Application Attachment E

Routing Study

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ERM

PREPARED FOR
NextEra Energy Transmission MidAtlantic, Inc. and NextEra Energy Transmission Virginia, Inc.

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Routing Study

MidAtlantic Resiliency Link Project

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SIGNATURE PAGE

Routing Study

MidAtlantic Resiliency Link Project

0718854

Heather Heater
Partner

Brett Shaver
Associate Partner

Christine Essick
Partner

Kathleen McDaniel
Principal Technical Consultant

Environmental Resources Management, Inc.

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ACRONYMS AND ABBREVIATIONS

Acronym	Description
BioNet	Biodiversity Conservation Network
CDP	census designated place
COMAR	Code of Maryland Regulations
Dominion Energy	Virginia Electric and Power Company d/b/a Dominion Energy Virginia
ERM	Environmental Resources Management, Inc.
FirstEnergy	FirstEnergy Corp.
FMA	Fisheries Management Area
GIS	Geographic Information System
NHL	National Historic Landmark
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
INA	Irreplaceable Natural Area
kV	kilovolt
Md. Code Ann.	Annotated Code of Maryland
MARL Project	MidAtlantic Resiliency Link Project
MBTA	Migratory Bird Treaty Act
MP	milepost
NEET MA	NextEra Energy Transmission MidAtlantic, Inc.
NEET VA	NextEra Energy Transmission Virginia, Inc.
PA Code	Pennsylvania Code
PJM	PJM Interconnection LLC
Pub. Util.	Public Utilities
ROW	right-of-way
SGL	State Game Land
USACE	U.S. Army Corps of Engineers
Va. Code	Virginia Code
W. VA. Code R.	West Virginia Code of Regulations
WMA	Wildlife Management Area
WVDNR	West Virginia Division of Natural Resources

1. INTRODUCTION

This report summarizes the findings of a routing study (Routing Study) conducted by Environmental Resources Management, Inc. (ERM) on behalf of NextEra Energy Transmission MidAtlantic, Inc. (NEET MA) and NextEra Energy Transmission Virginia, Inc. (NEET VA). The Routing Study evaluated the natural environment, built environment, cultural resources, social resources, and engineering constructability for the MidAtlantic Resiliency Link Project (MARL Project) for NEET MA's and NEET VA's proposed new 107.5-mile, 500 kilovolt (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.[1]

The purpose of the Routing Study was to identify a preferred end-to-end route (Proposed Route) across all four states that meets the following criteria:

1. Reasonably minimizes potential impacts on the natural and built environment (including both the transmission line as well as the access roads and temporary workspaces to facilitate construction).
2. Maximizes placement of proposed infrastructure adjacent to existing linear infrastructure and routing opportunities, where available.
3. Minimizes special design requirements that could result in increased costs (e.g., engineering factors or special structure designs), and can be constructed and operated in a safe, timely, and reliable manner.

1.1 OVERVIEW

PJM Interconnection LLC (PJM) has directed NEET MA and NEET VA to develop, construct, own, operate, and maintain the MARL Project to resolve significant and widespread reliability criteria violations on the Bulk Electric System that serves the PJM Region,[2] due to load growth and anticipated resource retirements in the PJM Region. To meet this purpose and need, the MARL Project will have the following facilities:

- A new single-circuit 500 kV transmission line on lattice structures from the FirstEnergy Corp. (FirstEnergy)-owned 502 Junction Substation to the existing FirstEnergy-owned Black Oak 500/138 kV Substation to an interconnection with new 500 kV transmission lines to be constructed by FirstEnergy and Virginia Electric and Power Company d/b/a Dominion Energy Virginia (Dominion Energy).[3]

[1] NEET MA is responsible for constructing the portions of the MARL Project in Pennsylvania, West Virginia, and Maryland. NEET VA is responsible for constructing the portions of the MARL Project in Virginia, as well as a new 500/138 kV Woodside Substation in Frederick County, Virginia. The permitting of the substation is subject to the siting authority of Frederick County, and information in this Routing Study related to the Woodside Substation is provided for overall context of the full MARL Project.
[2] The PJM Region includes all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and the District of Columbia.
[3] The MARL Project does not include the FirstEnergy and Dominion Energy portions of the PJM-approved West Cluster solutions.

- A new Woodside 500/138 kV substation in Frederick County, Virginia, which will connect to existing Dominion Energy and FirstEnergy infrastructure.[4]

NEET MA's and NEET VA's facilities are collectively referred to as "the MARL Project." Figure 1.1-1 below depicts the MARL Project Study Area.

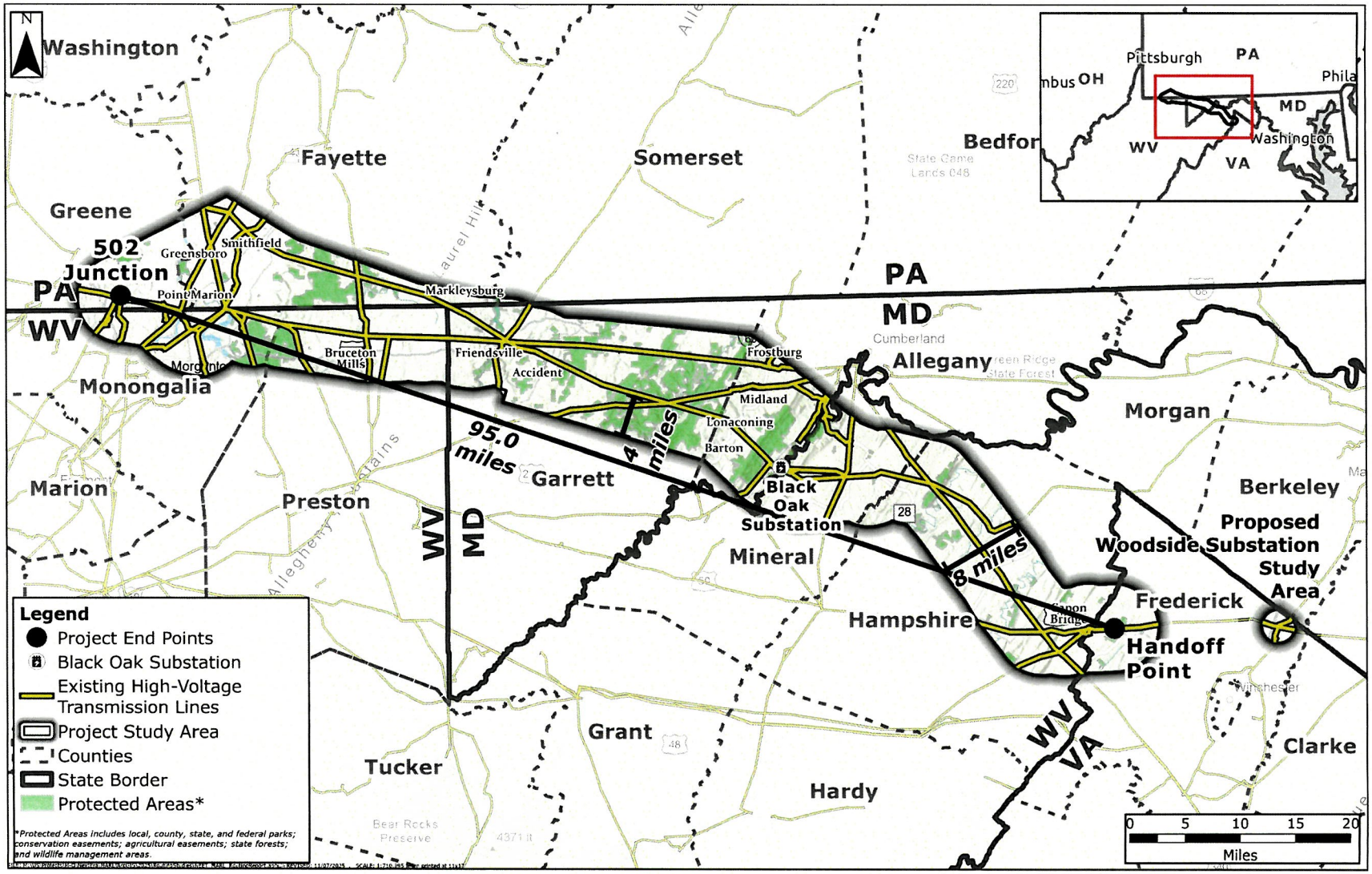
All mileposts (MPs) and distances associated with the MARL Project facilities listed above are rounded to the nearest 0.1 mile, and all land areas are rounded to the nearest 0.1 acre (unless otherwise specified). All references to MPs, distances, and acreages in this document are assumed to be approximate (e.g., a reference to "MP 1.2" or "124.3 acres" means "approximately at MP 1.2" or "approximately 124.3 acres," respectively).

Following PJM's direction to NEET MA and NEET VA to construct the MARL Project, NEET MA and NEET VA assembled a team of experienced internal subject-matter experts that have extensive experience in transmission development, including from its development, Transmission Planning, Engineering and Construction, Environmental Services, Land, Regulatory, Legal, Operations and Maintenance, and Tribal Relations groups, among other teams, and retained ERM as its expert outside routing and siting consultant (hereafter referred to as the "Routing Team") to develop and ultimately select the Proposed Route for the MARL Project. ERM was retained to perform the detailed routing and siting analysis (Routing Study) and prepare associated testimony for the respective state siting applications[5] for approval of the MARL Project as well as the environmental studies and permitting. NEET MA and NEET VA also retained ERM to lead the environmental scope of work associated with the transmission line routing analysis supporting the state siting applications and eventual federal, state, and local environmental permitting for the MARL Project. The ERM team is comprised of environmental scientists, planners, cultural resources specialists, and engineers. ERM was responsible for routing, permitting, and development of the Environmental Review Documents (Appendices A, B, C, and D) as well as supporting agency consultation.

[4] Specifically, the Woodside Substation will connect to Dominion Energy's existing 500 kV Bismark-Doubs transmission line, FirstEnergy's existing Stonewall 138 kV Substation via the Hampshire to Stonewall 138 kV line, and to FirstEnergy's upgraded Gore-Stonewall-Doubs 500 kV transmission line.

[5] NEET MA and NEET VA will be filing four state siting applications with the respective state public utility commissions. NEET MA is filing a Certificate of Public Convenience and Necessity application with the following state utility commissions: Maryland Public Service Commission and Public Service Commission of West Virginia. NEET MA is also filing a Certificate of Public Convenience and a Siting application with the Pennsylvania Public Utilities Commission. NEET VA is filing a Certificate of Public Convenience and Necessity application with the Virginia State Corporation Commission.

FIGURE 1.1-1 MARL PROJECT OVERVIEW AND STUDY AREA



MD = Maryland; PA = Pennsylvania; VA = Virginia; WV = West Virginia

In developing route alternatives for the MARL Project, the Routing Team considered the following:

- Facilities needed to construct and operate the MARL Project;
- Width of new right-of-way (ROW) that would be required;
- Amount of existing and proposed development in the area;
- Potential for impacts on the natural environment, built environment, cultural resources, and social resources;
- Engineering constructability; and
- MARL Project cost.

As discussed in Section 4, ERM identified six feasible Alternative Routes for the MARL Project.

1.2 PROJECT BACKGROUND

The MARL Project was approved by the PJM Board of Managers in December 2023 as part of PJM's annual Regional Transmission Expansion Plan process for 2022 and its resulting competitive solicitation process, which identified projects to address severe reliability issues in the region. As explained further in the respective state commission applications and supporting evidence, the MARL Project is needed to prevent extensive, severe, and widespread thermal overloads and potential voltage collapses, which could compromise the overall system reliability in the PJM Region and lead to widespread and extreme conditions, including system collapse and blackouts that could affect residents and businesses. These reliability needs are driven by exponential load growth in the region, the cumulative impact of generation changes including the deactivation and retirement of 11 gigawatts of generation resources, and changes in PJM's reliability criteria. Refer to the respective state commission applications and supporting testimony for a more detailed description of the MARL Project's background and need.

1.3 SCOPE OF REPORT

This Routing Study presents the steps and findings of how end-to-end route alternatives for the MARL Project were conceived across four states: Pennsylvania, West Virginia, Maryland, and Virginia. An overview map of the MARL Project Study Area is shown on Figure 1.1-1.

The following sections present ERM's overall approach to developing route alternatives that have an endpoint in Pennsylvania and another endpoint in Virginia. In developing the end-to-end route alternatives, ERM considered state-specific requirements and data, while also recognizing that the state-specific environmental data are different in each of the four states. Accordingly, ERM has developed state-specific Environmental Review Documents (Appendices A, B, C, and D) to present the different information that each state authority expects to see.

NEET MA and NEET VA requested ERM's services to define a study area for routing the MARL Project, collect information on routing constraints and opportunities within the study area, identify and compare route alternatives, select a Proposed Route, and document the routing efforts in this report. Mapbooks associated with the Routing Study are included in Appendix E, Mapbooks for Routing Study. More specifically, ERM's scope of work consisted of the following:

- Defining and describing the MARL Project Study Area;

- Gathering and assessing information about routing constraints and opportunities;
- Identifying and mapping routing constraints and opportunities within the MARL Project Study Area;
- Participating in public outreach efforts (e.g., public open houses and agency meetings) to gather input from stakeholders, agency staff, and the public;
- Identifying buildable route alternatives that meet the siting criteria of the four states;
- Comparing Alternative Routes based on an analysis of natural environment, built environment, cultural, and social impacts; and engineering constructability; and
- Recommending the Proposed Route and Alternative Routes to carry forward.

1.4 PROJECT DESCRIPTION

Table 1.4-1 shows the length, footprint acreage, number of structures, and structure characteristics for the six feasible Alternative Routes retained for evaluation analysis for the MARL Project. Refer to the respective state siting applications and supporting testimony for detailed discussions as they relate to engineering specifications for the MARL Project.

1.4.1 ROW WIDTHS AND STRUCTURE TYPES

The MARL Project will be constructed in a new ROW Corridor measuring, on average, 200 feet wide. The MARL Project will require a wider ROW Corridor in some areas where additional aerial easement rights are necessary to comply with electrical standards and requirements[6] (Figure 1.4-1). The full area of required MARL Project-specific ROW Corridor at any given point along the route is hereafter referred to as the "ROW Corridor." The number of aerial easement blowout areas for each Alternative Route are shown in Table 1.4-1, and the ROW Corridor for these areas ranges from 202 feet to 426 feet, averaging 289 feet wide (Figure 1.4-1).

[6] 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.

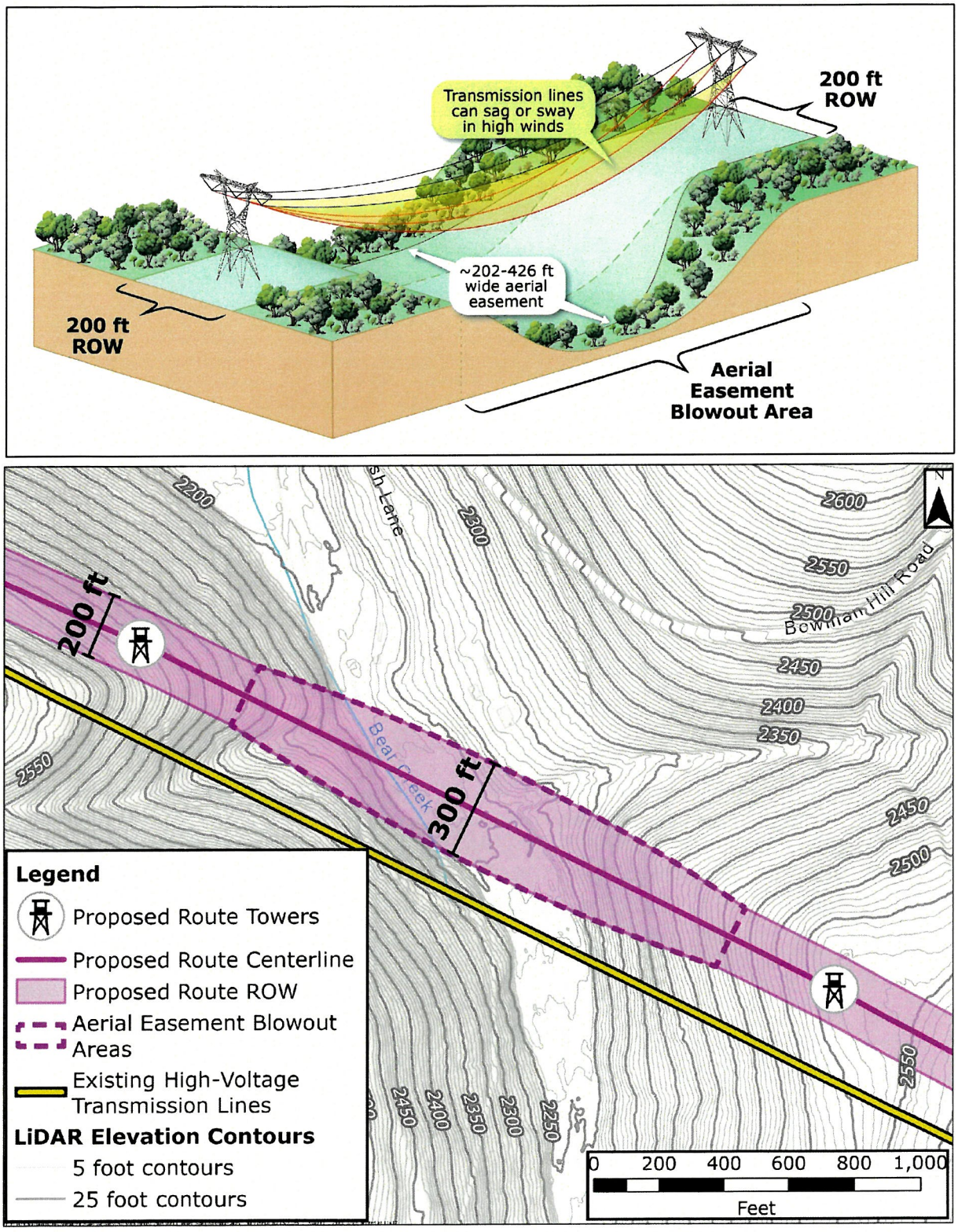
TABLE 1.4-1 PROJECT FEATURES FOR THE FINAL END-TO-END ALTERNATIVE ROUTES

Feature	Alternative Route A	Alternative Route B	Alternative Route C	Alternative Route D	Alternative Route E	Alternative Route F
Centerline Length (miles)	107.5	107.3	113.6	115.2	106.3	119.1
Siting Corridor (acres)	6,208.6	6,197.5	6,598.5	6,798.1	6,180.6	7,112.0
ROW Corridor (acres)	2,669.0	2,671.4	2,835.5	2,839.0	2,651.5	2,964.3
Aerial Easement Blowout Area [a] (count)	24	31	28	24	28	32
Paralleling Existing Transmission Line ROW (miles)	56.4	59.7	64.5	43.1	50.8	43.2
Paralleling Existing Transmission Line ROW (percentage)	52.5%	55.6%	56.8%	37.4%	47.8%	36.3%
Structures (count)	452	452	478	492	446	519
Minimum Structure Height (feet)	85	85	85	85	85	85
Maximum Structure Height (feet)	190	190	190	190	190	190
Average Structure Height (feet)	145	145	145	145	145	140
Average Span Length (feet)	1,258	1,256	1,240	1,224	1,259	1,213
Maximum Span Length (feet)	2,927	2,927	2,955	2,739	2,927	2,955
Spans Greater than 1,600 feet (count)	33	42	31	34	39	38
Estimated Costs	$1,167,236,674	$1,175,521,094	$1,204,723,343	$1,241,099,297	$1,159,876,697	$1,256,130,573

ROW = right-of-way

[a] 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.

FIGURE 1.4-1 GRAPHICAL DEPICTION OF ADDITIONAL AERIAL EASEMENT BLOWOUT AREAS



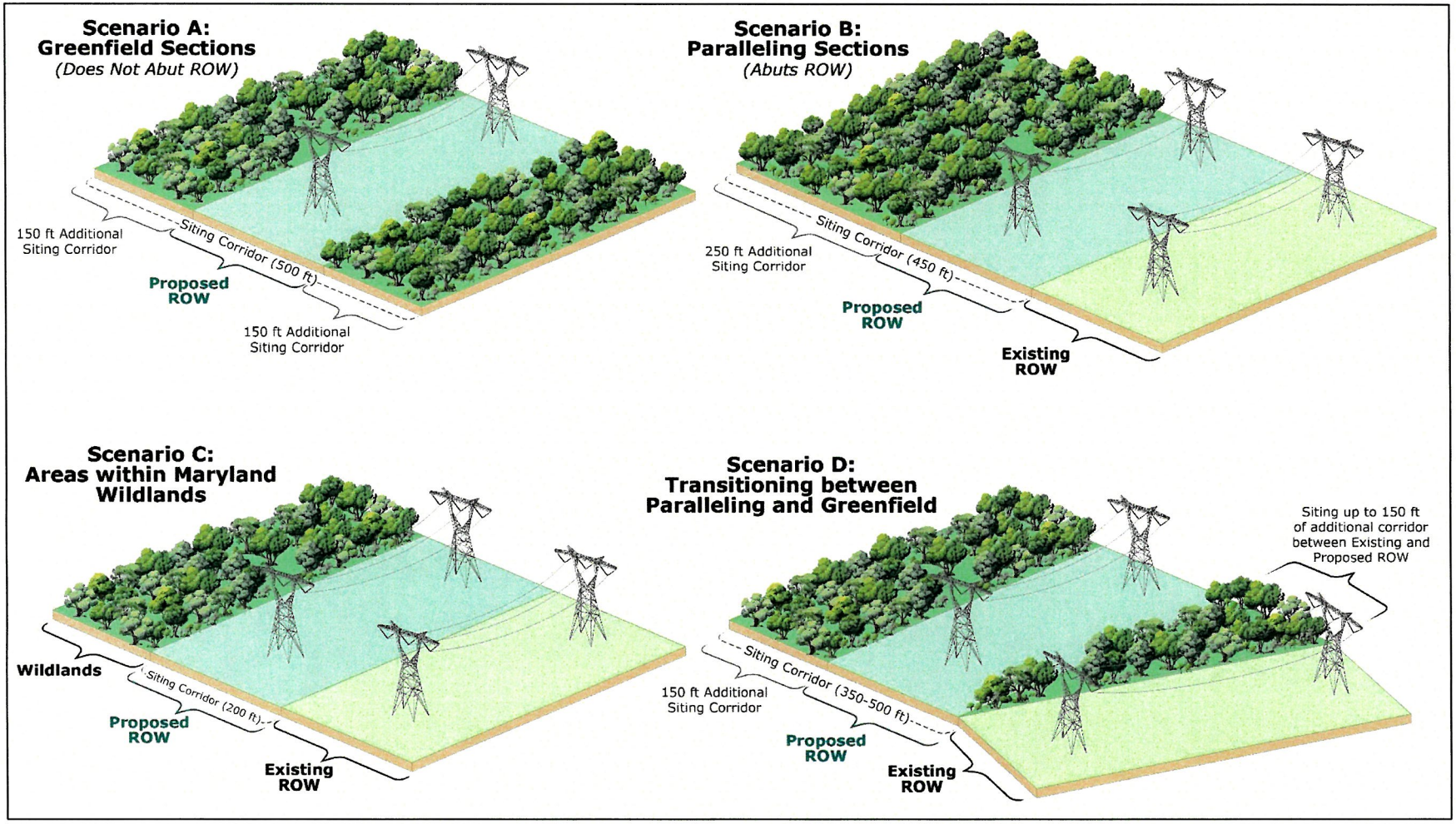
ft = feet; ROW = right-of-way

The MARL Project developed a predefined, Project-specific Siting Corridor, hereafter referred to as the "Siting Corridor," in which existing conditions were assessed to allow for reasonable flexibility to adjust the centerline on either side of the Alternative Routes, if necessary. The Siting Corridor was designed to abut and not overlap the ROW of any existing transmission lines when paralleling. The Siting Corridor width will range from 200 to 500 feet; however, in those areas that require aerial easement blowout, the maximum width for the Siting Corridor will be 715 feet. The Siting Corridor is inclusive of the MARL Project's ROW Corridor. The width of the Siting Corridor varies based on the MARL Project's ROW Corridor width and proximity to existing transmission lines. To account for the varying conditions along the ROW Corridor, such as paralleling existing transmission lines, greenfield sections, and legal requirements in the Maryland Wildlands, the Routing Team developed four scenarios that are shown on Figure 1.4-2 and described below:

A. **Scenario A:** For greenfield sections of the MARL Project that do not abut an existing transmission line corridor, the Siting Corridor is a 150-foot buffer on either side of the ROW Corridor. This typically results in a **500-foot-wide Siting Corridor** except in areas where additional aerial easement blowout rights are necessary.
B. **Scenario B:** For paralleling sections of the MARL Project that abut an existing transmission line corridor, the Siting Corridor is a 250-foot buffer of the ROW Corridor only on the opposite side of the existing transmission line corridor. This typically results in a **450-foot-wide Siting Corridor** except in areas where additional aerial easement blowout rights are necessary.
C. **Scenario C:** For areas of the MARL Project inside the Maryland Wildlands, the Siting Corridor does not extend beyond the ROW Corridor, and is therefore only a **200-foot-wide Siting Corridor.**
D. **Scenario D:** For areas where the MARL Project transitions from paralleling to greenfield sections, the Siting Corridor is a 150-foot buffer of the ROW Corridor on the opposite side of the existing transmission line corridor, and will also be a 150-foot buffer of the ROW Corridor on the side near the existing ROW that does not encroach on the existing transmission line corridor.

For the MARL Project, *paralleling* is defined as siting the proposed transmission line so the MARL Project ROW Corridor abuts the existing transmission line corridor. *Greenfield* is defined as a section of the MARL Project ROW Corridor for any portion of the route that does not abut an existing transmission line corridor.

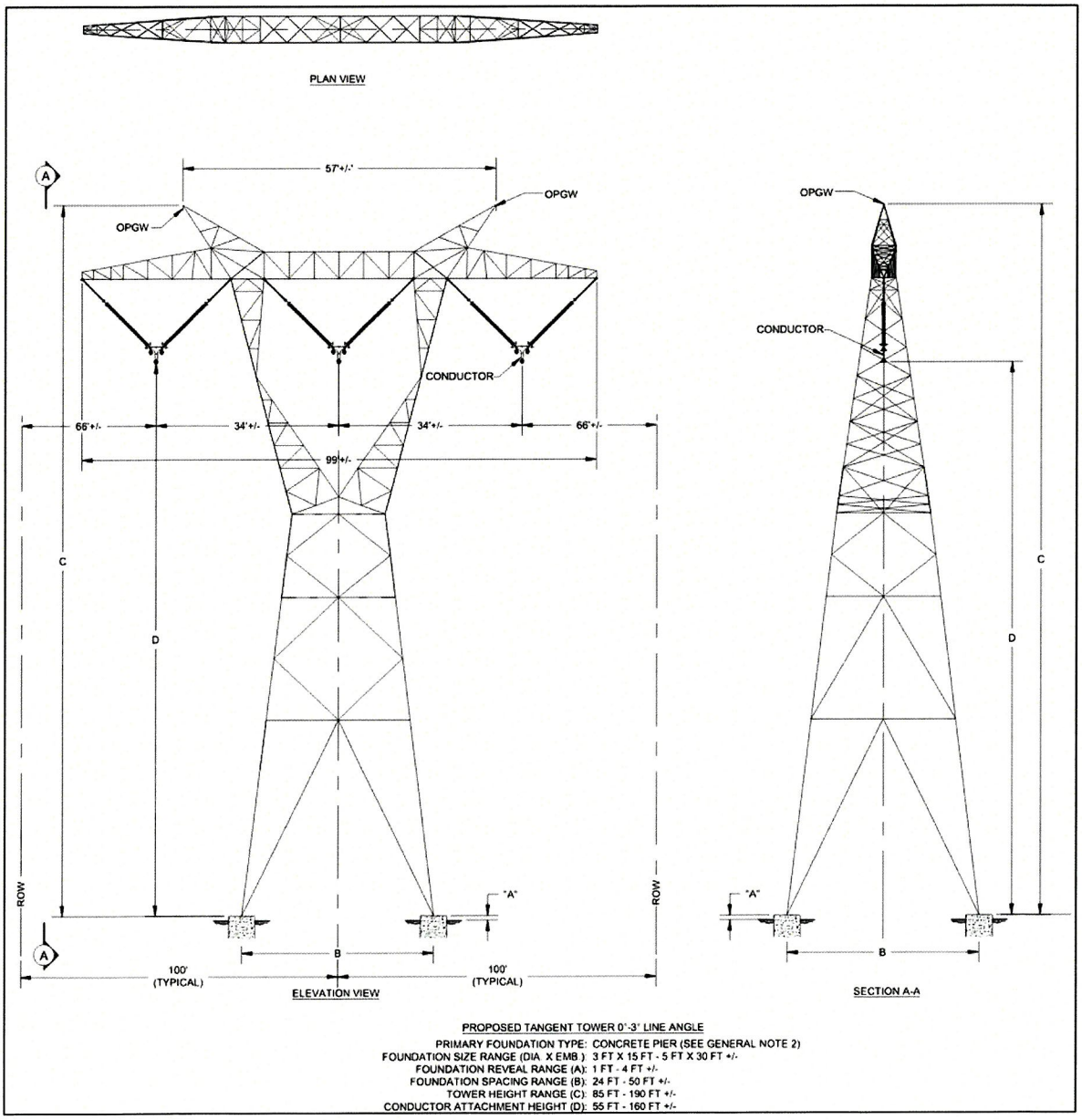
FIGURE 1.4-2 SITING CORRIDOR SCHEMATIC



ft = feet; ROW = right-of-way

NEET MA and NEET VA plan to use primarily lattice steel structures for the MARL Project. The proposed structures for the MARL Project will have four legs and be comprised of steel. Structure heights of all the Alternative Routes range from 85 to 190 feet, with an average structure height dependent on selected route and preliminary conceptual design, excluding foundation reveal. Final structure heights are subject to change based on final engineering. The average distance between towers (span) will be 1,258 feet for the MARL Project, with the span between transmission structures depending on the type of structure used, as well as topography, ground elevation, and nearby constraints. A typical lattice structure is shown on Figure 1.4-3.

FIGURE 1.4-3 TYPICAL LATTICE TRANSMISSION LINE STRUCTURE



FT = feet; OPGW = Optical Ground Wire; ROW = right-of-way

1.4.2 CONSTRUCTION, OPERATION, AND MAINTENANCE PROCESS

Construction of new overhead transmission lines will involve some or all of the steps listed below:

- Detailed survey of the route alignment;
- ROW acquisition and clearing;
- Construction of access roads and work pads, where necessary;
- Installation of tower foundations;
- Assembly and erection of new structures;
- Stringing and tensioning of conductors; and
- Final cleanup and land restoration.

More detailed discussion of the construction, operation, and maintenance process will be provided by the MARL Project's engineering expert (please see Testimony of Philip Givens). Required materials for the MARL Project's 500 kV structures will be delivered to each structure location within the ROW Corridor. Detailed foundation type and design will be determined based on the final engineering design, geophysical surveys, and geotechnical investigations prior to construction. Typical installation will be drilled piers with reinforced concrete; however, micropiles may be used in certain circumstances. Other foundation types will be considered on an as-needed basis. Structures will be erected with a crane or flown in via helicopter and anchored to the foundation during final assembly. In upland areas, the minimal amount of soils from each structure foundation construction will be used onsite to regrade the final ROW back to preconstruction conditions, to the maximum extent practicable. In wetland areas, excess soil will be removed from the excavation and hauled to an upland site within the ROW Corridor to be respread and stabilized. Typical construction equipment may include feller-bunchers, chippers, excavators or drilling equipment, earth moving equipment (e.g., bulldozer), cranes, wire stringing pullers and tensioners, skidsteers, backhoes, and trucks. To comply with state stormwater requirements, NEET MA and NEET VA will obtain coverage under the appropriate state stormwater permit for construction activities prior to any ground disturbance. A MARL Project-specific Erosion and Sediment Control Plan and Stormwater Pollution Prevention Plan will be developed in coordination with state and local agencies to meet applicable requirements, using best management practices.

Once the MARL Project is in-service, maintenance of the ROW Corridor under the transmission lines will be essential for the reliable operation of the lines as well as for public safety. Operation and maintenance of the MARL Project will include periodic inspections of the line and ROW Corridor and periodic vegetation management. Periodic inspections will occur through both aerial and ground patrols. Please refer to Appendix F for NEET MA's and NEET VA's Vegetation Management Plan.

2. METHODOLOGY

The process of routing a new electric transmission line begins with the definition of a study area encompassing and surrounding the beginning and endpoints for the new line. This is followed by evaluating routing opportunities and constraints within the study area, such as paralleling opportunities (e.g., roads or existing utility lines), land uses, planned developments, and environmental, visual, recreational, and cultural features. The study area is adjusted as needed based on constraints and opportunities. Feasible route alternatives, which avoid constraints and use opportunities to the extent practicable, are developed. Communication with stakeholders and analysis of impacts result in adjustments to routes throughout the process.

The fundamental objectives of the routing process are the same regardless of project or location: maximize paralleling opportunities with compatible linear features or land uses; avoid, and where avoidance cannot be achieved, minimize impacts, and then mitigate impacts where appropriate to the natural environment, built environment, cultural resources and social resources; incorporate engineering constructability to minimize to the extent practicable special engineering design requirements; and provide feasible, efficient, and equitable route alternatives that meet the purpose and need of a project.

2.1 GOAL OF THE ROUTING STUDY

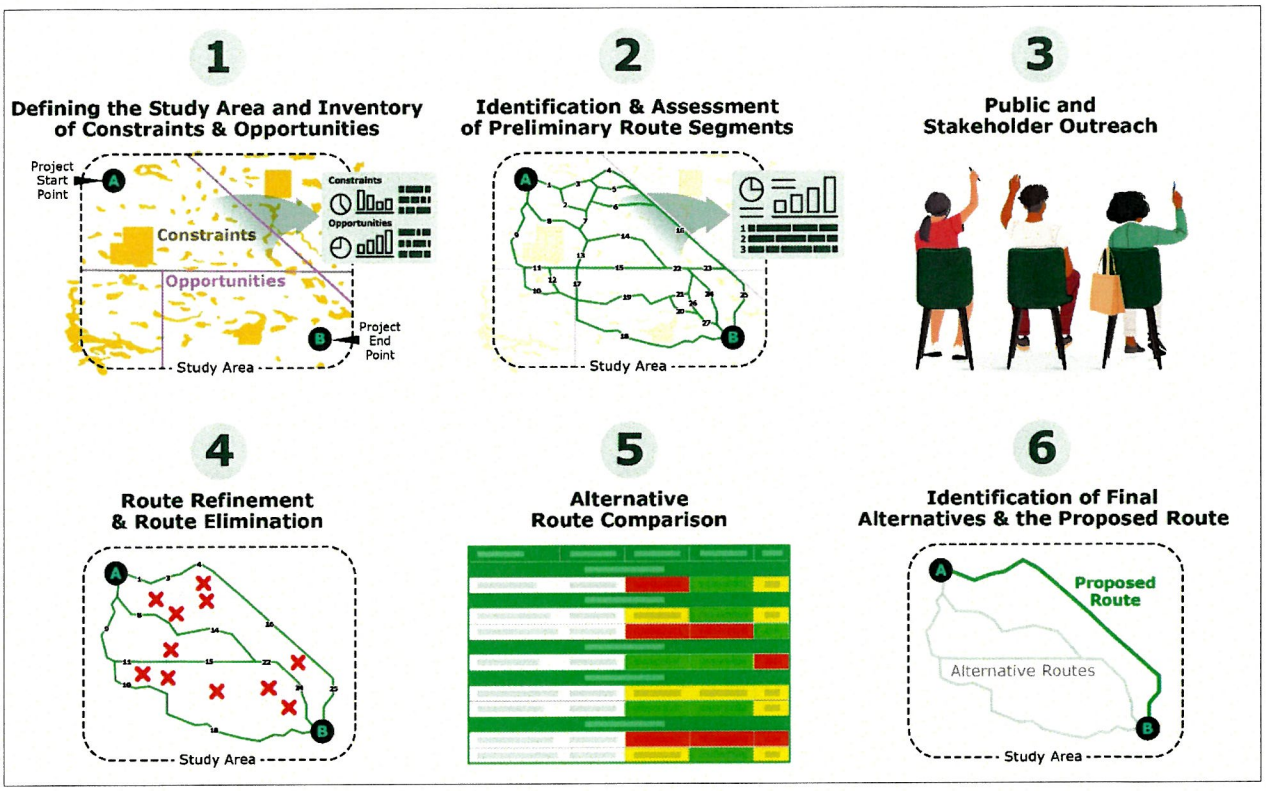
The goal of the routing process was to identify Alternative Routes that meet the technical and economic needs of the MARL Project while avoiding potential constraints (e.g., sensitive environmental resources, residential dwellings) and taking advantage of opportunity areas (e.g., existing linear infrastructure) to the greatest extent possible. Furthermore, the goal was to identify and evaluate opportunities and environmental constraints in the MARL Project Study Area to 1) facilitate the development of feasible Alternative Routes; 2) evaluate potential impacts associated with the Alternative Routes; and 3) ultimately, identify a Proposed Route that meets the MARL Project need that is constructable. The Proposed Route is the superior 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.

The Routing Study involved five main steps that included:

1. Definition of the MARL Project Study Area;
2. Identification of constraints and opportunities;
3. Identification and assessment of preliminary routes;
4. Execution of field reconnaissance and stakeholder engagement including open houses; and
5. Implementation of quantitative and qualitative analysis to identify feasible route alternatives, including the Proposed Route.

Furthermore, route viability was assessed through permitting risk, constructability, ROW acquisition, and cost after the least impactful alternatives were identified. As outlined below, the routing process establishes how the Routing Team identifies routes, screens route alternatives, and selects a Proposed Route (Figure 2.1-1).

FIGURE 2.1-1 TYPICAL ROUTING PROCESS

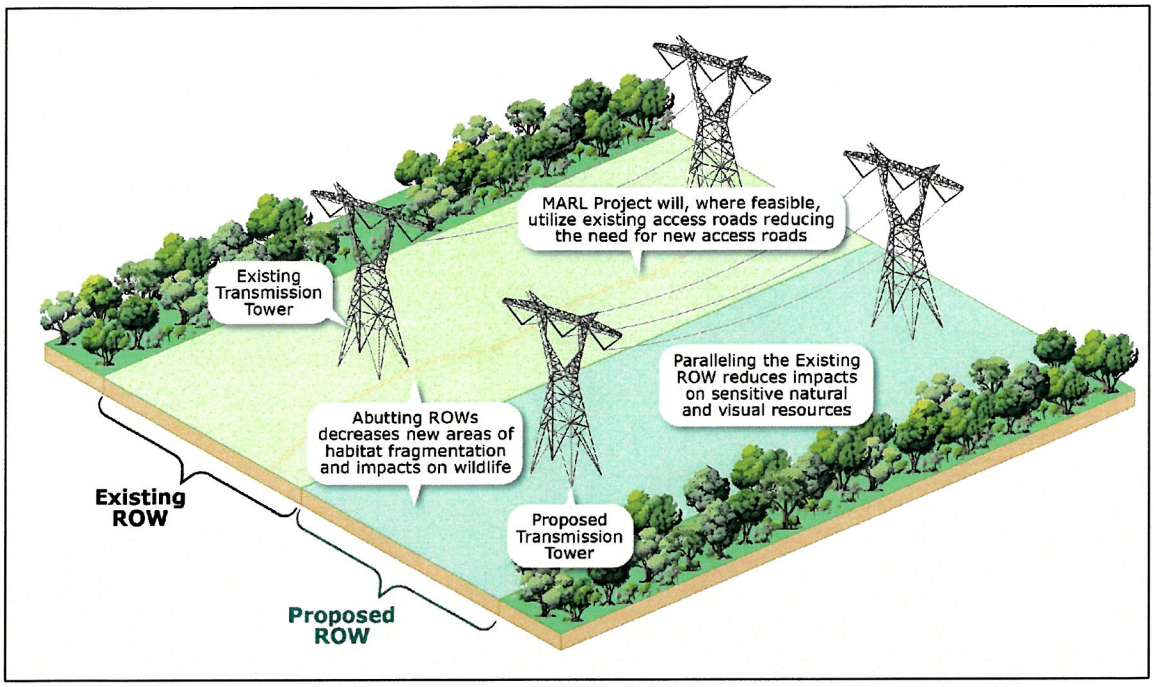


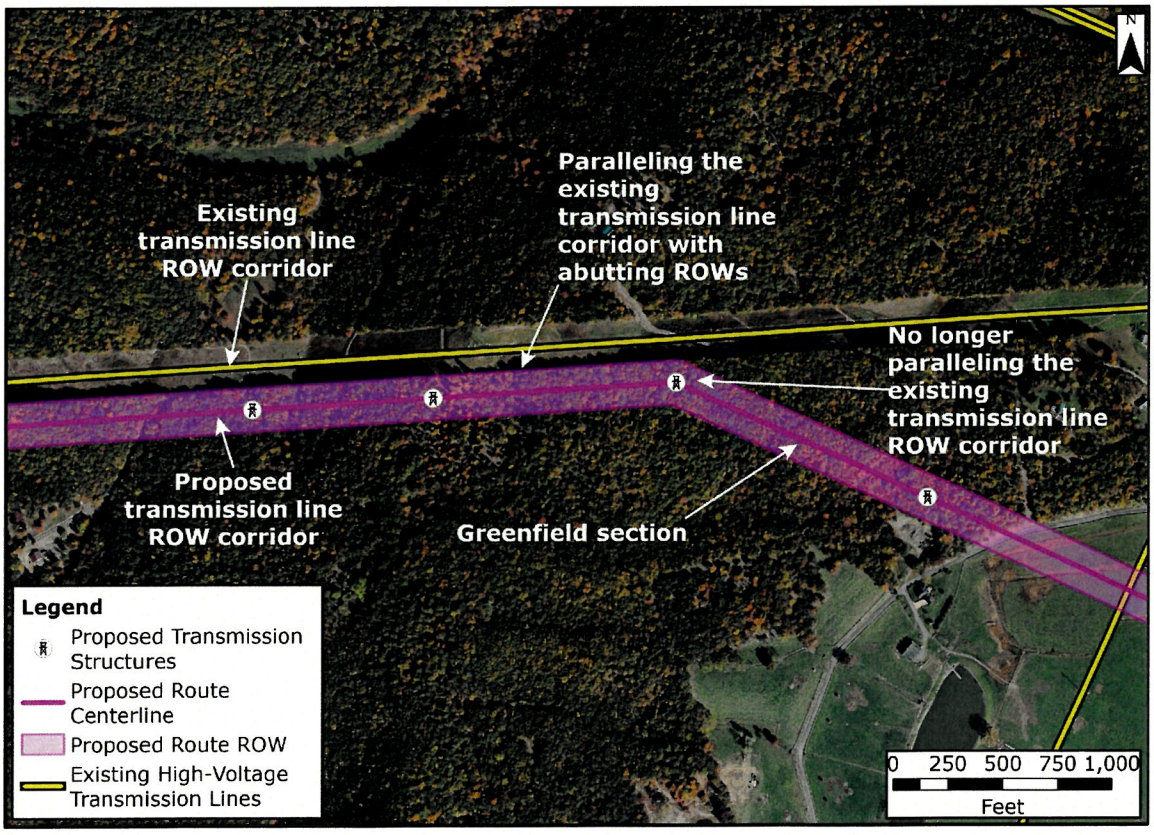
Both desktop and field reviews were performed by the Routing Team to identify key opportunities and constraints and to gain a comprehensive understanding of the landscape. The primary objective of the Routing Study was to identify at least three feasible transmission line route options for evaluation that minimized impacts on communities and the environment.

As part of the above, the Routing Team aimed to parallel existing transmission lines to the extent practicable to minimize visual, environmental, and access effects. Figure 2.1-2 provides an illustration of MARL Project paralleling. Benefits to paralleling existing transmission lines include:

- Limiting impacts on the local community;
- Providing easier construction access;
- Reducing the need for new access roads;
- Reducing impacts on sensitive natural and visual resources; and
- Decreasing new areas of habitat fragmentation and impacts on wildlife.

FIGURE 2.1-2 ILLUSTRATION OF MARL PROJECT PARALLELING





MARL Project = MidAtlantic Resiliency Link Project; ROW = right-of-way

2.2 DEFINING THE MARL PROJECT STUDY AREA

The first step in the routing process involved defining a geographic study area in alignment with PJM's identified electric reliability requirements, which included two fixed endpoints. The MARL Project Study Area was delineated to encompass the western terminus at the 502 Junction Substation in Greene County, Pennsylvania, and the eastern terminus at the PJM-designated handoff point in Frederick County, Virginia. In addition to these endpoints, the Study Area included a sufficiently broad area designed to capture geographically diverse opportunities for paralleling existing linear infrastructure—such as transmission lines, pipelines, and transportation corridors—thereby supporting the identification and evaluation of a reasonable range of routing alternatives. Additionally, and to the extent practicable, the limits of the Study Area were defined by reference to easily distinguished landmarks, such as roads or other features. This approach helped the Routing Team to clearly communicate the Study Area boundaries to stakeholders, including potentially affected landowners, county officials, and permitting agency staff. Section 3.1 describes the characteristics of the Study Area in detail.

2.3 INVENTORY OF CONSTRAINTS AND OPPORTUNITIES

The second step in the routing process involved identifying and mapping constraints that consisted of natural environment, built environment, cultural resources, and social resources; engineering considerations; and existing opportunities within the MARL Project Study Area. A geospatial database development played a critical role in the routing and siting of the MARL Project by integrating spatial data with analytical tools to support informed decision-making. This process involved collecting, organizing, and managing a wide range of geospatial data layers such as topography, slope, land use, environmental constraints, infrastructure, and socioeconomic factors. Using Geographic Information Systems (GIS), the Routing Team analyzed these datasets to identify optimal paths that minimize environmental impact, confirm constructability, and avoid populated or sensitive areas. Based on extensive data collection, this step resulted in an inventory of routing constraints and opportunities in the MARL Project Study Area, including, but not limited to:

- Existing electric transmission and other utility ROWs;
- Federal, state, county, and private road ROWs;
- Residences and residential areas and structures identified through high-resolution aerial imagery and LiDAR acquisition flown for and collected by NEET MA and NEET VA for MARL Project-specific data[7];
- Parcels;
- Planned developments;
- Public lands;
- Protected lands (e.g., federal, state, and local lands, parks, trails);

[7] NEET MA and NEET VA contracted SAM to capture high-resolution aerial imagery and LiDAR data for the MARL Project Study Area. Data acquisition was conducted during leaf-off conditions between December 2023 and February 2024, providing 3-inch-resolution imagery and LiDAR data used as part of the routing and siting process.

- Conservation easements (e.g., National Conservation Easement Database, state-specific databases);
- Parks and trails;
- Wetlands and waterbodies as well as floodplains;
- Forested land;
- Hospitals, schools, cemeteries, and convalescent centers;
- Natural heritage resources (e.g., conservation sites and habitat for rare, threatened, and endangered species);
- Visually sensitive resources—locations where views are protected by regulation or where higher quality views are an expected condition, regardless of regulatory status; and
- Archaeological and historic sites and other nationally or locally significant cultural resources.

2.4 IDENTIFICATION AND ASSESSMENT OF PRELIMINARY DRAFT ROUTES

The third step in the routing process was identifying broad conceptual route corridors—swaths of the MARL Project Study Area feasible for routing new transmission infrastructure—and excluding areas where transmission line routing would be impracticable due to land use or other constraints.

Following the route development criteria and guidelines listed in Section 2.7, ERM developed a network of preliminary route segments using GIS software and the constraint and opportunity database. To the extent practicable, preliminary route segments were identified that avoid natural environment and built environment constraints, cultural and social resources, as well as factor in engineering constructability, and parallel routing opportunities. Throughout this step, the Routing Team continued to collect and assess data on constraints obtained through desktop sources, field reconnaissance, and stakeholder/public engagement activities. The Routing Team used this information to validate and develop a better understanding of resources that could be affected and then identified routes to avoid or reduce potential impacts where feasible.

After the preliminary route segments were identified, the Routing Team assessed the viability of preliminary draft route options by evaluating environmental impacts, compatibility with existing and future land uses, permitting risk, community input, ability to acquire new ROW, constructability, and cost. Section 4 describes the route alternatives developed for the MARL Project as well as routes considered but dismissed from the MARL Project.

2.5 FIELD RECONNAISSANCE AND STAKEHOLDER ENGAGEMENT

The fourth step of the routing process consisted of conducting field reconnaissance and stakeholder/public engagement activities. These included establishing a MARL Project website, hosting open houses, distributing targeted mailings, and holding both virtual and in-person meetings. Section 4.3 discusses the specific platforms and surveys used to collect stakeholder and public feedback, and how that feedback was incorporated into the route selection process. These efforts were undertaken to gather local knowledge, identify sensitive resources, and inform routing and route selection. Collecting public feedback enabled the Routing Team to refine the preliminary draft route options identified during the third step, supporting further analysis and ultimately the selection of the Proposed Route. Section 3.3 describes the public engagement

activities conducted for the MARL Project and explains how feedback gathered through this process was incorporated into the development of Alternative Routes.

2.6 ROUTE ALTERNATIVE ANALYSIS AND ROUTE RECOMMENDATION

The fifth step of the routing process used data collected during field reconnaissance and stakeholder outreach activities to refine the preliminary draft route options, develop end-to-end route alternatives, and conduct both quantitative and qualitative analyses of those alternatives. In evaluating the final route alternatives, the Routing Team considered multiple factors, including public input received during engagement activities, constructability, feasibility, environmental and land use constraints, and compliance with applicable state siting requirements. Based on this comprehensive analysis, the team identified a set of Alternative Routes and ultimately selected a Proposed Route by comparing the relative advantages and disadvantages of each route. Routes determined to be too impactful, infeasible, or impracticable were not carried forward for further consideration as a potential Alternative Route.

2.7 ROUTE DEVELOPMENT CRITERIA AND GUIDELINES

The following criteria, guidelines, and considerations were developed by the Routing Team based on best practices and extensive experience in transmission line routing and siting projects. While there are no published studies or formal industry standards, the criteria reflect methodologies that have been applied to other greenfield projects and, in some cases, accepted by state commissions. These were considered and applied to the MARL Project, incorporating natural environment and built environment resources as well as land and engineering considerations provided by NEET MA and NEET VA that include, but are not limited to, the following:

- Maximize the separation distance from or minimize impacts on residential dwellings.
- Maximize the separation distance from or minimize impacts on commercial buildings.
- Maximize the separation distance from or minimize impacts on schools, churches, cemeteries, and other socially sensitive facilities.
- Minimize the removal of existing barns, garages, and other nonresidential structures.
- Minimize, to the extent possible, placement of structures within the middle of active agricultural and residential areas.
- Minimize impacts on agricultural use, including the operation of irrigation infrastructure, where possible.
- Maximize placement of the route to be immediately adjacent to existing transmission lines.
- Reduce circuitous routes and special design requirements, where possible.
- Minimize the number of affected parcels and/or landowners and follow parcel boundaries, to the extent possible, to prevent bifurcation of parcels, which could contribute to increased easement acquisition costs or creation of unbuildable lots.
- Minimize the crossing of large lakes, major rivers, and large wetland complexes.
- Minimize impacts on designated critical habitat, protected species, and other identified sensitive natural resources.

- Minimize new habitat fragmentation and impacts on designated areas of biodiversity concern.
- Minimize conflict with designated public resource lands such as local parks and other recreation lands, nature preserves, or other conservation areas.
- Minimize visibility from populated areas, scenic roadways, and designated scenic resources.
- Minimize interference with economic activities, including agricultural practices.
- Consider the proximity of floodplain boundaries, meandering rivers, creeks, and ravines due to banks subject to soil erosion and flooding, which can compromise the integrity of the design, and reduce the number crossings of meandering rivers, creeks, and/or ravines.
- Span over rivers, streams, and other water features to limit impacting the ordinary high-water mark and downstream hydrology.
- Place towers on high ground to minimize structure heights and avoid low areas (e.g., valleys, ravines) that extend tower heights and might result in more tree clearing, stream temperature changes, and construction access concerns.
- Consider accessibility of tower placement and line constructability (e.g., drainage ditches or dikes, use of existing roads or trails) to reduce construction access concerns.
- Consider the tower and line placement to minimize and/or avoid free-standing water areas to reduce costly foundations and constructability concerns.
- Consider the tower placement away from the brink of steep slopes to accommodate tower footprint and safe construction practices.
- Consider the space around towers for temporary construction activities.
- Consider the tower placement to provide for efficient span lengths of towers.
- Consider and avoid steep terrain with side slopes of 15 percent grade or more, if possible.
- Reduce and/or avoid clipping the corners of private properties, where possible.
- Minimize the number of existing high-voltage transmission line crossings.

Segments and route alternatives were quantitatively and qualitatively evaluated using the set of criteria developed by the Routing Team (Table 2.7-1) to align with MARL Project routing guidelines, minimize or avoid environmental and social constraints, and identify opportunities to parallel existing linear infrastructure, particularly existing transmission lines. Appendix G, Data Sources, provides a list of sources used for the Routing Study.

Route alternatives were developed through a comparative evaluation process that considered:

- Existing opportunities for paralleling;
- The presence and extent of constraints along potential routes; and
- When route alternatives were otherwise comparable in terms of constructability, length, and other technical factors, the Routing Team considered the types of constraints present along each route and their relative significance.

As part of the MARL Project, the Routing Team adhered to three principles when developing route alternatives:

- Parallel existing transmission lines where feasible.
- Avoid residential dwellings within the ROW Corridor where feasible.
- Minimize crossing conservation easements.

To support a comprehensive and balanced evaluation of routing alternatives for the MARL Project, the Routing Team applied both quantitative and qualitative assessments across a range of criteria, including natural environment, built environment, cultural resources, social resources, and engineering factors.

Although a wide array of criteria was considered in the evaluation of potential transmission line routes (as summarized in Table 2.7-1), the Routing Team elected not to assign explicit numerical weights or scores to individual routing criteria. Instead, the Routing Team opted for a hybrid quantitative-qualitative approach on route selection based on a comprehensive and balanced assessment rather than rigid numerical weighting. This approach was adopted for the following reasons:

- The relative importance of evaluation criteria (e.g., proximity to residential dwellings, presence of wetlands, constructability constraints) can vary significantly depending on geographic context. A rigid weighting system may overemphasize a single factor that is less relevant in one area but highly relevant in another. By avoiding fixed weights, the evaluation remains adaptable to site-specific conditions and local sensitive receptors.
- Flexible consideration of multiple criteria allows the routing process to be more responsive to stakeholder input, including feedback from landowners, communities, and regulatory agencies.
- This approach helps prevent unintentional bias or over-prioritization of one impact type over another. Numerical weighted scoring systems can create a false impression of mathematical precision and obscure how qualitative considerations influence route selection. A quantitative-qualitative hybrid approach promotes clearer communication with stakeholders and regulatory agencies, showing that decisions were based on a transparent understanding of constraints and opportunities rather than numeric weighting.

This methodology reflects best practices in infrastructure planning and supports that the selected route minimizes adverse impacts while meeting technical and regulatory requirements and addressing stakeholder preferences.

TABLE 2.7-1 QUANTITATIVE CONSTRAINTS AND OPPORTUNITIES EVALUATION CRITERIA

Constraints and Opportunities Evaluation Criteria	**Measure**
Route Length and Construction Footprint	
Centerline Length	Miles
ROW Corridor	Acres
Land Use and Social Resources	
Paralleling Existing Infrastructure [a]	
Paralleling Existing Transmission Lines	Miles; Percentage
Greenfield section (within 500 feet of Existing Transmission Lines)	Miles; Percentage
Greenfield section (within 500–1,000 feet of Existing Transmission Lines)	Miles; Percentage
Greenfield section (>1,000 feet of Existing Transmission Lines)	Miles; Percentage
Total Greenfield	Miles; Percentage
Paralleling railroad ROW	Miles; Percentage
Paralleling natural gas pipelines ROW	Miles; Percentage
Paralleling Highways	Miles; Percentage
Community and Recreational Resources [b, c, d, e, f, g, h, i]	
Parcels/ unique landowners	Count
Residential dwellings within ROW Corridor/ 250 feet / 500 feet of centerline	Count
Residential outbuildings within ROW Corridor / 250 feet / 500 feet of centerline	Count
Non-residential buildings within ROW Corridor / 250 feet / 500 feet of centerline	Count
Places of worship within 500 feet of the centerline	Count
Childcare Facilities within 500 feet of the centerline	Count
Public / private schools within 500 feet of centerline	Count
Trails crossings—Potomac Heritage National Scenic Trail and Hiking Trails	Count
State Scenic Byways	Count
Protected Lands [j, k, l, m, n, o, p]	
State Forest	Count; Miles; Acres
State Park	Count; Miles; Acres
Fisheries / Wildlife Management Area	Count; Miles; Acres
Pennsylvania State Wilderness Area	Count; Miles; Acres
Pennsylvania State Game Lands	Count; Miles; Acres
Maryland Wildlands	Count; Miles; Acres
Conservation Easements	Count; Miles; Acres
USACE Recreation Areas	Count; Miles; Acres
Total Protected Lands	Count; Miles; Acres
Cultural Resources [q, r, s, t]	
Cemeteries within ROW Corridor; 500 feet of centerline	Count
Archaeological Resources within ROW Corridor	Count
Architecture Resources—NRHP eligible, NRHP listed or NHL listed within ROW Corridor; 0.5-mile buffer from centerline	Count
Historic Districts Crossed	Count
Battlefields	Count; Acres

Constraints and Opportunities Evaluation Criteria	Measure
MD—Heritage Areas	Count; Acres
Agricultural Land [u]	
Not Prime Farmland Class	Acres
State Importance Farmland Class	Acres
Local Importance Farmland Class	Acres
Prime Farmland Class	Acres
Land Cover [v]	
Barren Land (Rock/Sand/Clay)	Acres
Cultivated Crops	Acres
Deciduous Forest	Acres
Developed, High Intensity	Acres
Developed, Low Intensity	Acres
Developed, Medium Intensity	Acres
Developed, Open Space	Acres
Emergent Herbaceous Wetlands	Acres
Evergreen Forest	Acres
Grassland/Herbaceous	Acres
Mixed Forest	Acres
Open Water	Acres
Pasture/Hay	Acres
Shrub/Scrub	Acres
Woody Wetlands	Acres
Forest Lands Total (Deciduous Forest, Evergreen Forest, and Mixed Forest)	Acres
Agricultural Lands Total (Pasture/Hay and Cultivated Crops)	Acres
Developed Lands Total (High, Low, Medium, Open Space)	Acres
Natural Environment	
Water Resources [w, x, y, z, aa, bb, cc, dd]	
NHD Stream/River Perennial [c]	Count; Feet
NHD Stream/River—Intermittent [c]	Count; Feet
NHD Waterbody	Count, Acres
Section 10 Navigable Waters	Count
Trout Streams and Coldwater Fisheries (all states)	Count; Feet
PA Trout Streams	Count; Feet
WV Trout Streams	Count; Feet
VA Trout Streams	Count; Feet
PA—Designated Use Streams (CWF, EV, HQ, TSF)	Count; Feet
MD—Designated Use Streams (Use III and III-P: Nontidal Cold Water and Public Water Supply)	Count; Feet
MD—Designated Use Streams (Use IV and IV-P: Recreational Trout Waters and Public Water Supply)	Count; Feet
VA—Threatened & Endangered Species Waters	Count; Feet
WV—Mussel Streams	Count; Feet

Constraints and Opportunities Evaluation Criteria	Measure
MD—Designated Use Streams (Use I and I-P Water Contact Recreation, Protection of Aquatic Live, and Public Water Supply)	Count; Feet
Modeled Wetlands [jj]	Acres
NWI—All Types	Acres
NWI—Freshwater Emergent	Acres
NWI—Freshwater Shrub Scrub	Acres
NWI—Freshwater Pond	Acres
NWI—Lake	Acres
NWI—Riverine	Acres
WV—DEP Wetlands	Acres
MD—DNR Wetlands of Special Concern	Acres
MD—DNR Wetlands	Acres
FEMA Flood Zone A/AE/AO—Areas with a 1% annual chance of flooding (100-year flood area)	Acres; Structure Count
FEMA Flood Zone X—Areas with 0.2% annual chance of flooding (500-year flood area)	Acres; Structure Count
FEMA Flood Zones Combined	Acres
Conservation and Habitat [y, i, ee, ff, gg, hh]	
USFWS Critical Habitat Final	Acres
USFWS Critical Habitat Proposed	Acres
State-listed Species Occurrence (from state NHI Element Occurrence Data)	Acres
Potentially Suitable State-listed Species, MBTA, and Foraging Bat Habitat	Acres
Potentially Suitable Monarch Butterfly	Acres
Bat Known Occupied Summer Habitat (all states)	Acres
Bat Hibernacula (all states)	Acres
Potentially Suitable Bat Roosting Habitat	Acres
MD—Irreplaceable Natural Areas	Count
MD—Irreplaceable Natural Areas	Acres
MD—Forest Interior Dwelling Species Confirmed	Acres
MD—Forest Interior Dwelling Species Probable	Acres
MD—Natural Heritage Areas	Acres
MD—Forests of Recognized Importance	Count
MD—Forests of Recognized Importance	Acres
MD—Federal or State-Listed Species	Acres
MD—Species of Concern	Acres
MD—BioNet Tier 1 (critically significant)	Acres
MD—BioNet Tier 2 (Extremely Significant)	Acres
MD—BioNet Tier 3 (Highly Significant)	Acres
MD—BioNet Tier 4 (Moderately Significant)	Acres
MD—BioNet Tier 5 (Significant)	Acres
PA—Natural Heritage Areas	Acres
VA—Ecological Core C1 (Outstanding)	Acres
VA—Ecological Core C2 (Very High)	Acres
VA—Ecological Core C3 (High)	Acres

Constraints and Opportunities Evaluation Criteria	Measure
VA—Ecological Core C4 (Moderate)	Acres
VA—Ecological Core C5 (General)	Acres
Engineering and Infrastructure Considerations [a, ee]	
Existing Transmission Line Crossings	
Electric Transmission Line Unknown kV Crossing	Count
Electric Transmission Line 69 kV Crossing	Count
Electric Transmission Line 115 kV Crossing	Count
Electric Transmission Line 132 kV Crossing	Count
Electric Transmission Line 138 kV Crossing	Count
Electric Transmission Line 500 kV Crossing	Count
Structures and Design	
Number of Structures	Count
Structures with Turn Angles 0-20 degrees	Count
Structures with Turn Angles 20-30 degrees	Count
Structures with Turn Angles greater than 30 degrees	Count
Span Length Greater than 1,600 feet	Count
Topography	
Very steep slope (31–90 degrees)	Miles
Steep slope (21–30 degrees)	Miles
Moderate slope (16–20 degrees)	Miles
Strongly sloping (6–15 degrees)	Miles
Flat to gentle slope (0–5 degrees)	Miles
Infrastructure Crossings	
Primary Road Crossing	Count
Secondary Road Crossing	Count
Tertiary Road Crossing	Count
Railroad Crossing	Count
Oil and Gas Wells: within the proposed ROW; 500 feet of centerline	Count
Natural Gas Pipeline Crossing (transmission / distribution / gathering)	Count
Wind turbines (within 500 feet and 0.5 mile of the centerline)	Count
Public Airports within 20,000 feet of the centerline	Count
Geologic Karst features within the ROW Corridor	Miles; Acres

Sources: [a] Rextag Infrastructure Data, [b] ReportAll [c] HIFLD, [d] MDOT, [e] WVDOT, [f] MDiMap, [g] WVGISTC, [h] PASDA, [i] ERM, [j] PAD-US, [k] NCED, [l] MDNR, [m] MDiMAP, [n] PASDA, [o] WVDEP, [p] VADCR, [q] PASHPO, [r] WVSHPO, [s] MHT, [t] VADHR, [u] USA SSURGO, [v] USGS NLCD 2024, [w] USGS NHD, [x] FEMA's National Flood Hazard Layer (NFHL), [y] USFWS, [z] MDE, [aa] PFBC, [bb] PADEP, [cc] WVDNR, [dd] VADWR, [ee] USGS, [ff] VADWR, [gg] PNHP, [hh] PADCNR, [jj] Appendix H, Wetland Identification Model Report

BioNet = Biodiversity Conservation Network; CWF = Coldwater Fishes; DEP = Department of Environmental Protection; DNR = Department of Natural Resources; EV = Exceptional Value; FEMA = Federal Emergency Management Agency; HQ = High Quality; kV = kilovolt; MBTA = Migratory Bird Treaty Act; MD = Maryland; NHD = National Hydrography Dataset; NHI = Natural Heritage Inventory; NHL = National Historic Landmark; NLCD = National Land Cover Database; NRHP = National Register of Historic Places; NWI = National Wetlands Inventory; PA = Pennsylvania; ROW = right-of-way; SSURGO = Soil Survey Geographic Database; TSF = Trout Stocking; USACE = U.S. Army Corps of Engineers; USFWS = U.S. Fish and Wildlife Service; VA = Virginia; WV = West Virginia; WMA = Wildlife Management Area

3. MARL PROJECT STUDY AREA

3.1 MARL PROJECT STUDY AREA DESCRIPTION

The Routing Team developed a study area broad enough to incorporate a diversity of routing options with a focus on using existing high-voltage transmission lines between the MARL Project's endpoints and other existing linear infrastructure. The MARL Project Study Area encompasses 1,053 square miles, is 95 miles west to east (straight-line distance) (Figure 1.1-1), and varies from 8 to 16 miles wide across the following states and counties:

- Pennsylvania: Greene and Fayette Counties;
- West Virginia: Monongalia, Preston, Mineral, and Hampshire Counties;
- Maryland: Garrett and Allegany Counties; and
- Virginia: Frederick County.

As depicted on Figure 1.1-1 and in Appendix E-1, Major Constraints and Opportunities, the Study Area generally follows existing transmission lines between the two Project endpoints and is bound by the following features:

- Morgantown in Monongalia County, West Virginia, to the southwest.
- Masontown and Fairchance in Greene County, Pennsylvania, to the northwest.
- Approximate 4-mile buffer of the 502 Junction Substation to the west near Interstate 79 in Greene County, Pennsylvania.
- Cumberland and Frostburg, Maryland to the north.
- Approximate 4-mile buffer of the existing high-voltage transmission lines to the south, including:
    - Potomac Edison's[8] 138 kV transmission line traveling west to east in Monongalia and Preston Counties, West Virginia, and Garret County, Maryland (referred to as Hazelton to Lake Lynn 138 kV, Jennings to Hazelton 138 kV, and Frostburg to Jennings 138 kV).
- Potomac Edison's 500 kV transmission line (referred to as Hatfield's Ferry Power Station to Black Oak 500 kV) traveling southeast from Fayette County, Pennsylvania to Black Oak Substation in Mineral County, West Virginia.
    - Potomac Edison's 138 kV transmission line (referred to as Hampshire to Ridgeley 138 kV) traveling southeast in Hampshire County, West Virginia.
    - Potomac Edison's 138 kV transmission line (referred to as Hampshire to Stonewall 138 kV) traveling west to east in Hampshire County, West Virginia, and Frederick County, Virginia.
- Approximate 4-mile buffer of the MARL Project endpoint to the east near US-522 (North Frederick Pike) in Frederick County, Virginia (referred to as the handoff point).

The Study Area encompasses 34 census designated places (CDP), including, but not limited to:

- Cheat Lake CDP, West Virginia
- Jennings CDP, Maryland

[8] Potomac Edison is a subsidiary electric company owned by FirstEnergy.

- Detmold CDP, Maryland
- Danville CDP, Maryland
- Rawlings CDP, Maryland
- Fort Ashby CDP, West Virginia
- Springfield CDP, West Virginia
- Gore CDP, Virginia

The Study Area also encompasses 19 incorporated places shown on Appendix E-1 including, but not limited to:

- Smithfield, Pennsylvania
- Fairchance, Pennsylvania
- Point Marion, West Virginia
- Morgantown, West Virginia
- Brandonville and Bruceton Mills, West Virginia
- Friendsville, Maryland
- Accident, Maryland
- Lanaconing Town, Maryland
- Capon Bridge, West Virginia

The Study Area traverses a diverse Appalachian landscape, characterized by rolling to rugged terrain within the Allegheny Mountains and Ridge-and-Valley physiographic provinces. The land cover is predominantly forested, interspersed with agricultural fields, rural residences, and small towns, reflecting a mix of low-density rural and exurban land uses. Morgantown, home to West Virginia University, marks the western end with a more urbanized core, while Gore, a small unincorporated community in Frederick County, Virginia, anchors the east with a more sparsely developed setting. The existing high-voltage transmission lines in the Study Area traverse rugged terrain in Maryland and West Virginia such as Savage River State Forest and Dan's Mountain in Maryland and Knobly Mountain, White Horse Mountain, and Dillons Mountain in West Virginia. The Study Area contains outdoor recreational activities including hiking, kayaking, and fishing highlighted in Section 3.2.

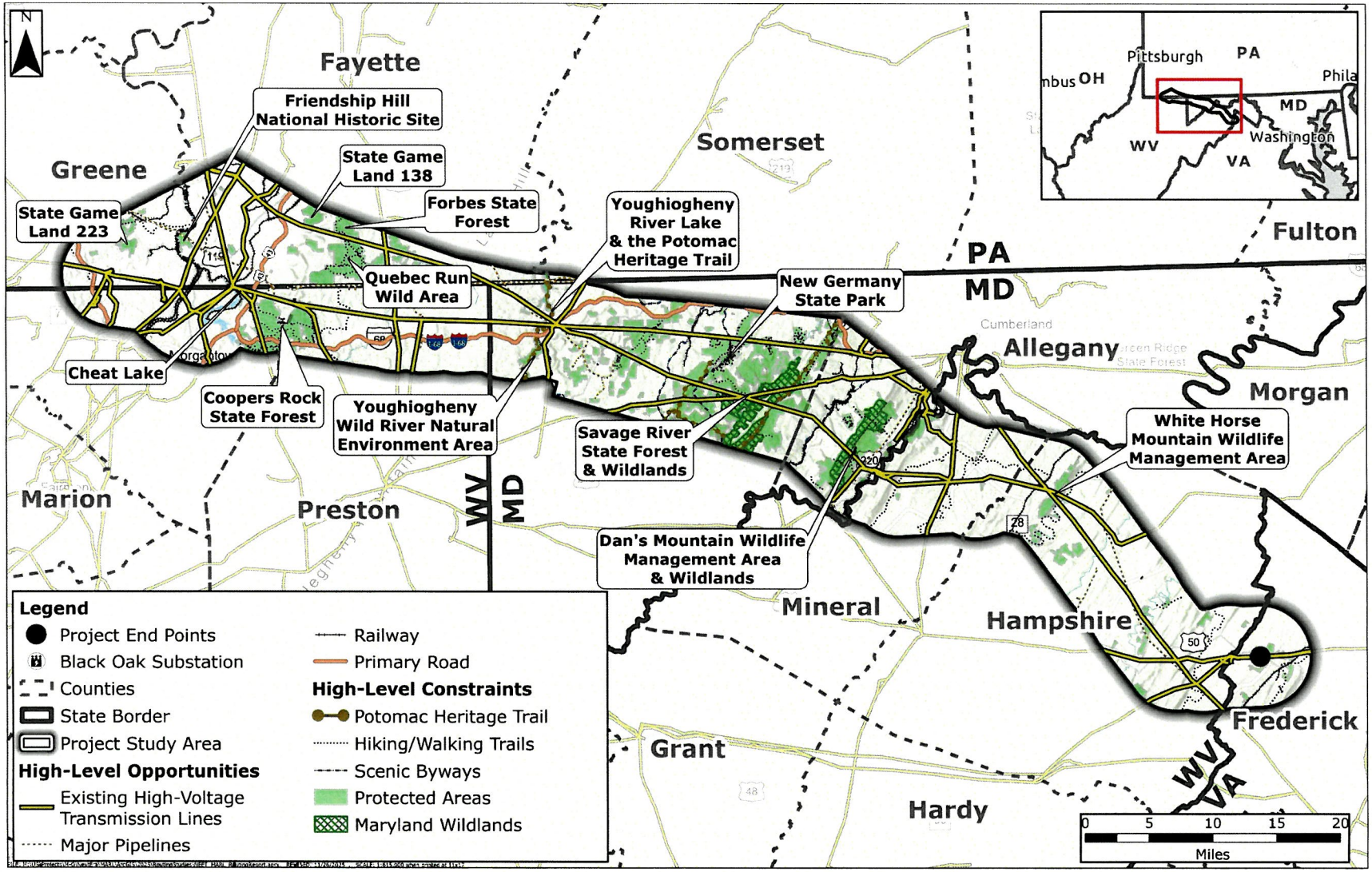
3.2 MAJOR ROUTING CONSTRAINTS AND OPPORTUNITIES IN THE MARL PROJECT STUDY AREA

This section summarizes the major constraints and opportunities in the MARL Project Study Area affecting transmission line routing. In accordance with the state siting requirements and/or guidelines,[9] ERM assessed constraints and opportunities for routing the MARL Project.

[9] 52 PA Code §57.75(e)(3); 52 PA Code §57.72(c)(7)-(13); 52 PA Code §69.3105; W. Va. Code R. §24-2-11a; W. Va. Code R. §150-3-9 (Electric Rule 9); COMAR §20.79.04.02–20.79.04.04; Md. Code Ann., Pub. Util., Section 7-207; and Guidelines for Transmission Line Applications Filed Under Title 56 of the Va. Code.

Routing opportunities within the Study Area included existing transmission lines, utility ROWs, and major roadways. Routing constraints included residential and non-residential buildings, existing and planned developments, public lands, and sensitive natural resources (e.g., streams, floodplains, wetlands). Often, features in the Study Area are both constraints and opportunities. For example, running parallel to existing transmission lines in a state forest could offer space for new ROWs, but it may not be compatible with the adjacent land uses (e.g., dwellings or businesses). ERM also identified routing constraints and opportunities through review of local land use plans and stakeholder engagement. Figure 3.2-1 depicts major routing constraints and opportunities in the Study Area and Appendix E-1 provides a detailed mapbook of these major routing constraints and opportunities within the Study Area. Appendix E-2, Terrain and Slope, provides a detailed mapbook of the slope and terrain that is throughout the Study Area.

FIGURE 3.2-1 MAJOR ROUTING CONSTRAINTS AND OPPORTUNITIES IN THE MARL PROJECT STUDY AREA



MD = Maryland; PA = Pennsylvania; VA = Virginia; WV = West Virginia

- **Existing Transmission Lines:** The MARL Project Study Area has several high-voltage transmission lines that were used as routing opportunities, including but not limited to:
  - A 500 kV transmission line operated by Keystone Appalachian Transmission Company from Fort Martin Power Station in Monongalia County, West Virginia, traveling north through the western portion of the Study Area. Referred to as "Ronco to Fort Martin 500 kV" in Section 4.1.
  - A 500 kV transmission line operated by Monongahela Power Company[10] from Hatfield's Ferry Power Station, traveling southeast through the Study Area. Referred to as "Hatfield's Ferry Power Station to Black Oak 500 kV" in Section 4.1.
  - A 500 kV transmission line operated by Potomac Edison from Black Oak to Bedington, traveling east-southeast. Referred to as "Black Oak to Bedington 500 kV" in Section 4.1.
  - A 138 kV transmission line operated by Potomac Edison from Lake Lynn Power Station, traveling east to Cumberland, Maryland. Referred to as "Hazelton to Lake Lynn 138 kV," "Jennings to Hazelton 138 kV" and "Frostburg to Jennings 138 kV" in Section 4.1.
  - A 138 kV transmission line operated by Potomac Edison from Cumberland, Maryland, traveling southeast to Capon Bridge, West Virginia. Referred to as "Hampshire to Ridgeley 138 kV" in Section 4.1.
  - A 138 kV transmission line operated by Potomac Edison from Romney, West Virginia, traveling east to the MARL Project endpoint in Frederick County, Virginia. Referred to as "French Mill to Hampshire 138 kV" or "Hampshire to Stonewall 138 kV" in Section 4.1.
  - A 500 kV transmission line operated by Virginia Electric & Power Company from Mount Storm Substation in Grant County, West Virginia, traveling east to the MARL Project endpoint in Frederick County, Virginia, and continuing to Doubs Substation in Frederick County, Maryland. Referred to as "Mt Storm to Doubs 500 kV" in Section 4.1.
- **Existing Natural Gas Pipelines:** The MARL Project Study Area has several natural gas pipelines, including gathering, distribution, and transmission. Several transmission pipelines were selected for routing opportunities, including, but not limited to:
  - A transmission natural gas pipeline operated by Columbia Gas Transmission, LLC traveling east to west along the Pennsylvania and West Virginia border.
  - A transmission natural gas pipeline operated by Texas Eastern Transmission, LP traveling southeast in Garrett County, Maryland.
  - A transmission natural gas pipeline operated by Texas Eastern Transmission, LP traveling south in Hampshire County, West Virginia.
- **Railways:** The Study Area has four predominant railways; however, these lines generally run southwest/northeast and do not offer opportunities to connect the MARL Project's endpoints.
- **Primary Road Networks:** The MARL Project Study Area has several primary roads including, but not limited to:
  - **Interstate 68**: Travels east to west from Monongalia County, West Virginia, to Garrett County, Maryland. This highway corridor was ultimately not used as an opportunity for

[10] Monongahela Power is a subsidiary of FirstEnergy.

routing due to its scenic nature, particularly as a national scenic highway known as the National Freeway that traverses Garrett and Allegany Counties, Maryland, and offers dramatic views of forested ridges, valleys, and mountain towns. In Monongalia and Preston Counties, West Virginia, Interstate 68 also offers several scenic opportunities near Coopers Rock State Forest.

- **Interstate 79:** Travels north to southwest of the MARL Project endpoint in Greene County, Pennsylvania. This highway corridor was not used as a routing opportunity due to its direction and location.
- **State Highway 43:** Travels north to south from Fairchance, Pennsylvania, to Morgantown, West Virginia. This highway corridor was not used as a routing opportunity due to its direction and location.

- **Protected Areas:** There are 188 protected areas in the MARL Project Study Area, including 69 agricultural easements, 44 conservation easements, 4 historic or cultural easements, 33 local parks or recreation areas, 1 military base, 16 private conservation areas, 2 recreation management areas, 6 state conservation areas, 4 state parks, 6 state resource management areas, and 2 state wilderness areas. There are also eight different state wildland areas designated in Maryland within the Study Area. The major constraints for routing include the following protected resources:
  - **Coopers Rock State Forest:** Coopers Rock State Forest is a 12,747-acre state forest located in Morgantown, West Virginia, that is managed by the West Virginia Division of Forestry. The northern section of this forest is known as the West Virginia University Research Forest and is a working forest used primarily for education and academic research. There are currently two existing high-voltage transmission lines within the research forest in the north that are used as routing opportunities for this Routing Study.
  - **Friendship Hill National Historic Site:** Friendship Hill National Historic Site is in Point Marion, Pennsylvania, on 675 acres of land near the Monongahela River and is managed by the National Park Service. It commemorates the life and legacy of Albert Gallatin, best known for his 13-year tenure as Secretary of the Treasury under Presidents Thomas Jefferson and James Madison. During his time in office, Gallatin significantly reduced the national debt, played a key role in the acquisition of the Louisiana Territory, and helped fund the Lewis and Clark Expedition.
  - **State Game Land No. 138:** Pennsylvania State Game Land No. 138 (SGL 138) is managed by the Pennsylvania Game Commission to provide hunting and trapping opportunities through the management of wildlife habitat. There is currently an existing 500 kV high-voltage transmission line in the southern portion that is used as a routing opportunity for this Routing Study.
  - **Forbes State Forest:** Forbes State Forest is an approximately 60,000-acre forest reserve managed by the Pennsylvania Department of Conservation and Natural Resources Bureau of Forestry. The southern portion is in the Study Area and there is currently an existing 500 kV high-voltage transmission line running through the state forest that is used as a routing opportunity for this Routing Study.

- **Youghiogheny River Lake:** The Youghiogheny River Lake, located north of Friendsville, Maryland, is a flood control reservoir managed by the U.S. Army Corps of Engineers (USACE) that is a popular recreation destination. The Eastern Continental Divide Trail, which is a 150-mile network of hiking and paddling that is part of the Potomac National Scenic Trail, also follows the Youghiogheny River Lake. There are currently two existing high-voltage transmission lines that cross the Youghiogheny River Lake north of Friendsville that are used as routing opportunities for this Routing Study.
- **Youghiogheny Wild River Natural Environmental Area:** The Youghiogheny Wild River Natural Environmental Area, located south of Friendsville and Interstate 68, is managed by the Maryland Park Service. It was the first officially designated state Wild River in Maryland and is used heavily for whitewater rafting and other recreational activities. The Eastern Continental Divide Trail, a 150-mile network of hiking and paddling that is part of the Potomac National Scenic Trail, also follows the river.
- **Savage River State Forest:** Savage River State Forest, located in Garrett County, Maryland, spans approximately 55,000 acres. It is used for recreation opportunities such as hiking, snowmobiling, camping, and hunting. The forest also supports sustainable timber harvesting through a forest stewardship plan. Of the 55,000 acres, 11,000 acres are designated as Maryland State Wildlands. Savage River State Forest contains two sections of the Potomac Heritage National Scenic Trail, including Meadow Mountain and Big Savage Mountain Trail. There are currently several routing opportunities within the state forest, including an existing 500 kV high-voltage transmission line operated by Potomac Edison traveling southeast through the middle of the forest and its associated Wildlands; an existing 138 kV high-voltage transmission line traveling west to east through the northern portion of the forest operated by Potomac Edison; and an existing 138 kV high-voltage transmission line traveling northeast operated by Potomac Edison going through the associated Wildlands.
- **Dan's Mountain Wildlife Management Area:** Dan's Mountain Wildlife Management Area (WMA) contains approximately 9,500 acres in Allegany County, Maryland, and is managed by the Maryland Department of Natural Resources. Approximately 50 percent of the WMA is designated as Maryland State Wildlands. There is currently an existing 500 kV high-voltage transmission line bisecting the WMA and Wildlands that is used as a routing opportunity for the Routing Study.
- **Maryland State Wildlands System**: The Maryland Wildlands System is a network of state-designated protected areas managed by the Maryland Department of Natural Resources. There are eight state-designated Wildlands in the Study Area that are part of Savage River State Forest and Dan's Mountain WMA including: Bear Pen, Big Savage, Big Savage Mountain, Dan's Mountain, High Rock, Middle Fork, Savage Ravines, and South Savage. Bear Pen, Big Savage Mountain, Big Savage, Savage Ravines, and Dan's Mountain currently have existing high-voltage transmission lines bisecting the protected areas that are used as routing opportunities for this Routing Study.

- **White Horse Mountain Wildlife Management Area**: The White Horse Mountain WMA is a 1,725-acre conservation and recreation area located in Hampshire County, West Virginia, and is managed by the West Virginia Division of Natural Resources (WVDNR). The Potomac Conservancy held a conservation easement on White Horse Mountain to protect it from development and transferred ownership to WVDNR to manage the land as a public recreation area and WMA. The area contains rugged ridgeline topography including Valley Mountain and River Mountain. The area currently contains two high-voltage transmission lines bisecting the WMA that travel southeast and are used as routing opportunities for this Routing Study.

- **Scenic Byways:** There are several state-designated scenic byways, in the MARL Project Study Area including Mountain Maryland Scenic Byways and The Historic National Road in Garrett and Allegany Counties and the Laurel Highlands Scenic Byway in Fayette County, Pennsylvania.
- **Recreation:** There are several recreational opportunities within the MARL Project Study Area including hiking, mountain biking, boating, kayaking, hunting, and fishing. The Study Area contains three sections of the Potomac Heritage National Scenic Trail. Cheat Lake and the Youghiogheny River Lake offer kayaking and boating recreational opportunities. Recreational areas in the Study Area include but are not limited to those areas identified under the protected areas noted above and the following:
  - **Walking, Hiking, Backpacking, and Biking Trails:** The Study Area contains 329 miles of multi-use trails located in Savage River State Forest, Coopers Rock State Forest, Quebec Run Wild Area, Forbes State Forest, Dan's Mountain WMA, Monongahela and Cheat River, and various private trails. These trails include two sections of the Potomac National Scenic Trail (Meadow Mountain and Big Savage Trail), the Margraff Trail System, Mount Aetna Trails, Bowman Hill North, New Germany State Park Trails, The Alleghany Trail (Section 1), to name a few.
  - **Boating, Kayaking, and Whitewater Rafting:** There are many water-based recreational activities in the various streams, rivers, and lakes in the Study Area including 11.2 miles of the Youghiogheny River Trail, which includes an area of whitewater rafting south of Friendsville, Maryland. The Study Area also has water trails on Patterson Creek, Cacapon River, Upper Monongahela River, and the South Branch and North Branch of the Potomac River.
  - **Fishing:** The Study Area contains many fishing opportunities across the 1,200+ miles of perennial streams, including 700+ miles of coldwater fisheries and trout streams. There are also 11+ miles of trout-stocked streams in Maryland, and 6 miles of trout-stocked streams in Pennsylvania.
  - **Camping:** There are various private and state-managed campgrounds in the Study Area including Coopers Rock State Forest, New Germany State Park, Hill Run Group Campsite in Dan's Mountain, and Big Run State Park Campground.
  - **Hunting:** There are various private and public hunting areas in the Study Area including Savage River State Forest, SGL 138, SGL 223, Dan's Mountain WMA, White Horse Mountain WMA, and Coopers Rock State Forest.

- **Cultural Resources:** There are many cultural resources in the MARL Project Study Area including resources listed in the National Register of Historic Places (NRHP), cemeteries, historic districts, and battlefields. Friendship Hill National Historic Site is also located in Fayette County, Pennsylvania, and includes the Gallatin house.
- **Sensitive Environmental Areas:** There are several sensitive environmental areas in the MARL Project Study Area including, but not limited to:
    - **Trout Streams:** West Virginia has many designated trout streams in Monongalia, Preston, and Hampshire Counties. Fayette County, Pennsylvania, contains many coldwater fisheries, Exceptional Value and High Quality Coldwater Fishery streams. Garrett and Allegany Counties, Maryland, contain many coldwater, recreational trout waters, and trout-stocked streams.
    - **Maryland Nontidal Wetlands of Special State Concern:** There are 37 Nontidal Wetlands of Special Concern within the Study Area. These wetlands are protected under Maryland's Nontidal Wetlands Protection Act and Code of Maryland Regulations (COMAR 26.23.06) and require a 100-foot protective buffer.
    - **Forests of Recognized Importance (Maryland):** In Maryland, Forests of Recognized Importance are forested areas that receive special attention and protection due to their ecological and water-quality significance. This includes 100-foot forested buffers along important streams.
    - **Biodiversity Conservation Network (Maryland):** The Biodiversity Conservation Network (BioNet) in Maryland is a dataset designed to guide conservation efforts across the state. Developed and maintained by Maryland Department of Natural Resources, BioNet identifies and maps biologically significant lands using multiple ecological criteria.
    - **Irreplaceable Natural Areas (Maryland):** Maryland established Irreplaceable Natural Areas (INAs) in June 2022 to preserve native biodiversity on state lands. There are 47 INAs in the Study Area that are part of Savage River State Forest, Dan's Mountain WMA, and the Youghiogheny River Natural Environmental Area.
    - **Virginia Natural Landscape Assessment Ecological Cores:** This dataset identifies large patches of natural land with at least 100 acres of interior cover known as a core area. These cores are broken down into categories of ecological importance (C1—Outstanding, C2—Very High, C3—High, C4—Moderate, and C4—General).

3.3 FIELD RECONNAISSANCE AND STAKEHOLDER ENGAGEMENT

The Routing Team conducted field reconnaissance reviews of various locations within the MARL Project Study Area and along identified route segments from public roads during 2025. These site visits were used to visually assess terrain, land use, vegetation, residential development, and existing infrastructure conditions. Photographs and field observations collected during these visits supplemented the desktop data to aid in the analysis and evaluation of route segments. Field reconnaissance also provided valuable on-the-ground context, helped the Routing Team verify data accuracy and identify potential constraints not visible in the high-resolution aerial imagery flown for the MARL Project, and helped refine the Routing Team's understanding of local conditions.

Starting in early 2025, the Routing Team initiated outreach to agencies and stakeholders as part of route development and evaluation. Throughout the outreach, the Routing Team gathered feedback on the Study Area and then the preliminary draft route options through engagement with the public, elected officials, regulatory and planning groups, land managing agencies, and the public. This led to the development of the final Alternative Routes identified in Section 4.5. NEET MA and NEET VA announced the MARL Project via mail and website in February 2025 and held eight in-person open houses in May to share information and receive feedback. NEET MA and NEET VA maintains the website with up-to-date Project information and an interactive online map displaying the current routes and high-level constraint and opportunity data. Additionally, during open comment periods, the public was able to pin geographically related comments on this platform. The Routing Team used stakeholder feedback to refine and optimize routes and help support decisions to remove segments from further consideration. Refer to Section 4 for how the routes were identified. A detailed list of agencies and stakeholders that have been engaged on the MARL Project can be found in the state commission applications and supporting testimony.

4. ROUTE IDENTIFICATION

The routing process for the MARL Project was structured as a multi-phased, iterative approach that integrated both quantitative and qualitative assessments at each stage. The Routing Team began by identifying broad conceptual route corridors within the MARL Project Study Area that generally followed existing transmission lines that maintained a similar directional alignment between the two MARL Project endpoints. From these conceptual route corridors, the Routing Team developed preliminary route segments that were evaluated using measurable criteria such as line length, potential for paralleling, and parcel crossings, as well as qualitative factors including land use compatibility, community context, and field observations. These route segments were presented as preliminary draft route options for public input through open houses and an online survey (Appendix I, Public Open House Content).

Following the public input period, the Routing Team assessed the input and further refined route segments. These refined route segments were consolidated into longer "trunks" or route groupings that were further evaluated quantitatively and qualitatively. Through continued refinement and comparative evaluation of the route groupings, the Routing Team ultimately identified six full end-to-end route alternatives that reflect technical and regulatory requirements and address stakeholder preferences. These six Alternative Routes and their respective features are presented in Table 1.4-1.

4.1 IDENTIFICATION OF CONCEPTUAL ROUTE CORRIDORS

As stated in Section 2, ERM collected data and analyzed the MARL Project Study Area for constraints and opportunities to identify route alternatives. To initiate the process, conceptual route corridors were developed as broad, general areas within which the MARL Project could feasibly be located and generally followed the existing transmission lines within the Study Area. The conceptual route corridors were developed at a high level to avoid mapped large area constraints and/or incorporate notable opportunity features—existing transmission lines—that could be paralleled. The conceptual route corridors were designed to provide options that allowed for:

- Paralleling existing transmission lines where feasible;
- Maximizing the separation distance from or minimizing impacts on residential dwellings; and
- Minimizing conservation easement crossings.

Additional considerations during conceptual route corridor development included:

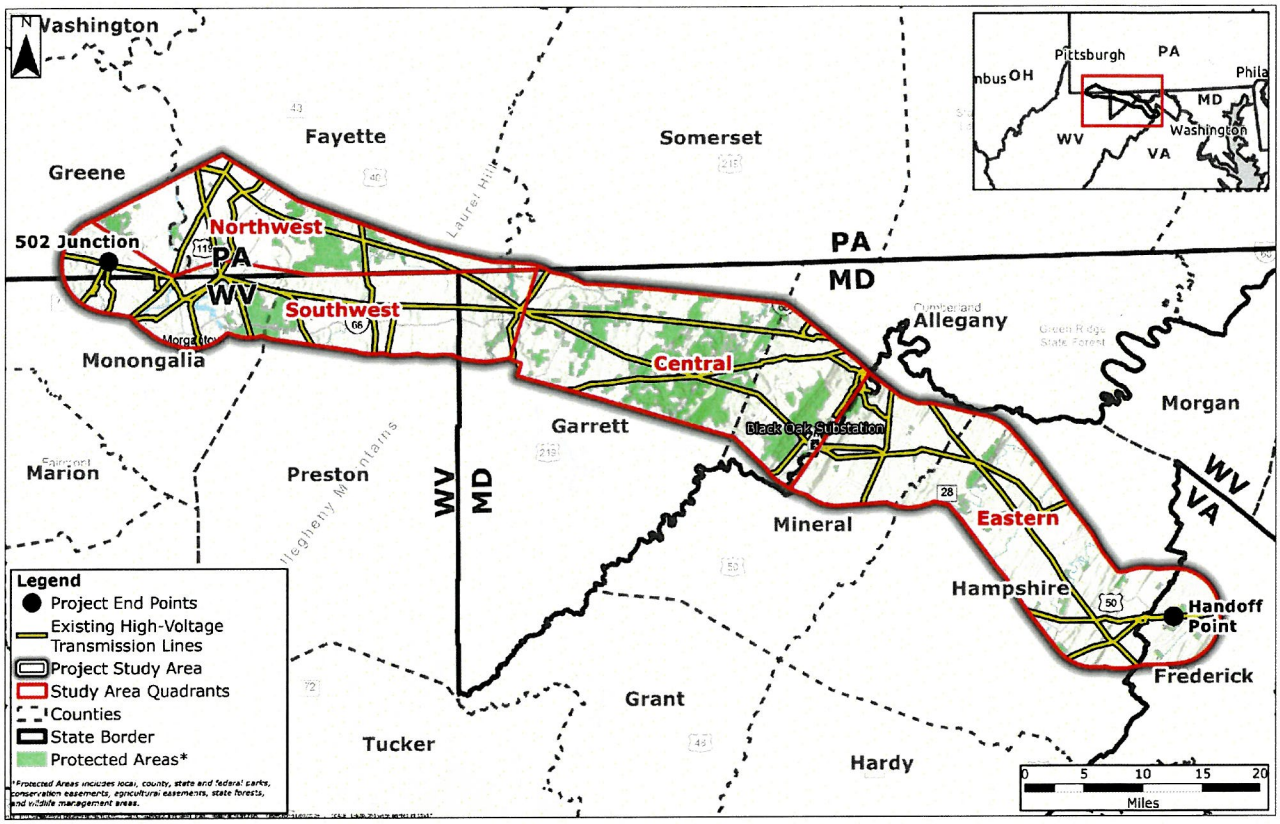
- Natural environment constraints (e.g., wetlands, wildlife habitats, protected lands);
- Built environment patterns (e.g., land use, residential neighborhoods, residential structures, commercial buildings);
- Engineering constructability (e.g., topography, access); and
- Regulatory and permitting constraints.

The conceptual route corridors were developed to parallel existing transmission lines to the greatest extent possible, focusing on those that traveled in the same general direction between the MARL Project's endpoints. This reduced the overall line length and associated potential

impacts. Appendix E-1 provides detailed mapping of the existing transmission lines within the Study Area.

To help facilitate development of conceptual route corridors, the Study Area was subdivided into four quadrants—Northwest, Southwest, Central, and Eastern—to facilitate a more organized and efficient review of routing alternatives across the large Study Area (Figure 4.1-1).

FIGURE 4.1-1 MARL PROJECT STUDY AREA QUADRANTS



MD = Maryland; PA = Pennsylvania; VA = Virginia; WV = West Virginia

Quantitatively, this enabled the evaluation of the criteria identified in Table 2.7-1 (e.g., length, paralleling, parcel crossings). Qualitatively, this allowed for an assessment of constraints that could not be quantitatively compared (e.g., land use patterns, community development, terrain characteristics). The combination of quantitative analysis and qualitative insight supported a transparent, data-driven decision-making process and made sure that development of route segments and alternatives were evaluated consistently throughout the process. This framework enabled the Routing Team to identify, evaluate, and refine potential route segments within each quadrant, ultimately supporting the development of end-to-end Alternative Routes.

Within each quadrant, routing efforts prioritized opportunities to parallel existing transmission lines and other compatible linear features, where feasible, while also avoiding large concentrations of developed areas. This approach was intended to:

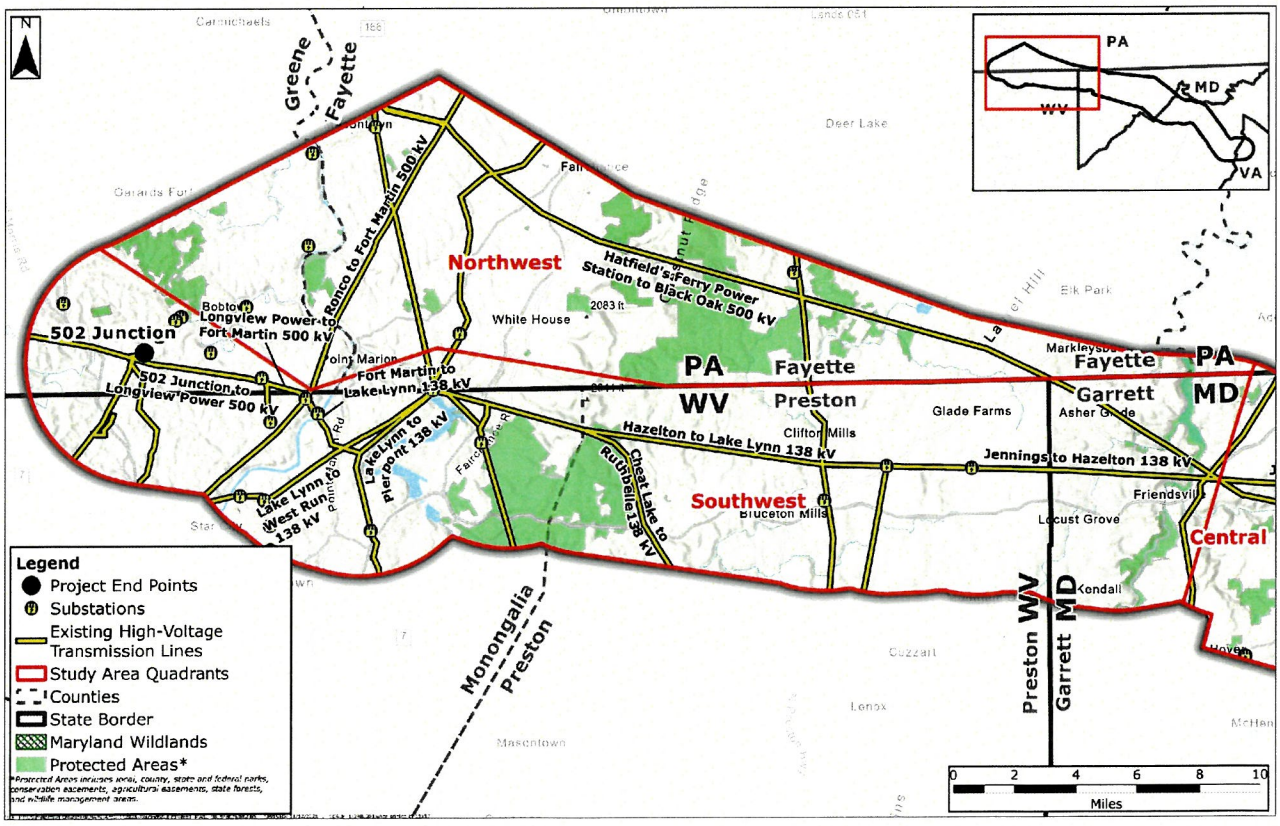
- Minimize impacts on the natural environment;
- Reduce potential conflicts with the existing built environment;
- Streamline permitting and stakeholder engagement; and
- Enhance constructability and long-term operational efficiency.

The Study Area has four quadrants that are as follows.

4.1.1 SOUTHWEST QUADRANT

Beginning at 502 Junction in Greene County, Pennsylvania, this area includes the southern portion of Greene and Fayette Counties. It also includes areas of northern Monongalia County and northern Preston County, West Virginia. This quadrant ends after the Youghiogheny River near Friendsville in Maryland where two primary existing transmission lines cross (Jennings to Hazelton 138 kV and Hatfield's Ferry Power Station to Black Oak 500 kV). Refer to Figure 4.1-2 for the southwest quadrant details.

FIGURE 4.1-2 EXISTING TRANSMISSION LINES IN THE SOUTHWEST AND NORTHWEST QUADRANTS



MD = Maryland; PA = Pennsylvania; VA = Virginia; WV = West Virginia

The southwest quadrant includes the following existing transmission lines targeted for paralleling:

- **502 Junction to Longview Power 500 kV Transmission Line:** This line travels east to southeast near the 502 Junction Substation and offered an opportunity for paralleling the existing transmission line immediately at the western terminus of the MARL Project. In this area, conceptual route corridors deviated from the existing transmission line in certain locations to reduce potential impacts on residential developments near Bald Hill Church Road and Matthews Road. Instead, the conceptual route corridors shifted south to traverse large expanses of undeveloped land and open fields, thereby minimizing residential proximity and potential land use conflicts.
- **Longview Power to Fort Martin 500 kV Transmission Line:** This line presented an opportunity for paralleling the existing transmission line to the southwest between Fort Martin and Longview Power, near Walnut Hill Road, where minimal residential development is present along the existing transmission lines.
- **Hazelton to Lake Lynn 138 kV Transmission Line:** This line extends approximately 18 miles west to east between the Lake Lynn Generating Station and the Hazelton Substation, offering numerous opportunities for paralleling the existing transmission line. It crosses through the northern section of Coopers Rock State Forest. Conceptual route corridors deviated from the existing transmission line in localized areas of residential development—such as near Fairchance Road in Monongalia County and Route 26 in Preston County, West Virginia—to minimize potential impacts on residents. The Routing Team also considered a conceptual route corridor to the north of the existing transmission line. Not directly paralleling adjacent to the existing transmission line provided options to avoid impacts on Coopers Rock State Forest, to the greatest extent possible, as well as crossings of the Cheat River north of Lake Lynn Dam, a Federal Energy Regulatory Commission-regulated hydroelectric dam. This conceptual route corridor to the north required approximately 16 miles of a greenfield section across private lands versus approximately 11 miles of paralleling adjacent to the existing transmission line.
- **Lake Lynn to West Run 138 kV Transmission Line and Fort Martin to Lake Lynn 138 kV Transmission Line:** The area between the Monongahela River and the Cheat River in Monongalia County contains two existing transmission lines: Lake Lynn to West Run 138 kV and Fort Martin to Lake Lynn 138 kV. These existing lines were initially considered for potential paralleling for the MARL Project conceptual route corridor; however, subsequent due diligence identified extensive residential development, and no routes within this area were advanced that met the criteria outlined in Section 2.7.
- **Cheat Lake to Ruthbelle 138 kV Transmission Line:** This line parallels the Hazleton to Lake Lynn 138 kV transmission line through Coopers Rock State Forest and deviates south toward Laurel Run West Virginia. Conceptual route corridors paralleled this existing transmission line through Coopers Rock State Forest.
- **Hatfield's Ferry Power Station to Black Oak 500 kV Transmission Line:** This line extends southeast through Forbes State Forest in Pennsylvania and crosses the Youghiogheny River into Maryland. Conceptual route corridors generally paralleled this existing transmission line, except in areas with higher residential density. As one of two existing transmission lines

that cross the Youghiogheny River near Friendsville, Maryland, it was specifically targeted for paralleling at the river crossing.

- **Jennings to Hazelton 138 kV:** This line runs approximately 18 miles west to east from Preston County, West Virginia, to Garrett County, Maryland, crossing the Youghiogheny River. It is the second of the two existing transmission lines that cross the Youghiogheny River near Friendsville, Maryland, and was similarly targeted for paralleling at that location.

4.1.2 NORTHWEST QUADRANT

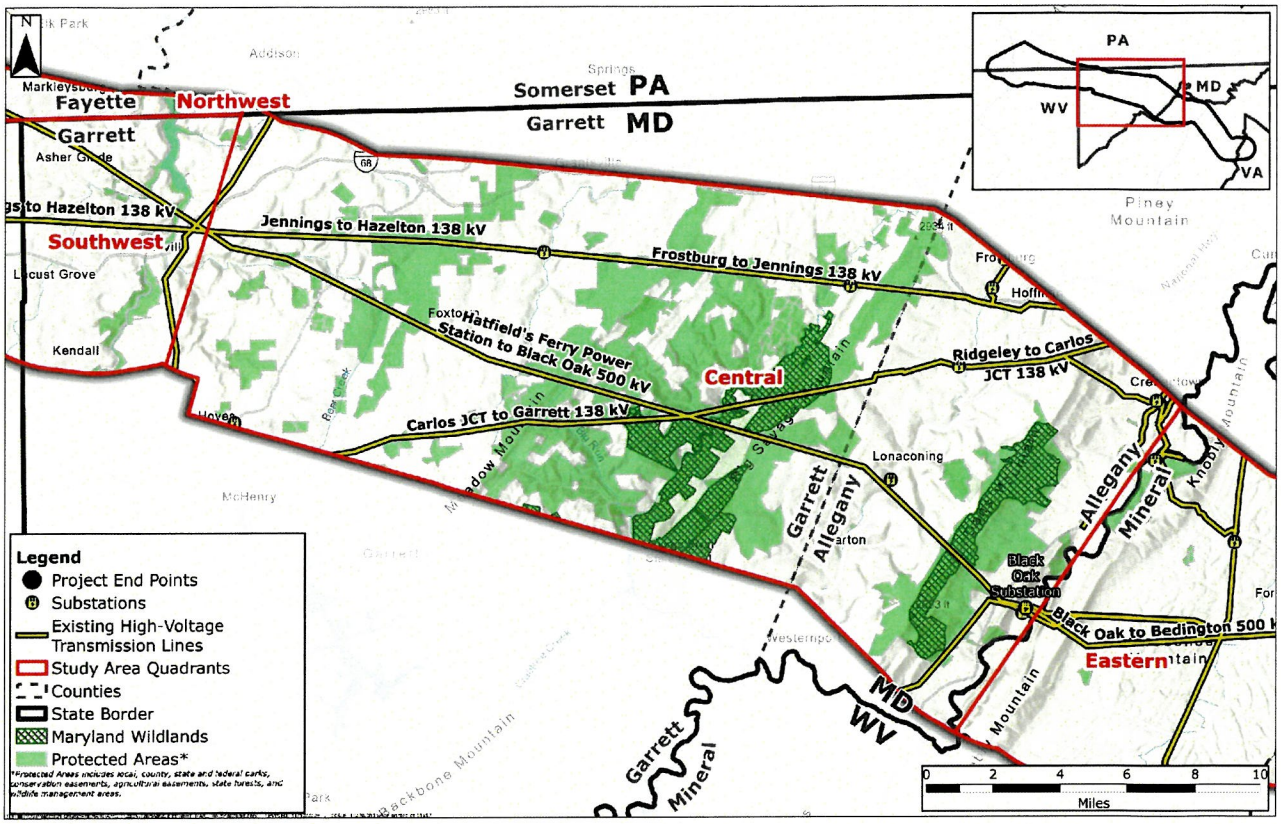
The northwest quadrant includes the southeastern corner of Greene County, Pennsylvania, and the southern portion of Fayette County, Pennsylvania, from the Friendship Hill National Historic Site in the east, through Haydentown, Elliotsville, and ending near Markleysburg, Pennsylvania. Refer to Figure 4.1-2 for the northwest quadrant details. The northwest quadrant includes two existing transmission lines targeted for paralleling: the Ronco to Fort Martin 500 kV Transmission Line and the Hatfield's Ferry Power Station to Black Oak 500 kV Transmission Line, which continues through the southwest and central quadrants.

These existing transmission lines provided conceptual route corridor optionality that avoided crossing Cheat Lake, Coopers Rock State Forest, and developed areas in Monongalia County. These conceptual route corridors provided a higher percentage of paralleling existing transmission lines. However, they required an overall longer length compared to the southern conceptual route corridors and had an increased amount of stream and state land crossings by crossing through three Pennsylvania state-managed lands (SGL 138, Quebec Run Wild Area, and Forbes State Forest).

4.1.3 CENTRAL QUADRANT

The central quadrant of the MARL Project Study Area begins after the Youghiogheny River in Friendsville, Maryland, extends through Garrett County into Allegany County, and ends at the North Branch of the Potomac River, which is the state line between Allegany County, Maryland, and Mineral County, West Virginia, near Danville, Maryland. Refer to Figure 4.1-3 for the central quadrant details.

FIGURE 4.1-3 EXISTING TRANSMISSION LINES IN THE CENTRAL QUADRANT OF THE MARL PROJECT STUDY AREA



MD = Maryland; PA = Pennsylvania; VA = Virginia; WV = West Virginia

The central quadrant includes the following existing transmission lines targeted for paralleling:

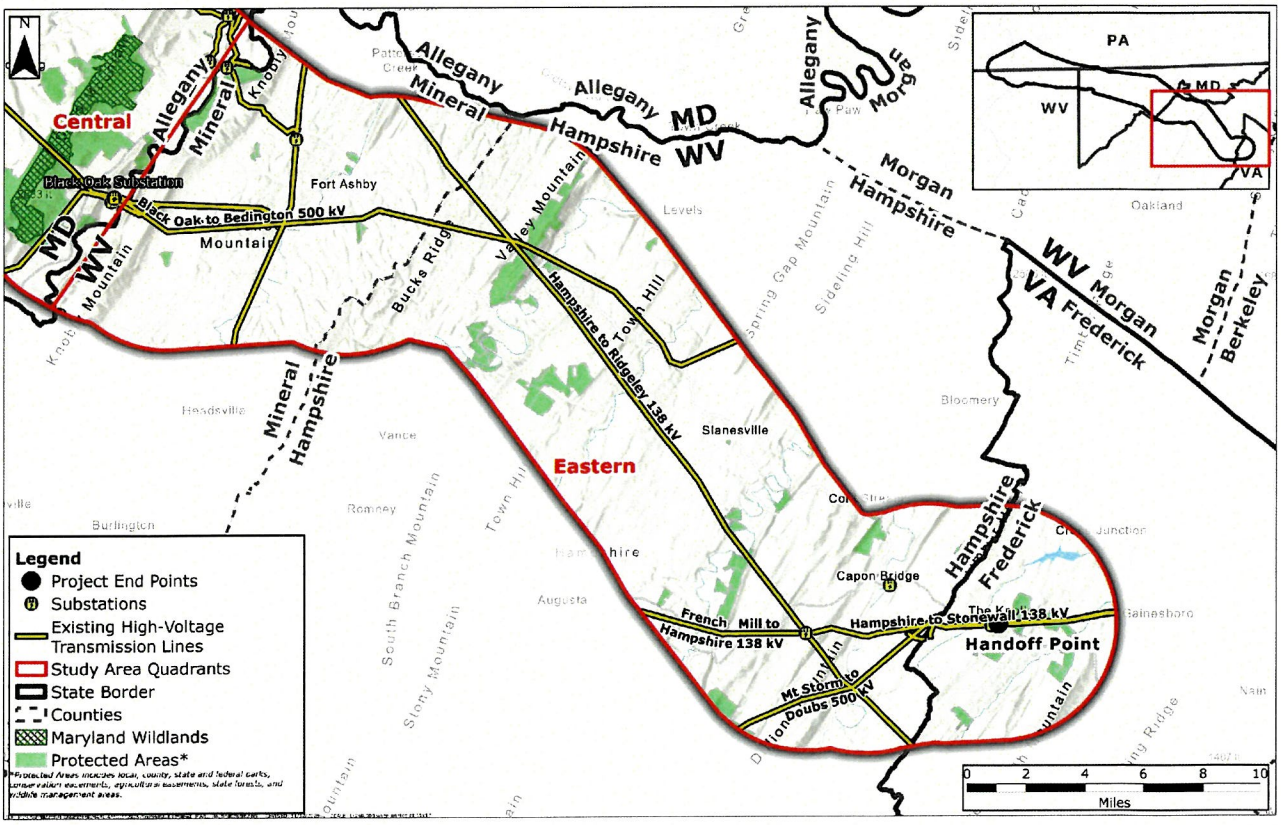
- **Hatfield's Ferry Power Station to Black Oak 500 kV Transmission Line:** This line travels in a southeast direction through the central portion of the MARL Project Study Area for 28 miles. It crosses through Savage River State Forest, Big Savage Wildlands, Dan's Mountain WMA, and Dan's Mountain Wildlands. The conceptual route corridors paralleled this existing transmission line through most of the central quadrant except in areas of residential development such as Fairview Road in Garrett County, Bear Creek Area near Kaese Mill, and as the line approaches Black Oak Substation.
- **Jennings to Hazelton 138 kV Transmission Line and Frostburg to Jennings 138 kV Transmission Line:** These two lines travel west to east for 25 miles through the central quadrant of the MARL Project Study Area. The conceptual route corridors paralleling these existing transmission lines provided optionality to avoid crossing larger sections of Savage River State Forest and avoid crossing through the Maryland Wildlands, including Dan's Mountain, Big Savage, and Bear Pen. The conceptual route corridors paralleled these lines for approximately 18 miles before a greenfield section heading south to avoid the built-up areas of Frostburg and connecting with the other existing transmission lines near Black Oak Substation. To avoid the Maryland Wildlands and Savage River State Forest crossings, these conceptual route corridors required approximately 12 miles of additional greenfield sections.

- **Carlos JCT to Garrett 138 kV:** This line travels west to northeast for 18 miles and crosses through Savage River State Forest, Bear Pen Wildlands, Big Savage Wildlands, and Savage Ravine Wildlands. Generally, this existing transmission line does not travel in the direction needed for the MARL Project to reach the endpoint; however, there were small sections of the existing transmission line targeted for paralleling adjacent to Bear Pen Wildlands to reduce greenfield sections in this part of Savage River State Forest.

4.1.4 EASTERN QUADRANT

The eastern quadrant of the MARL Project Study Area begins at the North Branch of the Potomac River, which is the state line between Allegany County, Maryland, and Mineral County, West Virginia, near Danville, Maryland, extends southeast through Hampshire County, West Virginia, and ends at the handoff point in Frederick County, Virginia. Refer to Figure 4.1-4 for the eastern quadrant details.

FIGURE 4.1-4 EXISTING TRANSMISSION LINES IN THE EASTERN QUADRANT OF THE MARL PROJECT STUDY AREA



MD = Maryland; PA = Pennsylvania; VA = Virginia; WV = West Virginia

The eastern quadrant includes the following existing transmission lines targeted for paralleling:

- **Black Oak to Bedington 500 kV Transmission Line:** This line extends east from the existing Black Oak Substation in Maryland and then through Fort Ashby and White Horse Mountain WMA. The conceptual route corridors parallel this existing transmission line to the extent feasible except for the residential development around the Fort Ashby area, which required greenfield sections of the conceptual route corridor further south that traverse through large undeveloped private lands. The Routing Team also considered a conceptual route corridor to the south that avoided impacts on White Horse Mountain WMA. This conceptual route corridor starts east of the Black Oak Substation, south of the existing transmission line and travels southeast to eventually parallel the Hampshire to Ridgeley 138 kV Transmission Line. However, this conceptual route corridor required approximately 12 miles of a greenfield section through private land and a new crossing of the South Branch of the Potomac River.
- **Hampshire to Ridgeley 138 kV Transmission Line:** This line travels southeast and crosses the Black Oak to Bedington 500 kV line just north of the White Horse Mountain WMA. The conceptual route corridors parallel this existing transmission line south through Hampshire County, West Virginia, until the Hampshire to Stonewall 138 kV line. The conceptual route corridors deviate from the existing transmission line in areas of residential development such as Points, Augusta, and Timber Mountain, West Virginia. The conceptual route corridors also deviate around newly developed conservation easements near North River.
- **French Mill to Hampshire 138 kV Transmission Line and Hampshire to Stonewall 138 kV Transmission Line:** These lines travel west to east for 16 miles from Hampshire County, West Virginia, to Frederick County, Virginia. The MARL Project terminates at the handoff point on the Hampshire to Stonewall 138 kV Transmission Line. The conceptual route corridors parallel these two existing transmission lines where feasible but deviate in areas of dense residential development such as Sycamore Drive and Sirbaugh Road in Capon Bridge, West Virginia, and around Fletcher Road in Gore, Virginia.
- **Mt. Storm to Doubs 500 kV Transmission Line:** This line travels east to northeast. There is significant residential development around the existing transmission line as it approaches the Virginia border. The MARL Project terminates at a handoff point adjacent to this existing transmission line. The conceptual route corridors parallel this line where feasible but deviate in areas of dense residential development in Capon Bridge, West Virginia, and Gore, Virginia.

4.2 IDENTIFICATION OF PRELIMINARY DRAFT ROUTE OPTIONS

After identification of the conceptual route corridors, the Routing Team identified and mapped preliminary route segments within the MARL Project Study Area quadrants for initial evaluation against the routing criteria and guidelines identified in Section 2.7. The preliminary route segments were quantitatively and qualitatively assessed on a continual basis by the Routing Team and adjusted as needed to support the development of preliminary route options for the MARL Project open houses and online survey, which were designed to gather stakeholder and public feedback. The objective of this process was to reduce the number of route segments such that those remaining were more suitable for routing a new transmission line and could be combined

into reasonable full end-to-end preliminary draft route options. These assessments were conducted by the Routing Team using a combination of data sources, including digital datasets, stakeholder and agency input, and windshield field reconnaissance.

Through the windshield field reconnaissance, additional qualitative observations were made that informed further refinement of the preliminary route segments. As a result, certain preliminary route segments were adjusted or removed based on field-verified conditions not observable in the high-resolution imagery, such as newly constructed homes, residences obscured from aerial view, unmarked cemeteries, engineering constraints, and other site-specific factors. These field-based insights complemented the quantitative data and verified that route development was grounded in both spatial analysis and real-world conditions.

The Routing Team compiled data analytics for each preliminary route segment using common starting and ending points and compared them against each other in the four quadrants of the MARL Project Study Area, removed those preliminary route segments that were less favorable, and then carried forward those remaining route segments. These remaining routes segments compromised the MARL Project "preliminary draft route options" that were presented to the public at the open houses and through the online survey. The preliminary draft route options that were shared publicly included route segments spanning approximately 310 total miles within the Study Area. These preliminary draft route options are shown on Appendix E-3, Preliminary Draft Route Options, and Appendix I.

4.3 STAKEHOLDER AND PUBLIC FEEDBACK

Stakeholder and public engagement played a critical role in shaping the routing process for the MARL Project. The Routing Team recognized the importance of gathering local knowledge, understanding community concerns, and incorporating stakeholder input into the development of route alternatives. To achieve this, a multi-faceted public outreach effort was launched, combining digital tools with in-person engagement across the four-state MARL Project Study Area and can be found in the state commission applications and supporting testimony.

The first step was an interactive online mapping survey, conducted in two phases. The initial online mapping survey, active from February 22 to April 5, 2025, invited landowners and stakeholders to share their primary concerns within the MARL Project Study Area. A total of 22,769 postcards were mailed to landowners within 2 miles of existing transmission lines that were targeted for paralleling to notify them of the survey. Landowners and the public were able to provide geographically-referenced specific feedback through an intuitive online platform. The MARL Project received 540 survey responses that helped the Routing Team identify sensitive areas and refine preliminary route segments.

The second phase of the online mapping survey, active from May 3 to June 6, 2025, presented the preliminary draft route options to the public. A total of 10,398 postcards were mailed to landowners within 1 mile of the preliminary draft route options. Using the interactive mapping tool, participants could explore the preliminary draft route options, highlight areas of concern, and submit comments directly tied to specific locations. The MARL Project received 719 survey responses that helped the Routing Team identify concerns along the preliminary draft route options, prioritize sensitive areas, and refine preliminary draft route options.

Concurrent with the second phase of the online mapping survey, the Routing Team hosted eight in-person open house meetings across the MARL Project Study Area in May 2025 and a virtual open house option on October 14, 2025, specific to the Maryland portion of the MARL Project. This public engagement effort aimed to educate the public about the MARL Project, gather constraint information not captured in existing datasets, and solicit input for route adjustments (please see Testimony of Kaitlin McCormick). The goal of the public engagement initiative was to collect any additional data to inform the route evaluation and selection process. Landowners within a 1-mile buffer of preliminary route options, along with local and state officials, received mailed invitations to attend the open houses:

- Monday, May 5, 2025, in Hampshire County, Slanesville, West Virginia 25444
- Tuesday, May 6, 2025, in Garrett County, Friendsville, Maryland 21531
- Wednesday, May 7, 2025, in Allegany County, Lonaconing, Maryland 21539
- Thursday, May 8, 2025, in Mineral County, Willey Ford, West Virginia 26767
- Monday, May 12, 2025, in Monongalia County, Morgantown, West Virginia 26506
- Tuesday, May 13, 2025, in Fayette County, Fairchance, Pennsylvania 15436
- Wednesday, May 14, 2025, in Preston County, Bruceton Mills, West Virginia 26525
- Tuesday, May 20, 2025, in Fredrick County, Gore, Virginia 22637
- Tuesday, October 14, 2025 (Virtual Maryland Open House)

At the end of the close of the online survey on June 6, 2025, a total of 1,259 comments were received in addition to feedback heard at the open houses. These comments provided critical qualitative insights that complemented the Routing Team's quantitative analysis, helping to refine route segments and eliminate routes that posed unacceptable impacts or constraints.

The team also held a virtual open house on October 14, 2025, related to the evaluation of the route options that crossed the designated Maryland Wildlands Preservation System. The team continued to receive input on the MARL Project from the community-project hotline and e-mail address.

In addition to public input, the Routing Team engaged with a wide range of local, state, and federal agencies across the four states. These agencies provided technical feedback, regulatory guidance, and data that further informed the routing process. This comprehensive public engagement effort—combining digital tools, in-person meetings, virtual open house, and agency coordination—was instrumental in shaping the final routes. The feedback received helped guide the transition from conceptual route corridors to refined route segments, ultimately contributing to the identification of six full end-to-end route alternatives for regulatory review. A full list of agencies consulted is included in the state commission applications and supporting testimony.

4.4 ROUTE REFINEMENT AND ROUTE SEGMENT ELIMINATION

Following the public engagement efforts outlined in Section 4.3, the Routing Team conducted additional evaluations to refine the preliminary draft route options/route segments using the evaluation criterion in Table 2.7-1.

As part of the route refinement process, route segments were combined, modified, or dismissed based on stakeholder concerns, engineering constructability, and natural environment, built environment, cultural, and social criteria. In total, 84 route segments were evaluated, each representing a potential part of the Alternative Routes. Refer to Appendix E-4, Route Segments. These segments were not static; they were dynamic elements subject to change based on engineering constructability, land use compatibility, environmental sensitivity, and most importantly, public and stakeholder feedback.

Through the combination of the online surveys, open house meetings, and agency coordination, the Routing Team gathered extensive input. This feedback was paired with quantitative data—such as segment length, proximity to existing infrastructure, and parcel crossings—and qualitative insights from field reconnaissance, community context, and land ownership patterns.

The results of this comprehensive evaluation are detailed below and are shown in Table 4.4-1. Table 4.4-1 provides details on each route segment and provides rationale on why a route segment was dismissed, carried forward, and/or refined. As a result, the following was determined:

- Thirty-five segments were dismissed due to constraints such as engineering, built environment, or natural environmental concerns highlighted by agencies and reiterated by public input.
- Forty-nine segments were carried forward, forming the backbone of the final route alternatives.

Of the segments carried forward, 41 were refined—some shortened, rerouted, or adjusted—to better align with stakeholder concerns and constructability. These route segments were then combined into longer, more continuous route groupings, which served as the foundation for assembling the final end-to-end route alternatives. Route groupings represented feasible routing paths that span significant portions of the MARL Project Study Area and were used to narrow down final route alternatives. The same quantitative and qualitative assessment was performed on these route groupings that resulted in the identification of the full end-to-end final Alternative Routes. The preliminary route options presented to the public and the final route alternatives identified are shown on Appendix E-5, Preliminary Draft Route Options and Final Route Alternatives.

This process was not only about dismissing routes but also about refining and adapting potential route segment options. Segments like 13d and 20b, each over 8 and 14 miles respectively, were reevaluated to account for engineering, and natural and built environment factors, demonstrating the complexity and scale of the routing effort.

Ultimately, this overall routing and siting approach led to the development of six full end-to-end route alternatives, each composed of carefully selected and refined route segments. These routes represent not only technical feasibility but input from the public, stakeholders, and regulatory agencies.

TABLE 4.4-1 ROUTE SEGMENTS

Segment	County [a]	Status	Length (miles)	Notes
Pennsylvania				
1a	Greene	Route segment considered but dismissed	0.9	Dismissed due to engineering considerations to meet the existing utilities requirements in 502 Junction Substation
1b	Greene	Final route segment	0.9	Added due to engineering considerations to meet the existing utilities requirements in 502 Junction Substation
2	Greene	Final route segment	1.8	No change
3a	Greene	Route segment considered but dismissed	3.2	Dismissed due to residential property land use considerations and to narrow the number of segments to more favorable routing options
15	Greene	Final route segment	2.1	Refined due to topographical constraints and to reduce sharp turn angles
4a	Fayette	Final route segment	3.4	Refined due to planned residential development discovered during open houses
5a	Fayette	Final route segment	4.2	Refined due to topographical constraints and to reduce sharp turn angles
15a	Fayette	Final route segment	5.4	Refined to reflect stakeholder feedback received during open houses, including indications of landowner openness to allow the route on their property
15b	Fayette	Route segment considered but dismissed	5.2	Dismissed due to proximity to residential dwellings, sharp turn angles, and to narrow the number of segments to more favorable routing options
16	Fayette	Final route segment	4.2	Refined due to topographical constraints and planned residential development discovered during open houses
17a	Fayette	Final route segment	2.9	Refined due to engineering considerations to reduce the number of sharp turn angles
17b	Fayette	Route segment considered but dismissed	3.0	Dismissed due to proximity to residential dwellings
18a	Fayette	Final route segment	3.3	Refined to more closely parallel the existing transmission line, reduce proximity to residential dwellings, and reduce impacts to a commercial business
18b	Fayette	Route segment considered but dismissed	5.2	Dismissed due to longer route length, proximity to residential dwellings, and extensive greenfield development
19	Fayette	Final route segment	4.1	Refined due to engineering considerations to reduce the number of sharp turn angles
20a	Fayette	Route segment considered but dismissed	15.1	Dismissed due to proximity to residential dwellings and impacts to an agricultural easement

Segment	County [a]	Status	Length (miles)	Notes
20b	Fayette	Final route segment	15.0	Refined due to topographical constraints and to reduce the number of sharp turn angles
West Virginia				
3b	Monongalia	Final route segment	3.6	Refined to reflect stakeholder feedback received during open houses, including indications of landowner openness to allow the route on their property
4b	Monongalia	Route segment considered but dismissed	3.8	Dismissed due to planned residential development discovered during open houses
4b to 5a	Monongalia	Route segment considered but dismissed	0.7	Dismissed due to planned residential development discovered during open houses
5b	Monongalia	Final route segment	5.4	Refined due to planned residential development discovered during open houses
5c	Monongalia	Route segment considered but dismissed	4.0	Dismissed due to proximity to residential dwellings, planned residential development, and infrastructure crossing constraints
5c to 5b	Monongalia	Route segment considered but dismissed	0.5	Dismissed due to proximity to residential dwellings
6a	Monongalia	Final route segment	1.2	Added to more closely parallel the existing transmission line and reduce impacts on residents on the north side of the existing line
7a	Monongalia	Route segment considered but dismissed	1.1	Dismissed due to greenfield development and topographical constraints
7b	Monongalia	Route segment considered but dismissed	2.3	Dismissed due to proximity to residential dwellings
7c	Monongalia	Final route segment	1.4	No change
8a	Preston	Route segment considered but dismissed	4.5	Dismissed due to its greater route length, increased greenfield development, and higher water resource impacts
8b	Preston	Route segment considered but dismissed	2.2	Dismissed due to topographical constraints, sharp turn angles, and additional greenfield development
8c	Preston	Final route segment	2.7	Refined due to engineering considerations to more closely parallel the existing transmission line corridor
8d	Preston	Route segment considered but dismissed	2.6	No change
8e	Preston	Final route segment	3.0	Added to provide greater optionality to parallel existing transmission lines through Coopers Rock State Forest
9a	Preston	Final route segment	1.6	No change
9c	Preston	Final route segment	7.5	No change
10a	Preston	Route segment considered but dismissed	4.7	Dismissed due to its greater route length and increased greenfield development

Segment	County [a]	Status	Length (miles)	Notes
10b	Preston	Final route segment	3.9	No change
11	Preston	Final route segment	2.1	No change
12a	Preston	Route segment considered but dismissed	1.7	Dismissed due to planned residential development discovered at the open houses
12b	Preston	Final route segment	1.6	Refined to reduce proximity to residential dwellings and reduce the number of sharp turn angles
13b	Preston	Route segment considered but dismissed	1.9	Dismissed due to infrastructure crossing considerations
28	Mineral	Final route segment	9.1	Refined to more closely parallel the existing transmission line based on landowner feedback received during open houses
29a	Mineral	Route segment considered but dismissed	4.8	Dismissed due to proximity to residential dwellings and crossing of a local park
29b	Mineral	Final route segment	4.7	Refined due to topographical constraints and to reduce the number of sharp turn angles
29c	Hampshire	Final route segment	13.4	Refined due to engineering considerations to reduce the number of sharp turn angles
30	Hampshire	Final route segment	4.3	Refined to more closely parallel the existing transmission line and follow property boundaries
30a	Hampshire	Final route segment	5.6	Refined to more closely parallel the existing transmission line based on stakeholder feedback during the open houses
30b	Hampshire	Route segment considered but dismissed	2.6	Dismissed due to increased greenfield development, sharp turn angles, and proximity to residential dwellings
31a	Hampshire	Route segment considered but dismissed	5.5	Dismissed due to sharp turn angles, proximity to residential dwellings, and to narrow the number of segments to more favorable routing options
31b	Hampshire	Final route segment	5.1	Refined due to engineering considerations to reduce the number of sharp turn angles
32a	Hampshire	Final route segment	1.0	Refined due to topographical constraints
32b	Hampshire	Route segment considered but dismissed	1.8	Dismissed due to crossing a new conservation easement discovered during the stakeholder engagement process
33a	Hampshire	Final route segment	5.4	Refined due to engineering considerations to reduce the number of sharp turn angles
33b	Hampshire	Final route segment	6.5	Refined to more closely parallel the existing transmission line and reduce the complexity of infrastructure crossings
34	Hampshire	Final route segment	0.2	No change
35	Hampshire	Final route segment	1.1	No change

Segment	County [a]	Status	Length (miles)	Notes
36a	Hampshire	Final route segment	1.3	Added to parallel the existing transmission line and reduce the number of 500 kV crossings
36b	Hampshire	Route segment considered but dismissed	1.6	Dismissed due to greenfield development and complexity of the existing transmission line crossings
Maryland				
13a	Garrett	Final route segment	8.7	Refined due to engineering considerations to reduce the number of sharp turn angles
13c	Garrett	Route segment considered but dismissed	1.8	Dismissed due to proximity to residential dwellings and to narrow the number of segments to more favorable routing options
13d	Garrett	Final route segment	8.8	Refined due to new residential development discovered during open houses and residential dwelling proximity when crossing the Youghiogheny River on the south side of the existing transmission line
14	Garrett	Final route segment	1.4	Refined due to infrastructure crossing considerations
21a	Garrett	Final route segment	1.9	Refined due to engineering and topographical constraints when crossing the Youghiogheny River
21b	Garrett	Route segment considered but dismissed	1.8	Dismissed due to proximity to residential dwellings and engineering and topographical constraints when crossing the Youghiogheny River
22a	Garrett	Final route segment	4.4	Refined due to proposed residential development discovered during open houses
22b	Garrett	Route segment considered but dismissed	3.7	Dismissed due to proposed residential development discovered during open houses
22c	Garrett	Final route segment	3.7	Refined to more closely parallel the existing transmission line through the Bear Creek Rural Legacy easement
22d	Garrett	Route segment considered but dismissed	5.6	Dismissed due to topographical constraints and greenfield development
23	Garrett	Final route segment	9.2	Refined due to engineering constraints and aerial blowout requirements near Big Run stream
23a	Garrett	Route segment considered but dismissed	2.0	Dismissed due to longer route length and greenfield development
24a	Garrett	Route segment considered but dismissed	2.8	Dismissed due to proposed residential development discovered during open houses
24b	Garrett	Route segment considered but dismissed	1.4	Dismissed due to greenfield Maryland Wildland crossing and proximity to Fairview Road residential dwellings

Segment	County [a]	Status	Length (miles)	Notes
24c	Garrett	Final route segment	2.8	Added to reduce impacts on residential dwellings near Fairview Road and to increase paralleling the existing transmission line
25b	Garrett	Final route segment	11.9	Refined due to topographical and engineering constraints while crossing Georges Creek and to more closely parallel the existing transmission line in response to landowner feedback
26	Garrett	Final route segment	1.7	Refined due to topographical constraints and to reduce the number of sharp turn angles
26a	Garrett	Route segment considered but dismissed	5.8	Dismissed due to longer route length
26b	Garrett	Final route segment	5.5	Refined due to topographical constraints and to reduce the number of sharp turn angles and reduce stream crossing impacts
25a	Allegany	Route segment considered but dismissed	13.1	Dismissed due to topographical constraints on the north side of the existing transmission line
27	Allegany	Final route segment	23.8	Refined due to topographical and new wind farm development constraints and to reduce the number of sharp turn angles
Virginia				
37a	Frederick	Final route segment	0.8	Refined due to engineering considerations to reduce the number of sharp turn angles
37b	Frederick	Final route segment	0.8	Refined due to engineering considerations to reduce the number of sharp turn angles
38a	Frederick	Route segment considered but dismissed	1.8	Dismissed due to proximity to residential dwellings and greenfield development
38b	Frederick	Route segment considered but dismissed	1.5	Dismissed due to proximity to residential dwellings
38c	Frederick	Final route segment	1.7	Added to more closely parallel the existing transmission line corridors on the south side
39	Frederick	Route segment considered but dismissed	6.0	Dismissed due to extensive greenfield development and longer route length

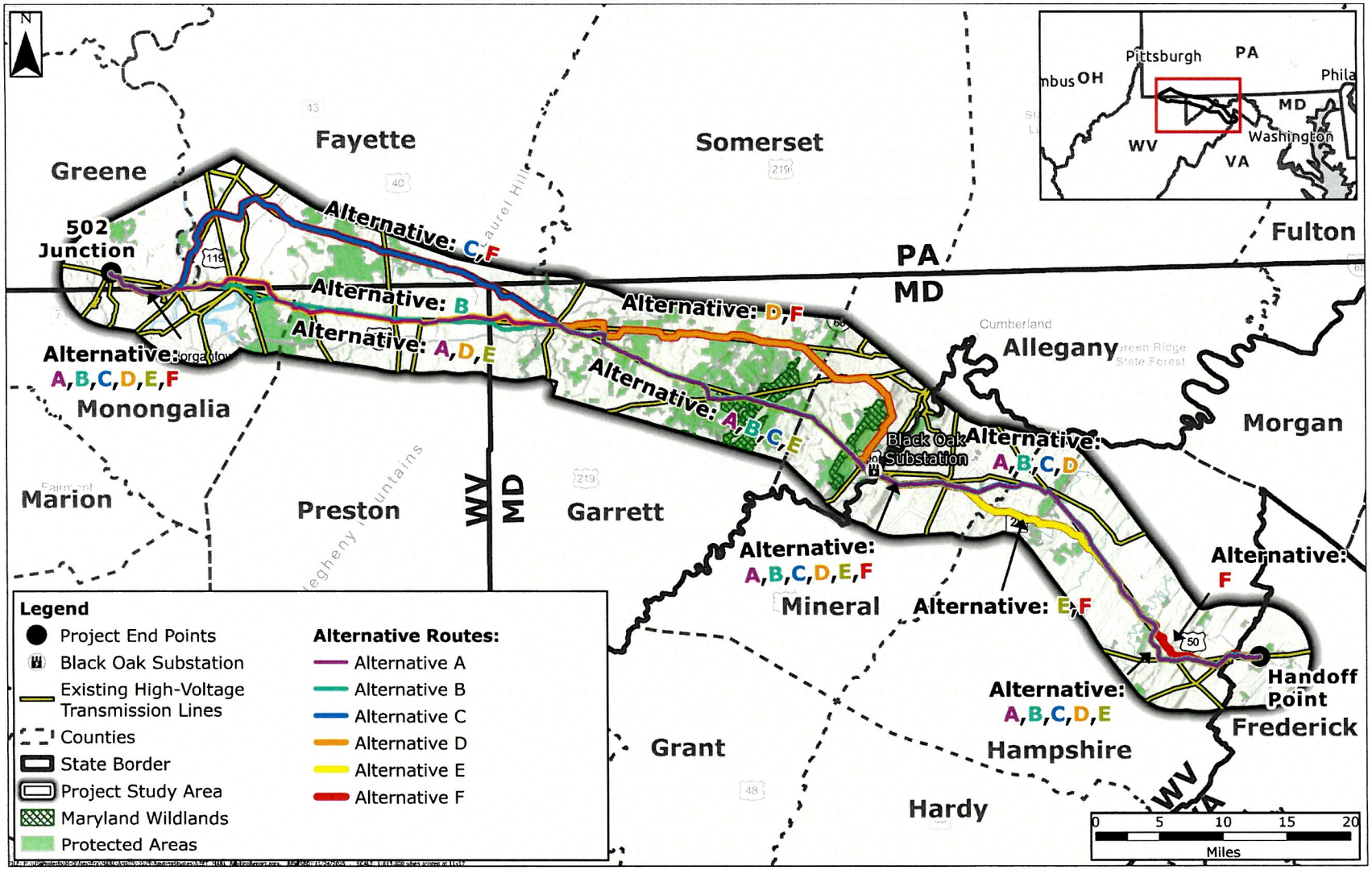
[a] Several route segments extend across county boundaries. The listed county represents the county in which the center point of the segment is located.

4.5 IDENTIFICATION OF FINAL ALTERNATIVE ROUTES

The Routing Team analyzed and combined the 49 route segments into six end-to-end Alternative Routes (A through F) for a detailed comparative analysis to ultimately determine a superior Proposed Route. From the more than 350 possible end-to-end routing combinations generated through the route segment analysis, a focused set of six representative alternatives was identified for detailed comparison. These six feasible Alternative Routes were selected to capture the full range of routing opportunities while minimizing overlap, making sure that each option meaningfully differed in terms of geographic alignment, land use context, and environmental setting. Selection emphasized routes that balanced engineering constructability with opportunities to avoid or reduce impacts on natural environmental and built environmental resources, cultural or social and/or recreational resources.

These six Alternative Routes (A through F) are described in the following sections and are shown on Figure 4.5-1. Appendix E-6, Alternative Routes Multi Panel, provides a detailed panel overview of the six feasible Alternative Routes that were identified by the Routing Team and Appendix E-7, Alternative Routes, provides a detailed mapbook of the MARL Project six feasible Alternative Routes that were identified by the Routing Team.

FIGURE 4.5-1 ALTERNATIVE ROUTES



MD = Maryland; PA = Pennsylvania; VA = Virginia; WV = West Virginia

4.5.1 ALTERNATIVE ROUTE A

Alternative Route A is comprised of route segments 1b, 2, 3b, 4a, 5a, 6a, 7c, 8e, 9c, 12b, 13a, 14, 22c, 23, 24c, 25b, 28, 29b, 30, 30a, 31b, 32a, 33b, 34, 35, 36a, 37b, and 38c. Alternative Route A was developed to parallel existing transmission lines and reduce greenfield sections to the extent possible. Alternative Route A parallels portions of the following transmission lines (listed in order from west to east):

- 502 Junction to Longview Power 500 kV Transmission Line
- Cheat Lake to Ruthbelle 138 kV Transmission Line
- Hazelton to Lake Lynn and Jennings to Hazelton 138 kV Transmission Lines
- Hatfield's Ferry Power Station to Black Oak 500 kV Transmission Line
- Carlos JCT to Garrett 138 kV Transmission Line
- Black Oak to Bedington 500 kV Transmission Line
- Hampshire to Ridgeley 138 kV Transmission Line
- French Mill to Hampshire 138 kV Transmission Line
- Hampshire to Stonewall 138 kV Transmission Line
- Mt. Storm to Doubs 500 kV Transmission Line

Alternative Route A is 107.5 miles long, crosses all four states (10.7 miles through Pennsylvania, 58.9 miles through West Virginia, 35.4 miles through Maryland, and 2.4 miles through Virginia), and requires 2,669.0 acres of ROW. Alternative Route A parallels existing transmission lines for 56.4 miles (52.5 percent of the total alignment) and proposes 51.0 miles of a greenfield section (47.5 percent of the total alignment). Alternative Route A crosses Coopers Rock State Forest, Youghiogheny River Lake and the Potomac Heritage Trail, Bear Creek Hatchery Fisheries Management Area (FMA), Savage River State Forest, including the associated Bear Pen and Big Savage Mountain Wildlands, Dans Mountain WMA and the associated Dans Mountain Wildlands, and the White Horse Mountain WMA—all of which have existing transmission lines that Alternative A parallels.

4.5.2 ALTERNATIVE ROUTE B

Alternative Route B is comprised of route segments 1b, 2, 3b, 4a, 5b, 8c, 11, 12b, 13d, 14, 22c, 23, 24c, 25b, 28, 29b, 30, 30a, 31b, 32a, 33b, 34, 35, 36a, 37a, and 38c. Alternative Route B was developed to traverse more into West Virginia, while paralleling the following existing transmission lines (listed in order from west to east):

- 502 Junction to Longview Power 500 kV Transmission Line
- Hazelton to Lake Lynn and Jennings to Hazelton 138 kV Transmission Line
- Hatfield's Ferry Power Station to Black Oak 500 kV Transmission Line
- Carlos JCT to Garrett 138 kV Transmission Line
- Black Oak to Bedington 500 kV Transmission Line
- Hampshire to Ridgeley 138 kV Transmission Line
- French Mill to Hampshire 138 kV Transmission Line

- Hampshire to Stonewall 138 kV Transmission Line
- Mt. Storm to Doubs 500 kV Transmission Line

Alternative Route B is 107.3 miles long, crosses all four states (8.5 miles through Pennsylvania, 60.9 miles through West Virginia, 35.5 miles through Maryland, and 2.4 miles through Virginia), and requires 2,671.4 acres of ROW. Alternative Route B parallels existing transmission lines for 59.7 miles (55.6 percent of the total alignment) and proposes 47.6 miles of a greenfield section (44.4 percent of the total alignment). Alternative Route B crosses Coopers Rock State Forest, Youghiogheny River Lake and the Potomac Heritage Trail, Bear Creek Hatchery FMA, Savage River State Forest, including the associated Bear Pen and Big Savage Mountain Wildlands, Dans Mountain WMA and the associated Dans Mountain Wildlands, and the White Horse Mountain WMA.

4.5.3 ALTERNATIVE ROUTE C

Alternative Route C is comprised of route segments 1b, 2, 3b, 15, 15a, 16, 17a, 18a, 19, 20b, 21a, 22c, 23, 24c, 25b, 28, 29b, 30, 30a, 31b, 32a, 33b, 34, 35, 36a, 37b, and 38c. Alternative Route C was developed to provide an alternative to crossing Coopers Rock State Forest and Preston County, West Virginia, while paralleling the existing 500 kV transmission lines in the northwestern quadrant of the MARL Project Study Area in Pennsylvania. Alternative Route C parallels portions of the following transmission lines (listed in order from west to east):

- 502 Junction to Longview Power 500 kV Transmission Line
- Ronco to Fort Martin 500 kV Transmission Line
- Hatfield's Ferry Power Station to Black Oak 500 kV Transmission Line
- Carlos JCT to Garrett 138 kV Transmission Line
- Black Oak to Bedington 500 kV Transmission Line
- Hampshire to Ridgeley 138 kV Transmission Line
- French Mill to Hampshire 138 kV Transmission Line
- Hampshire to Stonewall 138 kV Transmission Line
- Mt. Storm to Doubs 500 kV Transmission Line

Alternative Route C is 113.6 miles long, crosses all four states (34.2 miles through Pennsylvania, 40.5 miles through West Virginia, 36.4 miles through Maryland, and 2.4 miles through Virginia), and requires 2,835.5 acres of ROW. Alternative Route C parallels existing transmission lines for 64.5 miles (56.8 percent of the total alignment) and proposes 49.1 miles of a greenfield section (43.2 percent of the total alignment). Alternative Route C crosses SGL 138, Forbes State Forest, Quebec Run Wild Area, Youghiogheny River Lake and the Potomac Heritage Trail, Bear Creek Hatchery FMA, Savage River State Forest, including the associated Bear Pen and Big Savage Mountain Wildlands, Dans Mountain WMA and the associated Dans Mountain Wildlands, and the White Horse Mountain WMA.

4.5.4 ALTERNATIVE ROUTE D

Alternative Route D is comprised of route segments 1b, 2, 3b, 4a, 5a, 6a, 7c, 8e, 9c, 12b, 13a, 14, 22a, 26, 26b, 27, 28, 29b, 30, 30a, 31b, 32a, 33b, 34, 35, 36a, 37b, and 38c. Alternative Route D was developed to provide an alternative that minimizes impacts on the Savage River

State Forest and associated Wildlands and Dan's Mountain WMA and associated Wildlands. Alternative Route D deviates from Alternative Routes A, B, and C after crossing the Youghiogheny River to continue paralleling the Jennings to Hazelton 138 kV transmission line traveling west to east, after which the route requires a large greenfield section traveling south to connect back to the existing transmission lines near Black Oak Substation. Alternative Route D parallels portions of the following transmission lines (listed in order from west to east):

- 502 Junction to Longview Power 500 kV Transmission Line
- Cheat Lake to Ruthbelle 138 kV Transmission Line
- Hazelton to Lake Lynn and Jennings to Hazelton 138 kV Transmission Line
- Frostburg to Jennings 138 kV Transmission Line
- Carlos JCT to Garrett 138 kV Transmission Line
- Hatfield's Ferry Power Station to Black Oak 500 kV Transmission Line
- Black Oak to Bedington 500 kV Transmission Line
- Hampshire to Ridgeley 138 kV Transmission Line
- French Mill to Hampshire 138 kV Transmission Line
- Hampshire to Stonewall 138 kV Transmission Line
- Mt. Storm to Doubs 500 kV Transmission Line

Alternative Route D is 115.2 miles, crosses all four states (10.7 miles through Pennsylvania, 58.9 miles through West Virginia, 43.2 miles through Maryland, and 2.4 miles through Virginia), and requires 2,839.0 acres of ROW. Alternative Route D parallels existing transmission lines for 43.1 miles (37.4 percent of the total alignment) and proposes 72.1 miles of a greenfield section (62.6 percent of the total alignment). Alternative Route D crosses Coopers Rock State Forest, Youghiogheny River Lake and the Potomac Heritage Trail, Savage River State Forest, Dans Mountain WMA, and the White Horse Mountain WMA.

4.5.5 ALTERNATIVE ROUTE E

Alternative Route E is comprised of route segments 1b, 2, 3b, 4a, 5a, 6a, 7c, 8e, 9c, 12b, 13a, 14, 22c, 23, 24c, 25b, 8, 29c, 31b, 32a, 33b, 34, 35, 36a, 37b, and 38c. Alternative Route E was developed to provide an alternative to crossing the White Horse Mountain WMA by routing a greenfield section traveling south of White Horse Mountain WMA and north of a grouping of agricultural conservation easements before crossing the South Branch of the Potomac River. Alternative Route D parallels portions of the following transmission lines (listed in order from west to east):

- 502 Junction to Longview Power 500 kV Transmission Line
- Cheat Lake to Ruthbelle 138 kV Transmission Line
- Hazelton to Lake Lynn and Jennings to Hazelton 138 kV Transmission Line
- Hatfield's Ferry Power Station to Black Oak 500 kV Transmission Line
- Carlos JCT to Garrett 138 kV Transmission Line
- Black Oak to Bedington 500 kV Transmission Line

- Hampshire to Ridgeley 138 kV Transmission Line
- French Mill to Hampshire 138 kV Transmission Line
- Hampshire to Stonewall 138 kV Transmission Line
- Mt. Storm to Doubs 500 kV Transmission Line

Alternative Route E is 106.3 miles, crosses all four states (10.7 miles through Pennsylvania, 57.8 miles through West Virginia, 35.4 miles through Maryland, and 2.4 miles through Virginia), and requires 2,651.5 acres of ROW. Alternative Route E parallels existing transmission lines for 50.8 miles (47.7 percent of the total alignment) and proposes 55.6 miles of a greenfield section (52.3 percent of the total alignment). Alternative Route E crosses Coopers Rock State Forest, Youghiogheny River Lake and the Potomac Heritage Trail, Bear Creek Hatchery FMA, Savage River State Forest, including the associated Bear Pen and Big Savage Mountain Wildlands, and Dan's Mountain WMA and the associated Dans Mountain Wildlands.

4.5.6 ALTERNATIVE ROUTE F

Alternative Route F is comprised of route segments 1b, 2, 3b, 15, 15a, 16, 17a, 18a, 19, 20b, 21a, 22a, 26, 26b, 27, 28, 29c, 31b, 32a, 33a, 34, 35, 36a, 37a, and 38c. Alternative Route F was developed to provide an alternative that parallels existing transmission lines in the northwest quadrant of the MARL Project Study Area, and avoid impacts on the Coopers Rock State Forest, Bear Pen Wildlands, Big Savage Mountain Wildlands, Dans Mountain Wildlands and White Horse Mountain WMA. Alternative Route F parallels portions of the following transmission lines (listed in order from west to east):

- 502 Junction to Longview Power 500 kV Transmission Line
- Ronco to Fort Martin 500 kV Transmission Line
- Hatfield's Ferry Power Station to Black Oak 500 kV Transmission Line
- Jennings to Hazelton and Frostburg to Jennings 138 kV Transmission Line
- Carlos JCT to Garrett 138 kV Transmission Line
- Black Oak to Bedington 500 kV Transmission Line
- Hampshire to Ridgeley 138 kV Transmission Line
- French Mill to Hampshire 138 kV Transmission Line
- Hampshire to Stonewall 138 kV Transmission Line
- Mt. Storm to Doubs 500 kV Transmission Line

Alternative Route F is 119.1 miles, crosses all four states (34.2 miles through Pennsylvania, 38.3 miles through West Virginia, 44.1 miles through Maryland, and 2.4 miles through Virginia), and requires 2,964.3 acres of ROW. Alternative Route F parallels existing transmission lines for 43.2 miles (36.3 percent of the total alignment) and proposes 75.9 miles of a greenfield section (63.7 percent of the total alignment). Alternative Route F crosses SGL 138, Forbes State Forest, Quebec Run Wild Area, Youghiogheny River Lake and the Potomac Heritage Trail, Savage River State Forest, and Dans Mountain WMA.

5. ALTERNATIVE ROUTE COMPARISON

Section 2 identifies the goal of the Routing Study for the MARL Project and the criteria and guidelines used for the development of route selection. The Routing Team recognizes that no single route can simultaneously minimize all potential impacts or eliminate the need for non-standard design elements. Routing decisions inherently involve trade-offs. For example, in forested regions, a route that avoids residential development may require extensive tree clearing, while a route that minimizes ecological disturbance may affect more dwellings.

Accordingly, the routing process aimed not to only reduce impacts across all resource categories, but also to achieve a balanced outcome when competing constraints cannot be avoided. This balance was achieved by a comparative evaluation of Alternative Routes, stakeholder input, and technical feasibility.

The multi-criteria evaluation (Table 2.7-1) for analysis of the Alternative Routes was a comprehensive process that integrated the natural environment, built environment, cultural resources, social resources, and engineering constructability to identify the superior and least impactful route. Each route was assessed using a robust framework outlined in Section 2.7. The Routing Team systematically compared the identified Alternative Routes across quantitative and qualitative measures, including route length and footprint; land use considerations such as paralleling existing infrastructure, impacts on communities, protected lands, cultural resources and land cover; natural environment considerations such as water resources, and ecological and sensitive species; engineering and infrastructure; and estimated costs.[11] This process achieved an optimal balance among all evaluation criteria and identified a Proposed Route that is superior to the five other Alternative Routes.

As outlined in Section 2.7, the Routing Team decided not to assign explicit numerical weights or scores to individual routing criteria. Instead, the Routing Team opted for a hybrid quantitative-qualitative approach on route selection based on a comprehensive and balanced assessment rather than rigid numerical weighting. Section 2.7 provides an explanation on why this approach was taken for the MARL Project. The sections below evaluate the Alternative Routes against the quantitative criteria outlined in Table 2.7-1. Using a combination of quantitative and qualitative information, each Alternative Route was assigned a category of performance:

- Superior—High performance for the listed criteria with low impacts on category resources relative to the other Alternative Routes.
- Moderate—Average performance for the listed criteria with moderate impacts on category resources relative to the other Alternative Routes.
- Inferior—Poor performance for the listed criteria with high impacts on category resources relative to the other Alternative Routes.

[11] In the sections below, "criteria" are the benchmarks used in the Alternatives Routes analysis. The criteria are Route Length, Construction Footprint, Paralleling Existing Infrastructure, Community and Recreational Resources, Protected Areas, Cultural Resources, Agricultural and Land Cover, Water Resources, Sensitive Species and Habitats, Engineering and Infrastructure, and Estimated Costs. "Metric" is used when discussing an individual measure within the criteria, e.g., number of parcels, number unique landowners, acreage of wetland resources.

The results of this analysis are discussed in detail in Sections 5.1 through 5.5 and are summarized in Section 5.6 to help provide clarity and transparency on the decision-making process for the selection of the Proposed Route. For consistent evaluation across multiple states, the Routing Team relied on MARL Project Study Area-wide datasets and, where possible, merged state-specific data for a more accurate comparison. For state-specific analysis, please refer to the Environmental Review Documents (Appendices A, B, C, and D).

5.1 ROUTE LENGTH AND CONSTRUCTION FOOTPRINT

Route length and construction footprint were evaluated to assess the physical scale and potential land disturbance associated with each Alternative Route. Route length reflects the total linear mileage of the transmission line, while construction footprint represents the area required for the ROW Corridor. These criteria helped to characterize the extent of land disturbance and the relative efficiency of each Alternative Route. The "efficiency" of an Alternative Route refers to its total length in comparison to the straight-line distance between two points, commonly described "as the crow flies." As shown on Figure 1.1-1, the MARL Project's straight-line distance between the two endpoints is 95.0 miles. Shorter routes with smaller footprints reduce impacts on the natural environment and built environment, provide cost savings, and improve efficiency and constructability.

Evaluating against these criteria helped identify Alternative Routes that balanced engineering feasibility and efficiency with natural environment and built environment considerations (Table 5.1-1).

TABLE 5.1-1 ROUTE LENGTH AND CONSTRUCTION FOOTPRINT EVALUATION CRITERIA

Criteria	Unit	Alternative Route A	Alternative Route B	Alternative Route C	Alternative Route D	Alternative Route E	Alternative Route F
Centerline Length	Miles	107.5	107.3	113.6	115.2	106.3	119.1
ROW Corridor	Acres	2,669.0	2,671.4	2,835.5	2,839.0	2,651.5	2,964.3

Alternative Route A

Alternative Route A had superior performance for route length and construction footprint evaluation criteria. It has a total centerline length of 107.5 miles and a ROW Corridor footprint of 2,669.0 acres. Among the six Alternative Routes, Alternative Route A is one of three that minimize both route length and area required for the ROW Corridor, supporting the MARL Project objective of reducing total disturbance while maintaining a technically feasible alignment.

Alternative Route B

Alternative Route B had superior performance for route length and construction footprint evaluation criteria. It has a total centerline length of 107.3 miles and a ROW Corridor footprint of 2,671.4 acres, nearly identical to Alternative Route A. These two routes performed comparably, with Alternative Route B being slightly shorter; however, it resulted in a marginally larger footprint (due to additional aerial easement blowout requirements).

Alternative Route C

Alternative Route C had moderate performance for route length and construction footprint evaluation criteria. It has a total centerline length of 113.6 miles and a ROW Corridor footprint of 2,835.5 acres. Alternative Route C is one of three routes that resulted in longer total centerline length and ROW Corridor. The longer centerline and larger footprint would result in greater overall disturbance. Alternative Route C overlaps with Alternative Route A for 75.2 miles (66.2 percent of total length) except for a 38.4-mile-long section in Greene and Fayette Counties, Pennsylvania, and Garrett County, Maryland, designed to parallel the existing 500 kV transmission lines in the northwest quadrant of the MARL Project Study Area. This resulted in an additional 6.1 miles of line length as compared to Alternative Route A.

Alternative Route D

Alternative Route D had moderate performance for route length and construction footprint evaluation criteria. It has a total centerline length of 115.2 miles and a ROW Corridor footprint of 2,839.0 acres. Alternative Route D has the second-longest route and second-largest total footprint evaluated. Alternative Route D overlaps with Alternative Route A for 77.7 miles (67.5 percent of total length) except in Maryland, where it deviates to avoid potential impacts on the Maryland Wildlands. This required an additional 7.7 miles of route length. As a result, Alternative Route D would have a larger impact on the natural environment and built environment relative to the shorter Alternative Routes.

Alternative Route E

Alternative Route E had superior performance for route length and construction footprint evaluation criteria. It is the shortest route (106.3 miles) and has the smallest ROW Corridor footprint (2,651.5 acres). Alternative Route E resulted in a reduction of 1.0 to 1.2 miles in total length, and a decrease in ROW Corridor area of 17.5 to 19.9 acres when compared to Alternative Routes A and B. Alternative Route E overlaps with Alternative Route A for 92.6 miles (87.1 percent of total length) except in Mineral and Hampshire Counties, West Virginia, to avoid potential impacts on White Horse Mountain WMA. While this results in a slightly shorter alignment (1.2 miles shorter), it does so with a higher percentage of greenfield development as shown in Section 5.2.1.

Alternative Route F

Alternative Route F had an inferior performance for route length and construction footprint evaluation criteria. At 119.1 miles and 2,964.3 acres of ROW Corridor, Alternative Route F is the longest and has the largest ROW Corridor of all Alternative Routes. Its greater linear extent and broader footprint would result in a higher overall land disturbance.

Superior Alternative Routes

Alternative Routes A, B, and E have the shortest route length and smallest ROW Corridor footprint. These routes vary by 1.2 miles in total length and less than 1 percent in ROW Corridor area, reflecting consistently compact and efficient alignments with reduced land disturbance. Alternative Route E achieved the shortest total distance and smallest footprint overall, while

Alternative Routes A and B were comparable in length and ROW Corridor, and fell within the same category of minimized impact.

Moderate and Inferior Alternative Routes

Alternative Route F had inferior performance, with the greatest total length and largest overall construction footprint of 7 to 12 percent greater than the best performing Alternative Routes (A, B, and E). Additionally, Alternative Routes C and D had moderate performance. Alternative Routes C, D, and F have broader ROW Corridor footprints and longer route alignments, resulting in lower performance than the other Alternative Routes.

5.2 LAND USE AND SOCIAL RESOURCES

The land use and social resources criteria used in the Alternative Routes evaluation covered many different topics and datasets. Each subsection below highlights groups of thematic information to provide a more nuanced and detailed review of each specific criterion.

5.2.1 PARALLELING EXISTING INFRASTRUCTURE

Paralleling new transmission facilities adjacent to established utility corridors helps reduce visual, natural environment, and built environment impacts by concentrating infrastructure within areas previously cleared by utility development. Where feasible, the Routing Team prioritized paralleling existing transmission lines to reduce impacts. Figure 2.1-2 provides an illustration of the MARL Project definition of paralleling. Benefits to paralleling are discussed in Section 2.1. Appendix E-8, Alternative Routes—Land Use and Social Resources—Paralleling, Community and Recreation, and Protected Areas, shows where each Alternative Route parallels existing transmission lines compared to where the Alternative Routes are greenfield development. Appendix J includes a Visual Impact Assessment conducted for the MARL Project.

The Routing Team evaluated each route for the following metrics associated with the Paralleling Existing Infrastructure evaluation criteria presented in Table 5.2-1:

- **Paralleling sections**—Evaluating both the percentage and total mileage of paralleling provided a balanced assessment of each route's efficiency. The percentage of paralleling allowed the Routing Team to compare routes on an equal basis, independent of overall route length, while the total mileage of paralleling highlighted the absolute extent of total paralleling along each Alternative Route. Section 2.1 provides the benefits of paralleling; each criteria evaluation section below, where appropriate, takes this into account.
- **Greenfield sections**—Similar to paralleling, the Routing Team also evaluated the total length and percentage of greenfield development. Alternative Routes with a high percentage of paralleling, but a longer section of greenfield development, might be less favorable than a route with a slightly lower percentage of paralleling.

TABLE 5.2-1 PARALLELING EXISTING INFRASTRUCTURE EVALUATION CRITERIA

Criteria	Alternative Route A		Alternative Route B		Alternative Route C		Alternative Route D		Alternative Route E		Alternative Route F	
	Miles	%	Miles	%	Miles	%	Miles	%	Miles	%	Miles	%
Paralleling existing transmission lines [a]	56.4	52.5	59.7	55.6	64.5	56.8	43.1	37.4	50.8	47.7	43.2	36.3
Greenfield section development [b]	51.0	47.5	47.6	44.4	49.1	43.2	72.1	62.6	55.6	52.3	75.9	63.7
Paralleling railroad ROW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paralleling natural gas pipelines ROW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paralleling highways	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: Rextag Infrastructure data

ROW = right-of-way

[a] Paralleling for the MARL Project is defined as siting the proposed transmission line so the MARL Project ROW Corridor abuts the existing transmission line corridor.

[b] Greenfield section for the MARL Project is defined as a section of the MARL Project ROW Corridor for any portion of the route that does not abut an existing transmission line corridor.

Alternative Route A

Alternative Route A had superior performance for paralleling existing infrastructure and greenfield development criteria. It achieved a strong balance between maximizing paralleling and minimizing total greenfield development. With 56.4 miles (52.5 percent) of paralleling existing transmission lines, Alternative Route A maintained a high overall paralleling ratio among all route options. With regards to greenfield development, Alternative Route A has a total greenfield length of 51.0 miles (47.5 percent).

Alternative Route B

Alternative Route B had superior performance for paralleling existing infrastructure and greenfield development criteria. It also achieved a strong balance between maximizing paralleling and minimizing greenfield development, with 59.7 miles (55.6 percent) of its length located along existing transmission lines. Alternative Route B maintained a high overall paralleling ratio among all the route options. Alternative Route B had a total greenfield development of 47.6 miles (44.4 percent). This alternative maximized paralleling of existing transmission lines while maintaining the shortest route length.

Alternative Route C

Alternative Route C had superior performance for paralleling existing infrastructure and greenfield development criteria. It achieved the highest percentage of paralleling with 56.8 percent (64.5 miles); however, this was achieved at the expense of a longer overall route. Alternative Route C resulted in a total greenfield length of 49.1 miles. Although the paralleling percentage is the highest overall, this route's total length and greater construction footprint offset some of those benefits.

Alternative Route D

Alternative Route D had inferior performance for paralleling existing infrastructure and greenfield development criteria. It has only 37.4 percent paralleling (43.1 miles) and the second-largest percentage for greenfield development at 62.6 percent (72.1 miles). Alternative Route D has the same alignment as Alternative Route A except in Maryland, where it deviates to avoid crossing through the Maryland Wildlands. Avoiding the Maryland Wildlands necessitates an additional 21.1 miles of greenfield development, for a total of 31.1 miles of greenfield development in Maryland compared to 10.0 miles of greenfield development for Alternative Route A in Maryland.

Alternative Route E

Alternative Route E had moderate performance for paralleling existing infrastructure and greenfield development criteria. It achieved less balance between maximizing paralleling and minimizing greenfield development with 47.7 percent paralleling (50.8 miles) and 52.3 percent greenfield (55.6 miles). Alternative Route E has the same alignment as Alternative Route A except in Mineral and Hampshire Counties, West Virginia, where the route deviates to avoid crossing through the White Horse Mountain WMA. Avoiding White Horse Mountain WMA necessitates an additional 4.6 miles of greenfield development in West Virginia compared to Alternative Route A.

While efficient in overall route length, Alternative Route E has a lower percentage of paralleling compared to the top three shortest routes (Alternative Route A, B, and E).

Alternative Route F

Alternative Route F had an inferior performance for paralleling existing infrastructure and greenfield development criteria. It has the lowest percentage of paralleling existing transmission lines (43.2 miles; 36.3 percent). Alternative Route F also had the highest total greenfield mileage with 75.9 miles (63.7 percent). These characteristics suggest greater potential visual, land use, and natural environment impacts compared to the other Alternative Routes.

Superior Alternative Routes

Alternative Routes A, B, and C exhibit the highest degrees of paralleling with existing transmission lines, ranging from 52.5 to 56.8 percent paralleling which is more than half of the route length. Alternative Route B has the best combination of total paralleling percent (55.6 percent) to total greenfield mileage with the lowest total greenfield mileage (47.6 miles). Alternative Route C had the highest percentage of paralleling existing transmission lines; however, it does so at a longer overall route length when compared to Alternative Routes A and B. While Alternative Route A had 3.3 fewer miles of paralleling than Alternative Route B, and 8.1 fewer miles of paralleling than Alternative Route C, it had similar total greenfield mileage compared to Alternative Route C (51.0 miles for Alternative Route A versus 49.1 miles for Alternative Route C). All three routes qualify as superior in terms of maximizing paralleling of existing transmission lines and minimizing total greenfield mileage.

Moderate and Inferior Alternative Routes

Alternative Routes D and F had an inferior performance in terms of paralleling, with less than 50 percent of their alignments paralleling with existing transmission lines, which resulted in substantially higher greenfield mileage. Alternative Route F performed the worst, with the lowest percentage of paralleling (36.3 percent) and the highest total greenfield length (75.9 miles). Alternative Route E performed moderately for these criteria.

5.2.2 COMMUNITY AND RECREATIONAL RESOURCES

Routing criteria for the MARL Project was developed to minimize impacts on the community and recreation resources. The resulting evaluation data are provided in Table 5.2-2 and shown on Appendix E-8. Key indicators included buildings—both residential and non-residential—located at varying distances from the route centerline, including within the ROW Corridor, within 250 feet of the centerline, and within 500 feet of the centerline. This provided a graduated view of potential impacts on the built environment. Within this category, residential dwellings were of particular concern and Alternative Routes were developed to minimize impacts, to the extent practical, on dwellings while balancing the goal of maximizing paralleling existing transmission lines. For the MARL Project, building footprints were digitized using high-resolution (3-inch) aerial imagery contracted by NEET MA and NEET VA and captured during leaf-off conditions between December 2023 and February 2024 and county property data. This dataset may not reflect proposed or recently built structures and could include classification errors inherent to desktop study limitations (e.g., forest cover, image resolution, interpretation of aerial data).

TABLE 5.2-2 COMMUNITY AND RECREATIONAL RESOURCES EVALUATION CRITERIA

Criteria	Unit	Alternative Route A	Alternative Route B	Alternative Route C	Alternative Route D	Alternative Route E	Alternative Route F
Parcels / unique landowners	Count	500	531	532	518	476	535
		388	403	405	394	367	399
Residential dwellings [a,b] within ROW Corridor/ 250 feet / 500 feet of centerline	Count	1	1	1	1	1	1
		29	40	29	37	26	42
		151	192	161	170	142	184
Residential outbuildings [a,c] within ROW Corridor / 250 feet / 500 feet of centerline	Count	6	6	9	7	5	9
		50	56	57	62	44	63
		273	286	280	308	222	269
Non-residential buildings [a,d] within ROW Corridor / 250 feet / 500 feet of centerline	Count	25	21	25	24	22	19
		74	68	79	81	58	67
		187	178	193	199	166	180
Places of worship within 500 feet of the centerline	Count	1	1	1	1	1	0
Childcare facilities within 500 feet of the centerline	Count	0	0	0	0	0	0
Public / private schools within 500 feet of centerline	Count	0	0	0	0	0	0
Trails crossings—Potomac Heritage National Scenic Trail and Hiking Trails	Count	3	3	3	2	3	2
		9	9	9	16	9	16
State Scenic Byways	Count	4	4	5	4	4	5

Source: ReportAll, HIFLD, MDOT, WVDOT, MDiMap, WVGISTC, PASDA, ERM

[a] Footprints were digitized using high-resolution (3-inch) aerial imagery contracted by NEET MA and NEET VA and captured during leaf-off conditions between December 2023 and February 2024 and county property data. This dataset may not reflect proposed or recently built structures and could include classification errors inherent to desktop study limitations (e.g., forest cover, image resolution, interpretation of aerial data).

[b] A residential dwelling is defined as a building used for people to live in and includes buildings such as single-family homes, multi-family units, mobile/manufactured homes, etc.

[c] A residential outbuilding is defined as a secondary structure located on the same property as a residential dwelling and includes buildings such as detached garages, sheds, greenhouses, etc.

[d] A non-residential building is defined as any structure located on a non-residential property and includes buildings used for commercial purposes industrial use, agricultural, community, or government.

Of note, there is one dwelling located within the ROW Corridor of all six Alternative Routes. This single dwelling, located in Hampshire County, West Virginia, was identified via field reconnaissance after open house route refinement. The Routing Team is currently investigating a solution to avoid direct impacts on this dwelling.

In addition to buildings, parcels, and landowners, the Routing Team also analyzed hiking trails, scenic byways, and community resources such as schools, childcare facilities, and places of worship. Appendix E-8 shows the community and recreational resources.

Alternative Route A

Alternative Route A was one of two routes, along with Alternative Route E, that had superior performance for community and recreational resources criteria. It consistently performed near the top across most metrics in this category. This route has the second-lowest number of unique landowners within the ROW Corridor, with 388 landowners across 500 parcels. In terms of residential proximity, Alternative Route A has the second-lowest number of residential dwellings within 500 feet of the centerline (151) and one of two routes with the second lowest within 250 feet (29), indicating limited direct impact on resident dwellings. The residential outbuildings count is also the second lowest among the Alternative Routes, further minimizing potential impacts on landowners. For non-residential buildings, Alternative Route A fell within the middle of the routes. Trail crossings, scenic byways, and places of worship are generally similar across all Alternative Routes.

Alternative Route B

Alternative Route B had inferior performance for community and recreational resources criteria. It has the highest number of residential dwellings within 500 feet of the centerline (192) and the second highest within 250 feet (40), highlighting its greater proximity to homes and the built environment in certain areas. This route has the second-highest number of unique landowners affected, with 403 landowners across 531 parcels (third highest). Additionally, Alternative Route B has the second-highest count of residential outbuildings within 500 feet of the centerline (286), further increasing potential landowner impacts. However, Alternative Route B performed well for non-residential buildings, with the second-lowest number among all Alternative Routes within 500 feet of the centerline (178). Trail crossings, scenic byways, and places of worship are generally similar across all Alternative Routes.

Alternative Route C

Alternative Route C had moderate performance for community and recreational resources criteria. It has the highest number of unique landowners (405) impacted by the ROW Corridor while crossing 532 unique parcels (second highest). Alternative Route C has the second-lowest number of residential dwellings within 250 feet of the centerline (29) and third-lowest number within 500 feet of the centerline (161). This route has the second-highest number of non-residential buildings within 500 feet of the centerline (193). Additionally, Alternative Route C crosses the highest number of scenic byways (5).

Alternative Route D

Alternative Route D had moderate performance for community and recreational resources criteria, with the metrics for parcels, unique landowners, and residential dwellings falling near the middle of the range compared to other Alternative Routes. However, Alternative Route D has the highest number of residential outbuildings (308) and non-residential buildings (199) located within 500 feet of the centerline, indicating a greater degree of proximity to built structures. While the counts for trail crossings, scenic byways, and places of worship are generally similar across the Alternative Routes, Alternative Route D has the highest total number of trail crossings overall (16); however, it crosses the Potomac Heritage National Scenic Trail twice, while most Alternative Routes cross this trail three times.

Alternative Route E

Alternative Route E was one of two routes, along with Alternative Route A, that had superior performance for community and recreational resources criteria. It has the lowest number of unique landowners (367) and crosses the lowest number of parcels (476). In terms of building proximity, Alternative Route E also has the lowest number of residential dwellings within 250 feet (26) and within 500 feet (142) of the centerline. Furthermore, this route has the fewest number of outbuildings and non-residential buildings within 250 and 500 feet of the centerline. Trail crossings, scenic byways, and places of worship are generally similar across all Alternative Routes.

Alternative Route F

Alternative Route F had inferior performance for community and recreational resources criteria. It crosses the greatest number of parcels (535); however, the number of unique landowners (399) affected is moderate compared to the other Alternative Routes. With respect to proximity to built features, Alternative Route F has the highest number of residential dwellings (42) and residential outbuildings (63) located within 250 feet of the centerline, indicating a greater degree of proximity to homes and associated structures. However, this route has the lowest count of non-residential buildings within the ROW Corridor and the second lowest within 250 feet. Similar to Alternative Route D, it has the highest number of trail crossings at 16; however, it crosses the Potomac Heritage National Scenic Trail twice, while most Alternative Routes cross this trail three times. Alternative Route F crosses the highest number of scenic byways (5).

Superior Alternative Routes

Alternative Routes A and E had superior performance in this category across most metrics and had the lowest number of impacts on the built environment. Focusing on residential proximity, these two Alternative Routes performed the best with Alternative Route E having the lowest number of residential dwellings within 250 feet and 500 feet of the centerline. Alternative Route A had the second-best performance regarding residential dwellings with the second-lowest proximity to dwellings within 250 feet and 500 feet of the centerline. Both Alternative Routes A and E also had the lowest proximity to residential outbuildings in addition to dwellings. Alternative Routes A and E had the lowest number of parcels and unique landowners crossed by the ROW Corridor, further indicating their smaller impact on the community and residents when compared to the other

Alternative Routes. These two Alternative Routes also performed well for trail crossings, scenic byways, and places of worship.

Moderate and Inferior Alternative Routes

Alternative Routes B and F had inferior performance because they have the largest impact on the built environment and notably the largest impact on residential dwellings within 250 feet of the centerline (40 and 42, respectively) and residential dwellings within 500 feet of the centerline (192 and 184, respectively). Additionally, Alternative Route B has the second-highest number of unique landowners crossed by the ROW Corridor (403). Alternative Route F crosses through the highest number of parcels (535) and highest number of hiking trails (16). Alternative Routes C and D had moderate performance with the third and fourth highest number of residential dwellings within 500 feet (161 and 170, respectively).

5.2.3 PROTECTED AREAS

Avoiding protected lands, including designated areas such as state forests, WMAs, FMAs, Maryland Wildlands, conservation easements, and recreational areas managed by the USACE, was part of the siting criteria used for the MARL Project. By minimizing potential impacts on these protected areas, the Routing Team was able to minimize impacts on sensitive ecological resources and the likelihood of cumbersome environmental permitting. Due to the location of these resources throughout the MARL Project Study Area as well as the fact that the existing transmission lines cross through these resources, all Alternative Routes cross the Youghiogheny River Lake, the Potomac Heritage National Scenic Trail, and the Maryland Savage River State Forest. However, some Alternative Routes were designed to avoid crossing through these resources, resulting in trade-offs with potential impacts. Alternative Routes C and F avoid crossing Coopers Rock State Forest in West Virigina, and Alternative Routes A, B, D, and E avoid crossing Pennsylvania SGL 138, Forbes State Forest, and Quebec Run Wild Area. Alternative Routes E and F also avoid crossing the White Horse Mountain WMA. Alternative Routes D and F avoid crossing through Maryland Wildlands associated with Savage River State Forest and Dan's Mountain WMA.

Alternative Routes A, B, C, and E cross two privately owned conservation easements that are part of Maryland's Rural Legacy Program. The Routing Team is working with the landowners of these conservation easements. The Routing Team made concerted efforts to minimize crossing protected lands, where possible, and avoid crossing conservation easements. As shown in this report, Alternative Routes were developed to reduce the impact on these resources. When crossing protected lands, the Routing Team focused, where feasible, on paralleling existing transmission lines. The Routing Team evaluated each Alternative Route for the criteria presented in Table 5.2-3 and as shown on Appendix E-8. In addition, Table 5.2-4 details the specific protected lands each Alternative Route crosses and any existing transmissions lines paralleled within the protected lands.

TABLE 5.2-3 PROTECTED LAND EVALUATION CRITERIA

Criteria	Unit	Alternative Route A	Alternative Route B	Alternative Route C	Alternative Route D	Alternative Route E	Alternative Route F
State Forest	Count	2	2	2	2	2	2
	Miles	9.7	9.6	11.1	9.9	9.7	11.3
	Acres	248.3	246.1	281.4	245.6	248.3	278.7
State Park	Count	0	0	0	0	0	0
	Miles	0.0	0.0	0.0	0.0	0.0	0.0
	Acres	0.0	0.0	0.0	0.0	0.0	0.0
Fisheries / Wildlife Management Area	Count	3	3	3	2	2	1
	Miles	3.1	3.1	3.1	3.3	2.5	2.7
	Acres	75.8	75.8	75.8	79.1	61.0	64.2
Pennsylvania State Wilderness Area	Count	0	0	1	0	0	1
	Miles	0.0	0.0	0.2	0.0	0.0	0.2
	Acres	0.0	0.0	3.6	0.0	0.0	3.6
Pennsylvania State Game Lands	Count	0	0	1	0	0	1
	Miles	0.0	0.0	0.8	0.0	0.0	0.8
	Acres	0.0	0.0	20.0	0.0	0.0	20.0
Maryland Wildlands	Count	3	3	3	0	3	0
	Miles	2.4	2.4	2.4	0.0	2.4	0.0
	Acres	57.0	57.0	57.0	0.0	57.0	0.0
Conservation Easements	Count	3	3	3	1	2	0
	Miles	2.2	2.2	2.2	0.6	1.7	0.0
	Acres	55.2	55.2	55.2	14.9	40.4	0.0
USACE Recreation Areas	Count	1	1	1	1	1	1
	Miles	0.1	0.1	0.4	0.1	0.1	0.4
	Acres	3.9	4.3	14.3	3.9	3.9	14.3

Criteria	Unit	Alternative Route A	Alternative Route B	Alternative Route C	Alternative Route D	Alternative Route E	Alternative Route F
Total Protected Lands [a,b]	Count	8	8	10	5	7	6
	Miles	14.6	14.5	17.2	13.3	14.0	15.3
	Acres	368.4	366.6	435.5	328.6	353.5	380.9

Source: PAD-US, NCED, MDNR, MDiMAP, PASDA, WVDEP, VADCR

WMA = Wildlife Management Area; WVDNR = West Virginia Division of Natural Resources

[a] Total protected lands excludes the Maryland Wildlands to avoid double counting since Wildlands are within a state forest or WMA. In addition, White Horse Mountain WMA has an associated conservation easement. The White Horse Mountain WMA is a 1,725-acre conservation and recreation area located in Hampshire County, West Virginia, and is managed by the WVDNR. The Potomac Conservancy held a conservation easement on White Horse Mountain to protect it from development and transferred ownership to WVDNR to manage the land as a public recreation area and WMA. The statistics associated with White Horse Mountain WMA are included in both the "Conservation Easements" and "Fisheries / Wildlife Management Area" categories but are not double counted in total impact calculations.

[b] Totals may not match the sum of addends due to rounding.

TABLE 5.2-4 SPECIFIC PROTECTED LANDS CROSSED BY THE ALTERNATIVE ROUTES

Specific Protected Area [a]	State	Existing Transmission Line Corridor in Resource?	Alternative Route A	Alternative Route B	Alternative Route C	Alternative Route D	Alternative Route E	Alternative Route F
Coopers Rock State Forest	WV	Yes—138 kV	Yes	Yes	No	Yes	Yes	No
State Game Lands 138	PA	Yes—500 kV	No	No	Yes	No	No	Yes
Forbes State Forest	PA	Yes—500 kV	No	No	Yes	No	No	Yes
Quebec Run Wild Area	PA	Yes—500 kV	No	No	Yes	No	No	Yes
Youghiogheny River Lake Recreation Area (USACE)	MD	Yes—500 kV and 138 kV	Yes	Yes	Yes	Yes	Yes	Yes
Maryland Rural Legacy Property (Bear Creek RL-0396)	MD	Yes—500 kV	Yes	Yes	Yes	No	Yes	No
Maryland Rural Legacy Property (Bear Creek RL-35354)	MD	Yes—500 kV	Yes	Yes	Yes	No	Yes	No
Bear Creek Hatchery FMA	MD	Yes—500 kV	Yes	Yes	Yes	No	Yes	No
Savage River State Forest	MD	Yes—500 kV and two 138 kV	Yes	Yes	Yes	Yes	Yes	Yes
Bear Pen Wildlands	MD	Yes—138 kV	Yes	Yes	Yes	No	Yes	No
Big Savage Mountain Wildlands	MD	Yes—500 kV and 138 kV	Yes	Yes	Yes	No	Yes	No
Dan's Mountain WMA	MD	Yes—500 kV and 138 kV	Yes	Yes	Yes	Yes	Yes	Yes
Dan's Mountain Wildlands	MD	Yes—500 kV	Yes	Yes	Yes	No	Yes	No
White Horse Mountain WMA	WV	Yes—500 kV and 138 kV	Yes	Yes	Yes	Yes	No	No

Source: PAD-US, NCED, MDNR, MDiMAP, PASDA, WVDEP, VADCR

FMA = Fisheries Management Area; kV = kilovolt; MD = Maryland; PA = Pennsylvania; USACE = U.S. Army Corps of Engineers; WMA = Wildlife Management Area; WV = West Virginia

[a] Protected area listed west to east.

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Alternative Route A

Alternative Route A parallels existing transmission lines through the following resources: Coopers Rock State Forest, the Youghiogheny River Lake Recreation Area (USACE), two Bear Creek Rural Legacy conservation easements, Bear Creek Hatchery FMA, Savage River State Forest, Bear Pen Wildlands, Big Savage Mountain Wildlands, Dan's Mountain WMA and Wildlands, and White Horse Mountain WMA. Alternative Route A avoided crossing through SGL 138, Forbes State Forest and Quebec Run Wild Area.

Alternative Route A had moderate performance for protected areas criteria. It is one of two routes with the second-lowest mileage (9.7 miles) of crossings through state forest lands and is one of three routes with the lowest acreage (3.9 acres) of impact within the USACE-managed Youghiogheny River Lake Recreation Area. However, like Alternative Routes B, C, and E, Alternative Route A crosses the Maryland Wildlands and two Rural Legacy conservation easements. While Alternative Route A crosses the Maryland Wildlands, the Routing Team designed the crossing to parallel the existing transmission line and maintain a ROW Corridor width of 200 feet based on statutory requirements. In total, Alternative Route A crosses eight protected land areas over 14.6 miles (368.4 acres), placing it near the middle of the Alternative Routes in terms of overall protected land acreage disturbance.

Alternative Route B

Similar to Alternative Route A, Alternative Route B parallels existing transmission lines through the following resources: Coopers Rock State Forest, the Youghiogheny River Lake Recreation Area (USACE), two Bear Creek Rural Legacy conservation easements, Bear Creek Hatchery FMA, Savage River State Forest, Bear Pen Wildlands, Big Savage Mountain Wildlands, Dan's Mountain WMA and Wildlands, and White Horse Mountain WMA. Alternative Route B avoids crossing SGL 138, Forbes State Forest and Quebec Run Wild Area.

Alternative Route B had a moderate performance for protected areas criteria (similar to Alternative Route A) with slightly higher impacts (4.3 acres) to the USACE-managed Youghiogheny River Lake Recreation Area. However, like Alternative Routes A, C, and E, Alternative Route B crosses the Maryland Wildlands and two Rural Legacy conservation easements. While Alternative Route B crosses the Maryland Wildlands, the Routing Team designed the crossing to parallel the existing transmission line and maintain a ROW Corridor width of 200 feet based on statutory requirements. In total, Alternative Route B crosses eight protected land areas over 14.5 miles (366.6 acres), placing it near the middle of the Alternative Routes in terms of overall protected land acreage disturbance.

Alternative Route C

Alternative Route C parallels existing transmission lines through the following resources: SGL 138, Forbes State Forest, Quebec Run Wild Area, the Youghiogheny River Lake Recreation Area (USACE), two Bear Creek Rural Legacy conservation easements, Bear Creek Hatchery FMA, Savage River State Forest, Bear Pen Wildlands, Big Savage Mountain Wildlands, Dan's Mountain WMA and Wildlands, and White Horse Mountain WMA. Alternative Route C avoids crossing Coopers

Rock State Forest by paralleling existing 500 kV transmission lines in the northwest quadrant of the MARL Project Study Area in Pennsylvania.

Alternative Route C had an inferior performance for protected areas criteria. It has the highest impacts in comparison to the other Alternative Routes. In total, it crosses ten protected lands totaling 17.2 miles and 435.5 acres of impact. However, like other Alternative Routes, Alternative Route C parallels existing transmission lines through these protected resources. Similar to Alternative Routes A, B, and E, Alternative Route C crosses the Maryland Wildlands and two Rural Legacy conservation easements. While Alternative Route C crosses the Maryland Wildlands, the Routing Team designed the crossing to parallel the existing transmission line and maintain a ROW Corridor width of 200 feet based on statutory requirements.

Alternative Route D

Alternative Route D parallels existing transmission lines through the following resources: Coopers Rock State Forest, the Youghiogheny River Lake Recreation Area (USACE), Savage River State Forest, Dan's Mountain WMA (greenfield section), and White Horse Mountain WMA. Alternative Route D avoids crossing SGL 138, Forbes State Forest, Quebec Run Wild Area, Bear Pen Wildlands, Big Savage Mountain Wildlands, and Dan's Mountain Wildlands.

Alternative Route D had superior performance for protected areas criteria. It has the lowest total impact on protected lands by crossing five protected lands totaling 13.3 miles and 328.6 acres. However, Alternative Route D does so because of a higher percentage of greenfield development and longer overall route length. Avoiding the Maryland Wildlands necessitates an additional 21.1 miles of greenfield development in Maryland and an additional 7.7 miles of total line length in Maryland compared to Alternative Routes A and E.

Alternative Route E

Alternative Route E parallels existing transmission lines through the following resources: Coopers Rock State Forest, the Youghiogheny River Lake Recreation Area (USACE), two Rural Legacy conservation easements, Bear Creek Hatchery FMA, Savage River State Forest, Bear Pen Wildlands, Big Savage Mountain Wildlands, and Dan's Mountain WMA and Wildlands. Alternative Route E avoids crossing White Horse Mountain WMA by routing a greenfield section further south.

Alternative Route E had moderate performance for protected areas criteria. It has average total mileage (14.0 miles) and acreage (353.5 acres) through seven protected lands. Similar to Alternative Routes A, B, and C, Alternative Route E crosses the Maryland Wildlands and two Rural Legacy conservation easements. While Alternative Route E crosses the Maryland Wildlands, the Routing Team designed the crossing to parallel the existing transmission line and maintain a ROW Corridor width of 200 feet based on statutory requirements.

Alternative Route F

Alternative Route F parallels existing transmission lines through the following resources: SGL 138, Forbes State Forest, Quebec Run Wild Area, the Youghiogheny River Lake Recreation Area (USACE), Savage River State Forest, and Dan's Mountain WMA. Alternative Route F avoids crossing Coopers Rock State Forest by paralleling an existing 500 kV transmission line in the

northwest quadrant of the MARL Project Study Area in Pennsylvania, and avoids crossing the Maryland Wildlands by routing north via a large greenfield segment. Alternative Route F also avoids White Horse Mountain WMA by routing a greenfield section to the south.

Alternative Route F had moderate performance for protected areas criteria. It has the second-highest impact on protected areas with a total of 15.3 miles and 380.9 acres. Additionally, it has the highest state forest lands crossed by miles (11.3 miles), the second-lowest impacts on WMA, and no impacts on Maryland Wildlands and conservation easements. While Alternative Route F avoids these resources it did so with trade-offs of more miles of greenfield development to navigate around these resources, resulting in the lowest amount of parallelling existing transmission lines (36.3 percent).

Superior Alternative Routes

Alternative Route D demonstrated the lowest overall impact on protected lands compared to the other Alternative Routes. While all Alternative Routes cross through protected lands, Alternative Route D did so while paralleling existing transmission lines, and has the fewest number (5), and results in the lowest mileage (13.3 miles) and acreage (328.6 acres) of protected lands. This reduced impact on protected lands could result in less permitting requirements and potentially fewer ecological impacts. However, avoiding the Maryland Wildlands necessitates an additional 21.1 miles of greenfield development in Maryland and an additional 7.7 miles of total line length in Maryland compared to Alternative Routes A and E.

Moderate and Inferior Alternative Routes

Alternative Route C had inferior performance and exhibited the greatest level of impact on protected lands, both in mileage (17.2 miles), number of crossed areas (10), and the largest acreage of impact (435.5 acres). These higher impacts on protected lands could result in more permitting, more ecological impacts, and increased mitigation requirements and ecological impacts. Alternative Routes A, B, E, and F had a moderate performance across these criteria, with all four having average total acreage of impacts (368.4, 366.6, 353.5, and 380.9, respectively) and average count of crossings (8, 8, 7, and 6, respectively).

5.2.4 CULTURAL RESOURCES

The evaluation of cultural resources along the Alternative Routes is an important component of the MARL Project's siting process, by making sure that historic, archaeological, and community assets are identified and protected. Each route was assessed for proximity to NRHP listed or eligible resources, and National Historic Landmark (NHL) listed resources. These included archaeological sites, architectural resources, historic districts, cemeteries, and battlefields. Assessment was also made of designated heritage areas and historic easements. The Routing Team consulted each state's historic preservation offices to obtain relevant data, as well as relevant federal databases to conduct the analysis. The Routing Team evaluated each route for the criteria presented in Table 5.2-5 and shown on Appendix E-9, Alternative Routes—Land Use and Social Resources—Cultural Resources.

TABLE 5.2-5 CULTURAL RESOURCES EVALUATION CRITERIA

Criteria	Unit	Alternative Route A	Alternative Route B	Alternative Route C	Alternative Route D	Alternative Route E	Alternative Route F
Cemeteries within ROW Corridor; 500 feet of centerline	Count	0	0	0	0	0	0
		4	5	4	4	4	3
Archaeological Resources within ROW Corridor	Count	6	7	6	5	6	5
Architecture Resources—NRHP eligible, NRHP listed, or NHL listed within ROW Corridor; 0.5-mile buffer from centerline	Count	4	4	4	4	4	4
		7	10	13	6	7	12
Historic Districts Crossed	Count	6	5	4	6	6	4
Battlefields	Count	1	1	1	1	1	1
	Acres	38.0	38.0	38.0	38.0	38.0	12.9
MD—Heritage Areas	Count	1	1	1	1	1	1
	Acres	128.3	140.0	120.4	164.1	128.3	156.1

Source: PASHPO, WVSHPO, MHT, VADHR

MD = Maryland; NHL = National Historic Landmarks; NRHP = National Register of Historic Places; ROW = right-of-way

Alternative Route A

Alternative Route A had superior performance for cultural resources criteria. It is one of four that has the second-lowest number of cemeteries within 500 feet of the centerline (4) and one of three routes that has the second-lowest number of archaeological resources within the ROW Corridor (6). All Alternative Routes cross the same number of NRHP-eligible/NRHP-listed/NHL-listed resources within the ROW Corridor (4); however, Alternative Route A is one of two routes that has the second-lowest number of architecture resources within 0.5-mile of the centerline (7). It is one of three routes that has the highest number of historic districts crossed (6), along with Alternative Routes D and E. All Alternative Routes cross one Maryland heritage area (Mountain Maryland Gateway to the West Heritage Area), with Alternative Route A being one of two routes having the second-lowest amount of Maryland heritage areas within the ROW Corridor (128.3 acres). Additionally, all Alternative Routes cross one battlefield site (Hanging Rock), located in Capon Bridge, Hampshire County, West Virginia. Alternative Routes A, B, C, D, and E parallel an existing transmission line through the eastern corner of Hanging Rock Battlefield, and all have the same amount of acreage impacts (38.0 acres).

Alternative Route B

Alternative Route B had moderate performance for cultural resources criteria. It has the highest number of cemeteries within 500 feet of the centerline (5) and archaeological resources within the ROW Corridor (7). Alternative Route B also had moderate performance for architecture resources within 0.5-mile of the centerline. It crossed the second-lowest number of historic districts (5). Additionally, Alternative Route B crossed the one Maryland heritage area (Mountain Maryland Gateway to the West Heritage Area), with this route having the third-highest amount within the ROW Corridor (140.0 acres). Alternative Routes A, B, C, D, and E parallel an existing transmission line through the eastern corner of Hanging Rock Battlefield, and all have the same amount of acreage impacts (38.0 acres).

Alternative Route C

Alternative Route C had inferior performance for cultural resources criteria. For cemeteries within 500 feet of the centerline and archaeological resources within the ROW Corridor, Alternative Route C performed similar to Alternative Route A. Alternative Route C crossed the highest number of architecture resources within 0.5-mile of the centerline (13). Alternative Route C was one of two routes that crossed the lowest number of historic districts (4) and had the least impact on Mountain Maryland Gateway to the West Heritage Area. However, Alternative Route C crosses near one NHL, Friendship Hill National Historic Site in Point Marion, Fayette County, Pennsylvania. Alternative Routes A, B, C, D, and E parallel an existing transmission line through the eastern corner of Hanging Rock Battlefield, and all have the same amount of acreage impacts (38.0 acres).

Alternative Route D

Alternative Route D had superior performance for cultural resources criteria, falling near the top across most metrics. Alternative Route D is one of two routes that crosses the lowest number of archaeological resources (5) and one of four routes that had the second-lowest number of

cemeteries (4). Alternative Route D crosses the lowest number of NRHP-eligible/NRHP-listed/NHL-listed resources within 0.5-mile (6) of the centerline. However, the route is one of three routes that crosses the highest number of historic districts (6) and had the highest amount of Mountain Maryland Gateway to the West Heritage Area within the ROW Corridor (164.1 acres). Alternative Routes A, B, C, D, and E parallel an existing transmission line through the eastern corner of Hanging Rock Battlefield, and all have the same amount of acreage impacts (38.0 acres).

Alternative Route E

Alternative Route E had superior performance for cultural resources criteria. Its impacts are identical to Alternative Route A. It crosses the same number of cemeteries (4), archaeological resources (6), and historic districts (6). Alternative Route E is one of two routes that has the second-lowest number of architecture resources within 0.5-mile of the centerline (7). The impacts on Mountain Maryland Gateway to the West Heritage Area are identical to Alternative Route A, with 128.3 acres within the ROW Corridor. Alternative Routes A, B, C, and D, and E parallel an existing transmission line through the eastern corner of Hanging Rock Battlefield, and all have the same amount of acreage impacts (38.0 acres).

Alternative Route F

Alternative Route F had an inferior performance for cultural resources criteria. It has the second-highest count within 0.5-mile of the centerline (12). However, Alternative F provides the smallest impact on the Hanging Rock Battlefield by crossing 12.9 acres of the site and has the lowest number of cemeteries with 500 feet of the centerline (3). Alternative Route F is one of two routes that has lowest count of archaeological resources within the ROW Corridor (5) and historic districts crossed (4). Alternative Route F had the second-highest amount of Mountain Maryland Gateway to the West Heritage Area within the ROW Corridor, and crosses near one NHL, Friendship Hill National Historic Site in Point Marion, Fayette County, Pennsylvania.

Superior Alternative Routes

Alternative Routes A, D, and E provide the lowest impact on cultural resources. While the variability among cultural data is minimal, these Alternative Routes cross the second-lowest number of cemeteries (4) and have a low number of impacts on archaeological resources and architecture resources. Alternative Route D slightly outperformed Alternative Route A. However, Alternative Route D has the highest impact on heritage areas, impacting 35.8 acres more of Mountain Maryland Gateway to the West Heritage Area.

Moderate and Inferior Alternative Routes

Alternative Routes C and F had inferior performance and have the highest impacts on cultural resources. The variability among cultural data is minimal, but these Alternative Routes performed slightly worse than the other Alternative Routes. Alternative Routes C and F cross the highest number of architecture resources within 0.5-mile of the centerline. While Alternative Route F provided the lowest impact on the Hanging Rock Battlefield, and Alternative Route C provided the lowest impact on the Mountain Maryland Gateway to the West Heritage Area, both Alternative Routes cross near an NHL, Friendship Hill National Historic Site. Alternative Route B had moderate

performance, with Alternative Route B having the highest impacts on cemeteries and archaeological resources.

5.2.5 AGRICULTURAL AND LAND COVER

Agricultural lands within the MARL Project Study Area range from prime farmland—characterized by exceptional soil quality and productivity—to less fertile soils that may still hold local significance. Land cover refers to the varying footprints of an area and may be developed (e.g., residential and commercial land uses) and undeveloped areas (e.g., forested, pastureland, wetlands). Together, agricultural land classifications and land cover data provide a basis for evaluating how a project may affect soils, water resources, aquatic habitats and species, wetlands, floodplains, vegetation, wildlife, and special-status species. For example, forested vegetation may be converted to herbaceous or scrub/shrub land cover for the duration of the MARL Project.

To minimize new fragmentation of forested habitat, the MARL Project has been designed to parallel existing transmission line ROWs to the greatest extent practicable. Agricultural lands located within the ROW Corridor—many of which are also found along paralleling opportunities—would be temporarily unavailable for agricultural production during construction. However, once the MARL Project is in operation, most farming activities could continue to occur within the ROW Corridor in coordination with the landowners. This may result in short-term impacts on farming operations, including crop harvesting and grazing. However, agricultural activities will generally be permitted to resume during operation, and no long-term change in land cover is anticipated.

Each Alternative Route presents a distinct footprint and associated level of impact on agricultural lands and land cover. The analysis considers factors such as soil quality, crop productivity, and the extent of forest, wetland, and pastureland crossed. Routes with larger total acreage within the ROW Corridor generally correlate with greater impacts. Alternative Routes A, B, and E provide the least impact on the total footprint because of the lower ROW Corridor acres required for the routes, whereas Alternative Routes C, D, and F provide greater impacts. The Routing Team evaluated each route for the following criteria presented in Table 5.2-6 and Table 5.2-7 and as shown on Appendix E-10, Alternative Routes—Land Use and Social Resources—Agricultural and Land Cover.

TABLE 5.2-6 AGRICULTURAL LAND EVALUATION CRITERIA

Agricultural Land	Unit	Alternative Route A	Alternative Route B	Alternative Route C	Alternative Route D	Alternative Route E	Alternative Route F
Not Prime Farmland Class	Acres	1,789.5	1,780.9	1,926.7	1,895.7	1,782.4	2,033.6
State Importance Farmland Class	Acres	389.7	411.7	325.7	426.1	379.7	338.8
Local Importance Farmland Class	Acres	399.3	399.7	399.3	399.3	389.2	369.1
Prime Farmland Class	Acres	90.4	79.1	183.8	101.0	100.2	205.8

Source: USA SSURGO

TABLE 5.2-7 LAND COVER EVALUATION CRITERIA

Criteria	Unit	Alternative Route A	Alternative Route B	Alternative Route C	Alternative Route D	Alternative Route E	Alternative Route F
Barren Land (Rock/Sand/Clay)	Acres	20.2	25.2	21.4	29.9	20.2	31.0
Cultivated Crops	Acres	45.4	61.6	41.7	39.5	45.4	35.9
Deciduous Forest	Acres	1,836.0	1,821.8	1,927.6	1,906.3	1,820.5	1,960.4
Developed, High Intensity	Acres	0.0	0.0	1.3	0.0	0.0	1.3
Developed, Low Intensity	Acres	16.2	18.2	19.5	14.1	15.4	16.2
Developed, Medium Intensity	Acres	2.0	1.4	5.3	2.0	2.0	5.3
Developed, Open Space	Acres	82.2	84.1	86.4	85.0	80.3	91.7
Emergent Herbaceous Wetlands	Acres	0.0	0.0	2.2	0.0	0.0	2.2
Evergreen Forest	Acres	24.0	27.1	26.1	27.1	15.3	18.8
Grassland/Herbaceous	Acres	25.3	32.0	13.7	35.8	27.1	27.4
Mixed Forest	Acres	171.4	171.8	191.3	184.6	166.9	198.8
Open Water	Acres	13.0	13.7	8.1	13.0	14.3	9.6
Pasture/Hay	Acres	415.7	399.2	466.8	478.5	426.7	536.3
Shrub/Scrub	Acres	15.3	12.9	13.1	17.8	15.0	15.4
Woody Wetlands	Acres	2.5	2.5	11.1	5.5	2.5	14.1
Forest Lands Total [a] (Deciduous Forest, Evergreen Forest, and Mixed Forest)	Acres	2,031.4	2,020.7	2,145.0	2,118.0	2,002.7	2,178.0
Agricultural Lands Total [a] (Pasture/Hay and Cultivated Crops)	Acres	461.1	460.8	508.5	518.0	472.1	572.2
Developed Lands Total [a] (High, Low, Medium, Open Space)	Acres	100.4	103.7	112.5	101.1	97.7	114.5

Source: USGS NLCD 2024

[a] Totals may not match the sum of addends due to rounding.

Alternative Route A

Alternative Route A had superior performance for agricultural and land cover criteria. It has the second-smallest ROW Corridor (2,669.0 acres) and therefore would have less impact on select land cover than the longer Alternative Routes C, D, and F. Alternative Route A provides the second-lowest amount of agricultural land acreage within the ROW Corridor (461.1 acres), the third-lowest amount of forested land acreage within the ROW Corridor (2,031.4 acres) and the second-lowest amount of prime farmland acreage within the ROW Corridor (90.4 acres). Developed lands were similar across all Alternative Routes.

Alternative Route B

Alternative Route B had superior performance for agricultural and land cover criteria. It has the third-smallest ROW Corridor (2,671.4 acres) and therefore would have less impact on select land cover than the longer Alternative Routes C, D, and F. Alternative Route B has the lowest amount of agricultural land acreage within the ROW Corridor (460.8 acres), the second-lowest amount of forested land acreage within the ROW Corridor (2,020.7 acres) and the lowest amount of prime farmland in the ROW Corridor (79.1 acres). Developed lands were similar across all Alternative Routes.

Alternative Route C

Alternative Route C had inferior performance for agricultural and land cover criteria. It has the third-largest ROW Corridor (2,835.5 acres) and therefore would have more impact on select land cover than other Alternative Routes. Alternative Route C also has the third-highest amount of agricultural land acreage within the ROW Corridor (508.5 acres), the second-highest amount of forested land acreage within the ROW Corridor (2,145.0 acres) and the second-highest amount of prime farmland within the ROW Corridor (183.8 acres). Developed lands were similar across all Alternative Routes.

Alternative Route D

Alternative Route D had moderate performance for agricultural and land cover criteria. It has the second-largest ROW Corridor (2,839.0 acres) and therefore would have more impact on select land cover than other Alternative Routes. Alternative Route D has the second-highest amount of agricultural land acreage within the ROW Corridor (518.0 acres), but has the fourth-lowest amount of forested land acreage within the ROW Corridor (2,118.0 acres) and the fourth-lowest amount of prime farmland in the ROW Corridor (101.0 acres). Developed lands were similar across all Alternative Routes.

Alternative Route E

Alternative Route E had superior performance for agricultural and land cover criteria. It has the smallest ROW Corridor (2,651.5 acres) and therefore would have less impact on select land cover than the longer Alternative Routes C, D, and F. Alternative Route E has the third-lowest agricultural land acreage within the ROW Corridor (472.1 acres) and the lowest amount of forested land acreage within the ROW Corridor (2,002.7 acres). Developed lands were similar across all Alternative Routes.

Alternative Route F

Alternative Route F had inferior performance for agricultural and land cover criteria. It has the largest ROW Corridor (2,964.3 acres) and therefore would have more impact on select land cover than other Alternative Routes. Alternative Route F has the highest amount of agricultural land acreage within the ROW Corridor (572.2 acres), the highest amount of forested land acreage within the ROW Corridor (2,178.0 acres) and the highest amount of prime farmland within the ROW Corridor (205.8 acres). Developed lands were similar across all Alternative Routes.

Superior Alternative Routes

Alternative Routes A, B, and E have the lowest impacts on agricultural and forested lands and are three of the smaller ROW Corridors as well as three of the shortest alignments proposed. Alternative Routes A and B also include the highest percentage of paralleling existing transmission lines. Therefore, crossing these land cover types—forested and/or agricultural lands—minimizes potential additional habitat fragmentation and/or conflicting uses with agricultural lands. Overall, these three routes are less impactful to various land covers, and their shorter lengths have less overall impact on the existing environment.

Moderate and Inferior Alternative Routes

Alternative Routes C and F have the highest impacts on agricultural and forested lands, are two or the larger ROW Corridors, and are the two longest alignments proposed. Alternative Routes C and F are the two routes with the least percentage of paralleling and include more greenfield development, thereby increasing the impact on habitat fragmentation, conversion of forested habitat type, and potential conflicting uses with agricultural lands. Alternative Route D had moderate performance.

5.3 NATURAL ENVIRONMENT

The natural environment criteria used in the Alternative Routes evaluation covered many different environmental features and datasets. Each subsection below highlights groups of information for a detailed review of these topics.

5.3.1 WATER RESOURCES

Assessing the potential impact of transmission lines on water resources is essential because these areas provide critical ecological functions, support recreational uses, and are subject to additional permitting requirements and/or mitigation measures. The Routing Team prioritized minimizing impacts on sensitive water resources within the MARL Project Study Area, including coldwater fisheries and trout streams, wetlands, and floodplains. For consistent evaluation across multiple states, the team relied on study-area-wide datasets and, where possible, merged state-specific data for a more accurate comparison. This included merging trout stream and coldwater fishery data from individual state databases, which included the following datasets:

- Pennsylvania:
  - Class A Trout Streams
  - Naturally Reproducing Trout Streams

  - Wilderness Trout Streams
  - Designated Use Streams for Coldwater Fishes, Exceptional Value, High Quality, and Trout Stocking
- West Virginia:
  - Trout Streams
- Maryland:
  - Maryland Department of Natural Resources Trout Stock Streams
  - Designated Use III: Nontidal Cold Water—Natural Trout Water
  - Designated Use III-P: Nontidal Cold Water and Public Water Supply
  - Designated Use IV: Recreational Trout Waters
  - Designated Use IV-P: Recreational Trout Waters and Public Water Supply
- Virginia:
  - Virginia Water Quality Standards Trout Streams and Rivers

Some state-specific databases and details are presented in Table 5.3-1. Reducing impacts on water resources not only preserves natural ecosystems but also helps to reduce permitting processes. Where possible, the Routing Team attempted to parallel existing transmission lines across waterbodies to avoid additional habitat fragmentation and/or removal of canopy cover for these streams to minimize impacts on the species within the streams. Additionally, where feasible, the Routing Team proposed placing transmission structures peak to peak, to potentially reduce forested habitat as well as forested riparian buffers from being impacted. At these locations—referred to as riparian habitat exclusion zones—engineering solutions were developed to retain existing riparian vegetation within 100 feet on either side of the center of the stream. No vegetation clearing or ground disturbance will occur within these zones. These riparian habitat exclusion zones are discussed in more detail in Section 6.3.

All Alternative Routes cross some of the same large waterbodies. Where feasible, the Routing Team developed Alternative Routes that parallel existing transmission lines while crossing these large waterbodies. The waterbodies and crossing types for each Alternative Route are listed in Table 5.3-1. Notably, Alternative Route B is the only Alternative Route that crosses both the Cheat River and Cheat Lake (the impounded area south of the Lake Lynn Dam). Impacts on Cheat Lake can also be considered an impact on both land use and water resources as it is an area surrounded by campgrounds, trails, and other recreational, commercial, and residential developments. The Routing Team evaluated each route for the criteria presented in Table 5.3-2 and as shown on Appendix E-11, Alternative Routes—Natural Environment—Water Resources, which shows study-area-wide datasets for water resources. For more specific analysis on state-specific resources, please refer to the Environmental Review Documents (Appendices A, B, C, and D).

TABLE 5.3-1 WATERBODIES AND CROSSING TYPES FOR EACH ALTERNATIVE ROUTE

Large Waterbody [a]	State	Alternative Route A	Alternative Route B	Alternative Route C	Alternative Route D	Alternative Route E	Alternative Route F
Monongahela River	PA	Greenfield crossing south of Point Marion Lock and Dam	Same as Alternative Route A	Greenfield crossing north of Point Marion Lock and Dam	Same as Alternative Route A	Same as Alternative Route A	Same as Alternative Route C
Cheat River (north of Lake Lynn Dam)	PA	Greenfield crossing 0.8 mile north of Lake Lynn Dam	Greenfield crossing 0.3 mile north of Lake Lynn Dam	Does not cross	Same as Alternative Route A	Same as Alternative Route A	Does not cross
Cheat Lake (impounded area south of Lake Lynn Dam)	WV	Does not cross	Greenfield crossing	Does not cross	Does not cross	Does not cross	Does not cross
Georges Creek	PA	Does not cross	Does not cross	Greenfield crossing	Does not cross	Does not cross	Greenfield crossing
Big Sandy Creek	WV	Crossing parallel to existing 138 kV corridor northside	Crossing parallel to existing 138 kV corridor southside	Does not cross	Same as Alternative Route A	Same as Alternative Route A	Does not cross
Youghiogheny River	MD	Crossing parallel to existing 138 kV corridor	Same as Alternative Route A	Crossing parallel to existing 500 kV corridor	Same as Alternative Route A	Same as Alternative Route A	Same as Alternative Route C
Savage River	MD	Crossing parallel to existing 500 kV corridor	Same as Alternative Route A	Same as Alternative Route A	Greenfield crossing	Same as Alternative Route A	Greenfield crossing
Georges Creek	MD	Crossing parallel to existing 500 kV corridor	Same as Alternative Route A	Same as Alternative Route A	Crossing parallel to existing 138 kV corridor	Same as Alternative Route A	Crossing parallel to existing 138 kV corridor
North Branch Potomac River	MD/WV	Crossing parallel to existing 138 kV corridor	Same as Alternative Route A	Same as Alternative Route A	Same as Alternative Route A	Same as Alternative Route A	Same as Alternative Route A
Patterson Creek	WV	Greenfield crossing	Same as Alternative Route A	Same as Alternative Route A	Same as Alternative Route A	Same as Alternative Route A	Same as Alternative Route A

Large Waterbody [a]	State	Alternative Route A	Alternative Route B	Alternative Route C	Alternative Route D	Alternative Route E	Alternative Route F
South Branch Potomac River	WV	Crossing within 500 feet to an existing 138 kV corridor	Same as Alternative Route A	Same as Alternative Route A	Same as Alternative Route A	Greenfield crossing	Greenfield crossing
North River	WV	Greenfield crossing	Same as Alternative Route A	Same as Alternative Route A	Same as Alternative Route A	Same as Alternative A	Same as Alternative Route A
Cacapon River	WV	Crossing parallel to existing 138 kV corridor	Same as Alternative Route A	Same as Alternative Route A	Same as Alternative Route A	Same as Alternative Route A	Same as Alternative Route A

Source: USGS NHD

kV = kilovolt; MD = Maryland; NHD = National Hydrography Dataset; PA = Pennsylvania; WV = West Virginia

[a] Large waterbodies are defined as polygon areas in the NHD

TABLE 5.3-2 WATER RESOURCES CRITERIA

Water Resources	Unit	Alternative Route A	Alternative Route B	Alternative Route C	Alternative Route D	Alternative Route E	Alternative Route F
NHD Stream/River—Perennial	Count	81	77	76	99	79	93
	Corridor Length (feet)	27,326.6	26,002.9	24,614.3	30,557.4	27,231.4	27,948.3
NHD Stream/River—Intermittent	Count	37	37	47	37	37	43
	Corridor Length (feet)	9,911.6	9,403.4	13,628.2	9,911.6	9,663.1	12,156.6
NHD Waterbody	Count	14	12	13	17	13	14
	Area (acres)	4.2	5.2	5.0	6.6	4.1	7.1
Section 10 Navigable Waters	Count	3	3	2	3	3	2
Trout Streams and Coldwater Fisheries (all states) [a]	Count	39	33	50	50	39	61
	Corridor Length (feet)	13,513.2	10,950.6	16,728.8	15,891.5	13,512.9	19,350.3
PA Trout Streams	Count	1	0	2	1	1	2
	Corridor Length (feet)	258.2	0.0	729.4	258.2	258.2	729.4
WV Trout Streams	Count	7	7	3	7	7	3
	Corridor Length (feet)	1,821.7	1,867.9	703.6	1,821.7	1,821.7	946.9
VA Trout Streams	Count	0	0	0	0	0	0
	Corridor Length (feet)	0.0	0.0	0.0	0.0	0.0	0.0
PA—Designated Use Streams (CWF, EV, HQ, TSF)	Count	3	1	17	3	3	17
	Corridor Length (feet)	1,556.0	20.6	4,794.7	1,556.0	1,555.7	4,794.7
MD—Designated Use Streams (Use III and III-P: Nontidal Cold Water and Public Water Supply)	Count	27	24	27	38	27	38
	Corridor Length (feet)	9,410.2	8,595.0	10,034.0	12,043.5	9,410.2	12,667.3
MD—Designated Use Streams (Use IV and IV-P: Recreational Trout Waters and Public Water Supply)	Count	1	1	1	1	1	1
	Corridor Length (feet)	467.1	467.1	467.1	212.1	467.1	212.1

Water Resources	Unit	Alternative Route A	Alternative Route B	Alternative Route C	Alternative Route D	Alternative Route E	Alternative Route F
VA—Threatened & Endangered Species Waters	Count	1	1	1	1	1	1
	Corridor Length (feet)	438.6	438.6	438.6	438.6	438.6	438.6
WV—Mussel Streams	Count	8	8	6	8	8	6
	Corridor Length (feet)	2,221.3	2,218.3	1,612.8	2,221.3	2,394.1	1,996.5
MD—Designated Use Streams (Use I and I-P Water Contact Recreation, Protection of Aquatic Live, and Public Water Supply)	Count	1	1	1	5	1	5
	Corridor Length (feet)	264.6	264.6	264.6	1,117.1	264.6	1,117.1
Modeled Wetlands [b]	Acres	42.6	43.1	59.6	43.3	44.8	63.0
NWI—All Types [a]	Acres	42.7	43.6	53.9	48.8	44.1	62.8
NWI—Freshwater Emergent	Acres	3.9	3.6	5.3	3.4	3.7	5.0
NWI—Freshwater Shrub Scrub	Acres	11.7	10.9	20.8	15.9	11.8	26.1
NWI—Freshwater Pond	Acres	3.9	5.6	4.1	5.1	3.1	4.5
NWI—Lake	Acres	0.0	1.8	0.0	0.0	0.0	0.0
NWI—Riverine	Acres	23.2	21.6	23.7	24.4	25.6	27.2
WV—DEP Wetlands	Acres	8.0	9.3	5.6	8.0	10.4	7.9
MD—DNR Wetlands of Special Concern	Acres	0.0	0.0	0.0	0.0	0.0	0.0
MD—DNR Wetlands	Acres	5.7	4.3	5.2	7.0	5.7	6.5
FEMA Flood Zone A/AE/AO—Areas with a 1% annual chance of flooding (100-year flood area)	Acres	98.4	103.5	109.1	97.3	103.3	115.3
	Structure Count	8	8	7	9	7	7
FEMA Flood Zone X—Areas with 0.2% annual chance of flooding (500-year flood area)	Acres	3.5	3.5	4.0	3.0	5.0	5.1
	Structure Count	0	0	0	0	1	1
FEMA Flood Zones Combined [a]	Acres	101.9	107.0	113.1	100.3	108.3	120.4

Source: USGS NHD, FEMA's National Flood Hazard Layer (NFHL), USFWS, MDE, PFBC, PADEP, WVDNR, VADWR

CWF = Coldwater Fishes; DEP = Department of Environmental Protection; DNR = Department of Natural Resources; EV = Exceptional Value; FEMA = Federal Emergency Management Agency; HQ = High Quality; MD = Maryland; NHD = National Hydrography Dataset; NWI = National Wetlands Inventory; PA = Pennsylvania; TSF = Trout Stocking; VA = Virginia; WV = West Virginia

[a] Totals may not match the sum of addends due to rounding.

[b] ERM conducted a deep learning model to predict wetlands in the MARL Project Study Area. See Appendix H, Wetland Identification Model Report.

Alternative Route A

Alternative Route A had superior performance for water resources criteria. It has the lowest impact on modeled wetlands (42.6 acres) and National Wetlands Inventory (NWI) wetlands (42.7 acres). The route also has the second-lowest impact on National Hydrography Dataset waterbodies with 4.2 acres within the ROW Corridor and is one of two routes with the second-lowest number of trout stream crossings and coldwater fisheries, with 39 crossings and 13,513.2 feet. In addition, Alternative Route A has the second-lowest acreage of floodplains within the ROW Corridor (101.9 acres).

Alternative Route B

Alternative Route B had superior performance for water resources criteria. It has the second-lowest number of perennial stream crossings (77) and the smallest number of trout stream crossings and coldwater fisheries (33) as well as linear feet (10,950.6). This route has the second-lowest impact by acres on both modeled and NWI wetlands but has the lowest acreage of impact on NWI freshwater shrub scrub wetlands. In addition, Alternative Route B has the third-lowest acreage of floodplains within the ROW Corridor (107.0 acres).

Alternative Route C

Alternative Route C had inferior performance for water resources criteria. It has the second-highest impact by acres on both modeled and NWI wetlands (59.6 acres and 53.9 acres, respectively). However, Alternative Route C has the lowest linear feet of perennial streams within the ROW Corridor (24,614.3) but was one of two routes with the second-highest number of crossings of trout streams and coldwater fisheries (50 crossings and 16,728.8 linear feet). In addition, Alternative Route C has the second-highest acreage of floodplains within the ROW Corridor (113.1 acres).

Alternative Route D

Alternative Route D had moderate performance for water resources criteria. It has the highest number and linear feet of perennial stream crossings (99 and 30,557.4). Alternative Route D has the third-lowest impact by acres on modeled wetlands (43.3 acres) but has the fourth lowest for NWI wetlands (48.8 acres). However, Alternative Route D is one of two routes with the second-highest number of trout stream crossings and coldwater fisheries (50 crossings and 15,891.5 linear feet). Alternative Route D has the second-lowest acreage of floodplains within the ROW Corridor (100.3 acres).

Alternative Route E

Alternative Route E had moderate performance for water resources criteria. It is one of two routes with the lowest number of on trout stream crossings and coldwater fisheries, with 39 crossings and 13,512.9 linear feet. Alternative Route E has the third-lowest impact by acres on NWI wetlands (44.1 acres) and the fourth lowest for modeled wetlands (44.8 acres). Alternative Route E has the third-largest acreage of floodplains within the ROW Corridor (108.3 acres).

Alternative Route F

Alternative Route F had inferior performance for water resources criteria. It has the highest overall impact on water resources, and generally poor performance across these criteria. It has the second-highest impacts on perennial streams with 93 crossings and 27,948.3 linear feet within the ROW Corridor. In addition, it has the highest number of crossings and linear feet of trout streams and coldwater fisheries within the ROW Corridor, with almost twice the level of impacts on sensitive streams compared to Alternative Route B. This route has the highest impact on both modeled and NWI wetlands within the ROW Corridor compared to the other Alternative Routes. Alternative Route F has the highest acreage of floodplains within the ROW Corridor (120.4 acres).

Superior Alternative Routes

Alternative Routes A and B had the best performance across water resources and generally have the lowest impacts on water resources. Alternative Route B has the smallest number of trout streams and coldwater fisheries crossings and Alternative Route A is one of two routes with the second-smallest number of trout streams and coldwater fisheries crossings. In addition, Alternative Route A performed well with the lowest impact on wetlands; Alternative Route B has the second-lowest impact on wetlands. Overall, these two routes have the lowest impacts on water resources, likely due to their short length and small footprint relative to the other Alternative Routes.

Moderate and Inferior Alternative Routes

Alternative Routes C and F performed poorly across water resources with the highest impacts on streams, wetlands, and floodplains. Of these two Alternative Routes, Alternative Route F had the worst performance across most water resources with the largest impacts on wetlands and trout streams and coldwater fisheries compared to the other five Alternative Routes. Alternative Routes D and E had moderate performance across water resources.

5.3.2 SENSITIVE SPECIES AND HABITATS

Impacts on sensitive ecological resources, including impacts on known occupied individual species habitats, potentially suitable habitat for sensitive species, and sensitive habitat types have been minimized to the extent practicable across all Alternative Routes.

For consistent evaluation of impacts on these resources across multiple states, the Routing Team relied on study-area-wide datasets and, where possible, merged state-specific data for a more accurate comparison across the various Alternative Routes. This included merging known state- and federally listed species occurrence data from each state. However, there are multiple state-specific datasets that cannot be merged; these are presented in Table 5.3-3. The variability in state-specific information created challenges in evaluating Alternative Routes that cross four different states, with varying lengths in each state.

TABLE 5.3-3 SENSITIVE SPECIES AND HABITATS

Ecological Resources	Unit	Alternative Route A	Alternative Route B	Alternative Route C	Alternative Route D	Alternative Route E	Alternative Route F
USFWS Critical Habitat Final	Area (acres)	0.0	0.0	0.0	0.0	0.0	0.0
USFWS Critical Habitat Proposed	Area (acres)	0.9	0.9	0.9	0.9	0.9	0.9
State-listed Species Occurrence (from state NHI Element Occurrence Data)	Area (acres)	235.1	237.5	228.4	235.5	197.4	183.5
Potentially Suitable State-listed Species, MBTA, and Foraging Bat Habitat	Area (acres)	2,650.8	2,651.8	2,809.5	2,823.0	2,634.2	2,941.5
Potentially Suitable Monarch Butterfly	Area (acres)	538.4	528.2	582.2	617.1	549.1	673.0
Bat Known Occupied Summer Habitat (all states)	Area (acres)	104.3	104.3	104.3	179.4	104.3	179.4
Bat Hibernacula (all states)	Area (acres)	388.9	388.8	420.3	388.9	388.8	420.3
Potentially Suitable Bat Roosting Habitat	Area (acres)	2,033.9	2,023.1	2,156.1	2,123.5	2,005.2	2,192.1
MD—Irreplaceable Natural Areas	Count	11	11	11	7	11	7
MD—Irreplaceable Natural Areas	Area (acres)	88.7	88.7	88.7	49.9	88.7	49.9
MD—Forest Interior Dwelling Species Confirmed	Area (acres)	0.0	0.0	0.0	5.3	0.0	5.3
MD—Forest Interior Dwelling Species Probable	Area (acres)	83.0	99.5	105.7	134.4	83.0	157.1
MD—Natural Heritage Areas	Area (acres)	0.0	0.0	0.0	0.0	0.0	0.0
MD—Forests of Recognized Importance	Count	27	25	27	31	27	31
MD—Forests of Recognized Importance	Area (acres)	38.9	35.8	40.7	44.5	38.9	46.3
MD—Federal or State-Listed Species	Area (acres)	268.7	271.1	284.0	242.9	268.7	258.2
MD—Species of Concern	Area (acres)	7.2	7.2	7.2	36.6	7.2	36.6
MD—BioNet Tier 1 (critically significant)	Area (acres)	96.1	92.7	97.7	51.8	96.1	53.4
MD—BioNet Tier 2 (Extremely Significant)	Area (acres)	70.8	70.8	85.3	31.2	70.8	5.7
MD—BioNet Tier 3 (Highly Significant)	Area (acres)	345.1	351.2	339.9	534.9	345.1	529.7
MD—BioNet Tier 4 (Moderately Significant)	Area (acres)	226.3	209.3	240.9	195.0	226.3	209.0
MD—BioNet Tier 5 (Significant)	Area (acres)	76.9	89.1	103.1	117.7	76.9	144.0
PA—Natural Heritage Areas	Area (acres)	32.4	30.5	120.0	32.4	32.4	120.0
VA—Ecological Core C1 (Outstanding)	Area (acres)	0.0	0.0	0.0	0.0	0.0	0.0
VA—Ecological Core C2 (Very High)	Area (acres)	0.0	0.0	0.0	0.0	0.0	0.0
VA—Ecological Core C3 (High)	Area (acres)	0.0	0.0	0.0	0.0	0.0	0.0
VA—Ecological Core C4 (Moderate)	Area (acres)	24.4	24.4	24.4	24.4	24.4	24.4
VA—Ecological Core C5 (General)	Area (acres)	50.0	46.5	50.0	50.0	50.0	46.5

Source: USFWS, USGS, WVDNR, MDNR, VADWR, PNHP, PADCNR

BioNet = Biodiversity Conservation Network; MBTA = Migratory Bird Treaty Act; MD = Maryland; NHI = National Heritage Inventory; PA = Pennsylvania; USFWS = U.S. Fish and Wildlife Service; VA = Virginia

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Potentially suitable and known occupied habitats that are currently compatible with a maintained ROW (i.e., non-forested) would be temporarily unavailable to sensitive species that rely upon these habitats during construction. This may result in short-term impacts on species that use these habitats; however, individuals would be expected to return to the area following construction, and no long-term change in habitat suitability would be anticipated. Potentially suitable and known occupied forested habitats would be converted to herbaceous and shrub/scrub habitats and would no longer be available to species that use forested habitats.

Each Alternative Route presents a distinct footprint and associated level of impact on sensitive species and/or their habitats. Alternative Routes with larger total acreage within the ROW Corridor generally correlate with greater impacts. Alternative Routes A, B, and E provide the least impact on the total footprint because of their lower ROW Corridor acres, whereas Alternative Routes C, D, and F provide greater impacts. The Routing Team evaluated each route for the following criteria presented in Table 5.3-3 and as shown on Appendix E-12, Alternative Routes—Natural Environment—Sensitive Species and Habitat, which shows study-area-wide datasets for sensitive species and habitat resources. For more specific analysis on state-specific resources please refer to the Environmental Review Documents (Appendices A, B, C, and D), which also includes agency coordination for each respective state.

Alternative Route A

Alternative Route A had superior performance for sensitive species and habitat criteria. Alternative Route A has the second-lowest acreage for potentially suitable state-listed species, Migratory Bird Treaty Act (MBTA), and foraging bat habitat (2,650.8 acres) and also the second-lowest acreage for potentially suitable monarch butterfly habitat (538.4 acres). It has the fourth-lowest acreage within the ROW Corridor for state-listed species occurrence (235.1 acres) This route is one of four with the lowest acreage (104.3 acres) for bat known occupied summer habitat, one of four with the lowest acreage for bat hibernacula (388.9 acres), and third lowest for potentially suitable bat roosting habitat (2,033.9 acres).

Alternative Route B

Similar to Alternative Route A, Alternative Route B had superior performance for sensitive species and habitat criteria. While Alternative Route B has the highest acreage within the ROW Corridor for state-listed species occurrence (237.5 acres) it has the third-lowest acreage amount for potentially suitable state-listed species, MBTA, and foraging bat habitat (2,651.8 acres); the lowest acreage for potentially suitable monarch butterfly habitat (528.2 acres); one of four routes with the lowest acreage (104.3 acres) for bat known occupied summer habitat; one of four with the lowest acreage for bat hibernacula (388.8 acres); and second-lowest acreage for potentially suitable bat roosting habitat (2,023.1 acres).

Alternative Route C

Alternative Route C had moderate performance for sensitive species and habitat criteria. Alternative Route C has the third-lowest acreage within the ROW Corridor for state-listed species occurrence (228.4 acres); the fourth-lowest acreage for potentially suitable state-listed species, MBTA, and foraging bat habitat (2,809.5 acres); and the fourth-lowest acreage for potentially

suitable monarch butterfly habitat (582.2 acres). This route is one of four with the lowest acreage (104.3 acres) for bat known occupied summer habitat but is one of two routes with the largest acreage for bat hibernacula (420.3 acres) due primarily to its proximity to three known bat locations in Pennsylvania and the associated bat hibernation buffers. It also has the second-largest acreage impact for potentially suitable bat roosting habitat (2,156.1 acres).

Alternative Route D

Alternative Route D had inferior performance for sensitive species and habitat criteria. Alternative Route D has generally the second-largest impact acreage for state-listed species occurrence (235.5 acres); potentially suitable state-listed species, MBTA, and foraging bat habitat (2,823.0 acres); potentially suitable monarch butterfly habitat (617.1 acres); and bat known occupied summer habitat (179.4 acres). In addition, Alternative Route D has the third-largest impact on potentially suitable bat roosting habitat (2,123.5 acres) but is one of four routes with the lowest impact on bat hibernacula (388.9 acres).

Alternative Route E

Alternative Route E had superior performance for sensitive species and habitat criteria. Alternative Route E has the second-lowest acreage within the ROW Corridor for state-listed species occurrence (197.5 acres) and the lowest acreage for potentially suitable state-listed species, MBTA, and foraging bat habitat (2,634.2 acres). Alternative Route E has the third-lowest acreage for potentially suitable monarch butterfly habitat (549.1 acres), similar to Alternative Route A. This route is one of four with the lowest acreage (104.3 acres) for bat known occupied summer habitat, one of four for the lowest for bat hibernacula (388.8 acres), and lowest for potentially suitable bat roosting habitat (2,005.2 acres).

Alternative Route F

Alternative Route F had inferior performance for sensitive species and habitat criteria. Alternative Route F generally has the largest impact acreage for all criteria but has the lowest acreage for state-listed species occurrence.

Superior Alternative Routes

Alternative Routes A, B, and E demonstrated superior performance across multiple sensitive species and habitat criteria within the ROW Corridor. These routes consistently had the lowest or among the lowest acreage impacts on sensitive species habitats, including potentially suitable state-listed species, MBTA, monarch butterfly, foraging bat and roosting bat habitats. All three routes shared the lowest acreage (104.3 acres) for bat known occupied summer habitat and were among the lowest for bat hibernacula (388.8–388.9 acres).

Moderate and Inferior Alternative Routes

Alternative Routes D and F demonstrated inferior performance across the multiple sensitive species and habitat criteria. Although Alternative Route F has the lowest acreage for state-listed species occurrence (183.5 acres), it has the highest total acreage for potentially suitable state-listed species, MBTA, and foraging bat habitat; monarch butterfly habitat; bat known occupied

summer habitat; bat hibernacula; and potentially suitable bat roosting habitat. These cumulative impacts place Alternative Routes D and F as the least favorable options from a sensitive species and habitat standpoint. Alternative Route C had moderate performance.

5.4 ENGINEERING AND INFRASTRUCTURE

The engineering and infrastructure criteria used in the Alternative Routes evaluation are essential for selecting a Proposed Route that balances minimizing impacts on the natural environment and built environment while still maintaining Project feasibility through reduced technical complexity in design and construction considerations. Each Alternative Route introduces unique challenges, including the number of existing high-voltage transmission line crossings, structural turn angles, terrain steepness, and proximity to other infrastructure. For instance, Alternative Routes that have a higher number of existing high-voltage 500 KV transmission line crossings present unique engineering and logistical challenges (e.g., potential need for an outage). The MARL Project Study Area has mountainous terrain, and engineering a transmission line with steeper slopes may require specialized structure designs, longer span lengths, potentially more outages during construction, and increased construction effort, as well as longer access roads for construction and/or operation. To minimize impacts on the community, the Alternative Routes require navigating around the built-up environment. This may have resulted in the introduction of sharp turn angles that require more complex structure types, which increase costs. Additionally, proximity to oil and gas wells, pipelines, and karst features introduces the need for detailed geotechnical and safety assessments. By systematically comparing these variables, the Routing Team assessed the Alternative Routes that minimize the technical, engineering, and construction challenges. The Routing Team evaluated each Alternative Route for the criteria presented in Table 5.4-1 and as shown on Appendix E-13, Alternative Routes—Engineering and Infrastructure.

TABLE 5.4-1 ENGINEERING AND INFRASTRUCTURE CRITERIA

Criteria	Unit	Alternative Route A	Alternative Route B	Alternative Route C	Alternative Route D	Alternative Route E	Alternative Route F
Existing Transmission Line Crossings							
Electric Transmission Line Unknown kV Crossing	Count	11	10	13	10	11	12
Electric Transmission Line 69 kV Crossing	Count	0	0	0	0	0	0
Electric Transmission Line 115 kV Crossing	Count	1	1	1	1	1	1
Electric Transmission Line 132 kV Crossing	Count	1	1	0	1	1	0
Electric Transmission Line 138 kV Crossing	Count	21	22	17	23	19	15
Electric Transmission Line 500 kV Crossing	Count	7	7	11	7	7	11
Structures and Designs							
Number of Structures	Count	452	452	478	492	446	519
Structures with Turn Angles 0–20 degrees	Count	361	346	374	383	352	390
Structures with Turn Angles 20–30 degrees	Count	41	47	51	50	46	68
Structures with Turn Angles greater than 30 degrees	Count	50	59	53	59	48	61
Span Length Greater than 1,600 feet	Count	33	42	31	34	39	38
Topography							
Very Steep Slope (31–90 degrees)	Miles	1.6	1.6	1.5	1.3	1.5	1.2
Steep Slope (21–30 degrees)	Miles	6.4	6.4	6.4	5.7	6.6	5.9
Moderate Slope (16–20 degrees)	Miles	5.4	5.4	5.7	5.0	5.5	5.3
Strongly Sloping (6–15 degrees)	Miles	40.2	41.2	41.8	42.3	39.5	43.7
Flat to Gentle Slope (0–5 degrees)	Miles	53.9	52.7	58.2	61.0	53.2	63.0
Infrastructure Crossings							
Primary Road Crossing	Count	2	2	2	2	2	2

Criteria	Unit	Alternative Route A	Alternative Route B	Alternative Route C	Alternative Route D	Alternative Route E	Alternative Route F
Secondary Road Crossing	Count	14	13	16	14	14	16
Tertiary Road Crossing	Count	140	139	148	144	133	150
Railroad Crossing	Count	4	4	5	4	4	5
Oil and Gas Wells: within the ROW Corridor; 500 feet of centerline	Count	4	3	6	4	4	6
	Count	22	19	30	20	22	28
Natural Gas Pipeline Crossing (transmission / distribution / gathering)	Count	7	6	7	7	7	5
	Count	16	12	24	13	16	21
	Count	4	4	7	5	4	8
Wind turbines (within 500 feet and 0.5 mile of the centerline)	Count	0	0	0	0	0	0
	Count	0	0	0	7	0	7
Airports within 20,000 feet of the centerline: public/private	Count	0	0	0	0	0	0
	Count	4	4	6	4	5	7
Geologic Karst Features (miles / acres of ROW)	Miles	12.0	11.5	18.2	13.6	12.0	18.8
	Acres	302.9	291.8	454.2	336.9	302.9	464

Source: REXTAG, USGS

kV = kilovolt; ROW = right-of-way

Alternative Route A

Alternative Route A had superior performance for engineering and infrastructure criteria. It is one of two routes with the second-lowest number of total structures (452), the lowest number of structures with 20–30-degree angles (41), and the second-lowest number of structures with greater than 30-degree angles (50). Alternative Route A is one of four routes with the lowest number of 500 kV crossings (7). It also has the second-lowest number of spans greater than 1,600 feet (33). It does cross through 1.6 miles of very steep slope in the Bear Creek Area of Maryland while paralleling existing transmission lines. In addition, Alternative Route A is one of three routes with the second-lowest number of oil and gas wells within the ROW Corridor and a moderate number of natural gas pipeline crossings (27). Overall, Alternative Route A demonstrates a strong balance between minimizing structural complexity and maintaining efficient routing.

Alternative Route B

Alternative Route B had moderate performance for engineering and infrastructure criteria. Like Alternative Route A, it has the second-lowest number of total structures (452), but a much higher percentage of those structures have sharp turn angles with 47 structures with turn angles 20-30 degrees and 59 structures with turn angles greater than 30 degrees. Alternative Route B was one of four routes with the lowest number of 500 kV crossings (7). It crosses through the same very steep slope as Alternative Route A for 1.6 miles.

Alternative Route C

Alternative Route C had inferior performance for engineering and infrastructure criteria. It presents several engineering challenges that make it one of the least favorable routing options. It has some of the highest counts for transmission line crossings, gathering pipelines, and oil and gas wells located within the ROW Corridor and 500 feet of the centerline. Alongside Alternative Route F, it also has the highest number of 500 kV crossings (11), indicating greater potential complexity for construction and design. It also has an elevated presence of oil and gas infrastructure near the route, largely due to its alignment through heavily developed natural gas areas in Pennsylvania. It has an average number of transmission structures (478), including an average number of structures with sharp angles and the lowest number of spans greater than 1,600 feet at 31. These factors contribute to increased complexity, positioning Alternative Route C as a less desirable choice from an engineering standpoint.

Alternative Route D

Alternative Route D had moderate performance for engineering and infrastructure criteria. It has the highest number of 138 kV transmission line crossings (23) but is one of four routes with the lowest number of 500 kV crossings (7). It has the second-highest number of structures (492) and the second-highest number of turn angled structures greater than 20 degrees (109). It avoids some of the steeper terrain in the MARL Project Study Area by routing north of the Bear Creek area in Maryland and as a result has the second-flattest alignment. Alternative Route D does cross near two wind farms with seven turbines within 0.5-mile of the centerline, which presents engineering challenges.

Alternative Route E

Alternative Route E had superior performance for engineering and infrastructure criteria. It has the lowest total number of structures (446), indicating a potentially more cost-effective design. Additionally, it was second lowest in the number of structures with turn angles greater than 20 degrees (94), suggesting fewer complex directional changes. Like Alternative Routes A, B, and D, it also has the lowest number of 500 kV transmission line crossings (7), minimizing interference with major transmission infrastructure.

Alternative Route F

Alternative Route F had inferior performance for engineering and infrastructure criteria. Due to its longer length, it has the highest number of structures (519). It also has the highest number of structures with turn angles greater than 20 degrees (129). Like Alternative Route C, it has the highest number of 500 kV transmission line crossings (11), which present the significant engineering challenges described above. It avoids some of the steeper terrain in the MARL Project Study Area by routing north of the Bear Creek area in Maryland. As a result, it has the second-flattest alignment. Additionally, like Alternative Route C, Alternative Route F has an elevated presence of oil and gas infrastructure near the route, largely due to its alignment through heavily developed natural gas areas in Pennsylvania.

Superior Alternative Routes

Alternative Routes A and E demonstrated strong performance across the engineering evaluation criteria. Alternative Route A stood out for its balance among the criteria, including the fewest structures with turn angles greater than 20 degrees, a tie for the lowest number of 500 kV transmission line crossings—one of the most significant engineering challenges—and the second-lowest count of spans exceeding 1,600 feet. Similarly, Alternative Route E performed well, with the lowest total number of structures, the second-fewest structures with turn angles over 20 degrees, and it tied for the lowest number of 500 kV crossings. These characteristics suggest both Alternative Routes offer efficient and less complex routing options, making them favorable from an engineering standpoint.

Moderate and Inferior Alternative Routes

Alternative Routes C and F performed as the least favorable options based on engineering criteria. Alternative Routes C and F have the highest number of 500 kV transmission line crossings (11), which presents one of the largest engineering challenges. Additionally, Alternative Routes C and F traverse areas with dense oil and gas infrastructure—including elevated counts of wells and pipeline crossings—due to their alignment through heavily developed natural gas regions in Pennsylvania. Alternative Route D had moderate performance. Alternative Routes D and F also stand out for having the largest number of total structures and the highest counts of structures with turn angles greater than 20 degrees, indicating more complex design requirements. Alternative Routes D and F also pass near two wind farm developments, with seven turbines located within 0.5-mile of the centerline, presenting further engineering constraints that must be addressed during planning and construction.

5.5 ESTIMATED COSTS

Table 5.5-1 provides the estimated capital costs for the development and construction of each of the six end-to-end Alternative Routes.

TABLE 5.5-1 ESTIMATED CAPITAL COSTS FOR THE ALTERNATIVE ROUTES

Alternative Route A	Alternative Route B	Alternative Route C	Alternative Route D	Alternative Route E	Alternative Route F
$1,167,236,674	$1,175,521,094	$1,204,723,343	$1,241,099,297	$1,159,876,697	$1,256,130,573

5.6 SELECTION OF THE PROPOSED ROUTE

The Routing Team conducted a comprehensive multi-criteria evaluation of the Alternative Routes, assessing criteria described in Sections 5.1 through 5.5. These criteria included route length, construction footprint, paralleling existing infrastructure, community and recreational resources, protected areas, cultural resources, agricultural and land cover, natural environmental features—including water and ecological resources—engineering and infrastructure considerations, and estimated costs. Table 5.6-1 provides a summary matrix highlighting the performance of each Alternative Route for each set of criteria.

TABLE 5.6-1 ALTERNATIVE ROUTE EVALUATION RESULT MATRIX

Alternative Routes	Route Length and Construction Footprint	Paralleling Existing Infrastructure	Community and Recreational Resources	Protected Areas	Cultural Resources	Agricultural and Land Cover	Water Resources	Sensitive Species and Habitats	Engineering and Infrastructure	Estimated Cost
Alternative Route A	Superior	Superior	Superior	Moderate	Superior	Superior	Superior	Superior	Superior	Superior
Alternative Route B	Superior	Superior	Inferior	Moderate	Moderate	Superior	Superior	Superior	Moderate	Superior
Alternative Route C	Moderate	Superior	Moderate	Inferior	Inferior	Inferior	Inferior	Moderate	Inferior	Moderate
Alternative Route D	Moderate	Inferior	Moderate	Superior	Superior	Moderate	Moderate	Inferior	Moderate	Inferior
Alternative Route E	Superior	Moderate	Superior	Moderate	Superior	Superior	Moderate	Superior	Superior	Superior
Alternative Route F	Inferior	Inferior	Inferior	Moderate	Inferior	Inferior	Inferior	Inferior	Inferior	Inferior

Superior—High performance for the listed criteria with low impacts on category resources relative to the other Alternative Routes.
Moderate—Average performance for the listed criteria with moderate impacts on category resources relative to the other Alternative Routes.
Inferior—Poor performance for the listed criteria with high impacts on category resources relative to the other Alternative Routes.

5.6.1 ALTERNATIVE ROUTE A SELECTED AS THE PROPOSED ROUTE

As shown in Table 5.6-1, Alternative Route A had superior performance for all routing criteria except for one, where it had a moderate performance. Specifically, Alternative Route A had superior performance for route length and footprint, paralleling existing infrastructure, community and recreational resources, cultural resources, agricultural and land cover, water resources, sensitive species and habitats, and engineering criteria. It had moderate performance for protected lands. It did not have inferior performance for any criteria when compared to other Alternative Routes. Notably, Alternative Route A is the only Alternative Route with superior performance for three primary categories of criteria the Routing Team strived to achieve at the start of the MARL Project: route length and construction footprint, paralleling existing infrastructure, and community and recreational resource—which were important decision criteria for the selection of the Proposed Route. Therefore, based on this analysis, the Routing Team selected Alternative Route A as the Proposed Route for the MARL Project. Alternative Route A offers the most balanced solution that maximizes opportunities to parallel existing transmission lines, minimizes potential impacts on both natural environment and built environment, and minimizes the engineering and construction-related challenges.

For route length and construction footprint, Alternative Route A had superior performance with the second-smallest ROW Corridor (2,669.0 acres) and the third-smallest length (107.5 miles—almost identical to Alternative Route B [107.3 miles]). Alternative Routes A, B, and E vary by 1.2 miles in total length and less than 1 percent in ROW Corridor area, reflecting reduced impacts relative to the other three Alternative Routes. Alternative Route A has 6 to 10 percent less ROW Corridor area compared to Alternative Routes C, D, and F.

For paralleling existing infrastructure, Alternative Route A had superior performance. Although Alternative Route A only had the third-highest percent paralleling with 52.5 percent paralleling existing transmission lines, it had similar total mileage of greenfield development as Alternative C (51.1 miles for Alternative A versus 49.1 miles for Alternative C) and significantly higher percentage paralleling compared to Alternative Routes D, E, and F which were all below 50 percent. Alternative Route A has 20 percent more paralleling than Alternative F, 18 percent more than Alternative D, and 8 percent more than Alternative E.

For community and recreational resources, Alternative Route A had superior performance with the second-lowest impact on residential dwellings and landowners. It has 29 residential dwellings within 250 feet (second lowest), 151 residential dwellings within 500 feet (second lowest), and 388 unique landowners crossed (second lowest). These were key decision criteria for the selection of the Proposed Route. This represents 21 percent less impact on residential dwellings (41 fewer dwellings) within 500 feet of the centerline compared to the highest impact Alternative (Alternative B).

For protected areas, Alternative Route A had moderate performance when compared to the other Alternative Routes. It has the second-lowest mileage of crossings through state forest lands and has the lowest acreage of impact within the USACE-managed Youghiogheny River Lake. However, like Alternative Routes B, C, and E, it crosses the Maryland Wildlands and two Rural Legacy Easements. In total, Alternative Route A parallels existing transmission lines through eight

protected land areas over 14.6 miles. The strategy to parallel existing transmission lines contributes to its strong performance in other criteria (e.g., residential and community impacts) by leveraging existing infrastructure to minimize additional impacts, resulting in increased crossing of protected lands since many existing transmission corridors are located within these areas.

For cultural resources, the variability of impacts was small, but Alternative Route A had superior performance with generally the second-lowest number of impacts. It has the second-lowest number of cemeteries within 500 feet of the centerline (4), second-lowest number archaeological resources within the ROW Corridor (6), the second-lowest number of architecture resources within 0.5-miles (7) of the centerline.

For agricultural and land cover, Alternative Route A has superior performance. Alternative Route A has the second-smallest ROW Corridor (2,669.0 acres) and has the second-lowest amount of agricultural lands and the third lowest of forested lands within the ROW Corridor, and therefore presents less footprint of impacts on these resources than the longer Alternative Routes C, D, and F.

For the natural environment, Alternative Route A had superior performance for the water resources criteria. It has the smallest acreage of wetlands within the ROW Corridor—including both modeled wetlands and NWI wetlands. Additionally, Alternative A has the second-smallest number of crossings of trout streams and coldwater fisheries (39). For sensitive species and habitat criteria, Alternative Route A had superior performance with the second-lowest acreage amount for potentially suitable state-listed species, MBTA, and foraging bat habitat (2,650.8 acres) and the second-lowest acreage for potentially suitable monarch butterfly habitat (538.4 acres). This route is also one of four with the lowest acreage (104.3 acres) for bat known occupied summer habitat, and one of four for the lowest for bat hibernacula (388.9 acres).

For engineering and infrastructure criteria, Alternative Route A had superior performance. It has the second-lowest number of total structures (452) and the lowest number of structures with 20–30-degree angles and greater than 30-degree angles (41 and 50, respectively). Alternative Route A, along with Alternative Routes B, D, and E, have the lowest number of 500 kV crossings (7). It also has the second-lowest number of spans greater than 1,600 feet (33).

5.6.2 THE PROPOSED ROUTE COMPARED TO THE OTHER ALTERNATIVE ROUTES

This section presents a comparison between the Proposed Route and the other five Alternative Routes. While portions of the Alternative Routes overlap with the Proposed Route, the Proposed Route includes several key differences that result in fewer impacts and improved overall performance compared to the other Alternative Routes.

Table 5.6-2 provides a summary comparison of 1) the percentage of overlap between the Alternative Routes and the Proposed Route and 2) the high-level differences between the Alternative Routes compared to the Proposed Route. Table 5.6-3 highlights the difference in performance evaluation for the Alternative Routes compared to the Proposed Route. The performance of each Alternative Route is shown in Table 5.6-1.

TABLE 5.6-2 SUMMARY COMPARISON OF THE ALTERNATIVE ROUTES TO THE PROPOSED ROUTE

Alternative Route	Percent Overlap with the Proposed Route	Descriptive Difference
Alternative Route B	73.4	Overall, Alternative Route B performed well across most evaluation criteria, although it exhibited several notable differences from the Proposed Route, particularly in the community and recreational resources, and engineering criteria. Alternative Route B deviates from the Proposed Route in Fayette County, Pennsylvania; Monongalia and Preston Counties, West Virginia; and a small section in the northwest corner of Garrett County, Maryland, before the Youghiogheny River crossing. It was developed to provide an Alternative Route on the opposite side of the Hazelton–Lake Lynn 138 kV transmission line, offering a slightly higher percentage of paralleling with existing transmission infrastructure. While Alternative Route B achieved the second-highest level of paralleling among all routes (55.6 percent compared to 52.5 percent for the Proposed Route), this improvement came with a tradeoff in greater proximity to residential areas. Alternative Route B has more residential dwellings within 250 feet of the centerline (40 compared to 29 for the Proposed Route) and within 500 feet (192 compared to 150). Additionally, Alternative Route B crosses Cheat Lake and extends closer to residential developments along its eastern shore, whereas the Proposed Route avoids these dense residential areas by crossing farther north through less developed lands. Alternative Route B also crosses the FERC Project Boundary for the Lake Lynn Hydroelectric Project (P-2459-279) and parallels existing transmission lines through Federal Bureau of Prisons lands at United States Penitentiary Hazelton, both of which may introduce added permitting and coordination challenges. From an engineering perspective, Alternative Route B had lower performance due to a higher number of structures requiring turn angles greater than 20 degrees (106 versus 91) and a higher number of long spans exceeding 1,600 feet (42 versus 33), which introduce engineering challenges. Both Alternative Route B and the Proposed Route had similar performance for protected resources, water resources, and sensitive species and habitat criteria.
Alternative Route C	64.4	Alternative Route C demonstrated moderate to lower performance across most evaluation criteria, with the exception of its strong performance in paralleling existing infrastructure, where it achieved the highest percentage among all routes (56.8 percent). Alternative Route C deviates from the Proposed Route in Greene and Fayette Counties, Pennsylvania, and the northwestern portion of Garrett County, Maryland, prior to crossing the Youghiogheny River. Alternative Route C was developed to provide an alternative to crossing Coopers Rock State Forest in Preston County, West Virginia, and to parallel the existing 500 kV transmission lines in the northwestern quadrant of the MARL Project Study Area in Pennsylvania. However, while this Alternative Route increases paralleling, the northern deviation introduces additional line length—it is 6.1 miles longer than the Proposed Route—and requires an additional 166.6 acres of ROW. These factors contribute to greater land disturbance

Alternative Route	Percent Overlap with the Proposed Route	Descriptive Difference
		and higher potential impacts on community and recreational resources, intersecting 32 more parcels, 17 more unique landowners, and 10 more dwellings within 500 feet of the centerline compared to the Proposed Route. For protected areas, Alternative Route C performed worse than the Proposed Route with 67.1 more acres through protected lands and crossing through two additional resources. Alternative Route C also performed worse for cultural resources, agricultural and land cover, water resources, and engineering criteria. For the engineering criteria, Alternative Route C has 23 additional structures, 13 more structures with turn angles greater than 20 degrees, and four additional 500 kV transmission line crossings than the Proposed Route.
Alternative Route D	67.5	Alternative Route D demonstrated moderate to inferior performance across most evaluation criteria, with the exception of superior performance for the protected areas and cultural resources criteria. Alternative Route D shares 67.5 percent of its corridor with the Proposed Route but diverges in Maryland to avoid the Maryland Wildlands by paralleling the existing Jennings–Hazelton 138 kV transmission line north of the Proposed Route. It then transitions through a substantial greenfield segment near Midland, Maryland, crossing Dan's Mountain WMA traveling south before rejoining the Proposed Route near the Black Oak Substation. This deviation results in 7.7 additional miles of transmission line in Maryland and requires 170.0 more acres of ROW Corridor compared to the Proposed Route. Avoiding the Maryland Wildlands also necessitates an additional 21.1 miles of greenfield development in Maryland, for a total of 31.1 miles of greenfield compared to 10.0 miles of greenfield development for the Proposed Route in Maryland. Due to this larger greenfield development footprint, Alternative Route D has lower performance than the Proposed Route for community and recreational resources, agricultural and land cover, water resources, sensitive species and habitat, and engineering criteria.
Alternative Route E	87.1	Overall, Alternative Route E performed well across the evaluation criteria. It is the shortest Alternative Route (106.3 miles) with the smallest ROW Corridor (2,651.5 acres) and is 1.1 miles shorter and has 17.5 fewer acres of ROW Corridor than the Proposed Route. It overlaps with the Proposed Route for 87.1 percent of its ROW Corridor, with the exception of a greenfield section in Mineral and Hampshire Counties, West Virginia. Alternative Route E was developed to provide an alternative to crossing the White Horse Mountain WMA and demonstrate the differences a more direct, but greenfield path could create. To avoid crossing the White Horse WMA, Alternative Route E necessitates an additional 4.6 miles of greenfield development in West Virginia compared to the Proposed Route (35.7 miles versus 31.2 miles for the Proposed Route in West Virginia), resulting in 47.7 percent paralleling for Alternative Route E versus 52.5 percent for the Proposed Route. Alternative Route E also had slightly lower performance for the water resources evaluation criteria with higher acreage of NWI wetlands within the ROW Corridor (44.1 versus 42.7 for the Proposed Route), 2.2 additional acres of modeled wetlands, and 11.2 additional acres of ROW Corridor inside a flood zone than the Proposed Route. In addition to the criteria comparison outlined in Sections 5.1 through 5.5, Alternative Route E also received significantly more negative feedback from our online surveys, primarily in the area of greenfield development in Hampshire and Mineral Counties, West Virginia, compared to the Proposed Route.

Alternative Route	Percent Overlap with the Proposed Route	Descriptive Difference
Alternative Route F	20.2	Alternative F had inferior performance across most metrics in the evaluation criteria. Alternative Route F was developed to provide an Alternative Route that parallels existing transmission lines in the northwest quadrant of the MARL Project Study Area and avoids impacts on the Coopers Rock State Forest, Savage River State Forest and associated Wildlands, Dan's Mountain WMA and associated Wildlands, and White Horse Mountain WMA. To avoid these resources, Alternative Route F has an additional 11.6 miles of transmission line and 295.3 acres of ROW Corridor compared to the Proposed Route. It parallels existing transmission lines for 36.3 percent versus 52.5 percent for the Proposed Route, resulting in 24.9 additional miles of greenfield development compared to the Proposed Route. Alternative Route F performed worse than the Proposed Route in all evaluation criteria except for protected lands. For community and recreational resources, Alternative Route F has 33 additional dwellings within 500 feet of the centerline and crosses 35 more parcels compared to the Proposed Route. For water resources, Alternative Route F crosses 22 additional trout streams and coldwater fisheries (61 versus 39 for the Proposed Route), has 21 more acres of NWI wetlands and 35.3 more acres of floodplain inside the ROW Corridor compared to the Proposed Route. For the engineering criteria, Alternative Route F has four additional crossings of an existing 500 kV transmission line, 67 additional structures, and 38 additional structures with turn angles greater than 20 degrees when compared to the Proposed Route.

FERC =Federal Energy Regulatory Commission; kV = kilovolt; NWI = National Wetlands Inventory; ROW = right-of-way; WMA = Wildlife Management Area

Note: Totals may not match the sum of addends due to rounding.

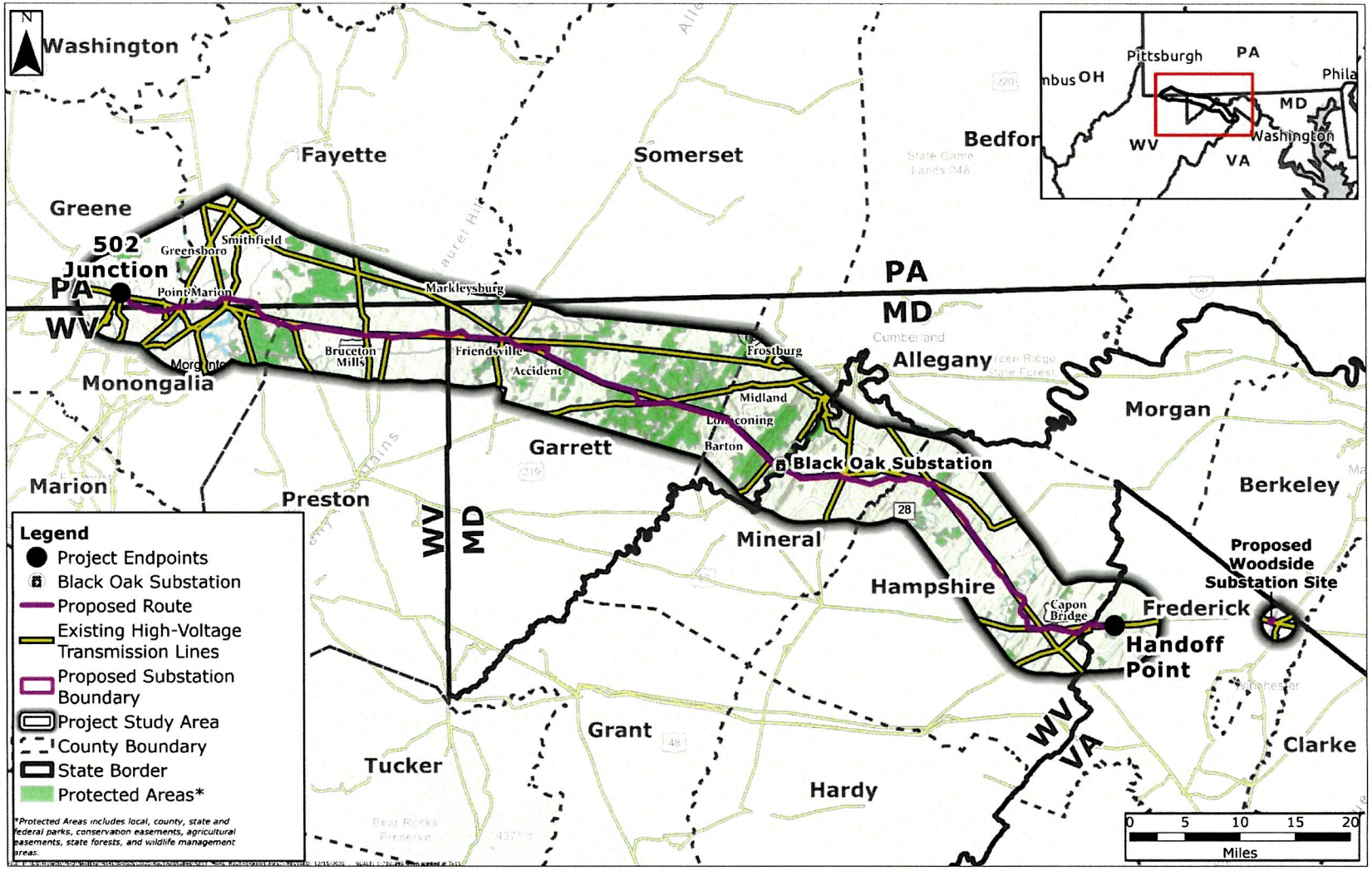
TABLE 5.6-3 SUMMARY OF COMPARISON TO THE PROPOSED ROUTE BASED ON EVALUATION CRITERIA

Alternative Route	Route Length and Construction Footprint	Paralleling Existing Infrastructure	Community and Recreational Resources	Protected Areas	Cultural Resources	Agricultural and Land Cover	Water Resources	Sensitive Species and Habitats	Engineering and Infrastructure	Estimated Cost
Alternative Route B	Same	Same	Lower	Same	Lower	Same	Same	Same	Lower	Same
Alternative Route C	Lower	Same	Lower	Lower	Lower	Lower	Lower	Lower	Lower	Lower
Alternative Route D	Lower	Lower	Lower	Higher	Lower	Lower	Lower	Lower	Lower	Lower
Alternative Route E	Same	Lower	Same	Same	Same	Same	Lower	Same	Same	Same
Alternative Route F	Lower	Lower	Lower	Same	Lower	Lower	Lower	Lower	Lower	Lower

6. CONCLUSION AND RECOMMENDATION

Based on the evaluation conducted in Section 5, Alternative Route A was selected as the Proposed Route (Figure 6-1). In addition to the Proposed Route, the MARL Project includes ancillary facilities required for both construction and long-term operation and maintenance. These ancillary facility workspaces consist of access roads, structure pads, and wire work areas as discussed in Section 6.2 and shown on Appendix E-14, Proposed Route. Additionally, where feasible, the MARL Project has identified locations where forested riparian buffers will be preserved to protect sensitive waterbodies. These riparian habitat exclusion zones are discussed in Section 6.3 and shown on Appendix E-14. The preservation of these sensitive riparian buffers reduces the potential impact on resource criteria that were considered in the evaluation in Section 5. Section 6.4 provides analysis tables showing the Proposed Route with and without maintaining the riparian habitat exclusion zones, the associated ancillary facility workspaces, and the Woodside Substation.

FIGURE 6-1 THE PROPOSED ROUTE



MD = Maryland; PA = Pennsylvania; VA = Virginia; WV = West Virginia

6.1 THE PROPOSED ROUTE DESCRIPTION

The Proposed Route will generally encompass the geographic area between the endpoints of the 502 Junction Substation in Greene County, Pennsylvania, and the handoff point (a new 500 kV transmission line to be constructed by FirstEnergy) in Frederick County, Virginia. The proposed Woodside Substation is also in Frederick County, Virginia, but approximately 11 miles to the east of the eastern terminus of the Proposed Route handoff point. The total Proposed Route will be 107.5 miles in length, with a ROW Corridor of 2,669.0 acres.

Beginning at 502 Junction in Greene County, Pennsylvania, the Proposed Route mostly parallels two existing transmission lines traveling southeast for 2.7 miles before entering Monongalia County, West Virginia, near MP 2.7. It then travels east for 3.1 miles before reentering Greene County, Pennsylvania, near Fort Martin Power Station at MP 5.8. The Proposed Route travels east for 1.4 miles in Greene County, Pennsylvania, before crossing the Monongahela River and entering Fayette County, Pennsylvania, at MP 13.8. 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, near MP 13.8. The Proposed Route travels east to southeast for 2.8 miles in northeastern corner of Monongalia County, West Virginia, while paralleling the existing Hazelton to Lake Lynn 138 kV Transmission Line near Coopers Rock State Forest. It crosses into Preston County, West Virginia, near Patterson Run at MP 16.6, where it primarily parallels the existing Hazelton to Lake Lynn 138 kV Transmission Line, traveling east for 15.8 miles before entering Garrett County, Maryland, near MP 32.5. In Garrett County, the Proposed Route parallels the existing Jennings to Hazelton 138 kV Transmission Line and Hatfield's Ferry Power Station to Black Oak 500 kV Transmission Line traveling east to southeast for 27.8 miles before entering Allegany County, Maryland, near MP 60.3. In Allegany County, Maryland, the Proposed Route parallels the existing Hatfield's Ferry Power Station to Black Oak 500 kV Transmission Line, traveling southeast for 7.6 miles before entering Mineral County, West Virginia, near Black Oak Substation at MP 67.9. In Mineral County, West Virginia, the Proposed Route travels east while mostly paralleling the existing Black Oak to Bedington 500 kV Transmission Line for 10.9 miles before entering Hampshire County, West Virginia, at MP 78.8. The Proposed Route then travels southeast for 26.2 miles while mostly paralleling the existing Hampshire to Ridgeley 138 kV Transmission Line. The Proposed Route enters Frederick County, Virginia, near MP 105.0 and travels east for 2.4 miles following the Mount Storm to Doubs 500 kV and Stonewall to Hampshire 138 kV Transmission Lines and paralleling where feasible, except in areas with residential development adjacent to the existing transmission lines before handing off to a new 500 kV transmission line to be constructed by FirstEnergy at MP 107.5. A detailed description of the Proposed Route in each county is outlined below.

The Proposed Route will require 452 structures, with an average span length of 1,258 feet. It will parallel existing transmission lines for 56.4 miles (52.5 percent of the Proposed Route), and strive to limit impacts on sensitive areas and communities to the extent possible. Table 6.1-1 highlights the lengths, ROW Corridor, and percentage of paralleling existing transmission lines for the Proposed Route in each county.

TABLE 6.1-1 THE PROPOSED ROUTE AND COUNTY CROSSINGS

County and State [a]	Length (miles)	ROW Corridor (acres)	Paralleling Existing Transmission Line (%)
Greene County, PA	4.1	103.1	55.3
Fayette County, PA	6.6	163.8	0.0
Monongalia County, WV	5.9	143.5	23.1
Preston County, WV	15.8	392.6	49.4
Garrett County, MD	27.8	695.0	71.6
Allegany County, MD	7.6	202.9	72.6
Mineral County, WV	10.9	267.2	46.1
Hampshire County, WV	26.2	641.4	51.5
Frederick County, VA	2.4	59.4	41.8
Total [b]	**107.5**	**2,669.0**	**52.5**

MA = Maryland; PA = Pennsylvania; ROW = right-of-way; VA = Virginia; WV = West Virginia

[a] Counties are listed west to east

[b] Totals may not match the sum of addends due to rounding.

Greene County, Pennsylvania: MP 0.0 to MP 2.7

The Proposed Route begins at the 502 Junction Substation origin point in Greene County, Pennsylvania, heading southwest near Bald Hill while paralleling two separate existing transmission lines. The Proposed Route then proceeds in an easterly direction for 0.8 mile before crossing an existing 500 kV transmission line and heading in a general southeasterly direction for 1.8 miles to avoid residential development built up adjacent to the existing line near Bald Hill, exiting Pennsylvania near MP 2.7.

Monongalia County, West Virginia: MP 2.7 to MP 5.8

The Proposed Route enters Monongalia County, West Virginia, north of Maidsville, West Virginia, and west of Old Taylortown Road near MP 2.7, then heads in an easterly direction for 3.1 miles through undeveloped private land as a greenfield section of the line before heading north back into Greene County, Pennsylvania, to avoid Fort Martin Power Plant and its associated infrastructure.

Greene County, Pennsylvania: MP 5.8 to MP 7.1

The Proposed Route reenters Pennsylvania at MP 5.8, crosses the existing Longview Power property to Fort Martin 500 kV line, and heads in an easterly direction. The route then crosses the Monongahela River near MP 7.1 and enters Fayette County, Pennsylvania.

Fayette County, Pennsylvania: MP 7.1 to 13.8

The Proposed Route continues in an easterly-northeasterly direction, crossing undeveloped private land while avoiding residential developments near Davison Road and Bortz Road until it crosses the Cheat River near MP 10.1 north of the Lake Lynn Hydro Station. The Proposed Route avoids residential developments east of the Cheat River near Lake Lynn Road and continues east within Fayette County as a greenfield section of the line. It follows large, undeveloped private lands and crosses the Mon-Fayette Expressway (PA Turnpike 43) near MP 12.8. At MP 13.2, the Proposed

Route heads in a southeasterly direction, exiting the state of Pennsylvania at MP 13.8 and reentering West Virginia to begin paralleling the existing Hazelton to Lake Lynn 138 kV Transmission Line.

Monongalia County, West Virginia: MP 13.8 to 16.6

The Proposed Route heads south across undeveloped private property over Ryan Hollow. At MP 15.0, the Proposed Route crosses the existing Hazelton to Lake Lynn 138 kV Transmission Line to parallel it on the south side for 2.8 miles. It then deviates from the existing line to avoid residential homes before crossing into Preston County near MP 16.6.

Preston County, West Virginia: MP 16.6 to 32.4

The Proposed Route enters Coopers Rock State Forest for 0.3 mile for a greenfield section before paralleling the existing Cheat Lake to Ruthbelle 138 kV Transmission Line for 1.0 mile. At MP 18.0, the Proposed Route exits Coopers Rock State Forest and heads in a northeasterly direction, crossing over the existing Cheat Lake to Ruthbelle 138 kV Transmission Line and Patterson Run and Laural Run streams before paralleling the Hazelton to Lake Lynn 138 kV Transmission Line.

From MP 19.3 to MP 24.4, the Proposed Route continues paralleling the existing Hazelton to Lake Lynn 138 kV Transmission Line, deviating between MP 20.3 to MP 20.5 to avoid a residential structure. At MP 24.4, the Proposed Route heads in a southeasterly direction for 0.2 mile before heading in an easterly direction for 0.8 mile, where it deviates around residential and agricultural buildings near MP 24.8, crossing two existing 138 kV transmission lines before paralleling the Hazelton to Lake Lynn 138 kV Transmission Line at MP 25.5. It continues paralleling this line from MP 25.5 to MP 26.8 before turning in a southeasterly direction to avoid residential homes and a substation located between MP 26.8 to MP 28.3. At MP 28.3, the Proposed Route crosses to the northern side of the Hazelton to Lake Lynn 138 kV Transmission Line and heads in an easterly direction for 0.9 mile before deviating to avoid residential homes located along the existing transmission line between MP 29.3 and MP 32.4. At MP 32.4, the Proposed Route exits the state of West Virginia and enters the state of Maryland.

Garrett County, Maryland: MP 32.4 to 60.3

The Proposed Route begins at the West Virgina-Maryland border at the western end of the South Branch Laurel Run stream (MP 32.5) and west of Blue Goose Road, approximately 1 mile north of Interstate 68, then heads in a northeasterly direction for approximately 1.5 miles before crossing Route 42/Friendsville Road, turning in a southeasterly direction for approximately 0.6 mile. From this point, the Proposed Route crosses Buffalo Run stream and turns in an easterly direction, paralleling the existing Jennings to Hazelton 138 kV Transmission Line for 0.6 mile before deviating around some residential homes near MP 35.7, then continuing to parallel the Jennings to Hazelton 138 kV line for 1.1 miles, and crossing over the Youghiogheny River / USACE Recreation Management Area near MP 37.3. The Proposed Route then deviates from the existing 138 kV transmission line to avoid residential homes and crosses over Interstate 68 around MP 37.7. At MP 37.9 to 38.1, the Proposed Route crosses an existing 115 kV transmission line and the Hatfield's Ferry Power Station to Black Oak 500 kV Transmission Line. It then turns in a southeasterly direction, crosses the existing Jennings to Hazelton 138 kV Transmission Line, and

parallels the existing Hatfield's Ferry Power Station to Black Oak 500 kV Transmission Line for 2.5 miles, crossing a tributary to Bear Creek and Fikes Run. At MP 41.0, the Proposed Route deviates from the existing transmission line to avoid residential development on Sale Barn Road, heading northeast-east for approximately 1.9 miles before heading in a southerly direction, crossing over Bear Creek and the associated challenging terrain. At MP 42.9 the Proposed Route begins paralleling the existing Hatfield's Ferry Power Station to Black Oak 500 kV Transmission Line again.

The Proposed Route crosses over private lands from MP 42.9 to MP 43.8 before entering Maryland Department of Natural Resources (DNR) State Lands, where it parallels the existing transmission line from MP 43.9 to MP 45.2 and crosses the Bear Creek Hatchery FMA parcel, Bear Creek, and Savage River State Forest. The Proposed Route then crosses a small area of private lands from MP 45.2 to MP 45.7. At MP 45.3, the Proposed Route deviates from the existing Hatfield's Ferry Power Station to Black Oak 500 kV Transmission Line to avoid spanning a Maryland DNR Wetlands of Special State Concern at MP 45.7 to MP 45.9, which is also located in Savage River State Forest. The Proposed Route crosses another portion of the Savage River State Forest, paralleling the existing transmission line, from MP 45.7 to 46.4. After exiting the Savage River State Forest, the Proposed Route parallels the existing transmission line for 3.1 miles across private lands before crossing another portion of Savage River State Forest from MP 49.6 to MP 49.9 and again from MP 50.2 to MP 51.6. Between MP 50.6 and MP 51.3, the Proposed Route shifts slightly from the existing transmission line to address terrain challenges and to meet the MARL Project's engineering requirements for aerial easement blowout. At MP 51.4, the Proposed Route crosses the existing 500 kV transmission line, heading south to avoid the residential area near Fairview Road. The Proposed Route continues in a southeasterly direction for 1.3 miles, crossing another small section of the Savage River State Forest. Beginning at MP 52.7, the Proposed Route travels in an easterly direction, paralleling the existing Carlos JCT to Garrett 138 kV Transmission Line crossing Savage River State Forest. At MP 53.3, the Proposed Route crosses the Carlos JCT to Garrett 138 kV Transmission Line on private property to continue paralleling it on the southern side. At MP 53.5, the Proposed Route enters Savage River State Forest and Bear Pen Wildlands, crossing Bear Pen Run until MP 54.6, where it exits and crosses private lands. The Proposed Route again enters Savage River State Forest and Bear Pen Wildlands at MP 55.1. At MP 55.5, the Proposed Route turns slightly in a southeasterly direction, again paralleling the existing Hatfield's Ferry Power Station to Black Oak 500 kV Transmission Line and crossing Savage River through Savage River State Forest and Big Savage Mountain Wildlands (MP 56.2 to MP 56.7). From MP 56.7 to MP 57.6, the Proposed Route travels across private lands and then parallels the existing transmission line from MP 57.6 to MP 59 within Savage River State Forest across Big Savage Mountain. The Proposed Route continues from MP 59 to MP 60.3 on private lands before crossing another small section of Savage River State Forest from MP 60.3 to MP 60.6.

Allegany County, Maryland: MP 60.3 to 67.9

At MP 60.3, the Proposed Route enters Allegany County, Maryland, continuing to parallel the existing Hatfield's Ferry Power Station to Black Oak 500 kV Transmission Line until MP 61.5, where it deviates from the existing transmission line due to terrain and engineering concerns. At MP 62.3, the Proposed Route continues to parallel the existing Hatfield's Ferry Power Station to

Black Oak 500 kV Transmission Line. At MP 64.4, the Proposed Route parallels the existing Hatfield's Ferry Power Station to Black Oak 500 kV Transmission Line through Maryland DNR State Lands, Dan's Mountain WMA, and Dan's Mountain Wildlands, exiting the Maryland DNR State Lands near MP 66.4. At MP 66.6, the Proposed Route deviates from the existing transmission line to traverse south around Black Oak Substation. At MP 67.9, the Proposed Route crosses the North Branch Potomac River and enters back into West Virginia.

Mineral County, West Virginia: MP 67.9 to 78.8

At MP 67.9, the Proposed Route exits the state of Maryland and reenters West Virginia after crossing the North Branch of the Potomac River in Mineral County. From MP 67.9 to MP 73.2, the Proposed Route parallels the existing Black Oak to Bedington 500 kV Transmission Line in a general easterly direction before heading southeasterly across Patterson Creek near MP 73.7, close to Potomac State College Farms. From MP 73.3 to MP 79.9, the Proposed Route heads in an easterly direction across private properties, deviating from the existing transmission line to avoid the built-up landscape of homes, the college, and Dam Site #21. The Proposed Route crosses into Hampshire County near MP 78.8.

Hampshire County, West Virginia: MP 78.8 to 105.0

In Hampshire County, the Proposed Route heads northeast to parallel the existing Black Oak to Bedington 500 kV Transmission Line near MP 79.9. It parallels the existing transmission line from MP 79.9 to MP 81.2 before deviating and turning in a southeasterly to northeasterly direction (MP 81.3 to MP 82.2) to avoid residential development near Greenspring Valley Road. The Proposed Route then heads in a southeasterly direction along an existing Hampshire to Ridgeley 138 kV Transmission Line. Near MP 82.5, the Proposed Route crosses the White Horse Mountain WMA and remains there for 0.6 mile. The Proposed Route continues in a southerly direction and crosses the South Branch of the Potomac River, paralleling the existing Hampshire to Ridgeley 138 kV Transmission Line from MP 83.5 to MP 85.1. At MP 85.1, the Proposed Route deviates from the existing transmission line to avoid residential homes and other structures before paralleling the existing Hampshire to Ridgeley 138 kV Transmission Line again at MP 87.6. The Proposed Route follows the existing Hampshire to Ridgeley 138 kV Transmission Line for 3.8 miles in a southeasterly direction before deviating from MP 91.4 to MP 93.5 to avoid residential and agricultural buildings near the existing line. At MP 93.5, the Proposed Route continues to parallel the existing Hampshire to Ridgeley 138 kV Transmission Line in a southeasterly direction for 1.1 miles before deviating to avoid the Cacapon & Lost Rivers Land Trust easement near MP 95.5. From MP 95.5 to MP 99.0, the Proposed Route heads in a southerly direction where it meets up with the existing French Mill to Hampshire 138 kV Transmission Line. At MP 99.0, the Proposed Route parallels this line, heading in an easterly direction along the northern side of the existing transmission line before crossing to the southern side around MP 99.8. The Proposed Route deviates for 0.6 mile from the existing French Mill to Hampshire 138 kV Transmission Line due to the convergence point of two existing transmission lines and a substation north of MP 100.4, at which point it parallels the existing Hampshire to Stonewall 138 kV Transmission Line, crossing the Cacapon River at MP 102.2. At MP 102.5, the Proposed Route deviates from the existing transmission line and heads in a southeasterly direction for a greenfield section, where it meets up

with the existing Mt. Storm to Doubs 500 kV Transmission Line at MP 103.6, paralleling it in a northeasterly direction from MP 103.7 to MP 105.0. At MP 105.0, the Proposed Route exits West Virginia and enters Virginia.

Frederick County, Virginia: MP 105.0 to 107.5

The Proposed Route enters Virginia in Frederick County at approximately MP 105.0, continuing southeast and paralleling the existing Mt. Storm to Doubs 500 kV Transmission Line for approximately 0.3 mile. The Proposed Route then deviates from the existing transmission line for approximately 0.6 mile to avoid residential properties off Fletcher Road. The Proposed Route then continues in a southeasterly direction until reaching the existing transmission line. At this point, it crosses the existing Mt. Storm to Doubs 500 kV and the Hampshire to Stonewall 138 kV Transmission Lines perpendicularly, crossing near MP 106.2. Once the Proposed Route crosses the transmission lines, it immediately heads east, paralleling the transmission lines on the south side, crossing over Isaacs Creek at MP 106.5. Near MP 106.7, the Proposed Route deviates from the existing transmission line to avoid a substation and residential development, crossing Parishville Road and terminating at the handoff point.

6.2 THE PROPOSED ROUTE ANCILLARY FACILITY WORKSPACES

The ancillary facility workspaces consist of both temporary and permanent access roads, temporary structure pads at each tower location, and temporary wire work areas for conductor stringing operations. These facilities will be located within and outside of the ROW Corridor. The ancillary facility workspaces vary in size due to topographic constraints and ground conditions.

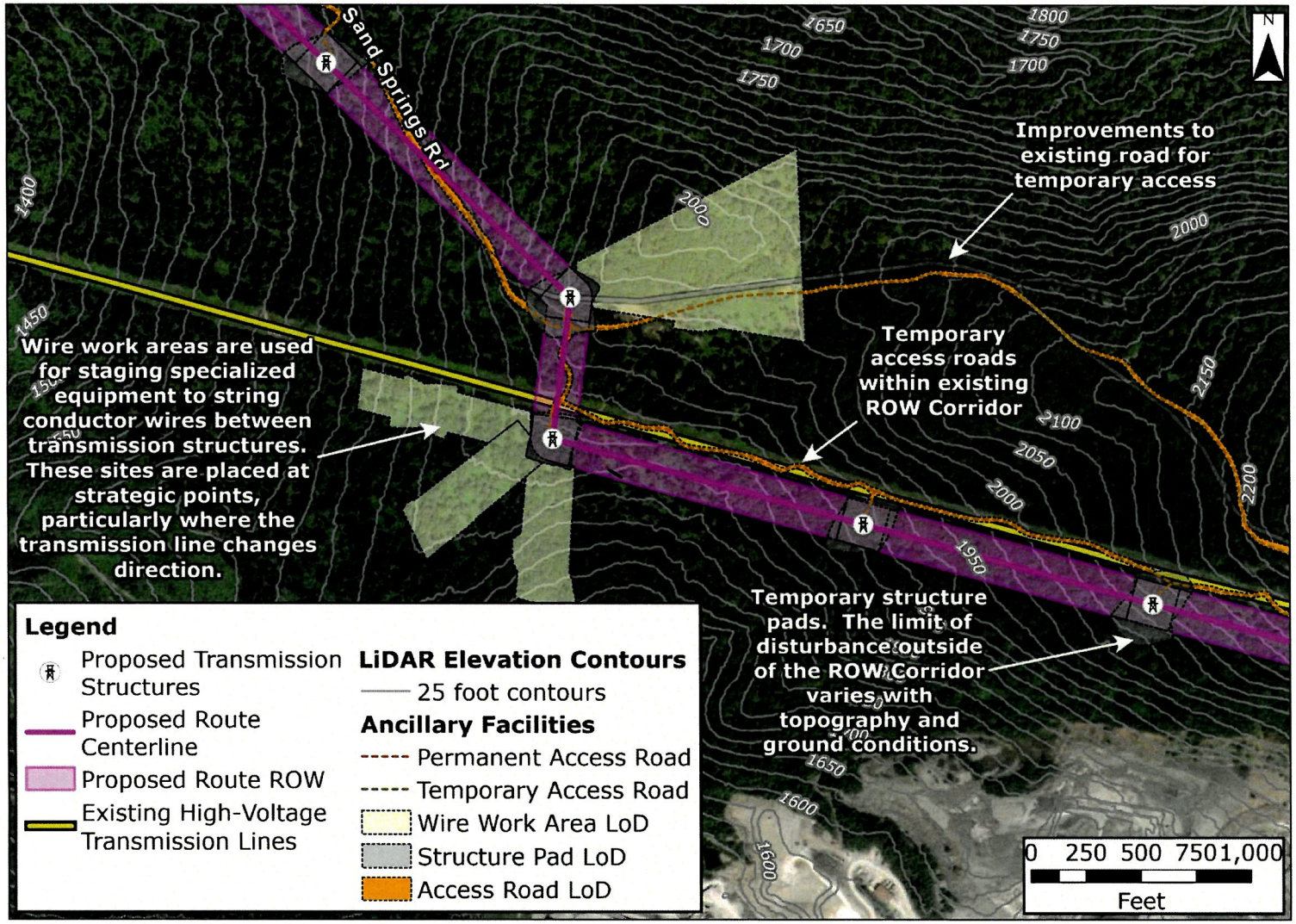
Access roads will include both improvements to existing roads and construction of new roads. They may be located within the ROW Corridor or extend beyond it, depending on site-specific access needs. Access roads are designated as either:

- Temporary—used solely during construction and treated as temporary impacts. Restoration is planned following construction.
- Permanent—required for ongoing operation and maintenance. These are reported in the Environmental Review Documents (Appendices A, B, C, and D) as permanent impacts.

Structure pads are constructed at each tower location to provide stable surfaces for equipment during installation and will have the appropriate dimensions to meet the terrain constraints. All structure pads are considered temporary construction impacts. The limit of disturbance associated with structure pads is variable and influenced by topography and ground conditions. These areas are treated as temporary impacts, with restoration planned post-construction.

Wire work areas are temporary work areas used for staging specialized equipment to string conductor wires between transmission structures. These sites are placed at strategic points, particularly where the transmission line changes direction. These areas are treated as temporary impacts, with restoration planned post-construction. Figure 6-2 depicts these ancillary facility workspaces relative to the Proposed Route near Sand Springs Road in Monongalia County, West Virginia.

FIGURE 6-2 EXAMPLE MAP OF THE ANCILLARY FACILITIES



LoD = limit of disturbance; ROW = right-of-way

Table 6.2-1 provides a summary of the ancillary facility workspaces within and outside of the ROW Corridor.

TABLE 6.2-1 ANCILLARY FACILITY WORKSPACES FOR THE PROPOSED ROUTE

Measure	Permanent Access Roads	Temporary Access Roads	Structure Pads	Wire Work Areas
Count of facility	NA	NA	452	108
LoD outside of the ROW Corridor (acres) [a]	7.1	231.4	123.3	233.9
Within ROW Corridor (miles)	2.7	70.7	NA	NA
Outside of the ROW Corridor (miles)	2.6	77.4	NA	NA

LoD = limit of disturbance; NA = not applicable; ROW = right-of-way

[a] Ancillary facility workspaces located inside the ROW Corridor are accounted for with the ROW Corridor acreage and are not presented to avoid double counting of impacts.

6.3 RIPARIAN HABITAT EXCLUSION ZONES

Where feasible, the MARL Project has identified initial locations of riparian habitat associated with streams that could be maintained to minimize impacts where topographic and engineering constraints allowed for such considerations along the Proposed Route. As part of this effort, the MARL Project has identified 20 locations where forested riparian buffers will be preserved to protect sensitive waterbodies (Table 6.3-1). These areas total 26.3 acres and contain 5,989.2 linear feet of stream length to be preserved. At these locations—referred to as riparian habitat exclusion zones—engineering solutions were developed to retain existing riparian vegetation within 100 feet on either side of the center of the stream. No vegetation clearing or ground disturbance will occur within these zones. As detailed MARL Project engineering continues to progress, additional areas that might be able to be maintained could be identified. If such a scenario arises, the impacts on resource areas could be reduced. Figure 6-3 is an example of a riparian habitat exclusion zone. Table 6.3-1 provides a list and descriptions of the identified riparian habitat exclusion zones.

Section 6.4 shows how resources will benefit from this engineering mitigation by comparing the results with and without incorporation of the riparian habitat exclusion zone. It also highlights how the preservation of riparian habitat exclusion zones contributes to minimizing impacts on sensitive environmental features and supports broader MARL Project mitigation objectives. The Proposed Route ROW Corridor incorporates the 20 riparian habitat exclusion zones. The associated statistics are shown in the tables below under the column headers "Proposed Route (with riparian)."

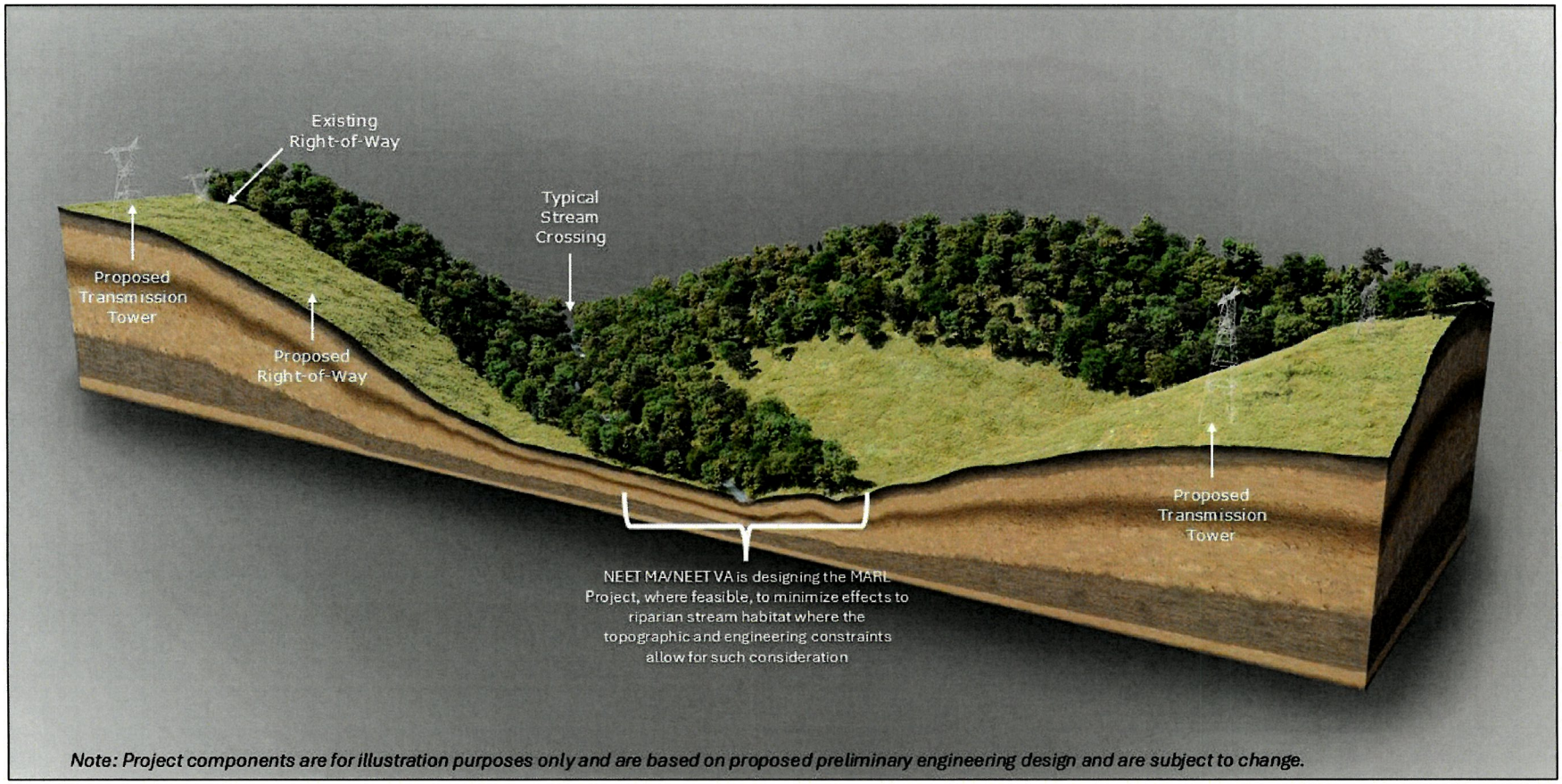
TABLE 6.3-1 IDENTIFIED RIPARIAN HABITAT EXCLUSION ZONES

Nearest MP	Stream Name	State	County	Stream Type	Linear Stream Length (feet)	Riparian Habitat Exclusion Zone (acres)
18.5	Patterson Run	WV	Preston	Trout Stream	384.1	1.8
19.1	Laurel Run / Big Sandy Creek	WV	Preston	Trout Stream/Mussel Stream	301.1	1.4
24.1	Big Sandy Creek	WV	Preston	High Quality Stream	204.5	0.9
37.3	Youghiogheny River	MD	Garrett	Use III-P: Nontidal Cold Water and Public Water Supply	389.8	1.2
39.8	Unnamed Tributary to Bear Creek	MD	Garrett	Use III-P: Nontidal Cold Water and Public Water Supply	201.8	0.9
40.7	Fikes Run	MD	Garrett	Use III-P: Nontidal Cold Water and Public Water Supply	211.2	1.0
41.5	Unnamed Tributary to Bear Creek	MD	Garrett	Use III-P: Nontidal Cold Water and Public Water Supply	271.4	1.2
41.9	Cove Run	MD	Garrett	Use III-P: Nontidal Cold Water and Public Water Supply	356.8	1.6
42.4	Bear Creek	MD	Garrett	Use III-P: Nontidal Cold Water and Public Water Supply	318.0	1.5
43.3	Bear Creek	MD	Garrett	Use III-P: Nontidal Cold Water and Public Water Supply	206.1	0.9
44.8	Bear Creek 4	MD	Garrett	Use III-P: Nontidal Cold Water and Public Water Supply	652.1	2.9
49.7	South Branch Casselman River	MD	Garrett	Use III: Nontidal Cold Water—Natural Trout Water	261.0	1.2
53.8	Bear Pen Run 1	MD	Garrett	Use III-P: Nontidal Cold Water and Public Water Supply	203.4	0.9
54.4	Silver Bell Run	MD	Garrett	Use III-P: Nontidal Cold Water and Public Water Supply	201.1	0.9
56.2	Savage River	MD	Garrett	Use III-P: Nontidal Cold Water and Public Water Supply	228.7	0.8
60.3	Laurel Run	MD	Allegany	Use III-P: Nontidal Cold Water and Public Water Supply	357.5	1.6
62.1	George's Creek	MD	Allegany	Use IV-P: Recreational Trout Waters and Public Water Supply	467.1	2.1
63.5	Unnamed Tributary to Jackson Run	MD	Allegany	Use III-P: Nontidal Cold Water and Public Water Supply	244.1	1.1
67.9	North Branch Potomac River [a]	MD/WV	Allegany / Mineral	Trout Streams	264.6	1.2
95.5	North River	WV	Hampshire	High Quality/Mussel Stream	264.8	1.2

MD = Maryland; MP = milepost; WV = West Virginia

[a] The North Branch of the Potomac River is located within both Maryland and West Virginia.

FIGURE 6-3 RIPARIAN HABITAT EXCLUSION ZONE



MARL Project = MidAtlantic Resiliency Link Project; NEET MA = NextEra Energy Transmission MidAtlantic, Inc.; NEET VA = NextEra Energy Transmission Virginia, Inc.

6.4 THE PROPOSED ROUTE ANALYSIS

The tables in this section (Table 6.4-1 through Table 6.4-11) correspond to those presented in Section 5[12] but are presented below to reflect the Proposed Route only. These tables show how the preservation of riparian habitat exclusion zones minimizes impacts on sensitive environmental features by comparing the results with and without the riparian habitat exclusion zones. The tables also outline the criteria within the ancillary facility workspaces outside of the ROW Corridor as well as the Woodside Substation.

TABLE 6.4-1 ROUTE LENGTH AND CONSTRUCTION FOOTPRINT ANALYSIS

Criteria	Unit	Proposed Route (no riparian)	Proposed Route (with riparian)	Permanent Access Roads [a]	Temporary Access Roads [a]	Other Temporary Ancillary Facilities [a]	Woodside Substation
Centerline length	Miles	107.5	107.5	2.6	77.4	NA	NA
ROW Corridor / Workspace / Substation	Acres	2,669.0	2,642.4	7.1	231.4	357.2	72.1

NA= not applicable; ROW = right-of-way

Notes:

No riparian = Proposed Route without riparian habitat exclusion zones

With riparian = Proposed Route with riparian habitat exclusion zones

Bolded/italicized values are different from the values shown for the Proposed Route (no riparian).

[a] Acreage was calculated for areas outside of the ROW Corridor only.

TABLE 6.4-2 PARALLELING EXISTING INFRASTRUCTURE ANALYSIS

Criteria	Proposed Route	
	Miles	%
Paralleling existing transmission lines [a]	56.4	52.5
Greenfield section development [b]	51.1	47.5
Paralleling railroad ROW	0.0	0.0
Paralleling natural gas pipelines ROW	0.0	0.0
Paralleling highways	0.0	0.0

Source: Rextag Infrastructure data

ROW = Right-of-Way

[a] Paralleling for the MARL Project is defined as siting the proposed transmission line so the MARL Project ROW Corridor abuts the existing transmission line corridor.

[b] Greenfield section for the MARL Project is defined as a section of the MARL Project ROW Corridor for any portion of the route that does not abut an existing transmission line corridor.

[12] Table 5.3-1 is not included in Section 6 of the Routing Study as it is not a table that reported analytics for the Proposed Route.

TABLE 6.4-3 COMMUNITY AND RECREATIONAL RESOURCES ANALYSIS

Criteria	Unit	Proposed Route (no riparian)	Proposed Route (with riparian)	Permanent Access Roads [a]	Temporary Access Roads [a]	Other Temporary Ancillary Facilities [a]	Woodside Substation
Parcels / unique landowners	Count	500	500	27	468	413	2
		388	388	24	364	335	2
Residential dwellings [b,c] within ROW Corridor or LoD / 250 feet / 500 feet of centerline	Count	1	1	0	0	0	1
		29	29	NA	NA	NA	NA
		151	151	NA	NA	NA	NA
Residential outbuildings [b,d] within ROW Corridor or LoD / 250 feet / 500 feet of centerline	Count	6	6	0	4	1	2
		50	50	NA	NA	NA	NA
		273	273	NA	NA	NA	NA
Non-residential buildings [b,e] within ROW Corridor or LoD / 250 feet / 500 feet of centerline	Count	25	25	0	3	3	0
		74	74	NA	NA	NA	NA
		187	187	NA	NA	NA	NA
Places of worship within 500 feet of the centerline	Count	1	1	NA	NA	NA	NA
Childcare facilities within 500 feet of the centerline	Count	0	0	NA	NA	NA	NA
Public / private schools within 500 feet of centerline	Count	0	0	NA	NA	NA	NA
Trails crossings—Potomac Heritage National Scenic Trail and Hiking Trails	Count	3	3	0	0	0	0
		9	9	0	5	0	0
State Scenic Byways	Count	4	4	0	0	0	0

Source: ReportAll, HIFLD, MDOT, WVDOT, MDiMap, WVGISTC, PASDA, ERM

LoD= limit of disturbance; NA= not applicable; ROW = right-of-way

Notes:

No riparian = Proposed Route without riparian habitat exclusion zones

With riparian = Proposed Route with riparian habitat exclusion zones

[a] Acreage was calculated for areas outside of the ROW Corridor only.

[b] Footprints were digitized using high-resolution (3-inch) aerial imagery contracted by NEET MA and NEET VA and captured during leaf-off conditions between December 2023 and February 2024 and county property data. This dataset may not reflect proposed or recently built structures and could include classification errors inherent to desktop study limitations (e.g., forest cover, image resolution, interpretation of aerial data).

[c] A residential dwelling is defined as a building used for people to live in and includes buildings such as single-family homes, multi-family units, mobile/manufactured homes, etc.
[d] A residential outbuilding is defined as a secondary structure located on the same property as a residential dwelling and includes buildings such as detached garages, sheds, greenhouses, etc.
[e] A non-residential building is defined as any structure located on a non-residential property and includes buildings used for commercial purposes industrial use, agricultural, community, or government.

TABLE 6.4-4 PROTECTED LAND ANALYSIS

Criteria	Unit	Proposed Route (no riparian)	Proposed Route (with riparian)	Permanent Access Roads [a]	Temporary Access Roads [a]	Other Temporary Ancillary Facilities [a]	Woodside Substation
State Forest	Count	2	2	1	2	2	0
	Miles	9.7	9.7	0.3	6.0	NA	NA
	Acres	248.3	241.5	0.8	15.4	47.3	0.0
State Park	Count	0	0	0	0	0	0
	Miles	0.0	0.0	0.0	0.0	NA	NA
	Acres	0.0	0.0	0.0	0.0	0.0	0.0
Fisheries / WMA	Count	3	3	0	3	3	0
	Miles	3.1	3.1	0.0	2.2	NA	NA
	Acres	75.8	75.8	0.0	5.7	3.7	0.0
Pennsylvania State Wilderness Area	Count	0	0	0	0	0	0
	Miles	0.0	0.0	0.0	0.0	NA	NA
	Acres	0.0	0.0	0.0	0.0	0.0	0.0
Pennsylvania State Game Lands	Count	0	0	0	0	0	0
	Miles	0.0	0.0	0.0	0.0	NA	NA
	Acres	0.0	0.0	0.0	0.0	0.0	0.0
Maryland Wildlands	Count	3	3	0	0	0	0
	Miles	2.4	2.4	0.0	0.0	NA	NA
	Acres	57.0	55.3	0.0	0.0	0.0	0.0
Conservation Easements	Count	3	3	0	3	5	0
	Miles	2.2	2.2	0.0	3.1	NA	NA
	Acres	55.2	54.4	0.0	8.7	12.0	0.0
USACE Recreation Areas	Count	1	1	0	0	0	0
	Miles	0.1	0.1	0.0	0.0	NA	NA
	Acres	3.9	2.7	0.0	0.0	0.0	0.0

Criteria	Unit	Proposed Route (no riparian)	Proposed Route (with riparian)	Permanent Access Roads [a]	Temporary Access Roads [a]	Other Temporary Ancillary Facilities [a]	Woodside Substation
Total Protected Lands [b,c]	**Count**	**8**	**8**	**1**	**7**	**9**	**0**
	Miles	**14.6**	**14.6**	**0.3**	**9.3**	**NA**	**NA**
	Acres	**368.4**	**359.6**	**0.8**	**24.5**	**62.1**	**0.0**

Source: PAD-US, NCED, MDNR, MDiMAP, PASDA, WVDEP, VADCR

NA= not applicable; ROW = right-of-way; USACE = U.S. Army Corps of Engineers; WMA = Wildlife Management Area; WVDNR = West Virginia Division of Natural Resources

Notes:

No riparian = Proposed Route without riparian habitat exclusion zones

With riparian = Proposed Route with riparian habitat exclusion zones

Bolded/italicized values are different from the values shown for the Proposed Route (no riparian).

[a] Acreage was calculated for areas outside of the ROW Corridor only.

[b] Total protected lands excludes the Maryland Wildlands to avoid double counting since Wildlands are within a state forest or WMA. In addition, White Horse Mountain WMA has an associated conservation easement. The White Horse Mountain WMA is a 1,725-acre conservation and recreation area located in Hampshire County, West Virginia, and is managed by the WVDNR. The Potomac Conservancy held a conservation easement on White Horse Mountain to protect it from development and transferred ownership to WVDNR to manage the land as a public recreation area and WMA. The statistics associated with White Horse Mountain WMA are included in both the "Conservation Easements" and "Fisheries / Wildlife Management Area" categories but are not double counted in total impact calculations.

[c] Totals may not match the sum of addends due to rounding.

TABLE 6.4-5 SPECIFIC PROTECTED LANDS ANALYSIS

Specific Protected Area [a]	State	Existing Transmission Line in Resource?	Proposed Route (no riparian)	Proposed Route (with riparian)	Permanent Access Roads [b]	Temporary Access Roads [b]	Other Temporary Ancillary Facilities [b]	Woodside Substation
Coopers Rock State Forest	WV	Yes—138 kV	Yes	Yes	No	Yes	Yes	No
State Game Lands 138	PA	Yes—500 kV	No	No	No	No	No	No
Forbes State Forest	PA	Yes—500 kV	No	No	No	No	No	No
Quebec Run Wild Area	PA	Yes—500 kV	No	No	No	No	No	No
Youghiogheny River Lake Recreation Area (USACE)	MD	Yes—500 kV and 138 kV	Yes	Yes	No	No	No	No
Maryland Rural Legacy Property (Bear Creek RL-0396)	MD	Yes—500 kV	Yes	Yes	No	Yes	Yes	No
Maryland Rural Legacy Property (Bear Creek RL-35354)	MD	Yes-500 kV	Yes	Yes	No	Yes	Yes	No
Bear Creek Hatchery FMA	MD	Yes—500 kV	Yes	Yes	No	Yes	Yes	No
Savage River State Forest	MD	Yes—500 kV and two 138 kV	Yes	Yes	Yes	Yes	Yes	No
Bear Pen Wildlands	MD	Yes—138 kV	Yes	Yes	No	No	No	No
Big Savage Mountain Wildlands	MD	Yes—500 kV and 138 kV	Yes	Yes	No	No	No	No
Dan's Mountain WMA	MD	Yes—500 kV and 138 kV	Yes	Yes	No	Yes	Yes	No
Dan's Mountain Wildlands	MD	Yes—500 kV	Yes	Yes	No	No	No	No

Specific Protected Area [a]	State	Existing Transmission Line in Resource?	Proposed Route (no riparian)	Proposed Route (with riparian)	Permanent Access Roads [b]	Temporary Access Roads [b]	Other Temporary Ancillary Facilities [b]	Woodside Substation
White Horse Mountain WMA	WV	Yes—500 kV and 138 kV	Yes	Yes	No	Yes	Yes	No

Source: PAD-US, NCED, MDNR, MDiMAP, PASDA, WVDEP, VADCR

FMA = Fisheries Management Area; kV = kilovolt; MD = Maryland; PA = Pennsylvania; USACE = U.S. Army Corps of Engineers; WMA = Wildlife Management Area; WV = West Virginia

Notes:

No riparian = Proposed Route without riparian habitat exclusion zones

With riparian = Proposed Route with riparian habitat exclusion zones

[a] Protected area listed west to east

[b] Acreage was calculated for areas outside of the ROW Corridor only.

TABLE 6.4-6 CULTURAL RESOURCES ANALYSIS

Criteria	Unit	Proposed Route (no riparian)	Proposed Route (with riparian)	Permanent Access Roads [a]	Temporary Access Roads [a]	Other Temporary Ancillary Facilities [a]	Woodside Substation
Cemeteries within ROW Corridor or Workspace; 500 feet of centerline	Count	0	0	0	0	0	0
		4	4	NA	NA	NA	NA
Archaeological Resources within ROW Corridor or Workspace	Count	6	6	0	3	1	0
Architecture Resources—NRHP eligible, NRHP listed or NHL listed within ROW Corridor; 0.5-mile buffer from centerline / Workspace	Count	4	4	0	1	0	0
		7	7	NA	NA	NA	NA
Historic Districts Crossed	Count	6	6	0	1	0	0
Battlefields	Count	1	1	0	1	1	0
	Acres	38.0	38.0	0.0	0.1	14.5	0.0
MD—Heritage Areas	Count	1	1	1	1	1	0
	Acres	128.3	126.1	0.02	9.8	16.5	0.0

Source: PASHPO, WVSHPO, MHT, VADHR

NA= not applicable; ROW = right-of-way; MD = Maryland; NHL = National Historic Landmarks; NRHP = National Register of Historic Places; ROW = right-of-way

Notes:

No riparian = Proposed Route without riparian habitat exclusion zones

With riparian = Proposed Route with riparian habitat exclusion zones

Bolded/italicized values are different from the values shown for the Proposed Route (no riparian).

[a] Acreage was calculated for areas outside of the ROW Corridor only.

TABLE 6.4-7 AGRICULTURAL LAND ANALYSIS

Agricultural Land	Unit	Proposed Route (no riparian)	Proposed Route (with riparian)	Permanent Access Roads [a]	Temporary Access Roads [a]	Other Temporary Ancillary Facilities [a]	Woodside Substation
Not Prime Farmland Class	Acres	1,789.5	1,764.3	5.1	161.1	247.3	2.7
State Importance Farmland Class	Acres	389.7	389.3	0.7	33.5	61.1	8.1
Local Importance Farmland Class	Acres	399.3	398.9	1.1	27.5	45.4	0.0
Prime Farmland Class	Acres	90.4	90.0	0.2	9.4	3.5	61.3

Source: USA SSURGO

Notes:
No riparian = Proposed Route without riparian habitat exclusion zones
With riparian = Proposed Route with riparian habitat exclusion zones
Bolded/italicized values are different from the values shown for the Proposed Route (no riparian).
[a] Acreage was calculated for areas outside of the ROW Corridor only.

TABLE 6.4-8 LAND COVER ANALYSIS

Criteria	Unit	Proposed Route (no riparian)	Proposed Route (with riparian)	Permanent Access Roads [a]	Temporary Access Roads [a]	Other Temporary Ancillary Facilities [a]	Woodside Substation
Barren Land (Rock/Sand/Clay)	Acres	20.2	20.2	0.1	3.7	2.8	0.0
Cultivated Crops	Acres	45.4	45.3	0.0	0.7	6.7	28.5
Deciduous Forest	Acres	1,836.0	1,823.8	6.1	142.5	265.6	2.8
Developed, High Intensity	Acres	0.0	0.0	0.0	0.0	0.0	0.0
Developed, Low Intensity	Acres	16.2	14.4	0.0	7.8	0.3	0.9
Developed, Medium Intensity	Acres	2.0	2.0	0.0	0.5	0.0	0.0
Developed, Open Space	Acres	82.2	79.9	0.1	39.9	4.5	6.3
Emergent Herbaceous Wetlands	Acres	0.0	0.0	0.0	0.0	0.0	0.0
Evergreen Forest	Acres	24.0	24.0	0.0	1.6	2.4	0.0
Grassland/Herbaceous	Acres	25.3	24.8	0.0	2.3	2.2	0.0
Mixed Forest	Acres	171.4	163.2	0.0	9.3	23.4	0.0
Open Water	Acres	13.0	11.3	0.0	0.0	0.0	0.0
Pasture/Hay	Acres	415.7	415.7	0.7	22.1	47.6	33.7
Shrub/Scrub	Acres	15.3	15.3	0.0	1.1	1.8	0.0
Woody Wetlands	Acres	2.5	2.5	0.0	0.0	0.0	0.0
Forest Lands Total [b] (Deciduous Forest, Evergreen Forest, and Mixed Forest)	**Acres**	**2,031.4**	**2,011.0**	**6.1**	**153.4**	**291.4**	**2.8**
Agricultural Lands Total [b] (Pasture/Hay and Cultivated Crops)	**Acres**	**461.1**	**461.0**	**0.7**	**22.8**	**54.3**	**62.2**
Developed Lands Total [b] (High, Low, Medium, Open Space)	**Acres**	**100.4**	**96.3**	**0.1**	**48.2**	**4.8**	**7.2**

Source: USGS NLCD 2024

Notes:
No riparian = Proposed Route without riparian habitat exclusion zones
With riparian = Proposed Route with riparian habitat exclusion zones
Bolded/italicized values are different from the values shown for the Proposed Route (no riparian).
[a] Acreage was calculated for areas outside of the ROW Corridor only.
[b] Totals may not match the sum of addends due to rounding.

TABLE 6.4-9 WATER RESOURCES ANALYSIS

Water Resources	Unit	Proposed Route (no riparian)	Proposed Route (with riparian)	Permanent Access Roads [a]	Temporary Access Roads [a]	Other Temporary Ancillary Facilities [a]	Woodside Substation
NHD Stream/River—Perennial	Count	81	61	0	23	8	0
	Corridor Length (feet)	27,326.6	21,432.4	0.0	958.5	269.1	0.0
NHD Stream/River—Intermittent	Count	37	37	1	9	5	0
	Corridor Length (feet)	9,911.6	9,911.6	171.0	614.7	827.5	0.0
NHD Waterbody	Count	14	14	0	0	3	0
	Area (acres)	4.2	3.2	0.0	0.0	0.1	0.0
Section 10 Navigable Waters	Count	3	2	0	0	0	0
Trout Streams and Coldwater Fisheries (all states) [b]	Count	39	22	0	6	1	0
	Corridor Length (feet)	13,513.2	8,150.1	0.0	391.3	3.6	0.0
PA Trout Streams	Count	1	1	0	0	0	0
	Corridor Length (feet)	258.2	258.2	0.0	0.0	0.0	0.0
WV Trout Streams	Count	7	3	0	0	0	0
	Corridor Length (feet)	1,821.7	668.4	0.0	0.0	0.0	0.0
VA Trout Streams	Count	0	0	0	0	0	0
	Corridor Length (feet)	0.0	0.0	0.0	0.0	0.0	0.0
PA—Designated Use Streams (CWF, EV, HQ, TSF)	Count	3	3	0	2	0	0
	Corridor Length (feet)	1,556.0	1,556.0	0.0	56.9	0.0	0.0
MD—Designated Use Streams (Use III and III-P: Nontidal Cold Water and Public Water Supply)	Count	27	15	0	4	1	0
	Corridor Length (feet)	9,410.2	5,667.6	0.0	334.5	3.6	0.0

Water Resources	Unit	Proposed Route (no riparian)	Proposed Route (with riparian)	Permanent Access Roads [a]	Temporary Access Roads [a]	Other Temporary Ancillary Facilities [a]	Woodside Substation
MD—Designated Use Streams (Use IV and IV-P: Recreational Trout Waters and Public Water Supply)	Count	1	0	0	0	0	0
	Corridor Length (feet)	467.1	0.0	0.0	0.0	0.0	0.0
VA—Threatened & Endangered Species Waters	Count	1	1	0	0	0	0
	Corridor Length (feet)	438.6	438.6	0.0	0.0	0.0	0.0
WV—Mussel Streams	Count	8	6	0	1	0	0
	Corridor Length (feet)	2,221.3	1,752.0	0.0	45.0	0.0	0.0
MD—Designated Use Streams (Use I and I-P Water Contact Recreation, Protection of Aquatic Live, and Public Water Supply)	Count	1	0	0	0	0	0
	Corridor Length (feet)	264.6	0.0	0.0	0.0	0.0	0.0
Modeled Wetlands [c]	Acres	42.6	36.6	0.0	0.8	3.4	0.0
NWI—All Types [b]	Acres	42.7	37.5	0.0	1.0	0.9	0.0
NWI—Freshwater Emergent	Acres	3.9	3.9	0.0	0.1	0.2	0.0
NWI—Freshwater Shrub Scrub	Acres	11.7	11.4	0.0	0.3	0.3	0.0
NWI—Freshwater Pond	Acres	3.9	3.9	0.0	0.1	0.3	0.0
NWI—Lake	Acres	0.0	0.0	0.0	0.0	0.0	0.0
NWI—Riverine	Acres	23.2	18.3	0.0	0.4	0.2	0.0
WV—DEP Wetlands	Acres	8.0	6.0	0.0	0.2	0.2	0.0
MD—DNR Wetlands of Special Concern	Acres	0.0	0.0	0.0	0.0	0.0	0.0
MD—DNR Wetlands	Acres	5.7	3.2	0.0	0.0	3.3	0.0
FEMA Flood Zone A/AE/AO—Areas with a 1% annual chance of flooding (100-year flood area)	Acres	98.4	88.6	0.0	6.7	0.8	0.0
	Structure Count	8	8	NA	NA	NA	NA
FEMA Flood Zone X—Areas with 0.2% annual chance of flooding (500-year flood area)	Acres	3.5	3.2	0.0	0.2	0.0	0.0
	Structure Count	0	0	NA	NA	NA	NA

Water Resources	Unit	Proposed Route (no riparian)	Proposed Route (with riparian)	Permanent Access Roads [a]	Temporary Access Roads [a]	Other Temporary Ancillary Facilities [a]	Woodside Substation
FEMA Flood Zones Combined [b]	Acres	101.9	91.8	0.0	6.9	0.8	0.0

Source: USGS NHD, FEMA's National Flood Hazard Layer (NFHL), USFWS, MDE, PFBC, PADEP, WVDNR, VADWR

CWF = Coldwater Fishes; DEP = Department of Environmental Protection; DNR = Department of Natural Resources; EV = Exceptional Value; FEMA = Federal Emergency Management Agency; HQ = High Quality; MD = Maryland; NHD = National Hydrography Dataset; NWI = National Wetlands Inventory; NA = not applicable; PA = Pennsylvania; TSF = Trout Stocking; VA = Virginia; WV = West Virginia

Notes:

No riparian = Proposed Route without riparian habitat exclusion zones

With riparian = Proposed Route with riparian habitat exclusion zones

Bolded/italicized values are different from the values shown for the Proposed Route (no riparian).

[a] Acreage was calculated for areas outside of the ROW Corridor only.

[b] Totals may not match the sum of addends due to rounding.

[c] ERM conducted a deep learning model to predict wetlands in the MARL Project Study Area. See Appendix H, Wetland Identification Model Report.

TABLE 6.4-10 SENSITIVE SPECIES AND HABITATS

Ecological Resources	Unit	Proposed Route (no riparian)	Proposed Route (with riparian)	Permanent Access Roads [a]	Temporary Access Roads [a]	Other Temporary Ancillary Facilities [a]	Woodside Substation
USFWS Critical Habitat Final	Area (acres)	0.0	0.0	0.0	0.0	0.0	0.0
USFWS Critical Habitat Proposed	Area (acres)	0.9	0.9	0.0	0.0	0.0	0.0
State-Listed Species Occurrence (from state NHI Element Occurrence Data)	Area (acres)	235.1	233.5	3.0	25.2	24.3	0.0
Potentially Suitable State-listed Species, MBTA, and Foraging Bat Habitat	Area (acres)	2,650.8	2,626.0	7.1	223.2	356.9	71.3
Potentially Suitable Monarch Butterfly Habitat	Area (acres)	538.4	535.7	0.9	65.4	56.0	40.0
Bat Known Occupied Summer Habitat (all states)	Area (acres)	104.3	102.4	0.7	11.8	17.3	0.0
Bat Hibernacula (all states)	Area (acres)	388.9	385.7	1.6	37.6	54.2	0.0
Potentially Suitable Bat Roosting Habitat	Area (acres)	2,033.9	2,013.5	6.1	153.3	291.4	2.8
MD—Irreplaceable Natural Areas	Count	11	10	0	3	7	0
MD—Irreplaceable Natural Areas	Area (acres)	88.7	82.4	0.0	0.2	12.3	0.0
MD—Forest Interior Dwelling Species Confirmed	Area (acres)	0.0	0.0	0.0	0.0	0.0	0.0
MD—Forest Interior Dwelling Species Probable	Area (acres)	83.0	79.5	0.0	5.3	22.4	0.0
MD—Natural Heritage Areas	Area (acres)	0.0	0.0	0.0	0.0	0.0	0.0
MD—Forests of Recognized Importance	Count	27	15	0	2	8	0
MD—Forests of Recognized Importance	Area (acres)	38.9	20.9	0.0	0.1	0.6	0.0
MD—Federal or State-Listed Species	Area (acres)	268.7	260.7	0.8	25.2	47.9	0.0
MD—Species of Concern	Area (acres)	7.2	6.2	0.0	0.0	0.2	0.0

Ecological Resources	Unit	Proposed Route (no riparian)	Proposed Route (with riparian)	Permanent Access Roads [a]	Temporary Access Roads [a]	Other Temporary Ancillary Facilities [a]	Woodside Substation
MD—BioNet Tier 1 (critically significant)	Area (acres)	96.1	93.0	0.8	19.5	15.9	0.0
MD—BioNet Tier 2 (Extremely Significant)	Area (acres)	70.8	67.8	0.0	1.2	12.1	0.0
MD—BioNet Tier 3 (Highly Significant)	Area (acres)	345.1	340.6	0.0	13.3	47.2	0.0
MD—BioNet Tier 4 (Moderately Significant)	Area (acres)	226.3	223.9	0.2	13.9	29.0	0.0
MD—BioNet Tier 5 (Significant)	Area (acres)	76.9	73.9	0.0	5.4	22.4	0.0
PA—Natural Heritage Areas	Area (acres)	32.4	32.4	0.0	5.4	5.9	0.0
VA—Ecological Core C1 (Outstanding)	Area (acres)	0.0	0.0	0.0	0.0	0.0	0.0
VA—Ecological Core C2 (Very High)	Area (acres)	0.0	0.0	0.0	0.0	0.0	0.0
VA—Ecological Core C3 (High)	Area (acres)	0.0	0.0	0.0	0.0	0.0	0.0
VA—Ecological Core C4 (Moderate)	Area (acres)	24.4	24.4	0.0	0.3	4.0	0.0
VA—Ecological Core C5 (General)	Area (acres)	50.0	50.0	0.0	0.4	13.1	0.0

Source: USFWS, USGS, WVDNR, MDNR, VADWR, PNHP, PADCNR

BioNet = Biodiversity Conservation Network; MBTA = Migratory Bird Treaty Act; MD = Maryland; NHI = National Heritage Inventory; PA = Pennsylvania; USFWS = U.S. Fish and Wildlife Service; VA = Virginia

Notes:

No riparian = Proposed Route without riparian habitat exclusion zones

With riparian = Proposed Route with riparian habitat exclusion zones

Bolded/italicized values are different from the values shown for the Proposed Route (no riparian).

[a] Acreage was calculated for areas outside of the ROW Corridor only.

TABLE 6.4-11 ENGINEERING AND INFRASTRUCTURE CRITERIA

Criteria	Unit	Proposed Route (no riparian)	Proposed Route (with riparian) [a]	Permanent Access Roads [b]	Temporary Access Roads [b]	Other Temporary Ancillary Facilities [b]	Woodside Substation
Existing Transmission Line Crossings							
Electric Transmission Line Unknown kV Crossing	Count	11	11	NA	NA	NA	NA
Electric Transmission Line 69 kV Crossing	Count	0	0	NA	NA	NA	NA
Electric Transmission Line 115 kV Crossing	Count	1	1	NA	NA	NA	NA
Electric Transmission Line 132 kV Crossing	Count	1	1	NA	NA	NA	NA
Electric Transmission Line 138 kV Crossing	Count	21	21	NA	NA	NA	NA
Electric Transmission Line 500 kV Crossing	Count	7	7	NA	NA	NA	NA
Structures							
Number of Structures	Count	452	452	NA	NA	NA	NA
Structures with Turn Angles 0-20 degrees	Count	361	361	NA	NA	NA	NA
Structures with Turn Angles 20-30 degrees	Count	41	41	NA	NA	NA	NA
Structures with Turn Angles greater than 30 degrees	Count	50	50	NA	NA	NA	NA
Span Length Greater than 1,600 feet	Count	33	33	NA	NA	NA	NA
Topography							
Very Steep Slope (31-90 degrees)	Miles	1.6	1.6	NA	NA	NA	NA
Steep Slope (21-30 degrees)	Miles	6.4	6.4	NA	NA	NA	NA
Moderate Slope (16-20 degrees)	Miles	5.4	5.4	NA	NA	NA	NA
Strongly Sloping (6-15 degrees)	Miles	40.2	40.2	NA	NA	NA	NA
Flat to Gentle Slope (0-5 degrees)	Miles	53.9	53.9	NA	NA	NA	NA

Criteria	Unit	Proposed Route (no riparian)	Proposed Route (with riparian) [a]	Permanent Access Roads [b]	Temporary Access Roads [b]	Other Temporary Ancillary Facilities [b]	Woodside Substation
Infrastructure Crossings							
Primary Road Crossing	Count	2	2	NA	NA	NA	NA
Secondary Road Crossing	Count	14	14	NA	NA	NA	NA
Tertiary Road Crossing	Count	140	140	NA	NA	NA	NA
Railroad Crossing	Count	4	4	NA	NA	NA	NA
Oil and Gas Wells: within the ROW Corridor or Workspace; 500 feet of centerline	Count	4	4	0	1	3	0
		22	22	NA	NA	NA	NA
Natural Gas Pipeline Crossing (transmission / distribution / gathering)	Count	7	7	NA	NA	NA	NA
		16	16	NA	NA	NA	NA
		4	4	NA	NA	NA	NA
Wind turbines (within 500 feet and 0.5 mile of the centerline)	Count	0	0	NA	NA	NA	NA
		0	0	NA	NA	NA	NA
Airports within 20,000 feet of the centerline: public/private	Count	0	0	NA	NA	NA	NA
		4	4	NA	NA	NA	NA
Geologic Karst Features (miles / acres of ROW)	Miles	12.0	12.0	0.5	11.0	NA	NA
	Acres	302.9	301.9	1.3	41.6	60.7	72.1

Source: REXTAG, USGS

kV = kilovolt; NA = not applicable; ROW = right-of-way

Notes:

No riparian = Proposed Route without riparian habitat exclusion zones

With riparian = Proposed Route with riparian habitat exclusion zones

Bolded/italicized values are different from the values shown for the Proposed Route (no riparian).

[a] Statistics for the Proposed Route including the riparian habitat exclusion zones is the same for all engineering and infrastructure criteria except for Geologic Karst Features due to counts and mileage lengths which do not change.

[b] Acreage was calculated for areas outside of the ROW Corridor only.

6.5 CONCLUSION

The purpose of the Routing Study was to identify a Proposed Route across all four states that met the following criteria:

1. Reasonably minimized potential impacts on the natural and built environment (including both the transmission line as well as the access roads and temporary workspaces to facilitate construction).
2. Maximized placement of proposed infrastructure adjacent to existing linear infrastructure and routing opportunities, where available.
3. Minimized special design requirements that could result in increased costs (e.g., engineering factors or special structure designs), and can be constructed and operated in a safe, timely, and reliable manner.

Following the steps outlined in in this Routing Study, the Routing Team identified six end-to-end Alternative Routes (A through F) that were comparatively analyzed using both quantitative and qualitative information that ultimately determined a superior Proposed Route. From this analysis, Alternative Route A was selected as the Proposed Route.

Alternative Route A offers the most balanced solution that maximizes opportunities to parallel existing transmission lines, minimizes potential impacts on both natural environment and built environment, and minimizes the engineering and construction-related challenges. As shown in Table 5.6-1, Alternative Route A had superior performance for all routing criteria except for one, where it had a moderate performance. Specifically, Alternative Route A had superior performance for route length and footprint, paralleling existing infrastructure, community and recreational resources, cultural resources, agricultural and land cover, water resources, sensitive species and habitats, and engineering criteria. It had moderate performance for protected lands. It did not have inferior performance for any criteria when compared to other Alternative Routes. Notably, Alternative Route A is the only Alternative Route with superior performance for three primary categories of criteria the Routing Team strived to achieve at the start of the MARL Project: route length and construction footprint, paralleling existing infrastructure, and community and recreational resource—which were important decision criteria for the selection of the Proposed Route.

The Proposed Route incorporates ancillary facility workspaces, including both temporary and permanent access roads, temporary structure pads at each tower location, and temporary wire work areas for conductor stringing operations. Additionally, where feasible, the Routing Team was able to identify 20 initial locations of riparian habitat associated with streams that could be maintained to minimize impacts where the topographic and engineering constraints allowed for such considerations along the Proposed Route. Therefore, the Proposed Route for the MARL Project is inclusive of the ancillary facility workspaces and the initial riparian habitat exclusive zones.

7. REFERENCES

See Appendix G, Data Sources.