NEET MA's road use and maintenance agreements with affected local governments and with the requirements in any crossing agreements, the applicable requirements of the Interconnection Agreements, as well as with NEET MA construction specifications, the Engineering Issued for Construction drawings, environmental permit requirements, the SWPPP, and landowner agreements.

Q. What method or methods will be used to clear and otherwise prepare the ROW for construction?

A. NEET MA intends to follow best management practices and anticipates using methods described below to prepare the ROW for construction:

- Where feasible, mechanized clearing will be utilized, and trees will be cut close to the ground line and mulched, or ground in place. In some sensitive areas in valleys where there is substantial conductor clearance over the tree canopy, trees may be left in place. Mulch will be spread within the ROW. Off-ROW trees that could impact the transmission line if they fall are cleared in a similar fashion.

- Where slopes are too steep for mechanized clearing, trees will be hand felled. Hand felled trees may be recovered by winching up the slope, pushing trees to the bottom of the slope, or flown out. Forestry mowing may be utilized to mow and or mulch smaller vegetation and immature trees.

- Grubbing will be required where cutting in roads and pads on steep terrain.

- Access roads will be needed to access the ROW and structure locations. At structure locations and conductor pull locations, pads will be needed. Existing roads will be utilized where possible and improved as necessary and maintained during construction. If new access roads are required, they may be permanent or temporary. Where temporary access and pads are needed, they will be restored after construction is complete. The access roads and pads will be graded. Grading ensures that heavy equipment can safely traverse to the construction location and can be safely set up and operated at each location. The methods required to establish new access roads and pads will be dependent on the terrain.

- An SWPPP will be developed with erosion and sediment control measures, in accordance with NEET MA's best management practices and in compliance with applicable permits.

- Where possible, the access will be within the ROW. Where streams or other barriers are encountered, temporary or permanent crossings may be used in compliance with permits, or alternative access will be used to go around the barrier.

- When necessary, NEET MA will modify and/or amend standard specifications to comply with required permits, such as wetlands.

Q. How will NEET MA dispose of materials cleared from the ROW?

A. Disposal methods are dependent on terrain, the vegetation density, and permitting and landowner requirements. The preferred method is to dispose of vegetation on the ROW. Where this is not possible, trees will be removed from the ROW by a variety of means, or lopped on the ROW and left where they will not interfere with the operation and

maintenance of the line, or otherwise disposed of in compliance with applicable state and local requirements.

Q. Please describe the steps that will be taken to control erosion and siltation of streams where the ground is disturbed during construction activities along the ROW.

A. Prior to construction, NEET MA's Contractor will develop the SWPPP. The SWPPP will include best practices for different ROW situations to control erosion and prevent siltration of streams. These practices are normally set forth in environmental permits and installation is undertaken in compliance with these permits. Generally, controls are installed after clearing, and before site grading activities. Perimeter controls such as silt fences and wattles are installed in steeper terrain on the downhill perimeter of ground disturbance areas or as a barrier for grading work adjacent to environmentally sensitive areas, such as streams.

Q. How will the MARL Project's construction impact landowners, and how will NEET MA seek to mitigate those impacts?

A. NEET MA will work with landowners to minimize impacts on their existing land uses during the construction process. NEET MA's easement agreements with landowners will have terms for ROW use, restoration, and maintenance. NEET MA will occupy the ROW in some form over the duration of construction, but there may be periods where no NEET MA activity will be occurring in between different phases of construction on a particular parcel. Construction of the transmission line follows a typical sequence of events. Various phases of construction occur at different locations throughout the construction process and

in many cases at the same time at different locations throughout the project area. This sequencing will minimize landowner impacts and allow for the most efficient transmission line construction so NEET MA can safely complete the Project in a timely manner. Ms. Powers describes NEET MA's interactions in more detail in NEET MA Statement No. 8. (NEET MA St. No. 8, pp. 8-11.) In addition, Section 2.3.6 of the Pennsylvania ERD (Appendix A of the Routing Study) discusses potential transportation impacts of the MARL Project's construction and NEET MA's proposed measures to minimize transportation impacts.

Q. What steps will be taken to restore disturbed ROW once construction is complete?

A. NEET MA's approach is to restore the property to its original condition to the extent possible with the exception of any permanent installations or other agreements with the landowner. Upon construction completion, the Contractor will provide all equipment, labor, and material to restore all temporarily disturbed land. NEET MA will require its Contractor to de-compact all soils, respread stockpiled onsite topsoil, and revegetate distributed lands. Other than in farmland, or as otherwise requested by a landowner, the Contractor will revegetate the areas with compatible native species and in accordance with Project permits and reclamation plans. Farmlands will be de-compacted and mulched for replanting by the owner. In highly erodible areas, the Contractor will install temporary and/or permanent stabilization measures to enhance vegetation re-growth. Prior to NEET MA's final acceptance of the Contractor's work, the Contractor will remove temporary erosion controls if and when vegetation reaches 70 percent re-growth in the particular location of the erosion control devices. Upon completion of revegetation and as a provision

of final acceptance, NEET MA will require its Contractor to refurbish all remaining erosion control devices so that they comply with the SWPPP, at which time the maintenance and/or removal of the remaining erosion control devices will become the responsibility of NEET MA.

VII. EMF MITIGATION MEASURES

Q. Does the Siting Application explain how NEET MA manages EMF?

A. Yes. My testimony explains the NEET MA's standards and mitigation policies for EMF management.

Q. How does NEET MA mitigate EMF in the construction of transmission lines?

A. NEET MA uses several means to mitigate EMF. First, NEET MA will comply with NESC Rule 232C, which requires that the electric field within the ROW be controlled by ensuring adequate conductor height or other means. Second, NEET MA's construction standards require grounding of fences and gates within the ROW. NEET MA and its affiliates have a history of working closely with pipeline and railroad companies to address AC interference issues. Finally, during the routing process, the routing team attempted to maintain a buffer to habitable structures to minimize potential EMF exposure.

During the design phase of the project, EMF levels are calculated and evaluated. Where review of the EMF levels determines that a reduction is required, such as for compliance with NESC Rule 232C, this can be accomplished by the following:

- Increasing ground clearance by raising the structure height or decreasing the conductor sag;

- Modifying the phase configuration where multiple circuits are adjacent to one another to provide the greatest cancellation of fields; and

- Modifying the phase configuration to increase distance from the outside conductor bundle to the edge of the ROW.

Q. Did NEET MA implement these measures in the design of the MARL Project?

A. Yes.

VIII. CONCLUSION

Q. Does this conclude your direct testimony?

A. Yes, it does.

PROJECT INFORMATION:

1. PROJECT NAME: MIDATLANTIC RESILIENCY LINK
2. LINE DESCRIPTION: OVERHEAD SINGLE CIRCUIT 500KV AC TRANSMISSION LINE
3. TYPICAL RIGHT-OF-WAY WIDTH: 200 FT
4. NUMBER OF CIRCUITS: ONE (1) CIRCUIT
5. NUMBER OF CIRCUITS PER STRUCTURE: ONE (1)
6. STRUCTURE TYPE: LATTICE TOWER
7. STRUCTURE MATERIAL: GALVANIZED STEEL
8. STEADY STATE RATINGS: 5,291 MVA (WINTER NORMAL) AND 4,490 MVA (SUMMER NORMAL)
9. AVERAGE SPAN LENGTH: 1,258 FT
10. CONDUCTOR TYPE: 3-BUNDLE ACSR 1780 KCMIL "CHUKAR"
11. CONDUCTOR CONFIGURATION: HORIZONTAL
12. OPGW QUANTITY & TYPE: TWO (2) 48 COUNT OPGW

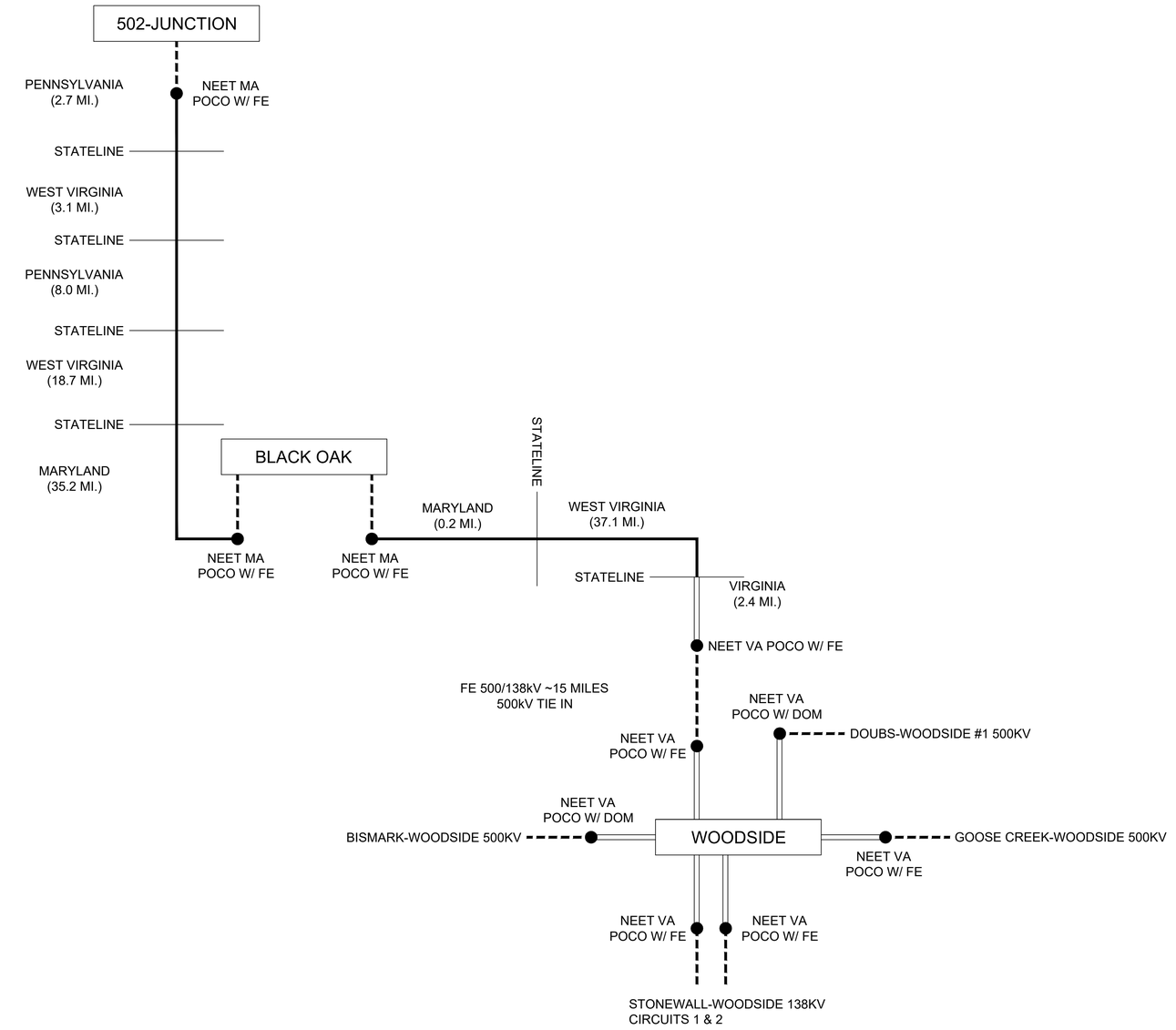
GENERAL NOTES:

1. 502 JUNCTION TO BLACK OAK POCO IS APPROXIMATELY 67.7 MILES.
2. BLACK OAK POCO TO FIRST ENERGY POCO IS APPROXIMATELY 39.7 MILES.
3. ALL POCO ARE WITH FIRST ENERGY (FE) OR DOMINION (DOM).
4. ALL POCO LOCATIONS ARE TO BE DETERMINED.
5. STATION LAYOUTS ARE PROVIDED FOR INFORMATIONAL PURPOSES ONLY AND DO NOT REPRESENT GEOGRAPHICAL OR PHYSICAL ORIENTATION.
6. THIS DRAWING IS SPECIFIC TO THE PREFERRED ROUTE.

STATE TOTAL LINE LENGTH	
PENNSYLANIA	10.7 MI.
WEST VIRGINIA	58.9 MI.
MARYLAND	35.4 MI.
VIRGINIA	2.4 MI.

LEGEND:

- CIRCUIT OWNED BY OTHERS
- CIRCUIT OWNED BY NEXTERA ENERGY TRANSMISSION VIRGINIA (NEET VA)
- CIRCUIT OWNED BY NEXTERA ENERGY TRANSMISSION MIDATLANTIC (NEET MA)
- POINT OF CHANGE OF OWNERSHIP (POCO)
- SUBSTATION



NO	DATE	REVISIONS AND RECORD OF ISSUE	DRWN	REV'D	APPR	COMP
0	01/13/2026	ISSUE FOR PERMITTING	MDW	JA	BDB	

SCALE: NONE

PREP: MDW CHKD: JA
APPD: BDB DATE: 01/13/2026

NEXTera ENERGY TRANSMISSION MIDATLANTIC

wsp

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NEXTERA ENERGY TRANSMISSION MIDATLANTIC
MIDATLANTIC RESILIENCY LINK
PROPOSED 500KV TRANSMISSION LINE

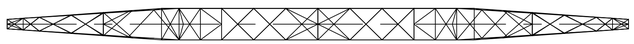
GENERIC - LINE OVERVIEW

PROJECT INFORMATION:

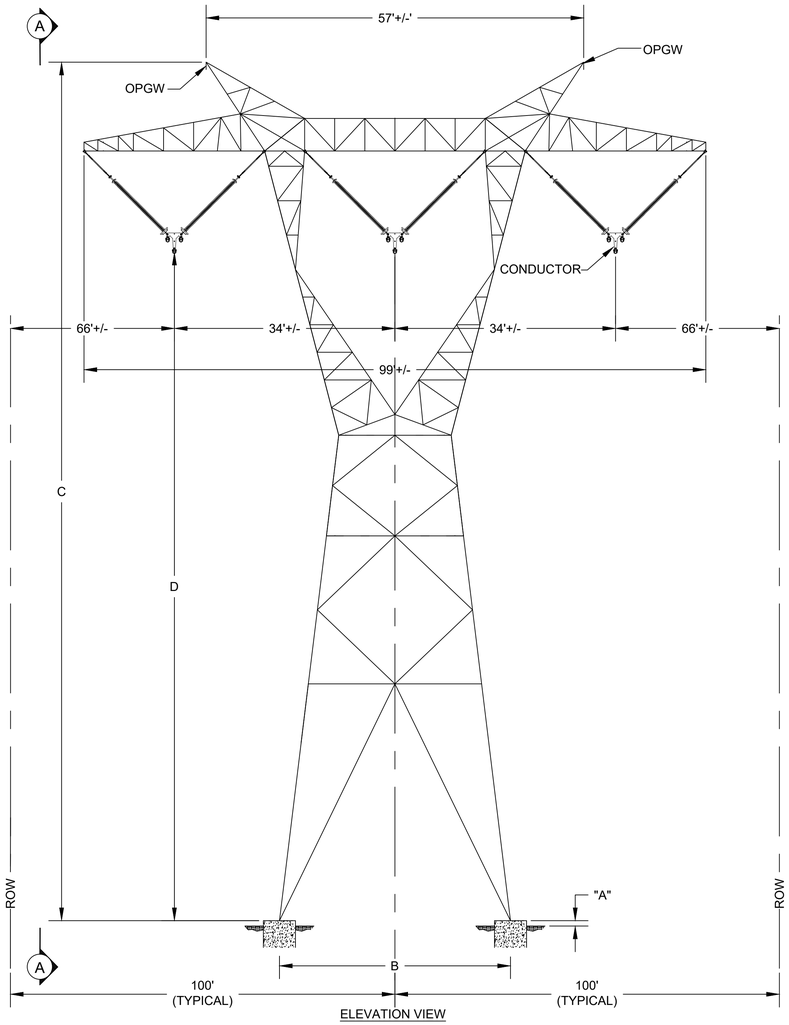
1. PROJECT NAME: MIDATLANTIC RESILIENCY LINK
2. LINE DESCRIPTION: OVERHEAD SINGLE CIRCUIT 500KV AC TRANSMISSION LINE
3. TYPICAL RIGHT-OF-WAY WIDTH: 200 FT
4. NUMBER OF CIRCUITS: ONE (1) CIRCUIT
5. NUMBER OF CIRCUITS PER STRUCTURE: ONE (1)
6. STRUCTURE TYPE: LATTICE TOWER
7. STRUCTURE MATERIAL: GALVANIZED STEEL
8. STEADY STATE RATINGS: 5,291 MVA (WINTER NORMAL) AND 4,490 MVA (SUMMER NORMAL)
9. AVERAGE SPAN LENGTH: 1,250 FT
10. CONDUCTOR TYPE: 3-BUNDLE ACSR 1780 KCMIL "CHUKAR"
11. CONDUCTOR CONFIGURATION: HORIZONTAL
12. OPGW QUANTITY & TYPE: TWO (2) 48 COUNT OPGW

GENERAL NOTES:

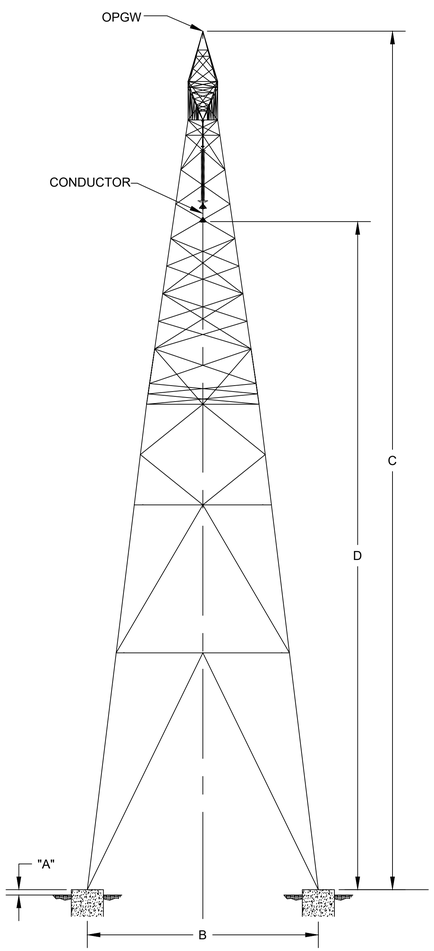
1. ALL DIMENSIONS ARE APPROXIMATE VALUES BASED ON PRELIMINARY DESIGN AND SUBJECT TO CHANGE.
2. OTHER ALTERNATIVE FOUNDATION TYPES INCLUDING, BUT NOT LIMITED TO, MICROPILE, GRILLAGE, HELICAL PILE, CAISSON, AND PAD AND PIER MAY BE USED IN PLACE OF DRILLED CONCRETE PIERS, BASED ON SITE SPECIFIC SOIL CONDITIONS.
3. REDUNDANT TOWER MEMBERS ARE NOT SHOWN.
4. DRAWING REPRESENTS TWO (2) TOWER TYPES WITH SIMILAR PHYSICAL CHARACTERISTICS:
   - LIGHT TANGENT TOWER 0°-1°
   - HEAVY TANGENT TOWER 0°-3°



PLAN VIEW



ELEVATION VIEW



SECTION A-A

PROPOSED TANGENT TOWER 0°-3° LINE ANGLE

PRIMARY FOUNDATION TYPE: CONCRETE PIER (SEE GENERAL NOTE 2)
FOUNDATION SIZE RANGE (DIA. X EMB.): 3 FT X 15 FT - 5 FT X 30 FT +/-
FOUNDATION REVEAL RANGE (A): 1 FT - 4 FT +/-
FOUNDATION SPACING RANGE (B): 24 FT - 50 FT +/-
TOWER HEIGHT RANGE (C): 85 FT - 190 FT +/-
CONDUCTOR ATTACHMENT HEIGHT (D): 55 FT - 160 FT +/-

NO	DATE	REVISIONS AND RECORD OF ISSUE	DRWN	REV'D	APPR	COMP
G	10/21/2025	ISSUE FOR REVIEW	MDW	JA	MS	
F	10/10/2025	ISSUE FOR REVIEW	MDW	JA	MS	
E	09/09/2025	ISSUE FOR REVIEW	MDW	JA	MS	
D	09/08/2025	ISSUE FOR REVIEW	MDW	JA	MS	
C	08/26/2025	ISSUE FOR REVIEW	JA	JA	MS	
B	08/21/2025	ISSUE FOR REVIEW	JA	JA	MS	
A	08/20/2025	ISSUE FOR REVIEW	RMN	JA	MS	

SCALE: NONE

PREP: RMN CHKD: JA
APPD: MS DATE: 08/20/2025

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OF LEGAL COUNSEL.

POWER ENGINEERS

NEXTERA ENERGY TRANSMISSION MIDATLANTIC
MIDATLANTIC RESILIENCY LINK
PROPOSED 500kV TRANSMISSION LINE
TANGENT TOWER 0°-3° LINE ANGLE

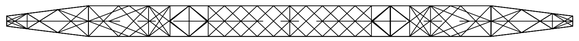
GENERIC - TANGENT TOWER ELEVATION

PROJECT INFORMATION:

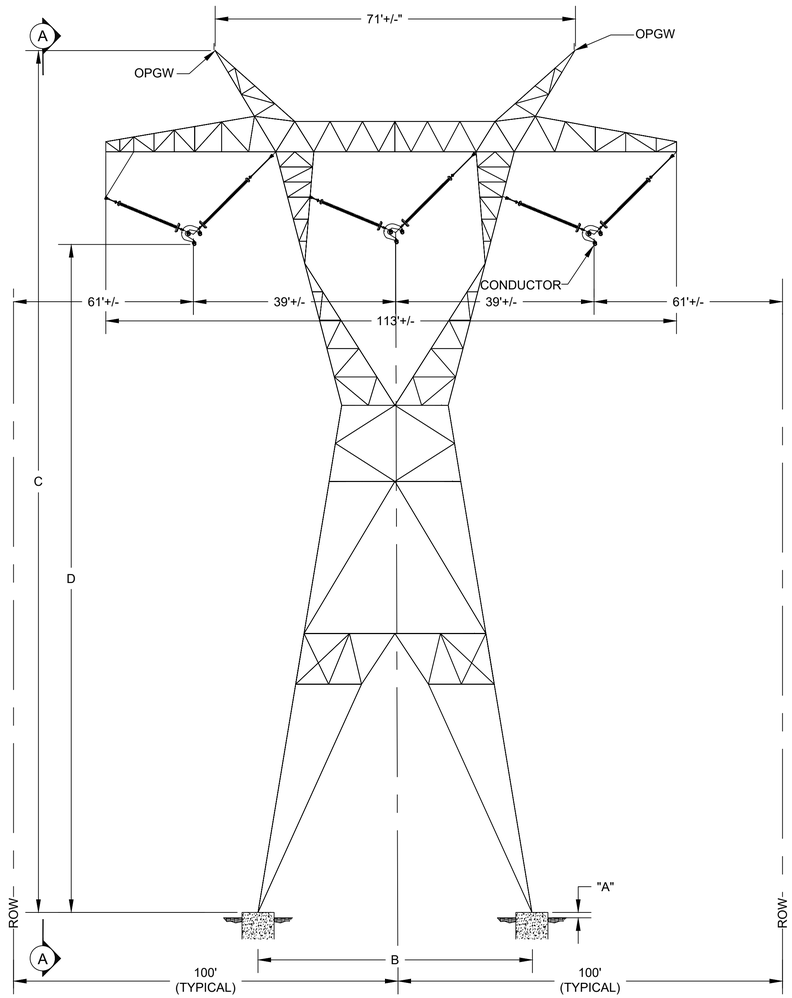
1. PROJECT NAME: MIDATLANTIC RESILIENCY LINK
2. LINE DESCRIPTION: OVERHEAD SINGLE CIRCUIT 500KV AC TRANSMISSION LINE
3. TYPICAL RIGHT-OF-WAY WIDTH: 200 FT
4. NUMBER OF CIRCUITS: ONE (1) CIRCUIT
5. NUMBER OF CIRCUITS PER STRUCTURE: ONE (1)
6. STRUCTURE TYPE: LATTICE TOWER
7. STRUCTURE MATERIAL: GALVANIZED STEEL
8. STEADY STATE RATINGS: 5,291 MVA (WINTER NORMAL) AND 4,490 MVA (SUMMER NORMAL)
9. AVERAGE SPAN LENGTH: 1,250 FT
10. CONDUCTOR TYPE: 3-BUNDLE ACSR 1780 KCMIL "CHUKAR"
11. CONDUCTOR CONFIGURATION: HORIZONTAL
12. OPGW QUANTITY & TYPE: TWO (2) 48 COUNT OPGW

GENERAL NOTES:

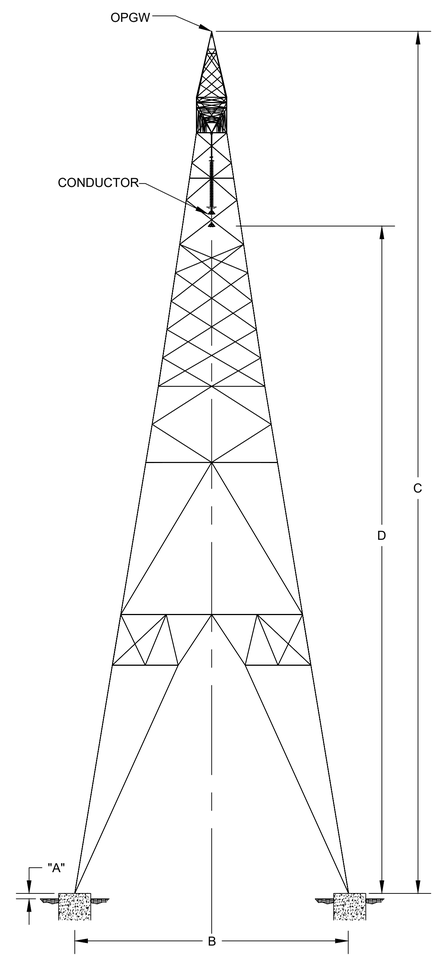
1. ALL DIMENSIONS ARE APPROXIMATE VALUES BASED ON PRELIMINARY DESIGN AND SUBJECT TO CHANGE.
2. OTHER ALTERNATIVE FOUNDATION TYPES INCLUDING, BUT NOT LIMITED TO, MICROPILE, GRILLAGE, HELICAL PILE, CAISSON, AND PAD AND PIER MAY BE USED IN PLACE OF DRILLED CONCRETE PIERS, BASED ON SITE SPECIFIC SOIL CONDITIONS.
3. REDUNDANT TOWER MEMBERS ARE NOT SHOWN.



PLAN VIEW



ELEVATION VIEW



SECTION A-A

PROPOSED RUNNING ANGLE TOWER 3°-20° LINE ANGLE

PRIMARY FOUNDATION TYPE: CONCRETE PIER (SEE GENERAL NOTE 2)
FOUNDATION SIZE RANGE (DIA. X EMB.): 3 FT X 15 FT - 6 FT X 40 FT +/-
FOUNDATION REVEAL RANGE (A): 1 FT - 4 FT +/-
FOUNDATION SPACING RANGE (B): 28 FT - 60 FT +/-
TOWER HEIGHT RANGE (C): 85 FT - 190 FT +/-
CONDUCTOR ATTACHMENT HEIGHT (D): 49 FT - 154 FT +/-

NO	DATE	REVISIONS AND RECORD OF ISSUE	DRWN	REV'D	APPR	COMP
G	10/21/2025	ISSUE FOR REVIEW	MDW	JA	MS	
F	10/10/2025	ISSUE FOR REVIEW	MDW	JA	MS	
E	09/09/2025	ISSUE FOR REVIEW	MDW	JA	MS	
D	09/08/2025	ISSUE FOR REVIEW	MDW	JA	MS	
C	08/26/2025	ISSUE FOR REVIEW	JA	JA	MS	
B	08/21/2025	ISSUE FOR REVIEW	JA	JA	MS	
A	08/20/2025	ISSUE FOR REVIEW	RMN	JA	MS	

SCALE: NONE

PREP: RMN CHKD: JA
APPD: MS DATE: 08/20/2025

NEXTera ENERGY TRANSMISSION MIDATLANTIC

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POWER ENGINEERS

NEXTERA ENERGY TRANSMISSION MIDATLANTIC
MIDATLANTIC RESILIENCY LINK
PROPOSED 500kV TRANSMISSION LINE
RUNNING ANGLE TOWER 3°-20° LINE ANGLE

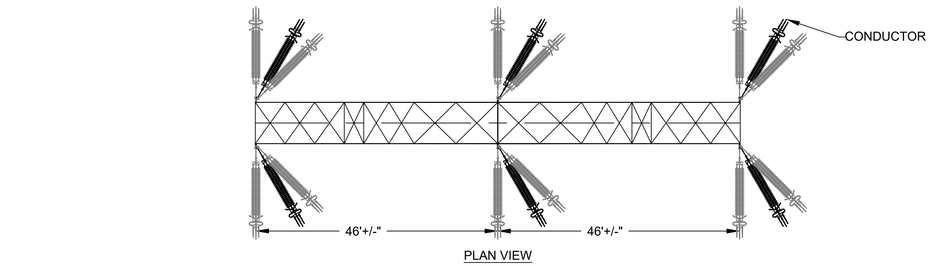
GENERIC - RUNNING ANGLE TOWER ELEVATION

PROJECT INFORMATION:

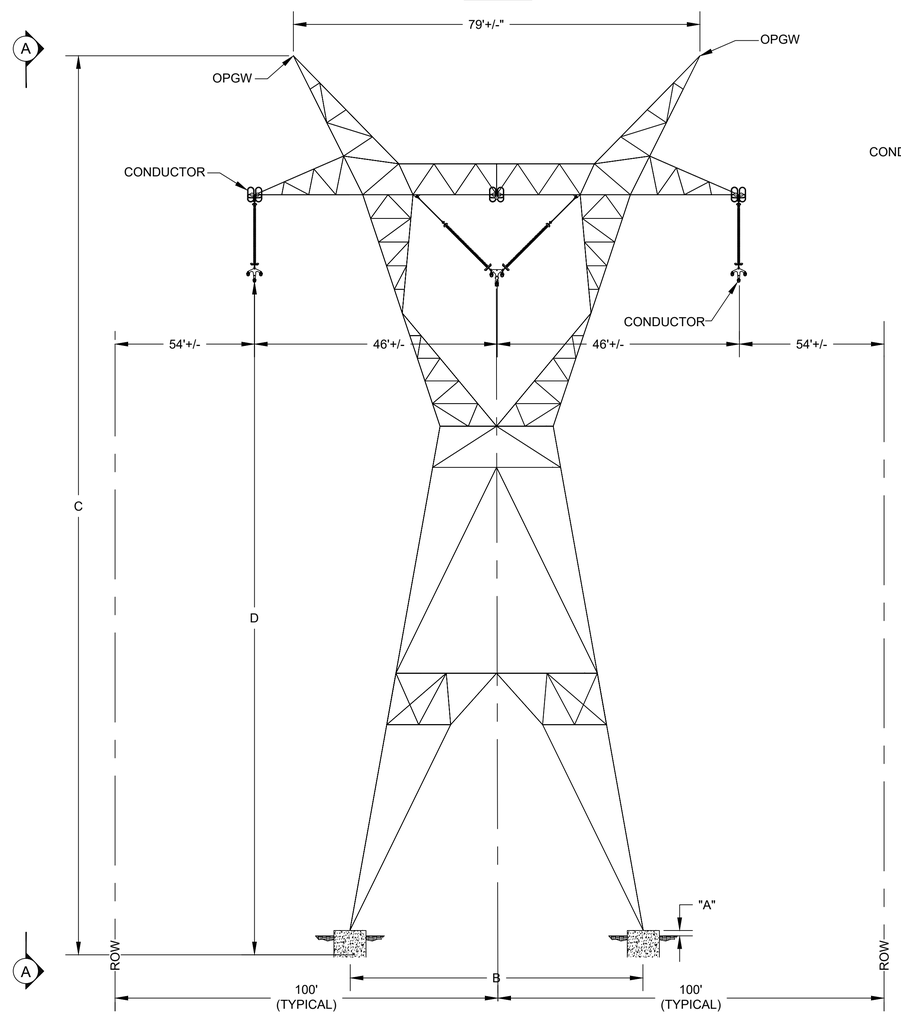
1. PROJECT NAME: MIDATLANTIC RESILIENCY LINK
2. LINE DESCRIPTION: OVERHEAD SINGLE CIRCUIT 500KV AC TRANSMISSION LINE
3. TYPICAL RIGHT-OF-WAY WIDTH: 200 FT
4. NUMBER OF CIRCUITS: ONE (1) CIRCUIT
5. NUMBER OF CIRCUITS PER STRUCTURE: ONE (1)
6. STRUCTURE TYPE: LATTICE TOWER
7. STRUCTURE MATERIAL: GALVANIZED STEEL
8. STEADY STATE RATINGS: 5,291 MVA (WINTER NORMAL) AND 4,490 MVA (SUMMER NORMAL)
9. AVERAGE SPAN LENGTH: 1,250 FT
10. CONDUCTOR TYPE: 3-BUNDLE ACSR 1780 KCMIL "CHUKAR"
11. CONDUCTOR CONFIGURATION: HORIZONTAL
12. OPGW QUANTITY & TYPE: TWO (2) 48 COUNT OPGW

GENERAL NOTES:

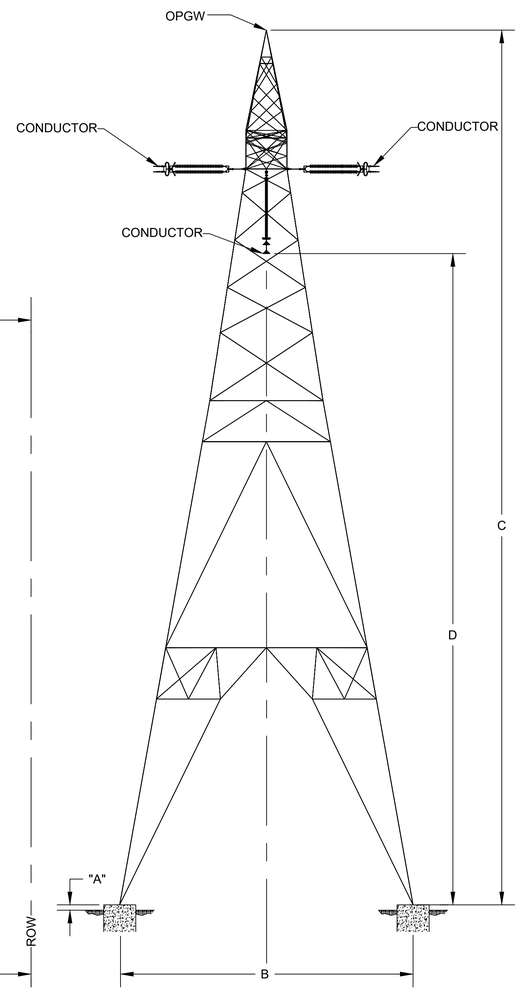
1. ALL DIMENSIONS ARE APPROXIMATE VALUES BASED ON PRELIMINARY DESIGN AND SUBJECT TO CHANGE.
2. OTHER ALTERNATIVE FOUNDATION TYPES INCLUDING, BUT NOT LIMITED TO, MICROPILE, GRILLAGE, HELICAL PILE, CAISSON, AND PAD AND PIER MAY BE USED IN PLACE OF DRILLED CONCRETE PIERS, BASED ON SITE SPECIFIC SOIL CONDITIONS.
3. REDUNDANT TOWER MEMBERS ARE NOT SHOWN.
4. DRAWING REPRESENTS THREE (3) TOWER TYPES WITH SIMILAR PHYSICAL CHARACTERISTICS:
   - STRAIN TOWER 0°-30°
   - DEADEND TOWER 0°-45°
   - DEADEND TOWER 45°-90°



PLAN VIEW



ELEVATION VIEW



SECTION A-A

PROPOSED STRAIN/DEADEND TOWER 0°-90° LINE ANGLE

PRIMARY FOUNDATION TYPE: CONCRETE PIER (SEE GENERAL NOTE 2)
FOUNDATION SIZE RANGE (DIA. X EMB.): 5 FT X 20 FT - 8 FT X 60 FT +/-
FOUNDATION REVEAL RANGE (A): 1 FT - 4 FT +/-
FOUNDATION SPACING RANGE (B): 27 FT - 68 FT +/-
TOWER HEIGHT RANGE (C): 85 FT - 190 FT +/-
CONDUCTOR ATTACHMENT HEIGHT (D): 58 FT - 163 FT +/-

NO	DATE	REVISIONS AND RECORD OF ISSUE	DRWN	REV'D	APPR	COMP
G	10/21/2025	ISSUE FOR REVIEW	MDW	JA	MS	
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B	08/21/2025	ISSUE FOR REVIEW	JA	JA	MS	
A	08/20/2025	ISSUE FOR REVIEW	RMN	JA	MS	

SCALE: NONE

PREP: RMN CHKD: JA
APPD: MS DATE: 08/20/2025

NEXTera ENERGY TRANSMISSION MIDATLANTIC

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POWER ENGINEERS

NEXTERA ENERGY TRANSMISSION MIDATLANTIC
MIDATLANTIC RESILIENCY LINK
PROPOSED 500kV TRANSMISSION LINE
STRAIN/DEADEND TOWER 0°-90° LINE ANGLE

GENERIC - STRAIN/DEADEND TOWER ELEVATION

PROJECT INFORMATION:

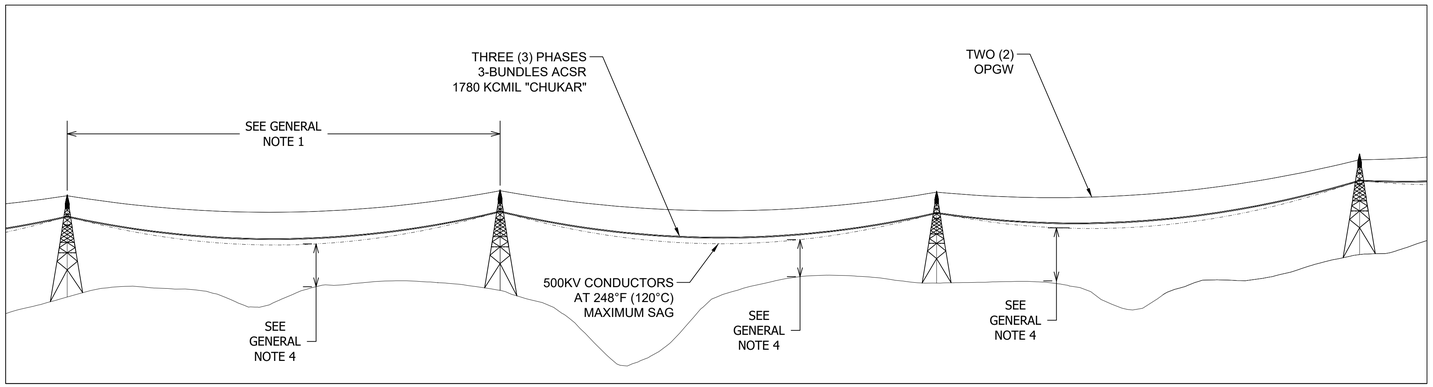
1. PROJECT NAME: MIDATLANTIC RESILIENCY LINK
2. LINE DESCRIPTION: OVERHEAD SINGLE CIRCUIT 500KV AC TRANSMISSION LINE
3. TYPICAL RIGHT-OF-WAY WIDTH: 200 FT
4. NUMBER OF CIRCUITS: ONE (1) CIRCUIT
5. NUMBER OF CIRCUITS PER STRUCTURE: ONE (1)
6. STRUCTURE TYPE: LATTICE TOWER
7. STRUCTURE MATERIAL: GALVANIZED STEEL
8. STEADY STATE RATINGS: 5,291 MVA (WINTER NORMAL) AND 4,490 MVA (SUMMER NORMAL)
9. AVERAGE SPAN LENGTH: 1,250 FT
10. CONDUCTOR TYPE: 3-BUNDLE ACSR 1780 KCMIL "CHUKAR"
11. CONDUCTOR CONFIGURATION: HORIZONTAL
12. OPGW QUANTITY & TYPE: TWO (2) 48 COUNT OPGW

GENERAL NOTES:

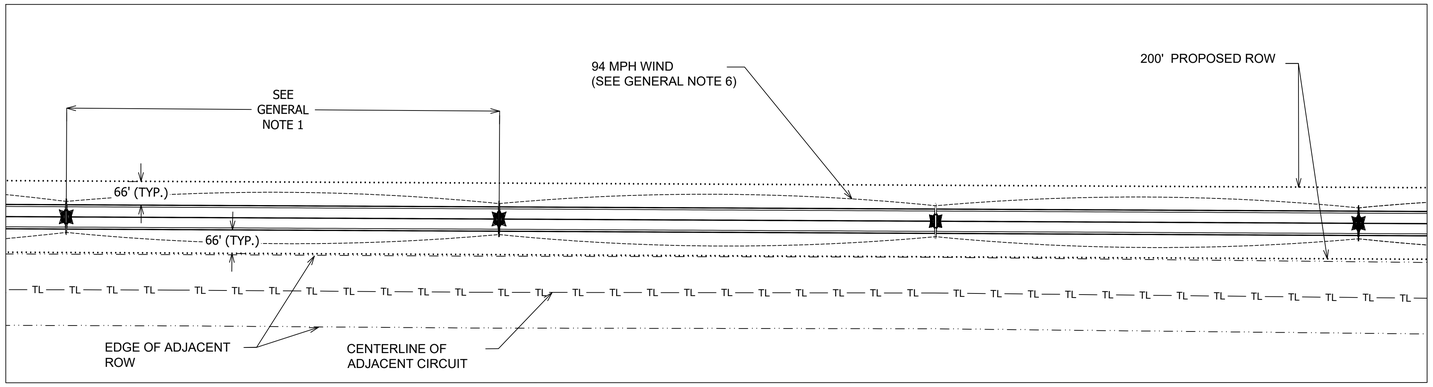
1. THE AVERAGE SPAN LENGTH IS APPROXIMATELY 1,250 FT.
2. THE SPAN LENGTHS REQUIRING ADDITIONAL RIGHT-OF-WAY RANGE FROM 1,600 FT TO 3,000 FT.
3. THE MINIMUM, MAXIMUM, AND AVERAGE TOWER HEIGHTS ARE 85 FT, 190 FT, AND 145 FT, RESPECTIVELY.
4. THE MINIMUM DESIGN GROUND CLEARANCE WITH CONDUCTOR AT MAXIMUM SAG CONDITION IS 31.5 FT.
5. ALL THE DIMENSIONS ARE APPROXIMATE VALUES THAT ARE BASED ON PRELIMINARY DESIGN AND SUBJECT TO CHANGE.
6. CONDUCTOR POSITION AT MAXIMUM DESIGN WIND SPEED (94 MPH) AND MAINTAINED IN THE RIGHT-OF-WAY.

LEGEND:

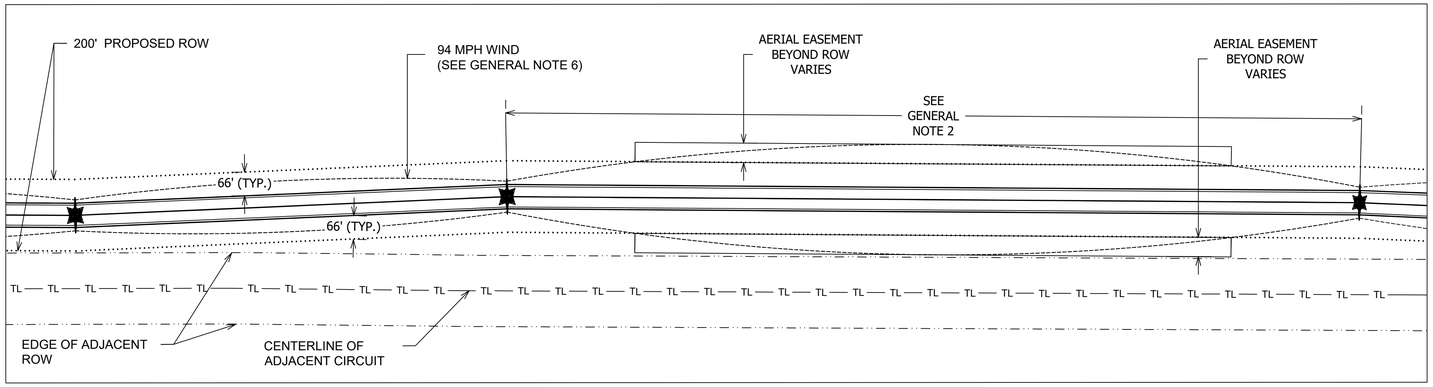
- PROPOSED CONDUCTOR
- PROPOSED OPGW
- PROPOSED TRANSMISSION ROW
- EXTREME WIND WEATHER CASE (GENERAL NOTE 6)
- PROPOSED TOWER
- EDGE OF ADJACENT ROW, WHERE APPLICABLE
- TL — CENTERLINE OF ADJACENT CIRCUIT, WHERE APPLICABLE



PROFILE VIEW (TYPICAL)



PLAN VIEW (TYPICAL)



PLAN VIEW
SPAN LENGTHS REQUIRING AERIAL EASEMENT BEYOND ROW

NO	DATE	REVISIONS AND RECORD OF ISSUE	DRWN	REV'D	APPR	COMP
H	10/21/2025	ISSUE FOR REVIEW	MDW	JA	MS	
G	10/20/2025	ISSUE FOR REVIEW	MDW	JA	MS	
F	10/09/2025	ISSUE FOR REVIEW	MDW	JA	MS	
E	09/09/2025	ISSUE FOR REVIEW	MDW	JA	MS	
D	09/08/2025	ISSUE FOR REVIEW	MDW	JA	MS	
C	08/26/2025	ISSUE FOR REVIEW	JA	JA	MS	
B	08/21/2025	ISSUE FOR REVIEW	JA	JA	MS	
A	08/20/2025	ISSUE FOR REVIEW	JA	BDB	BDB	

SCALE: AS NOTED
PREP: JA CHKD: BDB
APPD: BDB DATE: 08/20/2025

NEXTera ENERGY TRANSMISSION MIDATLANTIC

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POWER ENGINEERS

NEXTERA ENERGY TRANSMISSION MIDATLANTIC
MIDATLANTIC RESILIENCY LINK
PROPOSED 500KV TRANSMISSION LINE

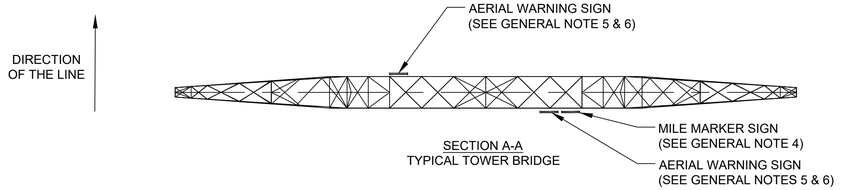
GENERIC - PLAN AND PROFILE VIEW

PROJECT INFORMATION:

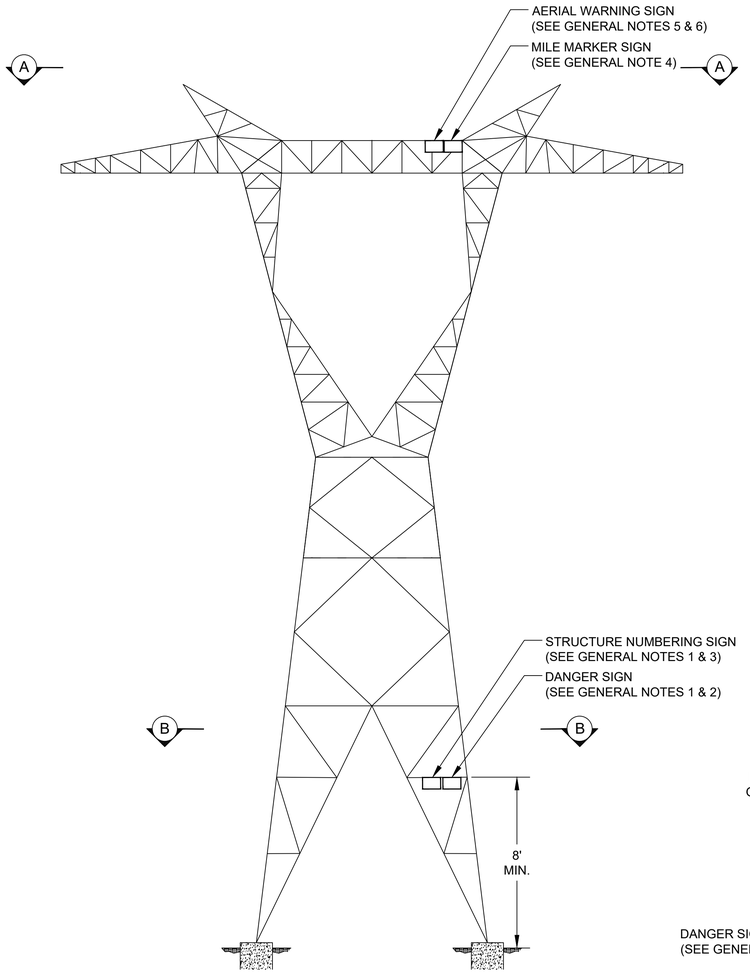
1. PROJECT NAME: MIDATLANTIC RESILIENCY LINK
2. LINE DESCRIPTION: OVERHEAD SINGLE CIRCUIT 500KV AC TRANSMISSION LINE
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9. AVERAGE SPAN LENGTH: 1,250 FT
10. CONDUCTOR TYPE: 3-BUNDLE ACSR 1780 KCMIL "CHUKAR"
11. CONDUCTOR CONFIGURATION: HORIZONTAL
12. OPGW QUANTITY & TYPE: TWO (2) 48 COUNT OPGW

GENERAL NOTES:

1. SIGNS SHALL BE INSTALLED AT A MINIMUM HEIGHT OF 8 FEET ABOVE GROUND.
2. ONE (1) DANGER SIGN WILL BE INSTALLED ON EACH SIDE OF THE TOWER.
3. ONE (1) STRUCTURE NUMBERING SIGN WILL BE INSTALLED ON ONE SIDE OF THE TOWER. THE FORMAT WILL BE A COMBINATION OF THE MILE MARKER FOLLOWED BY THE STRUCTURE NUMBER WITHIN THAT MILE.
4. ONE (1) MILE MARKER SIGN WILL BE INSTALLED ON THE FIRST STRUCTURE OF EACH MILE, WHERE APPLICABLE.
5. AT A MINIMUM, ONE (1) AERIAL WARNING SIGN WILL BE INSTALLED AT STRUCTURES ADJACENT TO CROSSING HAZARDS IN ORDER TO PROVIDE ADEQUATE SIGHT DISTANCE FOR AERIAL PATROL.
6. AERIAL WARNING SIGN WILL BE VISIBLE APPROACHING CROSSING HAZARD.



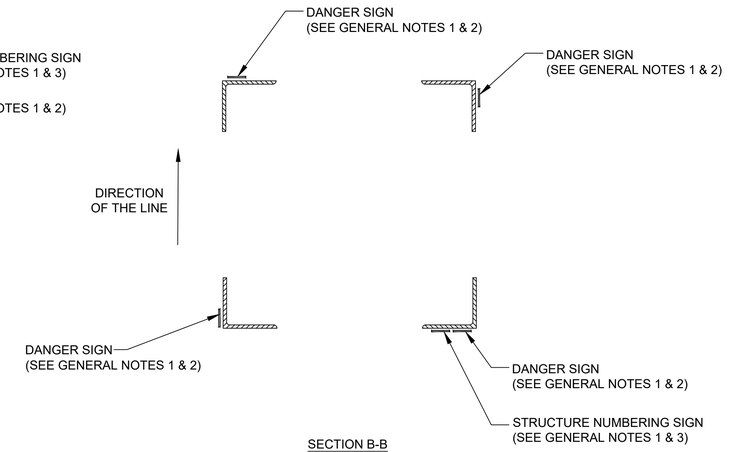
SECTION A-A
TYPICAL TOWER BRIDGE



TYPICAL ELEVATION VIEW



TYPICAL DANGER SIGN DETAILS



SECTION B-B
TYPICAL TOWER LEGS

NO	DATE	REVISIONS AND RECORD OF ISSUE	DRWN	REVD	APPR	COMP
B	10/30/2025	ISSUE FOR REVIEW	MDW	JA	MS	
A	10/09/2025	ISSUE FOR REVIEW	MDW	JA	MS	

SCALE: NONE

PREP: RMN CHKD: JA
APPD: MS DATE: 10/07/2025

NEXTera ENERGY TRANSMISSION MIDATLANTIC

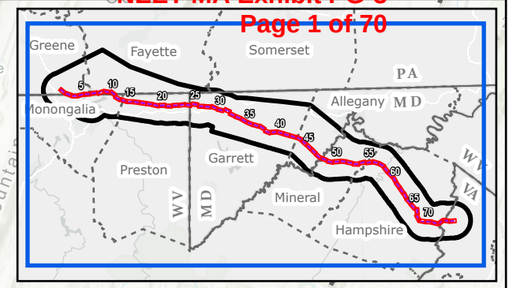
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POWER ENGINEERS

NEXTERA ENERGY TRANSMISSION MIDATLANTIC
MIDATLANTIC RESILIENCY LINK
PROPOSED 500kV TRANSMISSION LINE
TOWER WARNING AND NUMBERING SIGNS

GENERIC - TOWER WARNING AND NUMBERING SIGNS



Greene County
Fayette County
Somerset County
Fulton County
Washington County
Allegany County
Monongalia County
Morgan County
Garrett County
Preston County
Marion County
Mineral County
Berkeley County
Hampshire County
Taylor County
Harrison County
Barbour County
Tucker County
Grant County
Hardy County
Frederick County

PA
MD
WV
MD
WV
VA
WV

502-Junction
5
10
15
20
25
30
35
40
45
50
55
60
65
70

Handoff Point

Fayette
South Uniontown
Rockwood
Ohiopyle State Park
Laurel Hill
Confluence
Meyersdale
3209 ft
State Game Lands 048
State Game Lands 104
State Game Lands 082
Wills Mountain
Evitts Mountain
Grantsville
Cumberland
Allegany
Warrior Mountain
Green Ridge State Forest
Big Savage Mountain
Meadow Mountain
Savage River State Forest
Fort Ashby
Springfield
Bloomery
Slanesville
Romney
Capon Bridge
Gore
Frederick
Capon Mountain
Sideling Hill
Monongalia
Star City
Morgantown
Masontown
Fairmont
Pleasant Valley
Briery Mountains
3150 ft
Terra Alta
Backbone Mountain
Rowlesburg
Aurora
Grafton
Thornton
Taylor
Philippi
Mon River
Blaydard
Mill Creek Mountain
North River Mountain
Old Fields
Mineral
Hampshire
Stony River Mountain
Shenandoah Mountain
Cacapon Mountain
Paw Paw
40
68
79
72
93
219

Project Components
- Project Endpoints
- Proposed Route Towers
- Milepost
- Proposed Route Centerline
- Proposed Route ROW
- Aerial Easement Blowout Area
- Proposed Route Siting Corridor

Base Data
- Existing High-Voltage Transmission Lines
- County Boundary
- State Border
- Map Index Page

LiDAR Elevation Contours
- 5-foot contours
- 25-foot contours

Terrain - Slope Map
- Moderately Steep (16° - 20°)
- Steep (21° - 30°)
- Very steep (31° - 90°)

NOTES
1. Proposed tower locations are preliminary and subject to change
2. Data source: NEET, ERM, USGS, REXTAG

N

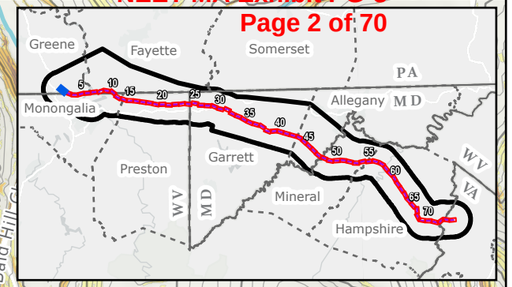
0 3.5 7 10.5 14
Miles
Scale: 1:400,000
1 inch equals 33,333 ft (when printed at 11x17)

Exhibit PG-4
Slope and Contour Mapbook
Page 1 of 70
MidAtlantic Resiliency Link

ERM

FILE: M:\US\Projects\M-O\NextEra\MARL\ArcGIS\CPCN\Testimony Support\NEET_MARL_TestimonySupport.aprx, REVISED: 12/10/2025 SCALE: 1:400,000 when printed at 11x17

Coordinate System: NAD 1983 UTM Zone 17N



502 Junction

West Penn Power Company ~unknown~ 500 kV

Wheeling Power Company 500 kV

West Penn Power Company Unknown kV

Bald Hill Rd

State Rte 2002

Dooley Run

0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1 1.1 1.2 1.3 1.4 1.5 1.6 1.7

Project Components
- Project Endpoints
- Proposed Route Towers
- Milepost
- Proposed Route Centerline
- Proposed Route ROW
- Aerial Easement Blowout Area
- Proposed Route Siting Corridor

Base Data
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- County Boundary
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NOTES
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N

0 0.05 0.1 0.15 0.2
Miles

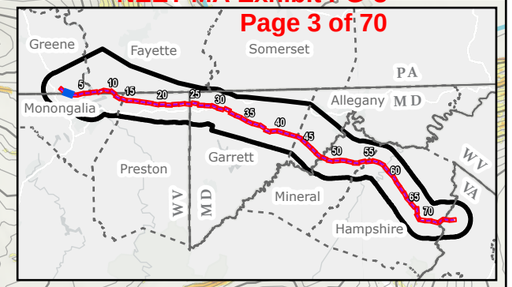
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Exhibit PG-4
Slope and Contour Mapbook
Page 2 of 70
MidAtlantic Resiliency Link

ERM

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Coordinate System: NAD 1983 UTM Zone 17N



Project Components
- Project Endpoints
- Proposed Route Towers
- Milepost
- Proposed Route Centerline
- Proposed Route ROW
- Aerial Easement Blowout Area
- Proposed Route Siting Corridor

Base Data
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- County Boundary
- State Border

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N

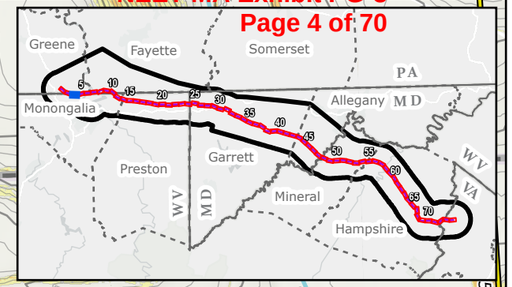
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Miles
Scale: 1:6,000
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Exhibit PG-4
Slope and Contour Mapbook
Page 3 of 70
MidAtlantic Resiliency Link

ERM

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Coordinate System: NAD 1983 UTM Zone 17N



Greene
Monongalia
PA
WV
500 kV
Co Rd 19/6
Lazelle School Rd
Co Rd 19/5 Crafts Run Rd
Crafts Run
3.3
3.4
3.5
3.6
3.7
3.8
3.9
4
4.1
4.2
4.3
4.4
4.5
4.6
4.7
4.8

Project Components
- Project Endpoints
- Proposed Route Towers
- Milepost
- Proposed Route Centerline
- Proposed Route ROW
- Aerial Easement Blowout Area
- Proposed Route Siting Corridor

Base Data
- Existing High-Voltage Transmission Lines
- County Boundary
- State Border

LiDAR Elevation Contours
- 5-foot contours
- 25-foot contours

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N

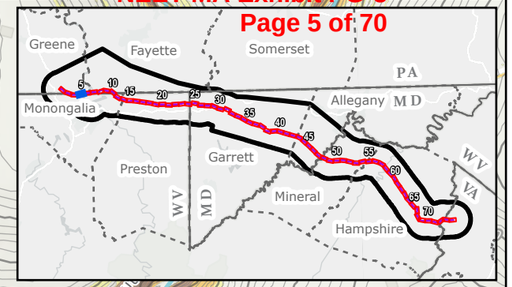
0 0.05 0.1 0.15 0.2
Miles
Scale: 1:6,000
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Exhibit PG-4
Slope and Contour Mapbook
Page 4 of 70
MidAtlantic Resiliency Link

ERM

FILE: M:\US\Projects\M-O\NextEra\MAR\ArcGIS\CPCN\Testimony Support\NEET_MARL_TestimonySupport.aprx, REVISED: 12/10/2025 SCALE: 1:6,000 when printed at 11x17

Coordinate System: NAD 1983 UTM Zone 17N



Wheeling Power Company 500 kV
~unknown~ 500 kV
State Rte 2011-Bobtown Rd
Crooked Run Rd
PA
WV
Greene
Monongalia
T312-Morley Rd
T312
Morley's Rd
T712
Walnut
4.8
4.9
5
5.1
5.2
5.3
5.4
5.5
5.6
5.7
5.8
5.9
6
6.1
6.2
6.3
Co Rd 513
Fort Martin Rd
West Penn Power Company 500 kV
Monongahela Power Company 500 kV
~unknown~ 500 kV
Monongahela Power Company 500 kV

Project Components
- Project Endpoints
- Proposed Route Towers
- Milepost
- Proposed Route Centerline
- Proposed Route ROW
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- Proposed Route Siting Corridor

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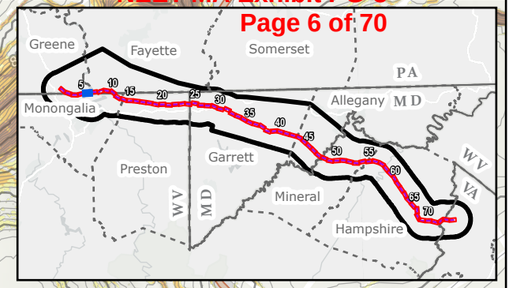
0 0.05 0.1 0.15 0.2
Miles
Scale: 1:6,000
1 inch equals 500 ft (when printed at 11x17)

Exhibit PG-4
Slope and Contour Mapbook
Page 5 of 70
MidAtlantic Resiliency Link

ERM

FILE: M:\US\Projects\M-O\NextEra\MARL\ArcGIS\CPCN\Testimony Support\NEET MARL_TestimonySupport.aprx, REVISED: 12/10/2025 SCALE: 1:6,000 when printed at 11x17

Coordinate System: NAD 1983 UTM Zone 17N



West Penn Power Company 500 kV
Morley's Rd
T712
Crooked Run Rd
Greene
Fayette
Sheepskin Trl
PA
WV
Greene
Monongalia
Crooked Run
Co Rd 53/4
Crooked Run
Monongahela River
Fayette
Monongalia
Caperton Trl
Nabors Rd
T and D Vlg
Ridenour Rd
Ridenour Rd
Cottrell Ln
6.4
6.5
6.6
6.7
6.8
6.9
7
7.1
7.2
7.3
7.4
7.5
7.6
7.7
7.8
7.9
88
119

Project Components
- Project Endpoints
- Proposed Route Towers
- Milepost
- Proposed Route Centerline
- Proposed Route ROW
- Aerial Easement Blowout Area
- Proposed Route Siting Corridor

Base Data
- Existing High-Voltage Transmission Lines
- County Boundary
- State Border

LiDAR Elevation Contours
- 5-foot contours
- 25-foot contours

Terrain - Slope Map
- Moderately Steep (16° - 20°)
- Steep (21° - 30°)
- Very steep (31° - 90°)

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N

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Miles

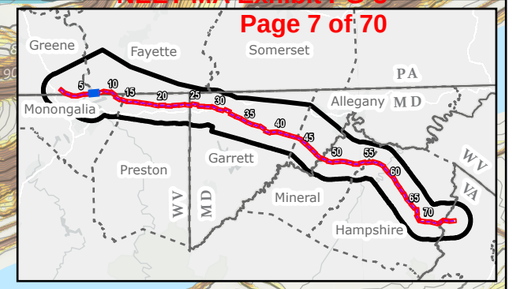
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MidAtlantic Resiliency Link

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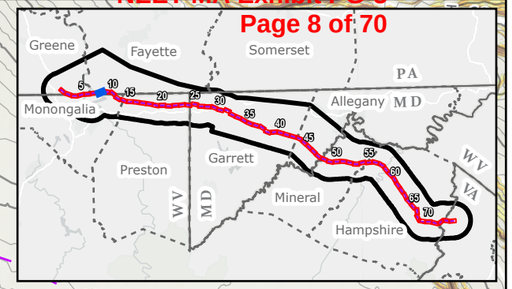
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Coordinate System: NAD 1983 UTM Zone 17N



Cheat River
Nilan Rd
West Penn Power Company Unknown kV
~unknown~ Unknown kV
West Penn Power Company 138 kV
West Penn Power Company 138 kV
West Penn Power Company 138 kV
Grassy Run
Lake Lynn Rd
Bunker Hill Rd
Bortz Mine Rd
Co Rd 651
PA
WV
Fayette
Monongalia
9.5
9.6
9.7
9.8
9.9
10
10.1
10.2
10.3
10.4
10.5
10.6
10.7
10.8
10.9
11
11.1

Project Components
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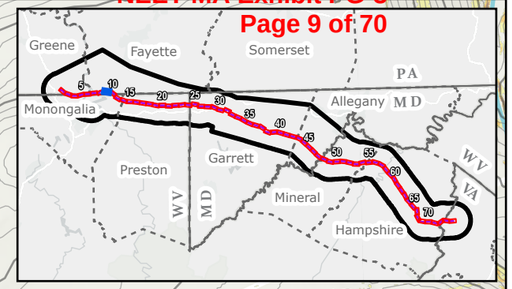
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Miles
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Coordinate System: NAD 1983 UTM Zone 17N



T468 Mustard Ln
West Penn Power Company 138 kV
West Penn Power Company 138 kV
Glenn Smith Rd T-470
Bunker Hill Rd
Grassy Run
Bunker Hill Rd
T303
T303
Bunker Hill Rd
Jordans Harbour Rd
T470
43
11.1
11.2
11.3
11.4
11.5
11.6
11.7
11.8
11.9
12
12.1
12.2
12.3
12.4
12.5
12.6

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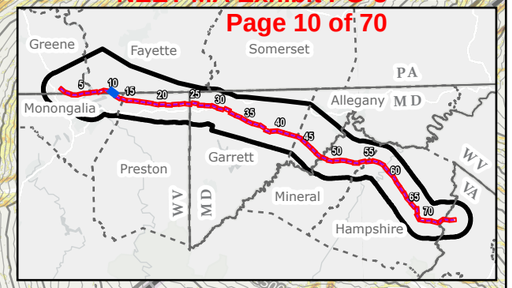
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Page 9 of 70
MidAtlantic Resiliency Link

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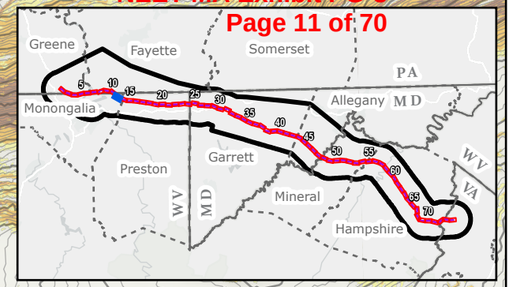
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MidAtlantic Resiliency Link

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Coordinate System: NAD 1983 UTM Zone 17N



14.3 14.4 14.5 14.6 14.7 14.8 14.9 15 15.1 15.2 15.3 15.4 15.5 15.6 15.7 15.8 15.9

~unknown~ 138 kV

Ryan Hollow E
Co Rd 69/10
Ryan Hollow W
Co Rd 69/1
Sand Springs Rd

Project Components
- Project Endpoints
- Proposed Route Towers
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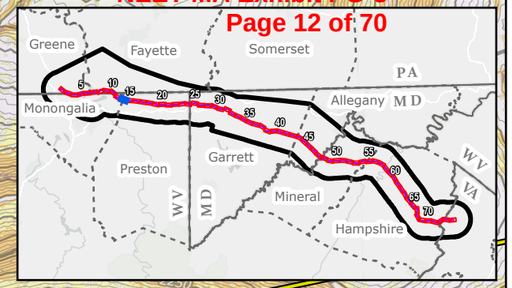
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MidAtlantic Resiliency Link

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Preston Monongalia

Potomac Edison 138 kV

~unknown~ 138 kV

Monongahela Power Company 138 kV

Co Rte 2/3

Greenville Rd

Ryan Hollow W

Co Rd 69/1

Sand Springs Rd

Co Rte 69/1

Little Laurel Creek

16 16.1 16.2 16.3 16.4 16.5 16.6 16.7 16.8 16.9 17 17.1 17.2 17.3 17.4 17.5

Project Components
- Project Endpoints
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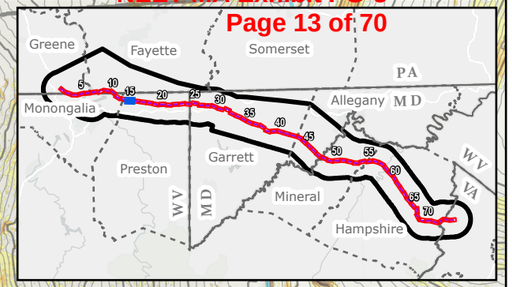
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Lake-O-Woods Rd
Co Rte 2/1
Hilemans Rd
Potomac Edison 138 kV
Co Rte 2/3
Greenville Rd
Monongahela Power Company 138 kV
Co Rte 2
Patterson Run
Laurel Run
17.5
17.6
17.7
17.8
17.9
18
18.1
18.2
18.3
18.4
18.5
18.6
18.7
18.8
18.9
19
19.1

Project Components
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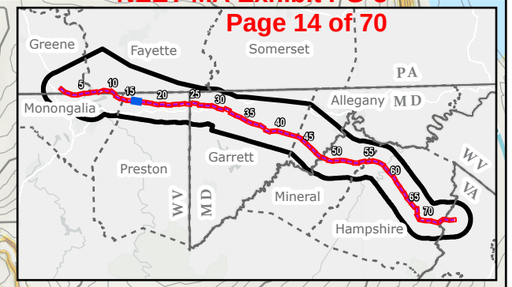
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Exhibit PG-4
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MidAtlantic Resiliency Link

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Coordinate System: NAD 1983 UTM Zone 17N



Potomac Edison 138 kV

Hazel Run

Laurel Run

19.1 19.2 19.3 19.4 19.5 19.6 19.7 19.8 19.9 20 20.1 20.2 20.3 20.4 20.5 20.6

Project Components
- Project Endpoints
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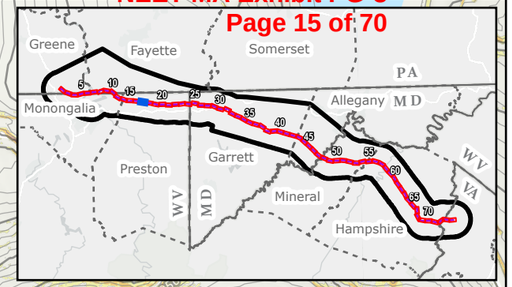
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Hazel Run
Co Rte 6/2
Eagles Nest Rd
Lake O' Woods-Hilleman
Potomac Edison 138 kV
Mount Grove Rd
Co Rte 73/9

20.6 20.7 20.8 20.9 21 21.1 21.2 21.3 21.4 21.5 21.6 21.7 21.8 21.9 22 22.1

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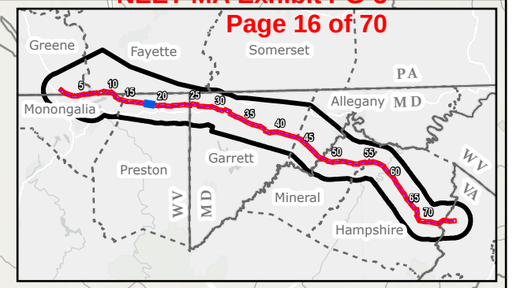
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Potomac Edison 138 kV

22.1 22.2 22.3 22.4 22.5 22.6 22.7 22.8 22.9 23 23.1 23.2 23.3 23.4 23.5 23.6

Eagles Nest Rd
Glade Run
Co Rte 44
Compressor Station Rd
Conley
Co Rte 613
Jim Smith Rd
Co Rte 6
Co Rte 6/4
Nieman Rd
1800
1850
1750
1700

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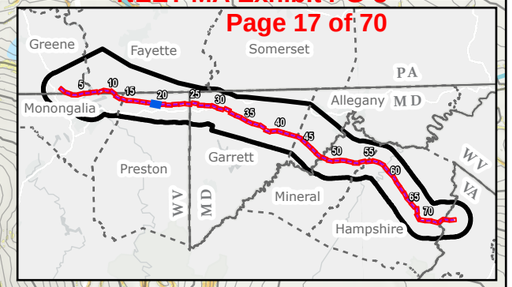
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Page 16 of 70
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ERM

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Big Sandy Creek
Old Clifton Mills Rd
Clifton Mills Rd
Co Rte 814 Big Sandy Rd
Co Rte 8
~unknown~ 138 kV
Potomac Edison 138 kV
Co Rte 26/14
Rexroad Farm Rd
Baker St
Glade Run
23.6
23.7
23.8
23.9
24
24.1
24.2
24.3
24.4
24.5
24.6
24.7
24.8
24.9
25
25.1
25.2

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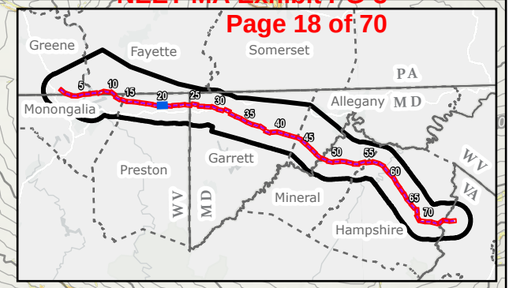
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Glade Run

Salem Rd

CO Rte 26/12

Potomac Edison 138 kV

Summit Ct

Sine Pl

Salem Rd

25.2 25.3 25.4 25.5 25.6 25.7 25.8 25.9 26 26.1 26.2 26.3 26.4 26.5 26.6 26.7

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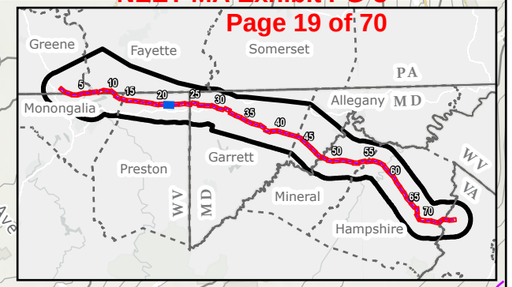
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Glade Run
Clifton Salem Co Rte 26/8
Co Rte 26/8
Filly Ln
Horseshoe Dr E
Horseshoe Dr W
Carriage Ln
Bridle Path
Gelding Ave
Horseshoe Dr E
Moyers Rd
Potomac Edison 138 kV
Co Rte 26/9
Barnes Run
Monongahela Power Company 132 kV
Moyers Center Station Co Rte 5/8
26.7
26.8
26.9
27
27.1
27.2
27.3
27.4
27.5
27.6
27.7
27.8
27.9
28
28.1
28.2
28.3

Project Components
- Project Endpoints
- Proposed Route Towers
- Milepost
- Proposed Route Centerline
- Proposed Route ROW
- Aerial Easement Blowout Area
- Proposed Route Siting Corridor

Base Data
- Existing High-Voltage Transmission Lines
- County Boundary
- State Border

LiDAR Elevation Contours
- 5-foot contours
- 25-foot contours

Terrain - Slope Map
- Moderately Steep (16° - 20°)
- Steep (21° - 30°)
- Very steep (31° - 90°)

NOTES
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N

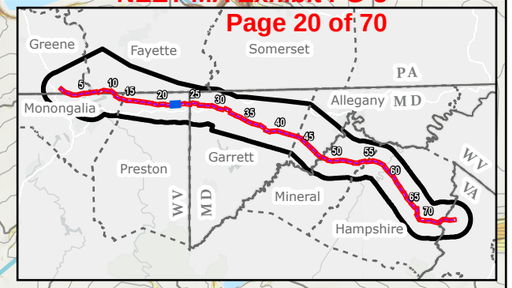
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Miles
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1 inch equals 500 ft (when printed at 11x17)

Exhibit PG-4
Slope and Contour Mapbook
Page 19 of 70
MidAtlantic Resiliency Link

ERM

FILE: M:\US\Projects\M-O\NextEra\MARL\ArcGIS\CPCN\Testimony Support\NEET_MARL_TestimonySupport.aprx, REVISED: 12/10/2025 SCALE: 1:6,000 when printed at 11x17

Coordinate System: NAD 1983 UTM Zone 17N



Co Rte 24/5
Co Rte 26/5
Moyers Rd
Moccasin Rocks Rd
Co Rte 26/9
Moyers Rd
Moyers Rte 26
Hanlin Rd Co Rte 5/6
Piney Run
Hog Run
Potomac Edison 138 kV

28.3 28.4 28.5 28.6 28.7 28.8 28.9 29 29.1 29.2 29.3 29.4 29.5 29.6 29.7 29.8

2100 2050 2000 1950 1900

FILE: M:\US\Projects\M-O\NextEra\MARL\ArcGIS\CPCN\Testimony Support\NEET_MARL_TestimonySupport.aprx, REVISED: 12/10/2025 SCALE: 1:6,000 when printed at 11x17

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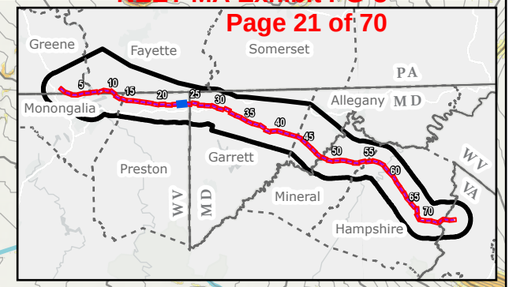
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Exhibit PG-4
Slope and Contour Mapbook
Page 20 of 70
MidAtlantic Resiliency Link

ERM

Coordinate System: NAD 1983 UTM Zone 17N



Beerbower Rd
Co Rte 5/2
Co Rte 5
Cherry Run Rd
Glade Farms Rd
Cherry Run
Potomac Edison 138 kV
29.9
30
30.1
30.2
30.3
30.4
30.5
30.6
30.7
30.8
30.9
31
31.1
31.2
31.3
2100
2050
2000
2150
2200
2250
2300

Project Components
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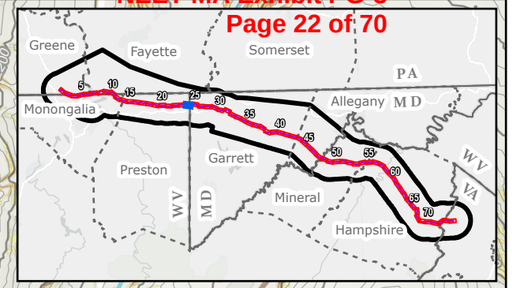
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Exhibit PG-4
Slope and Contour Mapbook
Page 21 of 70
MidAtlantic Resiliency Link

ERM

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Coordinate System: NAD 1983 UTM Zone 17N



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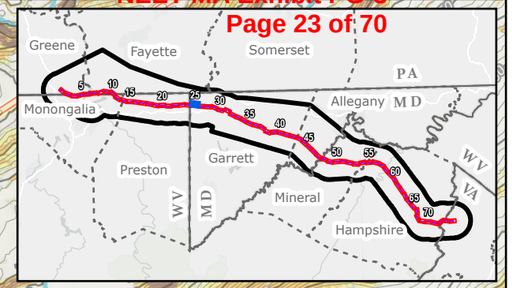
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Miles
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Exhibit PG-4
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Page 22 of 70
MidAtlantic Resiliency Link

ERM

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Coordinate System: NAD 1983 UTM Zone 17N



Blue Goose Rd
South Branch Laurel Run
Blue Goose Rd
Greengables Rd
Humberson Rd
Potomac Edison 138 kV
Buffalo Run
42
32.9
33
33.1
33.2
33.3
33.4
33.5
33.6
33.7
33.8
33.9
34
34.1
34.2
34.3
34.4
34.5
34.6

Project Components
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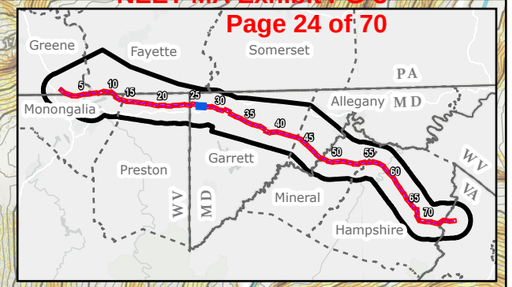
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Miles
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Exhibit PG-4
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Page 23 of 70
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Coordinate System: NAD 1983 UTM Zone 17N



Buffalo Run

34.6 34.7 34.8 34.9 35 35.1 35.2 35.3 35.4 35.5 35.6 35.7 35.8 35.9 36 36.1

Potomac Edison 138 kV

Old Morgantown Rd W

Stacy Fike Ln

Blain-Frantz Rd

Project Components
- Project Endpoints
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- Proposed Route Centerline
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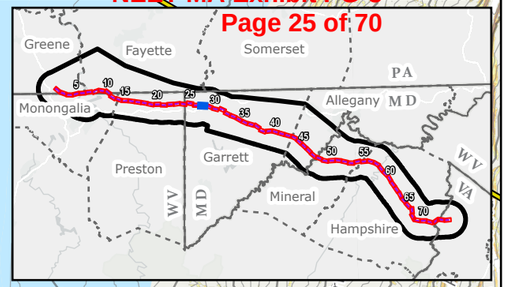
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Exhibit PG-4
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Page 24 of 70
MidAtlantic Resiliency Link

ERM

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Coordinate System: NAD 1983 UTM Zone 17N



Project Components
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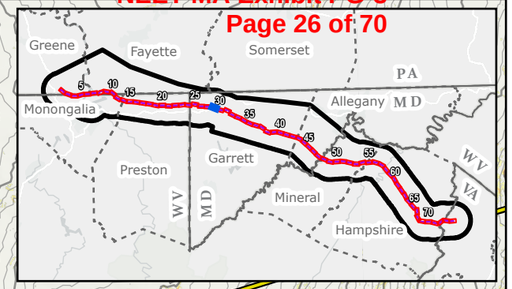
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Exhibit PG-4
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MidAtlantic Resiliency Link

ERM

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Coordinate System: NAD 1983 UTM Zone 17N



Potomac Edison 115 kV
Potomac Edison 138 kV
Potomac Edison 500 kV
New Gravel Hill Rd
Paul Fisher Rd
Friendsville Addison Rd
Mt Sinai Rd
Mount Sinai Rd
68

37.6 37.7 37.8 37.9 38 38.1 38.2 38.3 38.4 38.5 38.6 38.7 38.8 38.9 39 39.1 39.2

Project Components
- Project Endpoints
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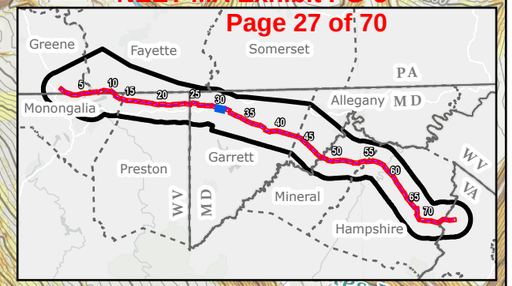
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Exhibit PG-4
Slope and Contour Mapbook
Page 26 of 70
MidAtlantic Resiliency Link

ERM

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Coordinate System: NAD 1983 UTM Zone 17N



Potomac Edison 138 kV

Potomac Edison 500 kV

Turkey Run Rd

Bearfoot Rd

Sam Friend Rd

Everly Rd

Fikes Run

Arthur Devine Rd

Bear Creek Rd

Bear Creek

Valley Ridge Rd

39.2 39.3 39.4 39.5 39.6 39.7 39.8 39.9 40 40.1 40.2 40.3 40.4 40.5 40.6 40.7

Project Components
- Project Endpoints
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N

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Miles

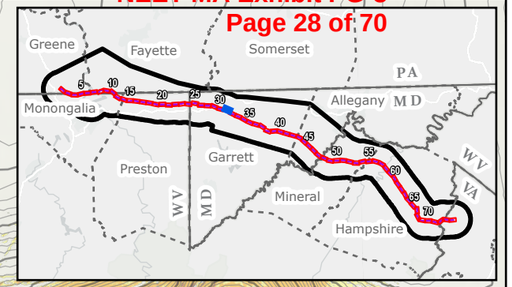
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Exhibit PG-4
Slope and Contour Mapbook
Page 27 of 70
MidAtlantic Resiliency Link

ERM

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Coordinate System: NAD 1983 UTM Zone 17N



Potomac Edison 138 kV
Harmon Rd
Cove Run
Everly Rd
Bear Creek Rd
Bear Creek
Sale Barn Rd
Wagner Hill Rd
Potomac Edison 500 kV
41
41.1
41.2
41.3
41.4
41.5
41.6
41.7
41.8
41.9
42
42.1
42.2
42.3
42.4
42.5
42.6
42.7
42.8
42.9
43
40.8
40.9

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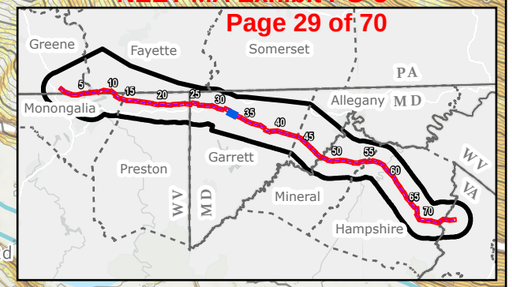
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Exhibit PG-4
Slope and Contour Mapbook
Page 28 of 70
MidAtlantic Resiliency Link

ERM

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Coordinate System: NAD 1983 UTM Zone 17N



Bear Creek Rd
Collier Rd
Rabbit Hollow Rd
Tyler Dr
Fish Hatchery Rd
Bear Creek
Pud Miller Rd
42.9
43
43.1
43.2
43.3
43.4
43.5
43.6
43.7
43.8
43.9
44
44.1
44.2
44.3
44.4
Potomac Edison 500 kV
Allegheny Power
Unknown kV
219
Kinks Ln

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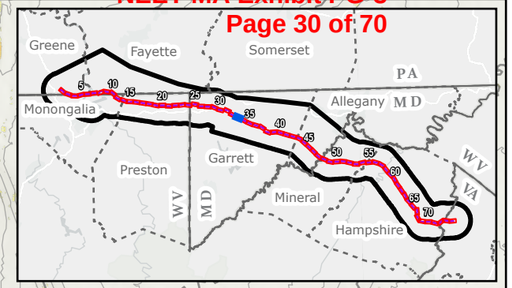
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Exhibit PG-4
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Page 29 of 70
MidAtlantic Resiliency Link

ERM

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Coordinate System: NAD 1983 UTM Zone 17N



Bear Creek
Bowman Hill Rd
Resh Ln
Potomac Edison 500 kV
44.4
44.5
44.6
44.7
44.8
44.9
45
45.1
45.2
45.3
45.4
45.5
45.6
45.7
45.8
45.9

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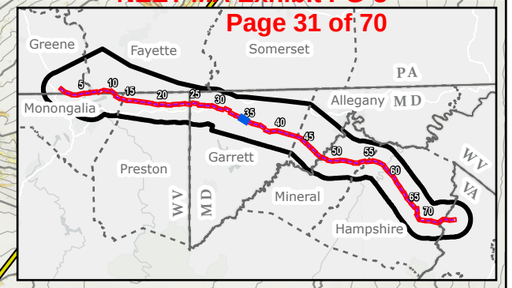
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Exhibit PG-4
Slope and Contour Mapbook
Page 30 of 70
MidAtlantic Resiliency Link

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Coordinate System: NAD 1983 UTM Zone 17N



Bowman Hill Rd

Foxtown Rd

Legeer Rd

Potomac Edison 500 kV

Potomac Edison Unknown kV

45.9 46 46.1 46.2 46.3 46.4 46.5 46.6 46.7 46.8 46.9 47 47.1 47.2 47.3 47.4

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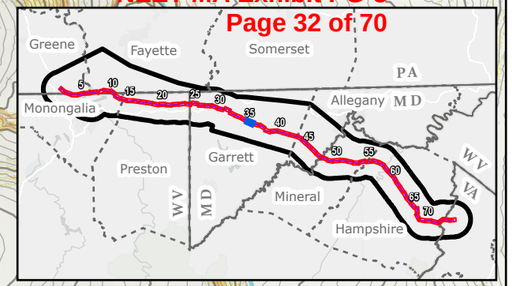
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Miles
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Exhibit PG-4
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Page 31 of 70
MidAtlantic Resiliency Link

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Coordinate System: NAD 1983 UTM Zone 17N



North Branch Casselman River

Potomac Edison 500 kV

47.4 47.5 47.6 47.7 47.8 47.9 48 48.1 48.2 48.3 48.4 48.5 48.6 48.7 48.8 48.9

495

Project Components
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N

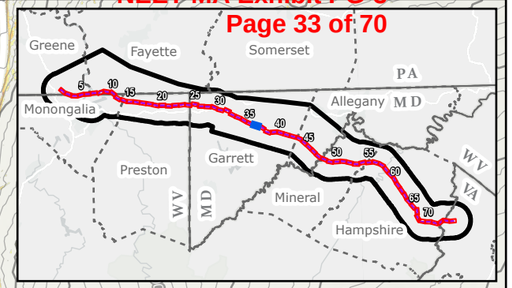
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1 inch equals 500 ft (when printed at 11x17)

Exhibit PG-4
Slope and Contour Mapbook
Page 32 of 70
MidAtlantic Resiliency Link

ERM

FILE: M:\US\Projects\M-O\NextEra\MARL\ArcGIS\CPCN\Testimony Support\NEET MARL TestimonySupport.aprx, REVISED: 12/10/2025 SCALE: 1:6,000 when printed at 11x17

Coordinate System: NAD 1983 UTM Zone 17N



48.9 49 49.1 49.2 49.3 49.4 49.5 49.6 49.7 49.8 49.9 50 50.1 50.2 50.3 50.4

Potomac Edison 500 kV

Bear Hill Rd

Maynardier Ridge Rd

South Branch Casselman River

2400 2450 2500 2550 2600 2650 2700

Project Components
- Project Endpoints
- Proposed Route Towers
- Milepost
- Proposed Route Centerline
- Proposed Route ROW
- Aerial Easement Blowout Area
- Proposed Route Siting Corridor

Base Data
- Existing High-Voltage Transmission Lines
- County Boundary
- State Border

LiDAR Elevation Contours
- 5-foot contours
- 25-foot contours

Terrain - Slope Map
- Moderately Steep (16° - 20°)
- Steep (21° - 30°)
- Very steep (31° - 90°)

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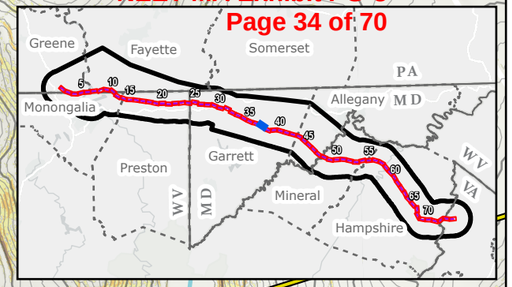
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Exhibit PG-4
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MidAtlantic Resiliency Link

ERM

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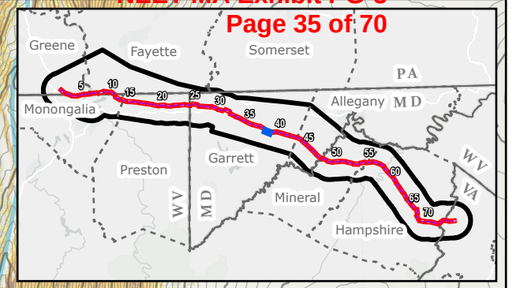
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MidAtlantic Resiliency Link

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Coordinate System: NAD 1983 UTM Zone 17N



Fairview Rd
Bear Pen Run
Potomac Edison 138 kV
Peapatch Ln
52.2
52.3
52.4
52.5
52.6
52.7
52.8
52.9
53
53.1
53.2
53.3
53.4
53.5
53.6
53.7
53.8
53.9
54
54.1

Project Components
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- Milepost
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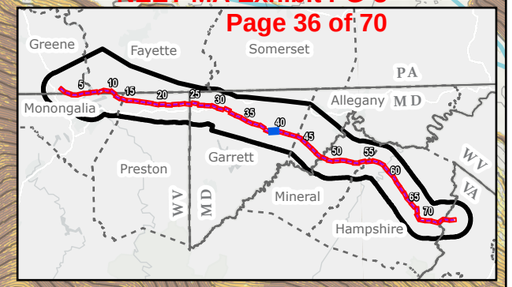
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Page 35 of 70
MidAtlantic Resiliency Link

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Coordinate System: NAD 1983 UTM Zone 17N



Fairview Rd

Potomac Edison 500 kV

Potomac Edison 138 kV

Silver Bell Run

Bear Pen Run

54 54.1 54.2 54.3 54.4 54.5 54.6 54.7 54.8 54.9 55 55.1 55.2 55.3 55.4 55.5

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Project Components
- Project Endpoints
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Base Data
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Terrain - Slope Map
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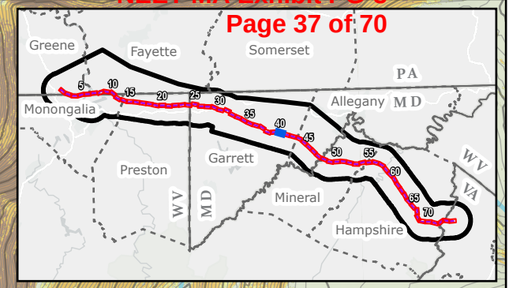
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Exhibit PG-4
Slope and Contour Mapbook
Page 36 of 70
MidAtlantic Resiliency Link

ERM

Coordinate System: NAD 1983 UTM Zone 17N



Potomac Edison 138 kV

Poplar Lick Run

Savage River

Potomac Edison 500 kV

55.5 55.6 55.7 55.8 55.9 56 56.1 56.2 56.3 56.4 56.5 56.6 56.7 56.8 56.9 57

Savage River Rd

Jesse Green Farm Rd

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Project Components
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Base Data
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Terrain - Slope Map
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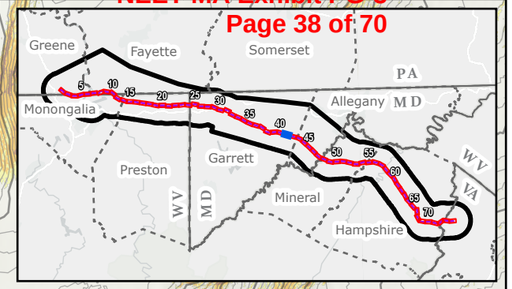
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Miles
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Exhibit PG-4
Slope and Contour Mapbook
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MidAtlantic Resiliency Link

ERM

Coordinate System: NAD 1983 UTM Zone 17N



Potomac Edison 500 kV

57 57.1 57.2 57.3 57.4 57.5 57.6 57.7 57.8 57.9 58 58.1 58.2 58.3 58.4 58.5

Swamp Run

Swamp Rd

Westernport Rd

Jesse Green Farm Rd

Project Components
- Project Endpoints
- Proposed Route Towers
- Milepost
- Proposed Route Centerline
- Proposed Route ROW
- Aerial Easement Blowout Area
- Proposed Route Siting Corridor

Base Data
- Existing High-Voltage Transmission Lines
- County Boundary
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- 5-foot contours
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Terrain - Slope Map
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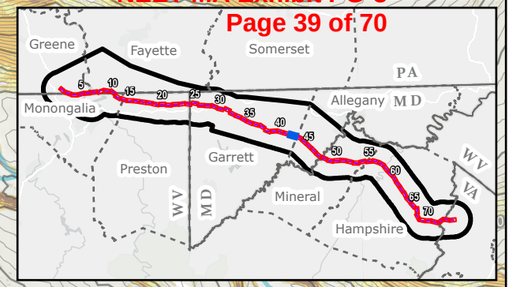
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Exhibit PG-4
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MidAtlantic Resiliency Link

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Potomac Edison 500 kV

58.5 58.6 58.7 58.8 58.9 59 59.1 59.2 59.3 59.4 59.5 59.6 59.7 59.8 59.9 60

Willow Crest Rd

Russell Rd

Project Components
- Project Endpoints
- Proposed Route Towers
- Milepost
- Proposed Route Centerline
- Proposed Route ROW
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Base Data
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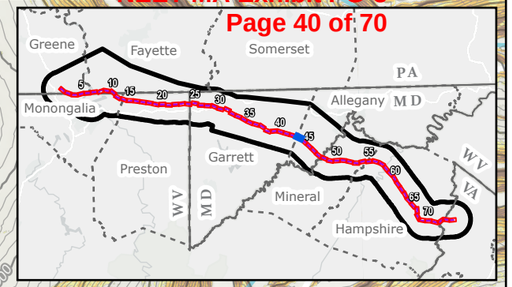
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MidAtlantic Resiliency Link

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Potomac Edison 500 kV

Jacobs Rd

Willow Crest Rd

Seldom Seen Rd SW

Laurel Run Rd SW

Laurel Run

Allegany
Garrett

60 60.1 60.2 60.3 60.4 60.5 60.6 60.7 60.8 60.9 61 61.1 61.2 61.3 61.4 61.5

Project Components
- Project Endpoints
- Proposed Route Towers
- Milepost
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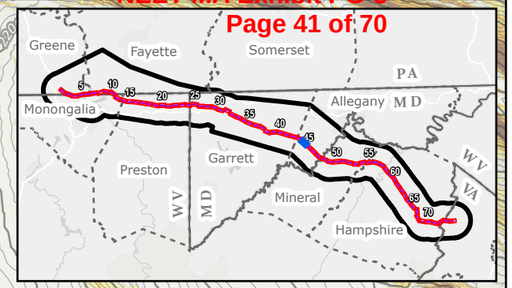
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Exhibit PG-4
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Page 40 of 70
MidAtlantic Resiliency Link

ERM

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Potomac Edison Unknown kV

Potomac Edison 500 kV

Jackson Mountain Rd SW

Better End Rd SW

Georges Creek

Pekin St SW

Pekin St

61.6 61.7 61.8 61.9 62 62.1 62.2 62.3 62.4 62.5 62.6 62.7 62.8 62.9 63 63.1

Project Components
- Project Endpoints
- Proposed Route Towers
- Milepost
- Proposed Route Centerline
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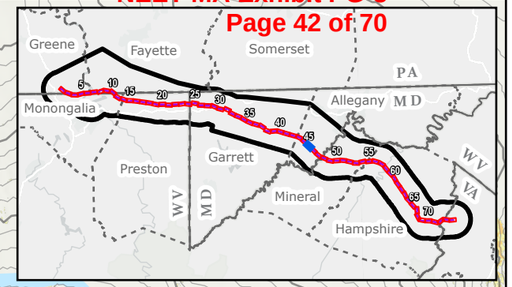
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Potomac Edison 500 kV

63.1 63.2 63.3 63.4 63.5 63.6 63.7 63.8 63.9 64 64.1 64.2 64.3 64.4 64.5 64.6

Longview

Jackson Mountain Rd SW

Project Components
- Project Endpoints
- Proposed Route Towers
- Milepost
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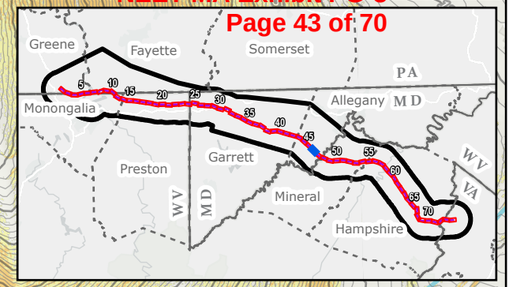
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Page 42 of 70
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Potomac Edison 500 kV

Middle Ridge Rd SW

64.6 64.7 64.8 64.9 65 65.1 65.2 65.3 65.4 65.5 65.6 65.7 65.8 65.9 66 66.1

Project Components
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- Milepost
- Proposed Route Centerline
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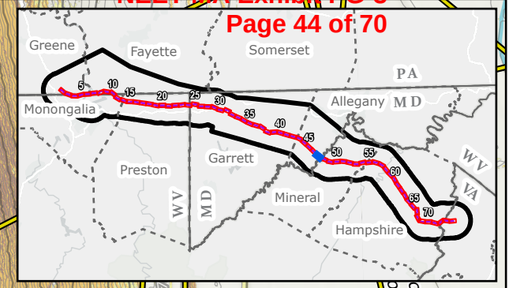
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Coordinate System: NAD 1983 UTM Zone 17N



Middle Ridge Rd SW
Harts N Flowers Rd
Dan Reed Rd
Vandes Ln
Potomac Edison 500 kV
Potomac Edison 138 kV
Allegheny Power Unknown kV
Alt Hill Ln
Carman Dr

66.1 66.2 66.3 66.4 66.5 66.6 66.7 66.8 66.9 67 67.1 67.2 67.3 67.4 67.5 67.6

Project Components
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- Proposed Route Centerline
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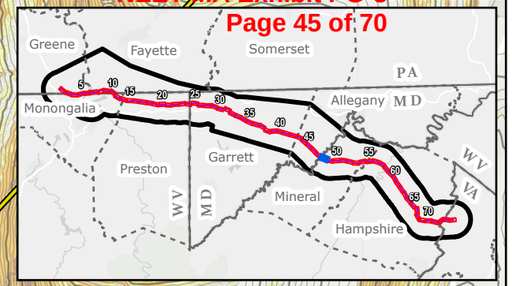
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Coordinate System: NAD 1983 UTM Zone 17N



Potomac Edison 138 kV
Potomac Edison 138 kV
Monongahela Power Company 500 kV
Potomac Edison 138 kV
Potomac Edison Unknown kV
~unknown~ 138 kV
Potomac Edison 138 kV
Monongahela Power Company 500 kV
Allegany
Mineral
MD
WV
Waxler Rd
Co Rte 8
North Branch Potomac River
Ashcabin Run
67.6
67.7
67.8
67.9
68
68.1
68.2
68.3
68.4
68.5
68.6
68.7
68.8
68.9
69
69.1

Project Components
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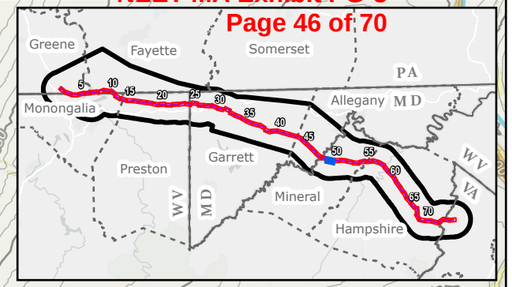
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Coordinate System: NAD 1983 UTM Zone 17N



Co Rte 8 Waxler Rd
Co Rd 9 Knobley
Pargut Run
Monongahela Power Company 500 kV
69.1
69.2
69.3
69.4
69.5
69.6
69.7
69.8
69.9
70
70.1
70.2
70.3
70.4
70.5
70.6
70.7

Project Components
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- Milepost
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- 25-foot contours

Terrain - Slope Map
- Moderately Steep (16° - 20°)
- Steep (21° - 30°)
- Very steep (31° - 90°)

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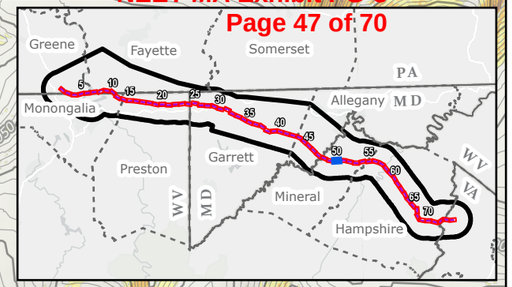
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Miles
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1 inch equals 500 ft (when printed at 11x17)

Exhibit PG-4
Slope and Contour Mapbook
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MidAtlantic Resiliency Link

ERM

FILE: M:\US\Projects\M-O\NextEra\MARL\ArcGIS\CPCN\Testimony Support\NEET_MARL_TestimonySupport.aprx, REVISED: 12/10/2025 SCALE: 1:6,000 when printed at 11x17

Coordinate System: NAD 1983 UTM Zone 17N



Monongahela Power Company 500 kV

70.7 70.8 70.9 71 71.1 71.2 71.3 71.4 71.5 71.6 71.7 71.8 71.9 72 72.1 72.2

Horseshoe Creek

Horseshoe Run

FILE: M:\US\Projects\M-O\NextEra\MARL\ArcGIS\CPCN\Testimony Support\NEET_MARL_TestimonySupport.aprx, REVISED: 12/10/2025 SCALE: 1:6,000 when printed at 11x17

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- County Boundary
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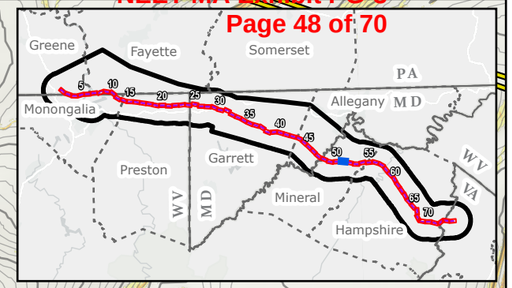
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MidAtlantic Resiliency Link

ERM

Coordinate System: NAD 1983 UTM Zone 17N



Monongahela Power Company 500 kV

72.2 72.3 72.4 72.5 72.6 72.7 72.8 72.9 73 73.1 73.2 73.3 73.4 73.5 73.6 73.7

Ponderosa Pine Ln

Co-Rte 4-617

Horseshoe Run Rd

Patomac Edison 138 kV

Project Components
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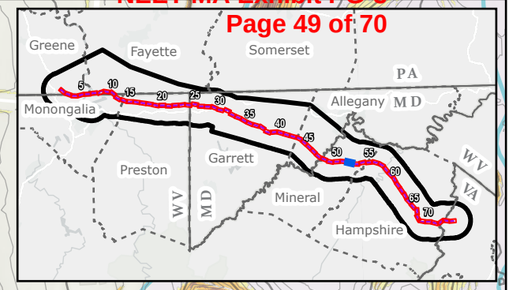
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Potomac Edison 138 kV
Monongahela Power Company 500 kV
Georges Run Rd
Ponderosa Pine Ln
Horseshoe Run Rd Co Rte 46/7
Patterson Creek
Co Rte 10
46
73.7
73.8
73.9
74
74.1
74.2
74.3
74.4
74.5
74.6
74.7
74.8
74.9
75
75.1
75.2
Co Rte 46/13
Mill Run
Co Rte 46/12 Deremer Rd Chas Deremer Rd
Kellar Run
Co Rte 46/16

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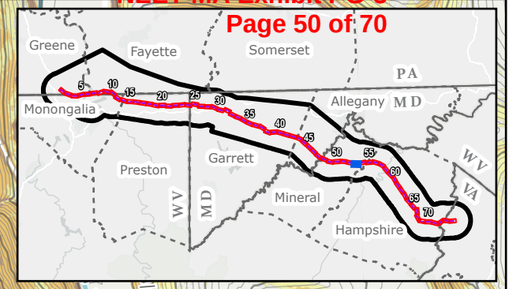
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Page 49 of 70
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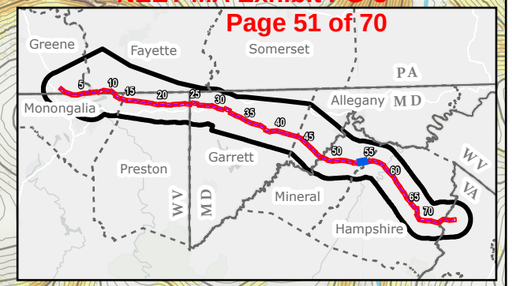
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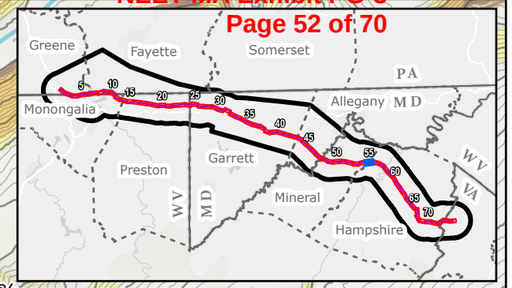
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Page 51 of 70
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ERM

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Monongahela Power Company 500 kV

Keller Run
Dennison Hollow
Donaldson Loop Rd Co Rte 19
Dennison Hollow Rd
Co Rte 17
Green Spring Run
Goldsborough Rd Co Rte 28/9
Mineral
Hampshire
Abernathy Run
Goldsborough Co Rte 28/9 Rd
Don Kenney Dr
28

78.3 78.4 78.5 78.6 78.7 78.8 78.9 79 79.1 79.2 79.3 79.4 79.5 79.6 79.7 79.8 79.9

Project Components
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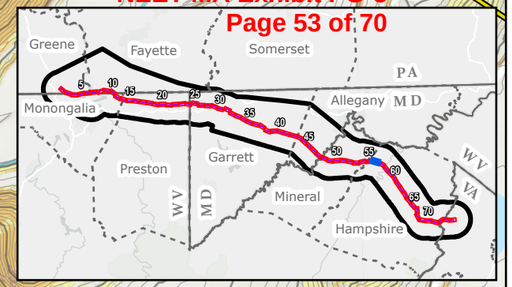
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Exhibit PG-4
Slope and Contour Mapbook
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MidAtlantic Resiliency Link

ERM

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Coordinate System: NAD 1983 UTM Zone 17N



Green Spring Run

Monongahela Power Company 500 kV

79.9 80 80.1 80.2 80.3 80.4 80.5 80.6 80.7 80.8 80.9 81 81.1 81.2 81.3 81.4

Trellis Dr

Co Rte 1

Greenspring

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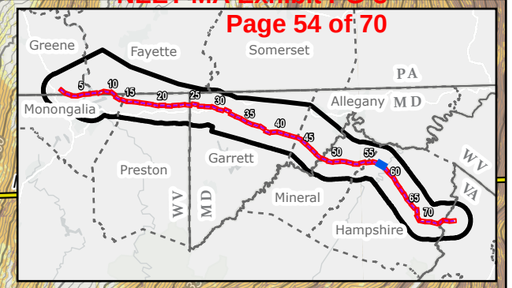
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Miles
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Exhibit PG-4
Slope and Contour Mapbook
Page 53 of 70
MidAtlantic Resiliency Link

ERM



Gladstone Rd
Prestine Ln
Trellis Dr
Swisher Hollow Rd
White Horse Loop
Potomac Edison 138 kV

82 82.1 82.2 82.3 82.4 82.5 82.6 82.7 82.8 82.9 83 83.1 83.2
81.5 81.6 81.7 81.8 81.9

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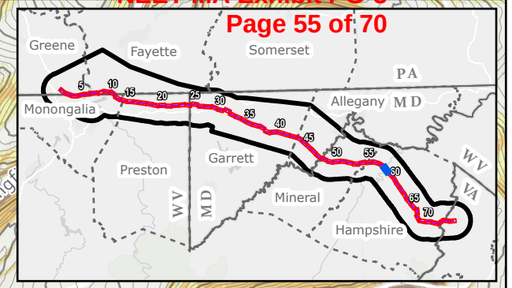
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Exhibit PG-4
Slope and Contour Mapbook
Page 54 of 70
MidAtlantic Resiliency Link

ERM

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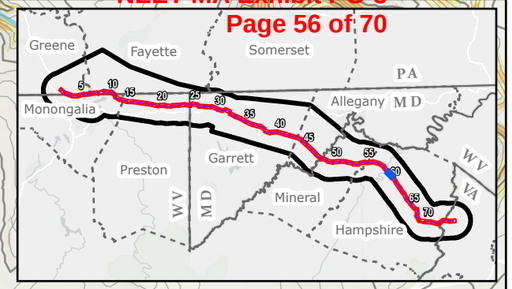
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Page 55 of 70
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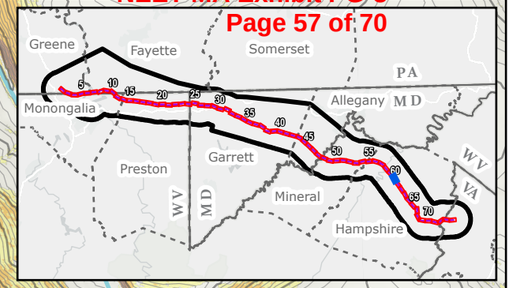
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Page 56 of 70
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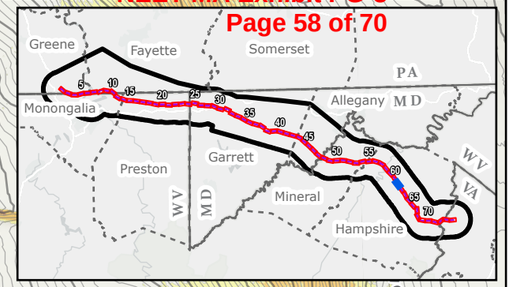
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Exhibit PG-4
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Page 58 of 70
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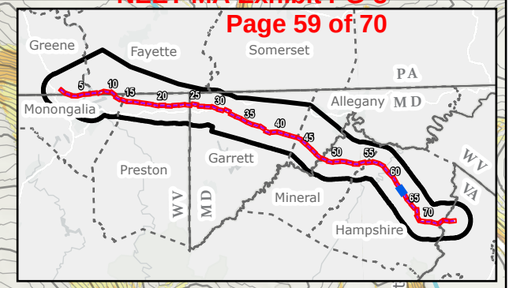
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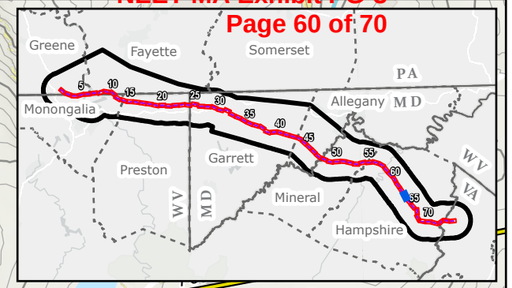
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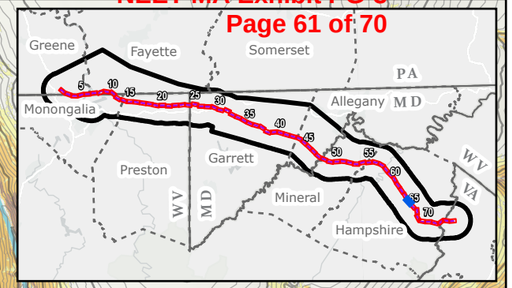
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- Very steep (31° - 90°)

NOTES
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2. *Data source: NEET, ERM, USGS, REXTAG*

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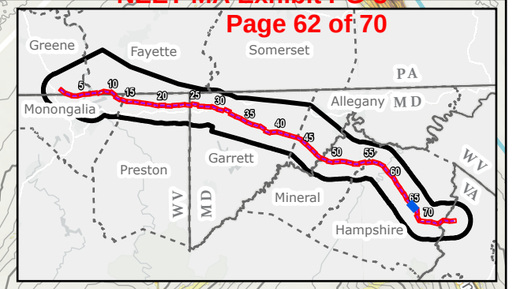
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Exhibit PG-4
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MidAtlantic Resiliency Link

ERM

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Coordinate System: NAD 1983 UTM Zone 17N



Project Components
- Project Endpoints
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- Milepost
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Base Data
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- County Boundary
- State Border

LiDAR Elevation Contours
- 5-foot contours
- 25-foot contours

Terrain - Slope Map
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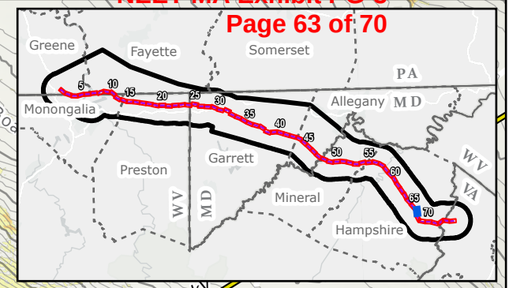
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95.2 95.3 95.4 95.5 95.6 95.7 95.8 95.9 96 96.1 96.2 96.3 96.4 96.5 96.6 96.7 96.8 96.9 97 97.1

Potomac Edison 138 kV

Big Horn Trl

Red Fern Ln

North River

Hickory Corner Rd

Co Rte 4/2 - N River

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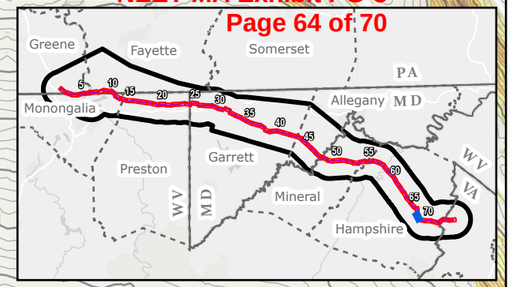
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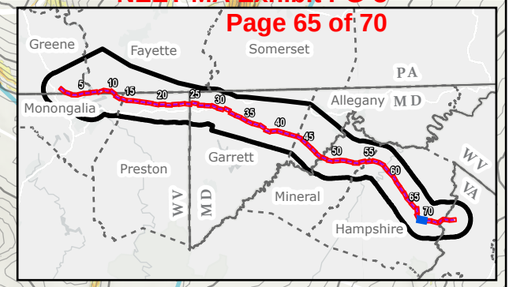
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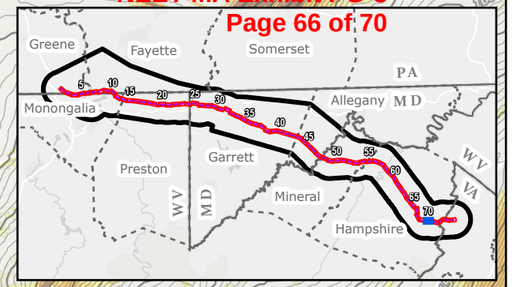
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100.5 100.6 100.7 100.8 100.9 101 101.1 101.2 101.3 101.4 101.5 101.6 101.7 101.8 101.9 102

Project Components
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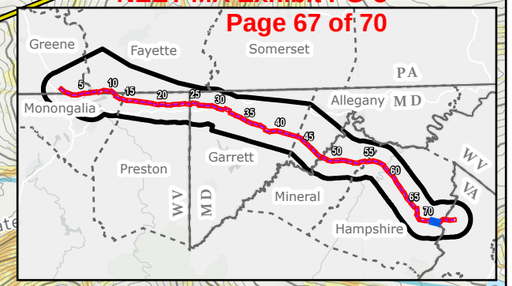
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Potomac Edison 138 kV
Cacapon River
Cacapon River Rd
Capon River
Christian Church Rd
Co Rte 13
Co Rte 1/3
Co Rte 13/5
Glenco School Rd
Co Rd 14
Cacapon River Rd
102
102.1
102.2
102.3
102.4
102.5
102.6
102.7
102.8
102.9
103
103.1
103.2
103.3
103.4
103.5

Project Components
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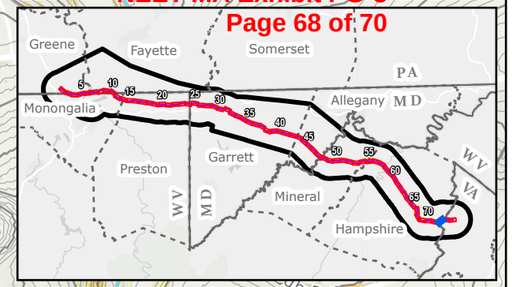
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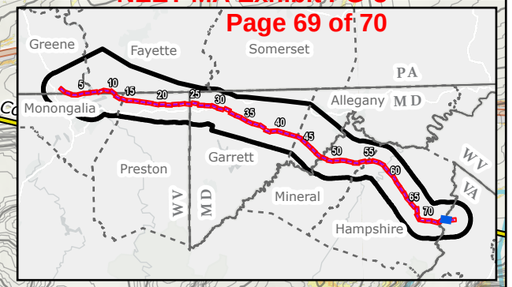
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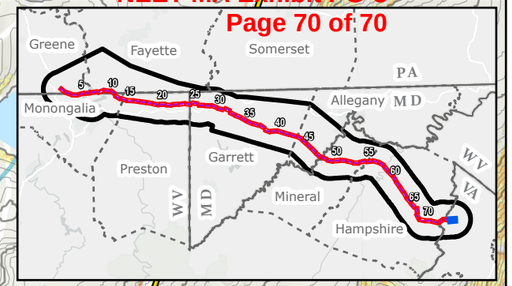
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Virginia Electric & Power Company (Dominion) 500 kV
Potomac Edison 138 kV
~unknown~ 500 kV
~unknown~ 230 kV
~unknown~ 138 kV
Handoff Point
106.6
106.7
106.8
106.9
107
107.1
107.2
107.3
107.4
Shenandoah Valley Electric Cooperative Unknown kV
Marpole Ln
Isaacs Creek
Deer Run Rd
Overlook Rd
Pond Rd
Parishville Rd
State Rte 610
State Rte 703
Whitacre Rd
Old Rte 50
Anchorage Ln
Welbourne Ln
Pugh Ln
State Rte 707
Hollow Rd

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Design Considerations

The proposed MARL Project will meet or exceed all National Electric Safety Code requirements.

Table 1 shows the minimum design conductor clearances for the proposed new 502 Junction to Black Oak and Black Oak to Woodside 500 kV Transmission Line segments owned by NEET MA and NEET VA.

Table 1: Vertical Clearances above Ground, Railway, and Water Surfaces (NESC Rule 232 - Standard Method[1])

Nature of Surface Beneath Conductors	NESC Base Clearance (ft)	Voltage Adder (ft)	Total NESC Clearance (Rounded) (ft)	Buffer[2] (ft)	Design Minimum Vertical Clearances[3] 500 kV (ft)
Track rails of railroads (except electrified railroads using overhead trolley conductors)	26.5	9.9	36.5	3.0	39.5
Roads, streets, and other areas subject to truck traffic (basic minimum clearance)	18.5	9.9	28.5	3.0	31.5
Other land, such as cultivated, grazing, forest, or orchard, that is traversed by vehiclesOther land, such as cultivated, grazing, forest, or orchard, that is traversed by vehicles	18.5	9.9	28.5	3.0	31.5
Water areas not suitable for sail boating or where it is prohibited	17.0	9.9	27.0	3.0	30.0
Water areas suitable for sail boating:					
• Area < 20 acres	20.5	9.9	30.5	3.0	33.5
• Area 20 acres - 200 acres	28.5	9.9	38.5	3.0	41.5
• Area 200 acres - 2,000 acres	34.5	9.9	44.5	3.0	47.5
• Area >2,000 acres	40.5	9.9	50.5	3.0	53.5
Public or private lands and water areas posted for rigging/launching sailboats	Clearance above ground shall be 5 ft greater than the required water area clearance for the type of water area served by the launching site.				

Notes:

1. Clearance values are based on a 500 kV nominal voltage with a 1.10 overvoltage multiplier.
2. Design clearances include 3 ft minimum adder on NESC minimum clearances.
3. Where applicable, clearances shall not be less than those specified by Rule 232C1c.

Table 2 lists the inputs utilized for the conductor thermal rating analyses of the proposed new 502 Junction to Black Oak and Black Oak to Woodside 500 kV Transmission Line segments owned by NEET MA and NEET VA.

Table 2: Conductor Ampacity Calculations Parameters	
Parameter	**Condition**
Ambient Air Temperature - Summer	35°C (95°F)
Ambient Air Temperature - Winter	10°C (50°F)
Emissivity	0.7
Absorptivity	0.8
Wind speed	2.0 ft/s
Wind direction	Perpendicular to conductor (90°)
Elevation	Per Local Elevation Assumed Maximum of 3,000 ft
Total Solar and Sky Radiated Heat Flux	93 W/sq. ft.
Conductor thermal limit	105°C (221°F) (Steady-State) 120°C (248°F) (Emergency)
Load Dump Duration	15 minutes
Load before t=0 for Load Dump	100% of steady state loading

Table 3 lists the conductor thermal ratings of the proposed new 502 Junction to Black Oak and Black Oak to Woodside 500 kV Transmission Line segments owned by NEET MA and NEET VA.

Table 3: Conductor Ratings						
Tri-bundle 1780 kcmil 84/19 ACSR "Chukar"						
Ambient Temperature	**Steady State (Per Phase)**		**Emergency 4hr (Per Phase)**		**Load Dump (Per Phase)**	
	Continuous Ampacity (A)	**MVA**	**Continuous Ampacity (A)**	**MVA**	**Ampacity (A)**	**MVA**
50°F (Winter)	6,109	5,291	6,609	5,723	7,041	6,098
59°F (Light Load)	5,940	5,144	6,459	5,594	6,897	5,973
95°F (Summer)	5,184	4,490	5,801	5,023	6,276	5,435

Notes:

1. Conductor ampacity calculated per IEEE 738-2006, steady state rating calculations.
2. The Thermal Calculator within PLS-CADD was utilized to calculate the above ampacity ratings.

Table 4 displays the weather case summary for the proposed new 502 Junction to Black Oak and Black Oak to Woodside 500 kV Transmission Line segments owned by NEET MA and NEET VA.

Table 5-4: Weather Case Summary						
Weather Case Design-nation	Weather Case Description	Wind Speed (mph)	Wind Pressure (psf)	Wire Ice Thickness (in)	Wire Temperature (°F)	Ambient Temperature (°F)
WC_1	NESC 250B Heavy (4 psf, 0.50", 0°F)	39.5	4	0.5	0	0
WC_2	NESC 250C Extreme Wind (94 mph, 60°F)	94	22.6	0	60	60
WC_3	NESC 250D Concurrent Ice & Wind (40 mph, 0.75", 15°F)	40	4.1	0.75	15	15
WC_4	32 Deg, No Wind, NESC District Ice (0.5", 32°F)	0	0	0.5	32	32
WC_5	Ice, no wind (0 psf, 32°F, 0.75" Ice)	0	0	0.75	32	32
WC_6	Extreme Ice (1.25", 0°F)	0	0	1.25	32	0
WC_7	NESC Blowout 234.A.2 (6 psf, 60°F)	48.4	6	0	60	60
WC_8	Construction (2 psf, 60°F)	27.9	2	0	60	60
WC_9	Construction (3 psf, 30°F)	34.2	3	0	30	30
WC_10	No Wind (Swing 1) (52°F)	0	0	0	52	52
WC_11	Moderate Wind (Swing 2) (6 psf, 52°F)	48.4	6	0	52	52
WC_12	Moderate Wind (Swing 3) (6 psf, 60°F)	48.4	6	0	60	60
WC_13	High Wind (Swing 4) (75 mph, 60°F)	75	14.4	0	60	60
WC_14	Galloping Swing (2 psf, 0.5", 32°F)	28	2	0.5	32	32
WC_15	Galloping Sag (0.5", 32°F)	0	0	0.5	32	32
WC_16	Construction and Maintenance (35 mph, 25.3°F)	35	3.1	0	25.3	25.3
WC_17	Unbalanced Ice (0.5"/0.25", 32°F)	0	0	0.5	32	32
WC_18	PJM Extreme Wind (100 mph, 60°F)	100	25.6	0	60	60
WC_19	PJM Concurrent Ice & Wind (40 mph, 0.75", 15°F)	40	4.1	0.75	15	15
WC_20	PJM Heavy Ice (1.25", 0°F)	0	0	1.25	0	0

Table 5-4: Weather Case Summary						
Weather Case Design-nation	Weather Case Description	Wind Speed (mph)	Wind Pressure (psf)	Wire Ice Thickness (in)	Wire Temperature (°F)	Ambient Temperature (°F)
WC_21	PJM Broken Wire and Maintenance (40 mph, 0.5", 32°F)	40	4.1	0.5	32	32
WC_22	PJM Differential Ice (40 mph, 0.5"/0", 32°F)	40	4.1	0.5/0	32	32
WC_23	Uplift (15.3°F)	0	0	0	15.3	15.3
WC_24	AAMT (17.1°F)	0	0	0	17.1	17.1
WC_25	ATCM (25.3°F)	0	0	0	25.3	25.3
WC_26	AAT (52°F)	0	0	0	52	52
WC_27	-20°F Bare	0	0	0	-20	-20
WC_28	0°F Bare	0	0	0	0	0
WC_29	30°F Bare	0	0	0	30	30
WC_30	32°F Bare	0	0	0	32	32
WC_31	50°F Bare	0	0	0	50	50
WC_32	60°F Bare	0	0	0	60	60
WC_33	90°F Bare	0	0	0	90	90
WC_34	120°F Bare	0	0	0	120	90
WC_35	167°F Bare	0	0	0	167	90
WC_36	212°F Bare	0	0	0	212	95
WC_37	221°F Bare	0	0	0	221	95
WC_38	MOT (248°F)	0	0	0	248	95

Table 5 displays the loading conditions for the proposed new 502 Junction to Black Oak and Black Oak to Woodside 500 kV Transmission Line segments owned by NEET MA and NEET VA.

Table 5-5 – Lattice Tower Loading Conditions											
Load Case No.	Load Case Description	Weather Case							Deflection Limit (% of Structure Height AGL)	Condition of Wires	Structure Group Applied
		Weather Case Designation	Wind on Wire (lb./ft²)	Wind on Structure (lb./ft²)	Wind Direction[10]	Radial Ice Thickness[9] (in.)	Conductor Temp. (°F)	Ambient Temp. (°F)			
1	NESC 250B Heavy District	WC_1	4	4	Transverse (NA)	0.5	0	0	NA	Intact, Initial Sag	All
2	NESC 250C Extreme Wind	WC_2	22.6	22.6	Yawed[7]	0	60	60	7%	Intact, Initial Sag	All
3	NESC 250D Extreme Ice & Wind	WC_3	4.1	4.1	Yawed[7]	0.75	15	15	7%	Intact, Initial Sag	All

Table 5-5 – Lattice Tower Loading Conditions											
Load Case No.	Load Case Description	Weather Case							Deflection Limit (% of Structure Height AGL)	Condition of Wires	Structure Group Applied
		Weather Case Designation	Wind on Wire (lb./ft²)	Wind on Structure (lb./ft²)	Wind Direction[10]	Radial Ice Thickness[9] (in.)	Conductor Temp. (°F)	Ambient Temp. (°F)			
4	Everyday Non-Deadend	WC_32	0	0	-	0	60	60	2%	Intact, Initial Sag	Tangent, Angle
5	Everyday Deadend	WC_32	0	0	-	0	60	60	1%	Intact, Initial Sag	Strain, Deadend
6	Static Construction Snub 3:1 + Vertical Load[1]	WC_16	3.1	3.1	Transverse (NA)	0	25.3	25.3	NA	1 of 2 wires snubbed, others intact, Initial Sag	Angle, Strain, Deadend
7	Conductor Construction Snub 3:1 + Vertical Load[1]	WC_16	3.1	3.1	Transverse (NA)	0	25.3	25.3	NA	1 of 3 phases snubbed, others intact, Initial Sag	Angle, Strain, Deadend
8	Maintenance[2]	WC_16	3.1	3.1	Transverse (NA)	0	25.3	25.3	NA	Intact, Initial Sag	All
9	Broken Shield Wire[5]	WC_26	0	0	-	0	52	52	NA	1 of 2 wires broken in the most impactful configuration, Final (Creep) Sag	Angle, Strain
10	Broken Conductor[5]	WC_26	0	0	-	0	52	52	NA	1 of 3 phases broken in the most impactful configuration, Final (Creep) Sag	Angle, Strain
11	Unbalanced Ice[11]	WC_17	0	0	-	0.5" Ahead or back, 0.25" opposite direction	32	32	NA	Ice load 1 Ahead or Back, Ice load 2 opposite side, Final (Creep) Sag	All
12	Stringing Deadend	WC_16	3.1	3.1	Transverse (NA)	0	25.3	25.3	NA	Ahead Span or Back Span only, Initial Sag	Strain
13	NESC 250B Heavy Deadend	WC_1	4	4	Transverse (NA)	0.5	0	0	NA	Ahead Span or Back Span only, Initial Sag	Deadend

Table 5-5 – Lattice Tower Loading Conditions											
Load Case No.	Load Case Description	Weather Case							Deflection Limit (% of Structure Height AGL)	Condition of Wires	Structure Group Applied
		Weather Case Designation	Wind on Wire (lb./ft²)	Wind on Structure (lb./ft²)	Wind Direction[10]	Radial Ice Thickness[9] (in.)	Conductor Temp. (°F)	Ambient Temp. (°F)			
14	NESC 250C Extreme Wind Deadend	WC_2	22.6	22.6	Transverse (NA)	0	60	60	7%	Ahead Span or Back Span only, Initial Sag	Deadend
15	NESC 250D Extreme Ice & Wind Deadend	WC_3	4.1	4.1	Transverse (NA)	0.75	15	15	7%	Ahead Span or Back Span only, Initial Sag	Deadend
16	Oblique Wind	WC_2	22.6	22.6	Oblique	0	60	60	NA	Wind in the most impactful direction, no conductor, no shield wires attached	All
17	Static Construction Bound Stringing Block[6]	WC_26	0	0	-	0	52	52	NA	Longitudinal load simulating a bound stringing block, Initial Sag	All
18	Conductor Construction Bound Stringing Block[6]	WC_26	0	0	-	0	52	52	NA	Longitudinal load simulating a bound stringing block, Initial Sag	All
19	PJM (ASCE 74) Extreme Wind[12]	WC_18	25.6	25.6	Yawed[7]	0	60	60	NA	Intact, Initial Sag	All
20	PJM (ASCE 74) Ice with Concurrent Wind[12]	WC_19	4.1	4.1	Yawed[7]	0.75	15	15	NA	Intact, Initial Sag	All
21	PJM Heavy Ice	WC_20	0	0	-	1.25	0	0	NA	Intact, Initial Sag	All
22	PJM Broken Shield Wire[4,11]	WC_21	4.1	4.1	Transverse (NA)	0.5	32	32	NA	1 of 2 wires broken in the most impactful configuration, Initial Sag	Tangent, Angle, Strain
23	PJM Broken Sub-Conductor[4,11]	WC_21	4.1	4.1	Transverse (NA)	0.5	32	32	NA	1 of 3 sub-conductors broken in the most impactful configuration, Initial Sag	Tangent, Angle, Strain
24	PJM Maintenance[3]	WC_21	4.1	4.1	Transverse (NA)	0.5	32	32	NA	Intact, Initial Sag	All

Table 5-5 – Lattice Tower Loading Conditions											
Load Case No.	Load Case Description	Weather Case							Deflection Limit (% of Structure Height AGL)	Condition of Wires	Structure Group Applied
		Weather Case Designation	Wind on Wire (lb./ft²)	Wind on Structure (lb./ft²)	Wind Direction[10]	Radial Ice Thickness[9] (in.)	Conductor Temp. (°F)	Ambient Temp. (°F)			
25	PJM Differential Ice[11]	WC_22	4.1	4.1	Transverse (NA)	0.5" Ahead or back, 0" opposite direction	32	32	NA	Ice load 1 Ahead or Back, Ice load 2 opposite side, Final (Creep) Sag	All
26	PJM (ASCE 74) Extreme Wind Deadend[12]	WC_18	25.6	25.6	Transverse (NA)	0	60	60	NA	Ahead Span or Back Span only, Initial Sag	Deadend
27	PJM (ASCE 74) Ice with Concurrent Wind Deadend[12]	WC_19	4.1	4.1	Transverse (NA)	0.75	15	15	NA	Ahead Span or Back Span only, Initial Sag	Deadend
28	PJM Heavy Ice Deadend	WC_20	0	0	-	1.25	0	0	NA	Ahead Span or Back Span only, Initial Sag	Deadend
29	Maintenance Fall Protection[8]	WC_16	3.1	3.1	Transverse (NA)	0	25.3	25.3	NA	Point Load Applied to Tower Arms or Bridge, Intact, Initial Sag	All

Notes:

1. Construction Snub Load: An assumed vertical load equal to 1/3 of the stringing tension, to account for 3:1 slope for pulling/tensioning equipment location. Loading shall be applied at any one static or at any one conductor attachment point in order to produce the worst-case loading scenario.
    a. Snub loading conditions were not applied to tangent towers. Site-specific loading due to snubbing during construction will be analyzed on a case-by-case basis
2. In addition to wire load, a 300 lb vertical point load at each conductor attachment where a single construction or maintenance person could stand or otherwise be supported.
3. In addition to wire load, a 250 lb vertical point load at each conductor attachment where a single construction or maintenance person could stand or otherwise be supported.
4. Any one phase conductor or static wire is assumed broken. For bundled phase conductors, one sub-conductor of any one phase bundle shall be assumed broken, the other sub-conductor(s) of that phase shall be assumed intact. All other conductors and static wires are intact. The longitudinal load shall be the tension of the broken static wire or broken sub conductor.
5. All sub-conductors of one phase or one static wire is assumed broken.
6. Longitudinal load is determined by considering the conductor stringing equal to 50% sagging tension, conductor hung in block.
7. Wind is applied at 0°, 15°, 30°, 45°, and 90° with respect to the bisector.
8. A 5-kip factored load is applied to each attachment point, one point at a time.
9. The density of ice is assumed to be 57 lb/ft³.
10. Where wind is specified as 'Transverse (NA)', the magnitude of the wind load on the wires will be calculated assuming the wind is normal to all wires and the calculated magnitude will be applied in the transverse direction. Wind on the tower will be applied in the transverse `direction. Where wind is specified as "Oblique" the wind shall be applied in the direction that has the most impact to the structure.
11. The tension for conductor suspension assemblies may be reduced by the assumed insulator swing. The tension relaxation for OPGW/OHSW suspension assemblies and strain assemblies will not be considered.
12. Per the PJM Designated Entity Standard, Sections 3.2.1.2 and 3.2.1.3, PJM Extreme Wind and PJM Extreme Ice with Concurrent Wind load cases correspond to a 100-year return period as defined in ASCE Manual of Practice 74-20.

Table 6 displays the overload factors to be used with Table 5-5 for the proposed new 502 Junction to Black Oak and Black Oak to Woodside 500 kV Transmission Line segments owned by NEET MA and NEET VA.

Table 6 – Overload Factors					
Load Case No.	Case Description	Overload Factor			
		Vertical	Transverse Wind	Line Tension	Wind on Tower
1	NESC 250B Heavy	1.5	2.5	1.65	2.5
2	NESC 250C Extreme Wind	1.0	1.0	1.0	1.0
3	NESC 250D Extreme Ice & Wind	1.0	1.0	1.0	1.0
4	Everyday Non Deadend	1.0	1.0	1.0	1.0
5	Everyday Deadend	1.0	1.0	1.0	1.0
6	Static Construction Snub 3:1 + Vertical Load	1.5	1.5	1.5	1.5
7	Conductor Construction Snub 3:1 + Vertical Load	1.5	1.5	1.5	1.5
8	Maintenance	1.5	1.5	1.5	1.5
9	Broken Shield Wire	1.0	1.0	1.0	1.0
10	Broken Conductor	1.0	1.0	1.0	1.0
11	Unbalanced Ice	1.0	1.0	1.0	1.0
12	Stringing Deadend	1.25	1.25	1.25	1.25
13	NESC 250B Heavy Deadend	1.5	2.5	1.65	2.5
14	NESC 250C Extreme Wind Deadend	1.0	1.0	1.0	1.0
15	NESC 250D Extreme Ice & Wind Deadend	1.0	1.0	1.0	1.0
16	Oblique Wind	1.0	1.0	1.0	1.0
17	Static Construction – Bound Stringing Block	1.0	1.0	1.0	1.0
18	Conductor Construction – Bound Stringing Block	1.0	1.0	1.0	1.0
19	PJM (ASCE 74) Extreme Wind	1.0	1.0	1.0	1.0
20	PJM (ASCE 74) Ice with Concurrent Wind	1.0	1.0	1.0	1.0
21	PJM Heavy Ice	1.0	1.0	1.0	1.0
22	PJM Broken Shield Wire	1.0	1.0	1.0	1.0
23	PJM Broken Sub-Conductor	1.0	1.0	1.0	1.0
24	PJM Maintenance	1.5	1.5	1.5	1.5
25	PJM Differential Ice	1.0	1.0	1.0	1.0
26	PJM (ASCE 74) Extreme Wind Deadend	1.0	1.0	1.0	1.0
27	PJM (ASCE 74) Ice with Concurrent Wind Deadend	1.0	1.0	1.0	1.0
28	PJM Heavy Ice Deadend	1.0	1.0	1.0	1.0
29	Maintenance Fall Protection	1.5	1.5	1.5	1.5

Table 7 and 8 display the strength reduction factors for the proposed new 502 Junction to Black Oak and Black Oak to Woodside 500 kV Transmission Line segments owned by NEET MA and NEET VA.

Table 7 – Strength Factors for Structures (NESC Table 261)		
Strength factors for use with NESC 250B load case in Table 5-5		
Description	**NESC**	**Project Specific**
Metal and Pre-Stressed Concrete Structures	1.0	1.0
Wood and Reinforced Concrete Structures	0.65	0.65
Guy Wires	0.9	0.9
Guy Anchors and Foundations	1.0	-
Hardware	1.0	1.0
Strength factors for use with NESC 250C and NESC 250D load cases in Table 5-5		
Description	**NESC**	**Project Specific**
Metal and Pre-Stressed Concrete Structures	1.0	1.0
Wood and Reinforced Concrete Structures	0.75	0.75
Guy Wires	0.9	0.65
Guy Anchors and Foundations	1.0	-
Hardware	0.8	0.5

Table 8 – Allowable Percentages of Strength Ratings (NESC Table 277-1)			
Insulator Type	**Load Case NESC 250B**	**Load Cases NESC 250C & 250D**	**Strength or Load Rating**
Toughened Glass & Porcelain			
Suspension Type	50%	50%	Combined Mechanical & Electrical
Line & Station Post	40%	40%	Cantilever
	50%	50%	Tension & Compression
Polymer			
Suspension Type	50%	65%	Specified Mechanical Load (SML)
Line Post	50%	50%	Specified Cantilever Load (SCL)
	50%	50%	Specified Tensile Load (STL)

Wire Tension Criteria:
Wire sag and tension shall not exceed the following limits, per the NESC, Rule 261.H.1.:

1. NESC 250B, initial condition, 60% ultimate
2. NESC 250C, initial condition, 80% ultimate
3. NESC 250D, initial condition, 80% ultimate
4. 0°F bare, initial condition, 35% ultimate (Aeolian Vibration Reduction – Heavy District)

5. 0°F bare, final after creep condition, 25% ultimate (Aeolian Vibration Reduction – Heavy District)

In addition, the following project specific limits shall not be exceeded:

6. NESC 250C, initial condition, 60% ultimate
7. NESC 250D, initial condition, 60% ultimate
8. PJM Heavy Ice (1.25" Radial Ice, 0°F Bare), initial condition, 70% ultimate (Fiber Strain Reduction)
9. 0°F bare, final after load condition, 25% ultimate (Aeolian Vibration Reduction – Heavy District)

The sag of the OPGW at 60°F with no ice, no wind shall be approximately 70%-80% of the phase conductor sag at 60°F with no ice, no wind.